

NBA Team 1

Edwin Luhnnow, Nathan Brence, Sid Shah, Leyton Allen



ROTY Race

PPG: Points Per Game
RPG: Rebounds Per Game
APG: Assists Per Game
ROTY: Rookie of the Year

Cooper Flagg

21.0 PPG
6.7 RPG
4.5 APG
Stronger Defense
1st Option



- -175 ROTY odds*

Kon Knueppel

18.5 PPG
5.3 RPG
3.4 APG
47.5/42.5/86.3
Team success



- +135 ROTY odds*

The Problem

ORTG: Offensive Rating

DRTG: Defensive Rating

PER: Player Efficiency Rating

Basic Stats Aren't Enough!

- Differences in stats often results from factors outside of player performance
 - Outside systematic factors (Position, Team Ability, Defensive Conditions, etc.)
 - Purely random influences we can't measure
- Incomplete information of player performance

Even Advanced Metrics Aren't Perfect!

- Often calculated using basic stats (PER, DRTG, ORTG, etc.) – Same issues carry over
- Structure and calculation sometimes favor certain contributions over others
 - Ex: PER can be inflated by offensively elite players with lacking defensive contributions

So What Do We Do?

- Use combination of metrics that each correct for a specific form of systematic variation
 - Separate offensive, defensive, and team analysis



NBA Expected Field Goal % (xFG%) Model

- Using NBA's recently created xFG% models
- Optical tracking systems record advance data 60 times per second
- Track 29 points on players bodies
- Machine Learning Model trained on this data and the actual outcomes to create a predictor of FG%



Shooter Feature Inputs



Shot Distance

From player center of mass
to the hoop



Vertical Tilt

Angle between shooter and
vertical Z-axis



Head-Facing%

% of time player has
visibility of basket before
the shot



Rotational Speed

Direction and speed
shooter's hips are rotating
with respect to basket



Hang Time

Time the player is in the air
before taking the shot



Head Angle

Angle of the player's head
relative to the basket

Other inputs: speed, velocity to basket, full rotation (rotation just before and after shot), hang time distance

Defender Feature Inputs



Closest Defender Joint

Distance between the nearest defender hand and the ball



Height of Contest

Difference between height of ball and defender hand height



Elbow Contact

Distance between defender's hand and shooter's elbow (1 sec before)



