# The Sports Revolution: Recognizing Intangible Abilities in Players

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## INTRODUCTION

Each year, sports franchises spend about 80 million dollars signing players to huge contracts, betting on these players to play a key role in the success of the team. However, not all of these players fulfill the teams' hopes; in fact most players do not improve after earning their paychecks and hit a plateau. On the other hand, some teams salvage the player they need in the 6th round of the draft, signing a fantastic player that brings home a championship at little expense.

How exactly does one find the players that will contribute to a team's success?

The answer lies in the ability to measure the intangible abilities. In searching for the right players succeed, scouts often look at athleticism, success in college, and basic stats. However, intangibles such as hustle, improvement rate, and versatility have proven to be the key factors in dictating a player's success and value in pro leagues. For example, versatile soccer players that can pass, create scoring opportunities for themselves, and



shoot accurately can play multiple roles on teams, and thus they are more coveted and successful. For this reason, sports analytics and its ability to recognize certain qualities in players is the future of sports operations and management. In fact, Forbes Magazine recently claimed that sports analytics' "high efficiency, low out system has... revolutionized...professional sports as a whole." Therefore, in an effort to join this sports revolution, improve the scouting process, and ultimately save millions of dollars in the sports industry, this project will seek to not only recognize intangible traits, but also develop models to calculate these intangibles through the study of sports charts, data, and trends.

## **Research Methodology**

To derive the algorithms that calculated intangible traits, players displaying strength in only one intangible trait were studied via their respective shot charts, statistics, and trends. Studying players that specialize in only one intangible trait isolated that ability as if it were an independent variable, and thus when a trend was noticed between the statistics and that ability, one would know for certain that those statistics must be associated with the trait. After studying those trends, direct correlations between the basic stats and the intangible ability were determined, and the correlations were utilized to create models to calculate the intangible abilities. Finally, the model was applied to players possessing multiple intangibles including the ability being calculated. Theoretically, the model would still correctly calculate that specific ability despite the player showcasing multiple intangibles. Thus, players that possessed multiple intangibles acted as a check to see if the model held true.

One intangible trait calculated in this project that thoroughly demonstrated the research process was tough-shot scoring ability, or the ability to score regardless of how well the opponent plays defense against the player. In order to measure this trait, studies were conducted on players in the NBA who were widely regarded as fantastic shooters, such as J.J. Redick and Kyle Korver. After deriving a formula to calculate their tough shot shooting percentage, the algorithm was applied to players that were great shooters but also possessed other intangibles such as Stephen Curry and Kevin Durant. Through this means intangible abilities were accurately and thoroughly calculated, as the wide variety of players and their respective skillsets in the NBA provided us with many scenarios in which flaws in the algorithm could potentially be exposed; therefore algorithms that held true for multiple players were proven to be accurate.

# Conclusion and Continuation: Developing more Formulae and Predictive Analysis

After building an app for these intangibles, one could expand the app by creating more algorithms for basketball. All five of the basketball abilities measured this year dictated offensive prowess, while none of them determined defensive ability. Thus, next year defensive traits will be measured, which would have a greater impact on sports analytics because there are few stats right now that accurately portray an athlete's ability to defend. After these algorithms have been calculated, all the models created so far will be used for predictive analysis purposes. We will utilize the models to solve pressing issues in the sports world and create intriguing simulations. Some of the projects we will be working on are assembling the ultimate team with average players, selecting the team of best fit for a superstar basketball player, and the schemes that teams should implement to suit their players.

