To Crash or Not To Crash

J. Wiens, G. Balakrishnan, J. Brooks, J. Guttag
Massachusetts Institute of Technology

7TH ANNUAL
MIT SLOAN
SPORTS ANALYTICS CONFERENCE
MARCH 1-2, 2013 BOSTON CONVENTION AND EXHIBITION CENTER
presented by ESPN

SAP

42 ANALYTICS


To crash, or not to crash
Nationwide

To Crash or Not To Crash:
A Quantitative Look at the Relationship Between Offensive Rebounding and Transition Defense in the NBA

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42 ANALYTICS


What should they do?
?
?
?
NETS
20
HUMPHRIES
43
12
17

Two Philosophies in the NBA

Attack the Offensive Boards

“When in doubt attack.”
– American General
George S. Patton

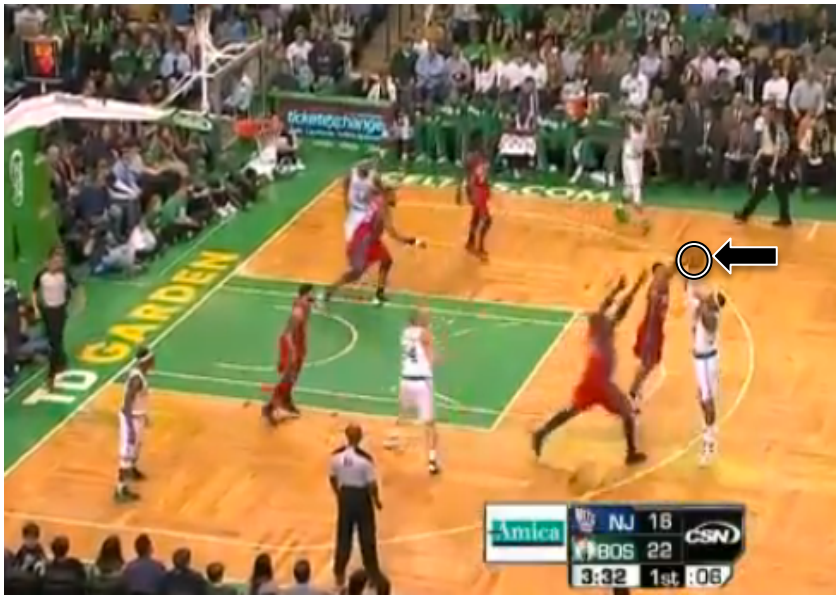
Get Back on Defense

"A great general, should know when to retreat, and to dare to do it."
– 1st Duke of Wellington

Is One Philosophy Better?

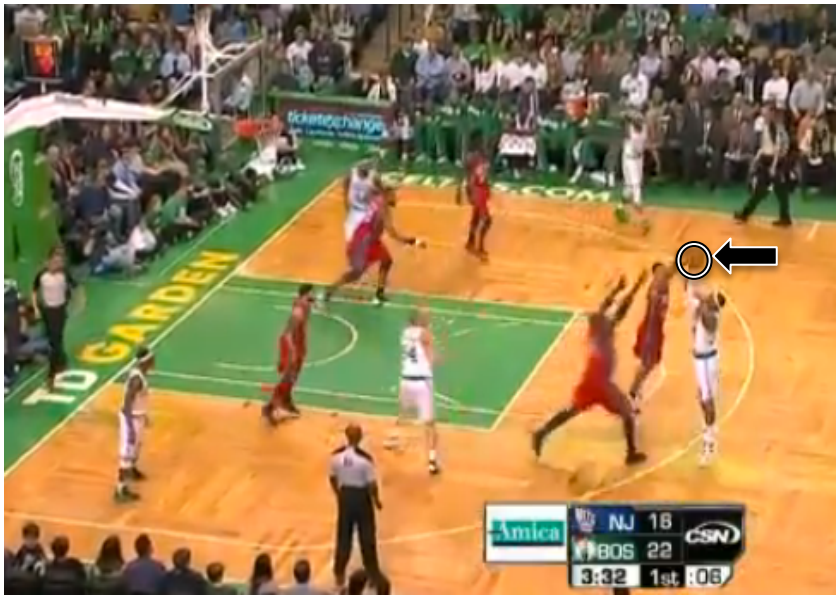
- Of course, the truth lies in the middle
  - Personnel matters
  - Game situation matters
  - Referees matter
- But it is possible to make an informed decision based upon useful generalities