Hip Distance

Distance between the defender's and shooter's hips



Pressure Score

The pressure exerted on the shooter by their matchup defender



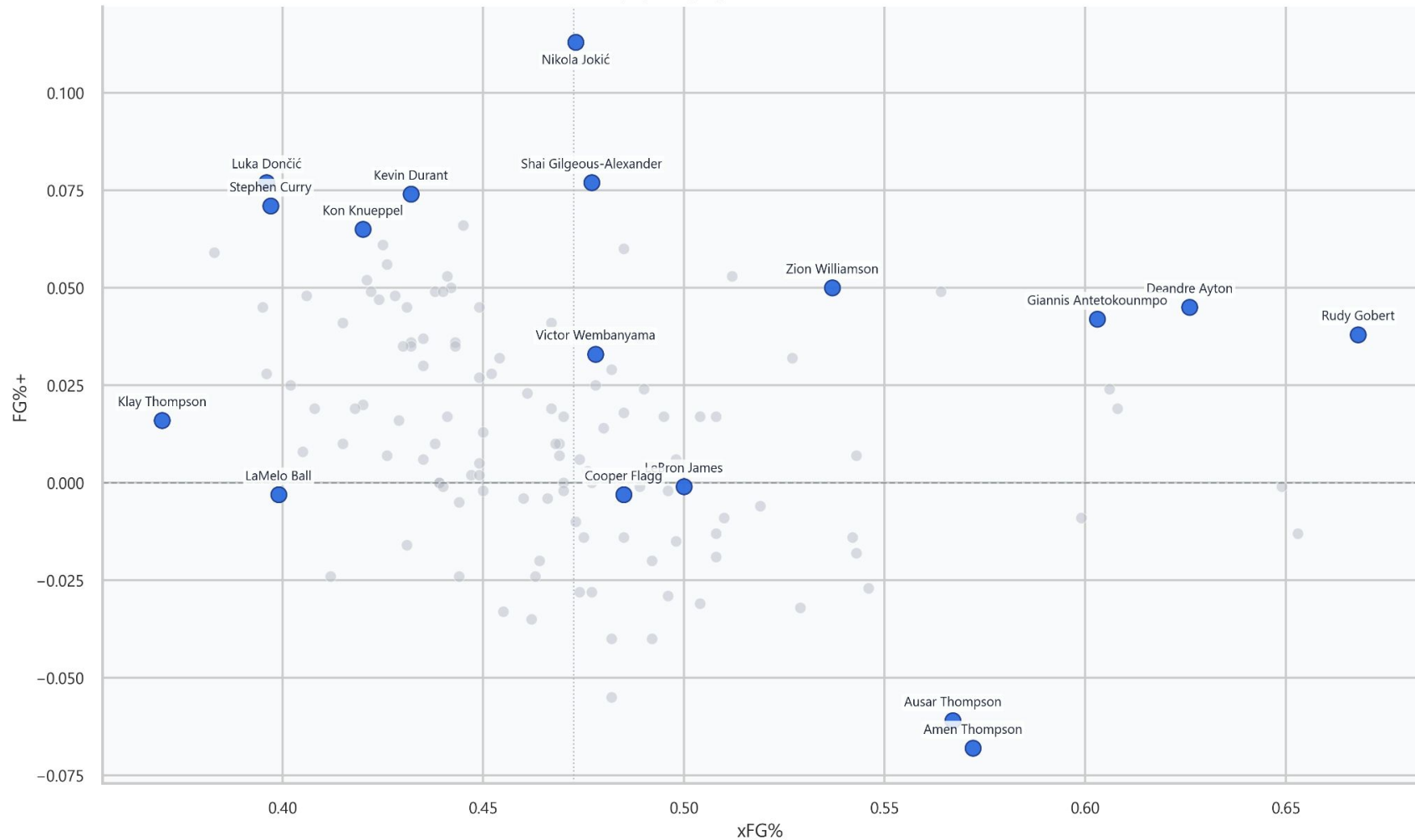
Vision Interference

Quantity to which the defender obscures the shooter's vision

Other inputs: defensive hand contest angle, defender angle relative to basket, defender speed, average pressure score

Shot Quality vs Finishing Over Expectation

Selected players highlighted; all others muted for context



Shot Quality Analysis

xFG%: Expected Field Goal %

3PT xFG%: 3PT Expected Field Goal %

FGM %UAST: % of FG made unassisted

TS%: True Shooting %

Cooper Flagg

xFG%: 48.5%

FG%: 48.2%

3PT xFG%: 36.5%

3PT FG%: 30.2%

FGM %UAST: 55.8%

TS%: 54.8%



Kon Knueppel

xFG%: 42.0%

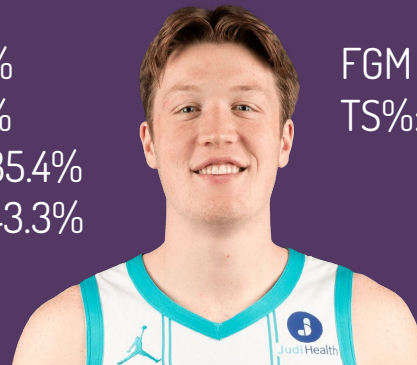
FG%: 48.5%

3PT xFG%: 35.4%

3PT FG%: 43.3%

FGM %UAST: 23.3%

TS%: 63.3%



Flagg



30%



50%

Knueppel



■ xFG%

● FG%

■ 3PT xFG%

● 3PT FG%

Knueppel is a better shooter, Flagg is a better shot creator

Playmaking Comparison

AST%: % of team FG assisted while on court

AST/TO: Assist to turnover ratio

TOV%: % of player's possessions that they turnover

Cooper Flagg

APG	4.5
AST%	21.2
AST/TO	1.96
TOV%	5.4



Kon Knueppel

APG	3.4
AST%	15.8
AST/TO	1.70
TOV%	7.3

Flagg beats Knueppel in all playmaking stats

Team Analysis



VS



First Look: Basic Team Stats

Dallas Mavericks



26-56 (25th)
31.7% (25th)
56.7% (28th)
111.2 (27th)
116.5 (20th)
0.18 (10th)
-5.33 (23rd)

Win/Loss Record

Win %

True Shooting % (TS%)