## Glossary of Intangible Skills

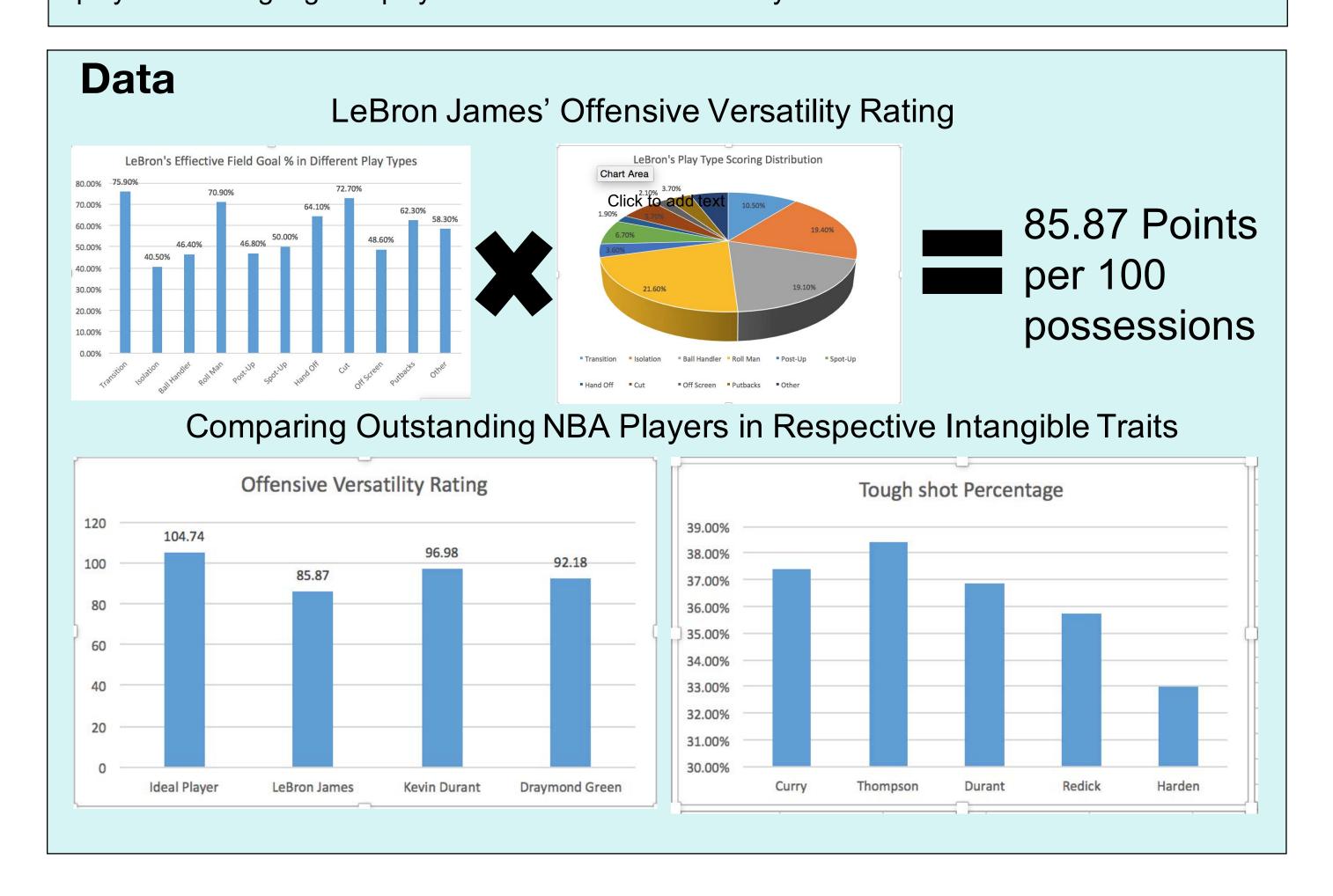
**Offensive Versatility** - A composite score of how efficient a player is at scoring in different scenarios. The stat is calculated as if a player is given 100 possessions, and simulates how the player would go about scoring on those 100 possessions based on their methods of scoring in the game. Players that rely too heavily on one play type are not considered versatile, and thus they are penalized by a decrease in their amount of points scored. Field goal percentage is then factored in to determine the percentage of shots that the player takes that are makes.

**Tough-Shot Shooting** % - The average shooting percentage of a player in scenarios where the player takes a difficult shot. All shots are weighed as if they were an average tight shot. Therefore, field goal percentages for difficult shots are weighed more heavily than that of open shots, as their percentage is scaled higher to match that of the average difficult shot as opposed to wide open shots being scaled lower to match the percentage. Then, average of all the field goal percentages is taken to determine one composite value.

**Off-ball Points Created** - The average number of points that a player creates while moving without the ball. Both scored baskets, assists, and other types of shots created are factored in.

**Pick-and-Roll Points Created** - The average number of points that a player creates in a pick-and-roll scenario, which is the most common play in the NBA. Both scored baskets, assists, and other types of shots created are factored in.

Adjusted Points Created Rate - The percentage of points scored through an assist or a basket as opposed to the percentage of attempts at scoring in a half-court formation, set, or play. This stat gauges a player's execution and efficiency in the half-court offense



### Discussion

The intangible traits defined and calculated above have numerous, unprecedented uses in helping coaches and managers pick the right players they need for their basketball team. For example, intangible abilities such as off-ball points created and pick-and-roll points created are incredibly useful in selecting players. The pick-and-roll is the most successful play in all of basketball history, simply because of all the options one has in it; one could use the screen to drive in and score, drive in and pass it out, lob it to the screener, and so much more. Therefore, having great pick-and-roll players is absolutely vital in assembling a successful team, which is what makes this stat so useful. Furthermore, successful teams also want to have good off-ball movement, as off-ball movement forces the defending team to run around more, which exploits holes in their defense. Therefore, it is essential that one is able to gauge pick-and-roll and off-ball movement ability, as these two concepts are key to success in basketball.

Perhaps the most important intangible statistic in our arsenal is the offensive versatility rating. The offensive versatility rating calculates the numerous ways in which a player can efficiently score. On any successful team, one wants a player who can score in many different ways, as a player that is more of a scoring threat attracts more of the opponent's attention on the defensive end, which gives his teammates a better opportunity to score. The results show that Kevin Durant can score in the most ways the most efficiently, which is consistent with what people think of Kevin Durant: a 6-foot-9 monster who can post up, pull up for deep three point shots, and drive in for a sledgehammer dunk.