Players have a choice



The shot is released

Players have a choice



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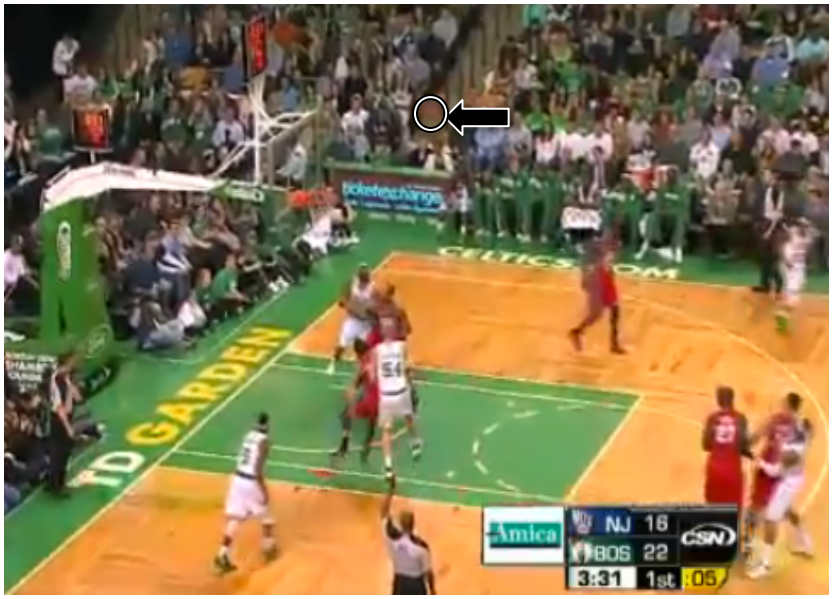


…and just before the ball hits the rim.

Players have a choice

Crash: go for the offensive rebound

or

Retreat: get back and get ready to defend

Players have a choice

Crash: go for the offensive rebound

or

Retreat: get back and get ready to defend

…or do nothing

How are crashing and retreating currently measured?

They aren’t!

To be fair…

Offensive Rebounds
Transition Pts. Allowed

To be fair…

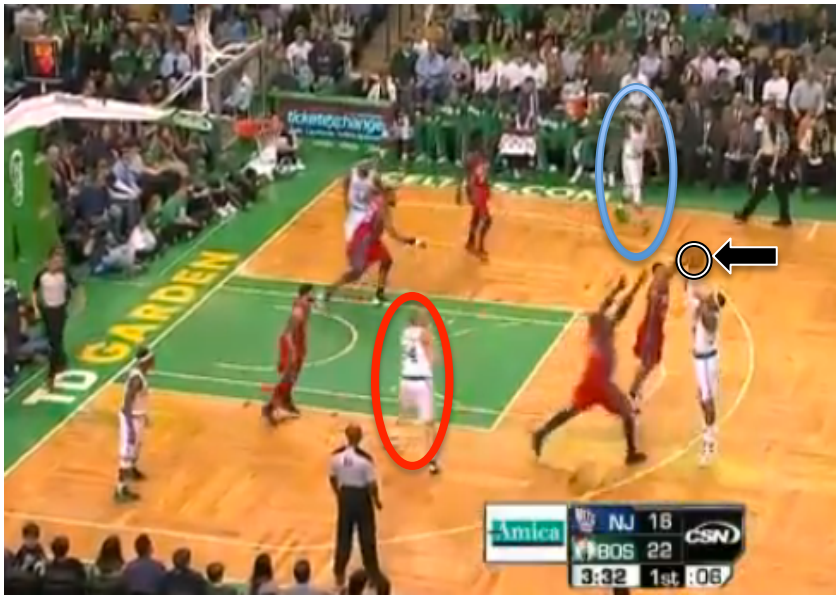
Offensive Rebounds
Transition Pts. Allowed