Offensive Rating (ORTG)

Defensive Rating (DRTG)

Strength of Schedule (SOS)

Simple Rating (SRS)

Charlotte Hornets



44-38 (16th)
53.7% (16th)
58.9% (10th)
119.4 (5th)
114.4 (12th)
-0.35 (28th)
4.48 (8th)

Immediate indication of Hornets being a superior team

ORTG: Offensive Rating

DRTG: Defensive Rating

TOV%: % of Possessions with Turnover

eFG%: Effective Field Goal Percentage

OBPM: Offensive Box Plus/Minus

DBPM: Defensive Box Plus/Minus

VORP: Value over Replacement

Selected Stats: Individual Difference

Cooper Flagg

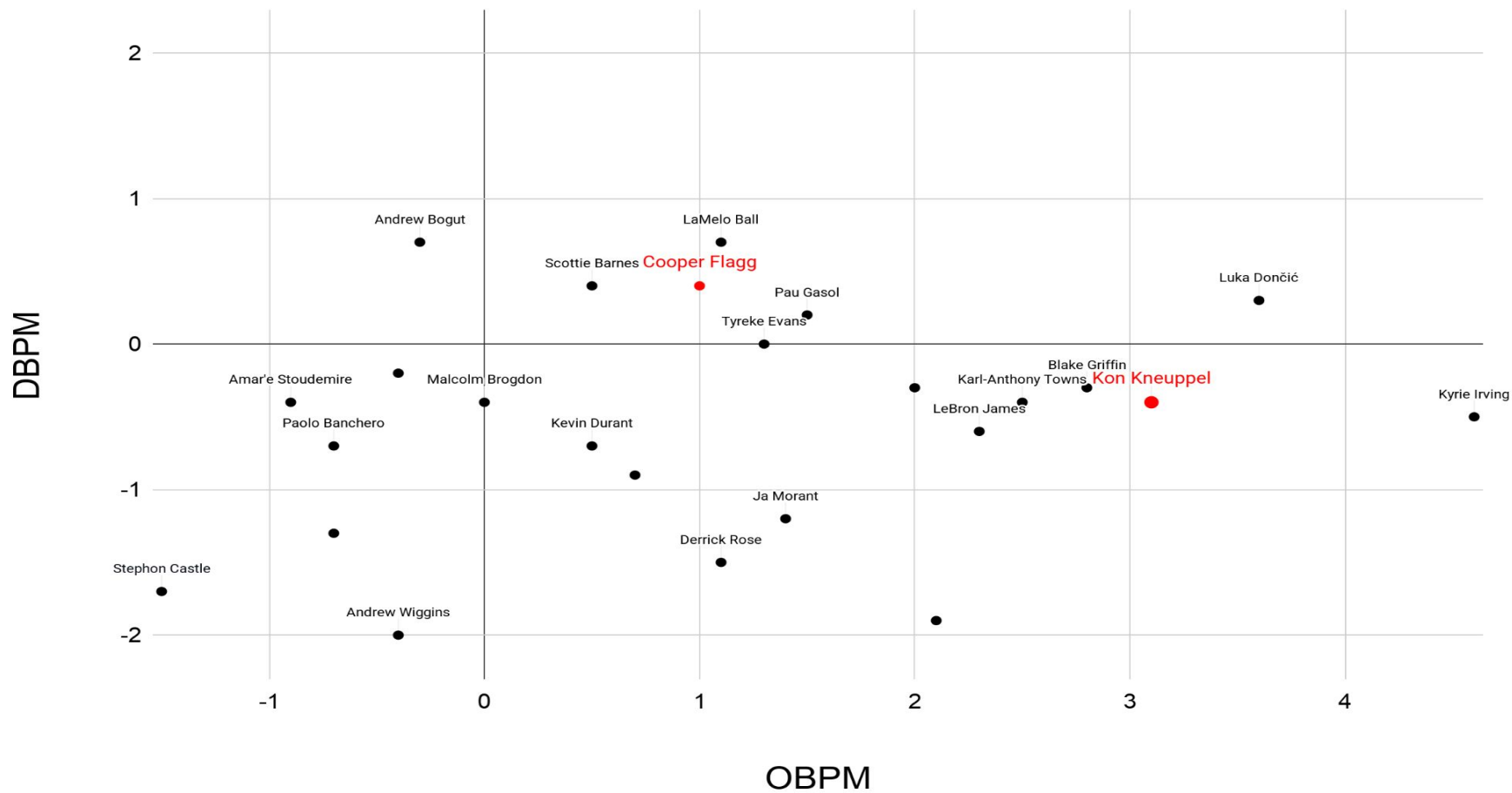
TEAM	ON	OFF	DIFF
ORTG	112.4	111.7	+0.7
DRTG	117.6	117.0	+0.6
TOV%	13.6%	15.1%	-1.5%
eFG%	52.6%	52.9%	-0.3%
OPPONENT	ON	OFF	DIFF
TOV%	12.9%	13.4%	-0.5%
eFG%	54.3%	55.0%	-0.7%
INDIVIDUAL	OBPM	DBPM	VORP
FLAGG	1.0	0.4	2.0