## Mathematical Models of Intangible Skills

#### Offensive Versatility Rating

 $\sum 2(EFG\% * Play Type Frequency * (1 - Free Throw Frequency) + FT\% * Play Type Frequency * (Free Throw Frequency)$ 

for all play types. If Play Type Frequency  $> \left(\frac{4}{3}\right)$  Average League Frequency then use

 $\binom{4}{2}$  Average League Frequency instead of Play Type Frequency

## Tough-Shot Shooting %

 $\frac{\sum Shot\ FG\%*\left(\frac{League\ Average\ Tight\ 3P\ Shot\ FG\%}{League\ Average\ Shot\ FG\%}\right)}{6}$  for all very tight, tight, and open 2-pt and 3-pt shots

### **Adjusted Points Created % in the Half Court**

 $\frac{\sum Play\ Type\ Points + EV(Assists + S\ Assists) + 2*FT\%*FT\ Assists - EFG\%*Turnovers}{Offensive\ Rating*(\frac{Minutes}{48})*Team\ PACE*True\ Usage\%}$ 

### Off-Ball Points Created

 $\sum Play\ Type\ Points\ +$ 

Play Frequency[EV(Assists + SASsists) + 2 \* Team FT% \* FT Assists)]
For cutting, off-screen, and roll-man play types

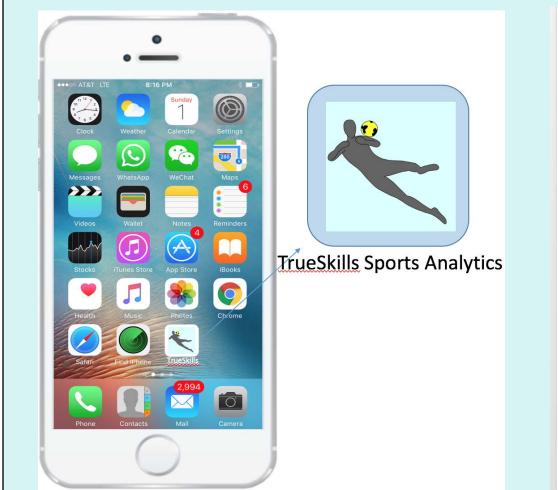
#### **Off-Ball Points Created**

 $\sum Play\ Type\ Points\ +$ 

Play Frequency[EV(Assists + SASsists) + 2 \* Team FT% \* FT Assists)]
For ball-handler and roll-man play types

# Conclusion and Continuation: Developing an App for global Access of the formulae and data

There will be a continuation of this project in the following year, and there are numerous ways in which this project can be extended. Firstly, the intangibles and the formulae used to calculate them will be implemented into an app, which brings many benefits to the project overall. By computerizing the formulae, one will have access to all athlete related data via online databases from sports analytics companies such as Synergy Sports and ESPN. The use of databases is advantageous because it is almost 100x faster to gather data for players via API protocols as opposed to recording the statistics by hand; as a result, by computerizing the project the intangible abilities of *all* players in pro sports leagues can be measured, rather than taking a small sample size like in this project. Furthermore, creating an app that harbors all this data allows everyone to utilize the research and algorithms, which was the original intent of the project. Below is a mock-up blueprint of what the app will look like next year:



Home Screen With the TrueSkills App

Downloaded

public Player(double[] playFrequency, double[] playEPG, double[]

double[] playPoints, double[] playFrequency, int gamesPlayed

playFreeFrequency, double freeThrowPercent){

/Constructor to Calculate Offensive Versatility

this.playFreeFrequency = playFreeFrequency;

public Player(double[] basicStats, double[] assistVals,

this.freeThrowPercent = freeThrowPercent;

this.playFrequency = playFrequency;

Constructor to Calculate Set Point Stats

this.basicStats = basicStats;

this.assistVals = assistVals:

this.playPoints = playPoints;

this.offensiveRating = OR;

public double OVersatility(){

this.playFrequency = playFrequency;

//Constructor to Calculate Tough Shot Percentage

for(int i=0; i < playFrequency.length; i++){</pre>

v = v + 2\*(playEPG[i]/100\*scaled

if(playFrequency[i] > scaled){

double scaled = (4/3 \* averageFrequency[i]);

\*(1-playFreeFrequency[i]/100)

v = v + 2\*(playEPG[i]/100\*playFrequency[i]

+ freeThrowPercent/100\*scaled\*playFreeFrequency[

\*(1-playFreeFrequency[i]/100) + freeThrowPercent

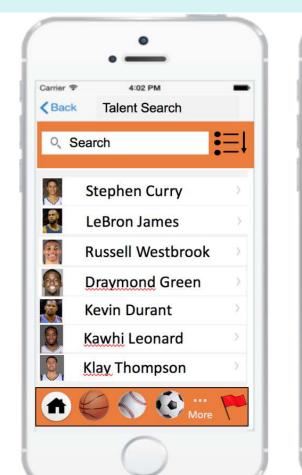
\*playFrequency[i]\*playFreeFrequency[i]/100);

Sampling of the App Source Code

this.gamesPlayed = gamesPlayed;

public Player(double[] areaShooting){
 this.areaShooting = areaShooting;







TrueSkills App Page Navigation



Generic Player Page