Kon Knueppel

TEAM	ON	OFF	DIFF
ORTG	121.4	116.2	+5.2
DRTG	115.8	113.2	+2.6
TOV%	15.4%	16.8%	-1.4%
eFG%	56.2%	53.3%	+2.9%
OPPONENT	ON	OFF	DIFF
TOV%	12.6%	14.1%	-1.5%
eFG%	53.0%	54.5%	-1.5%
INDIVIDUAL	OBPM	DBPM	VORP
KNUEPPEL	3.1	-0.4	3.1

For their teams, Flagg has small edge in defensive contributions, while Knueppel is an offensive powerhouse

DBPM vs. OBPM of ROTYs since 2000



Teammate Quality

OBPM: Offensive Box Plus/Minus
DBPM: Defensive Box Plus/Minus
VORP: Value over Replacement
TS%: True Shooting Percentage

Cooper Flagg & Mavericks

- 9 Teammates with 40+ GP
 - One of which is Top 100 in at least one basic stat; None are Top 50

Advanced Averages

TEAM STAT	TEAM MEDIAN	FLAGG
OBPM	-1.0	1.0
DBPM	0.1	0.4
VORP	0.2	2.0
TS%	57.2%	54.8%

Kon Knueppel & Hornets

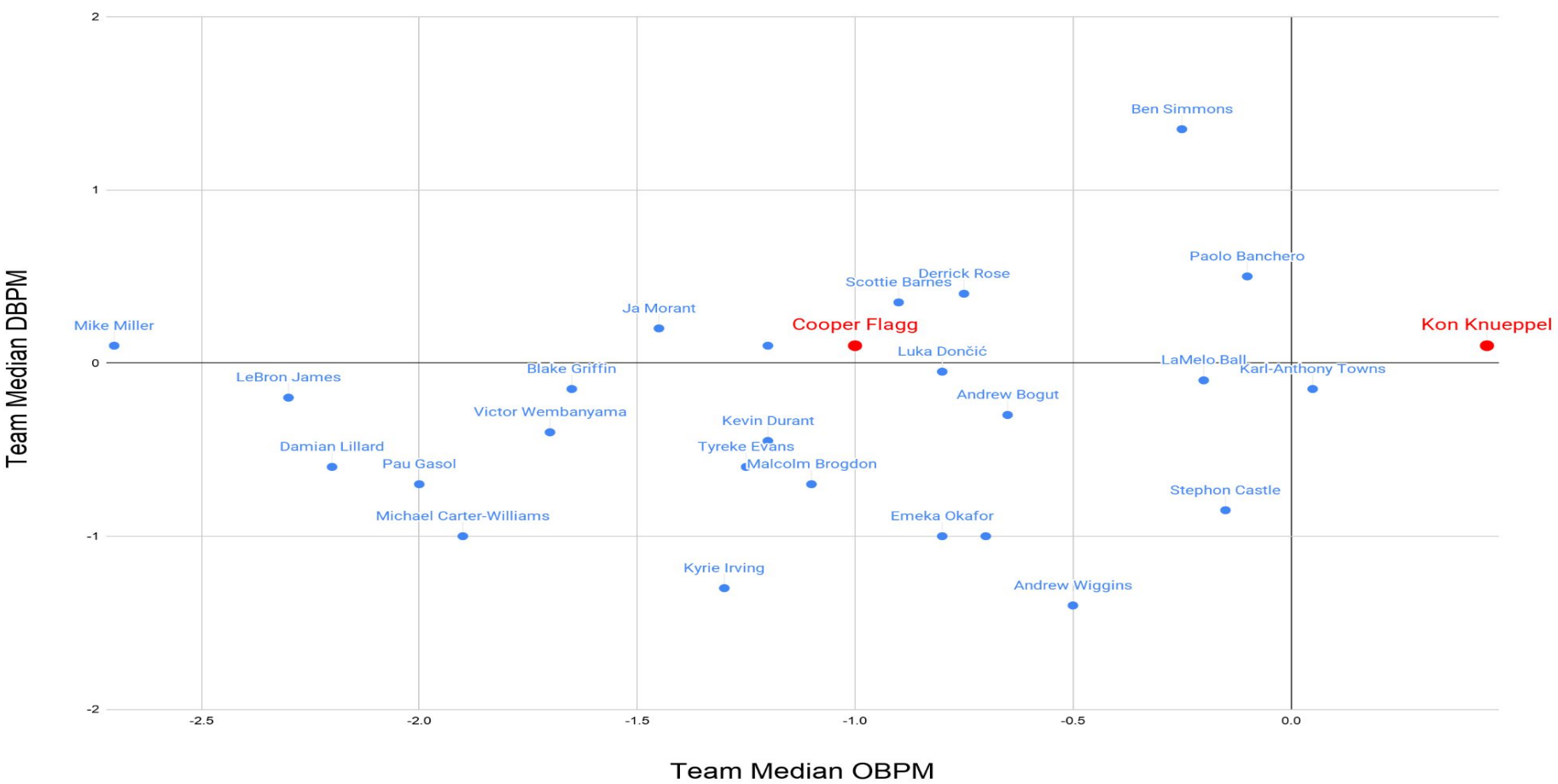
- 10 Teammates with 40+ GP
 - Four of which are Top 100 in at least one basic stat; Two are Top 50

Advanced Averages

TEAM STAT	TEAM MEDIAN	KNUEPPEL
OBPM	0.45	3.1
DBPM	0.1	-0.4
VORP	1.05	3.1
TS%	58.0%	63.3%

Hornets are stronger than the Mavericks offensively and defensively

Team Median OBPM and DBPM of ROTYs since 2000



Defensive Analysis



Key Defensive Metrics

Advanced Stats

Opponent Expected Field goal Percentage

(eFG%)

Opponent Turnover Percentage (Opp TOV%)

Defensive Rating (DRTG)

League Expected Field Goal Percentage (League eFG%)

Created Metrics

Adjusted eFG Defense (negative = better)

- How well a player limits opponent shooting
- $\text{Opp eFG (on floor)} - \text{League eFG}$

Matchup Suppression % (positive = better)

- How much a player improves team shooting defense when on the court
- $\text{Opp eFG (off floor)} - \text{Opp eFG (on floor)}$

Contest Quality Index (less negative = better)

- Proxy for shot contest effectiveness using shooting + pressure
- $-(\text{Opp eFG(on)}) + 0.5(\text{Opp TOV(on)})$

Defensive On/Off Impact Score (less negative = better)

- Composite metric
- $0.4 (\text{change in DRTG}) + 0.4 (\text{change in Opp eFG\%}) + 0.2 (\text{change in Opp TOV})$

Created composite metrics to measure net defensive impact



Adjusted eFG Defense: -0.2

Matchup Suppression %: 0.7

Contest Quality Index: -47.85

Defensive On/Off Impact: -0.06



Adjusted eFG Defense: -1.5

Matchup Suppression %: 1.5

Contest Quality Index: -46.7

Defensive On/Off Impact: -0.74

Takeaway: Knueppel is a stronger individual shot defender, whereas Flagg has a stronger team defensive impact.

ROTY Conclusions

Comparisons

Basic Stats → **Flagg**

Shot Creation → **Flagg**

Shooting → **Knueppel**

Playmaking → **Flagg**

Offensive Team Contribution → **Knueppel**

Defensive Team Contribution → **Flagg**

Individual Defense → **Knueppel**

Overall: Cooper Flagg

Although Knueppel is a **better contributor** to a more successful team, and a **better shooter**, ROTY is an individual award. Flagg is unable to rely on his teammates, yet he shows **better team defense, rebounding, playmaking, and scoring ability**.