These "Box Score" statistics are insufficient

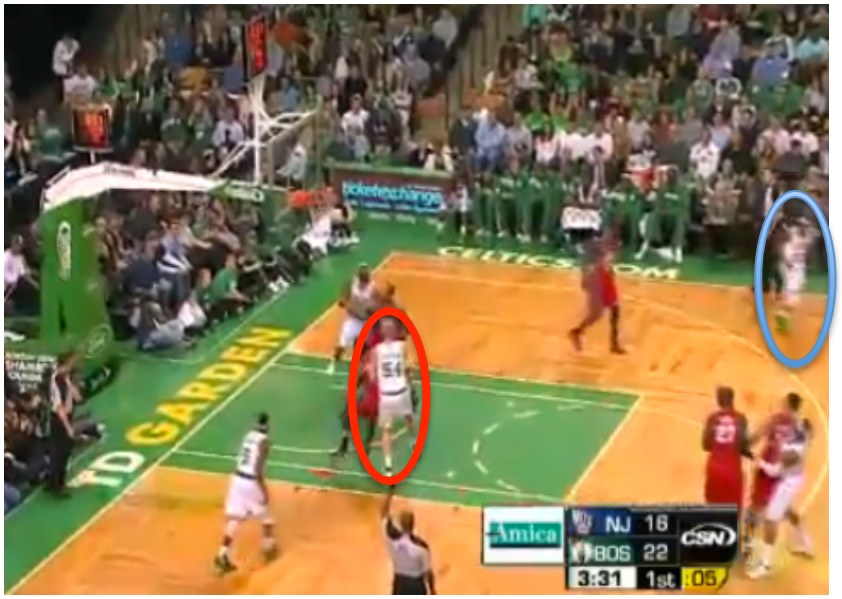
STATS LLC SportVu Data

- {x, y} coordinates of all players (& officials)
- {x, y, z} coordinates of the ball
- 25 frames per second
- augmented by play-by-play data

Defining Crash and Retreat Indices Per Possession

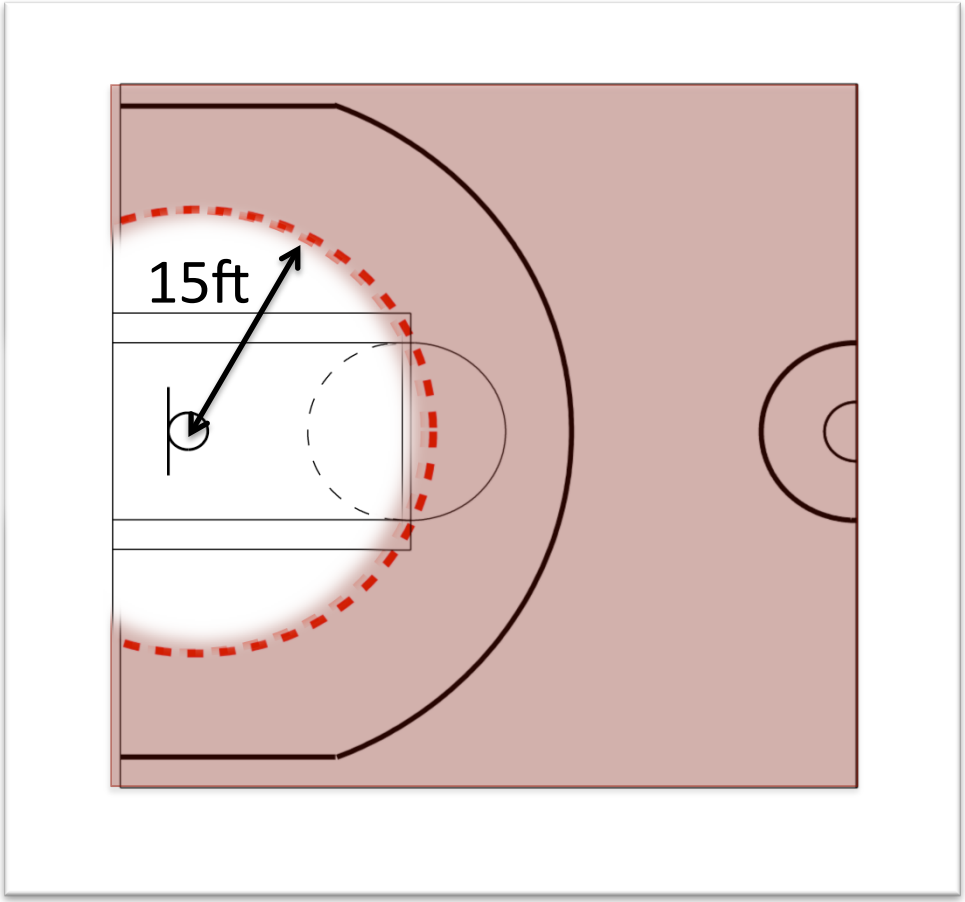


We consider *where* players are when a shot is released



…and *where* they go immediately after (until the ball is rebounded).

Jump Shots



Defining Crash and Retreat Indices

Crash $\stackrel{?}{=}$ move toward basket

Retreat $\stackrel{?}{=}$ move away from basket

Defining Crash and Retreat Indices

Crash $\stackrel{?}{=}$ move toward basket

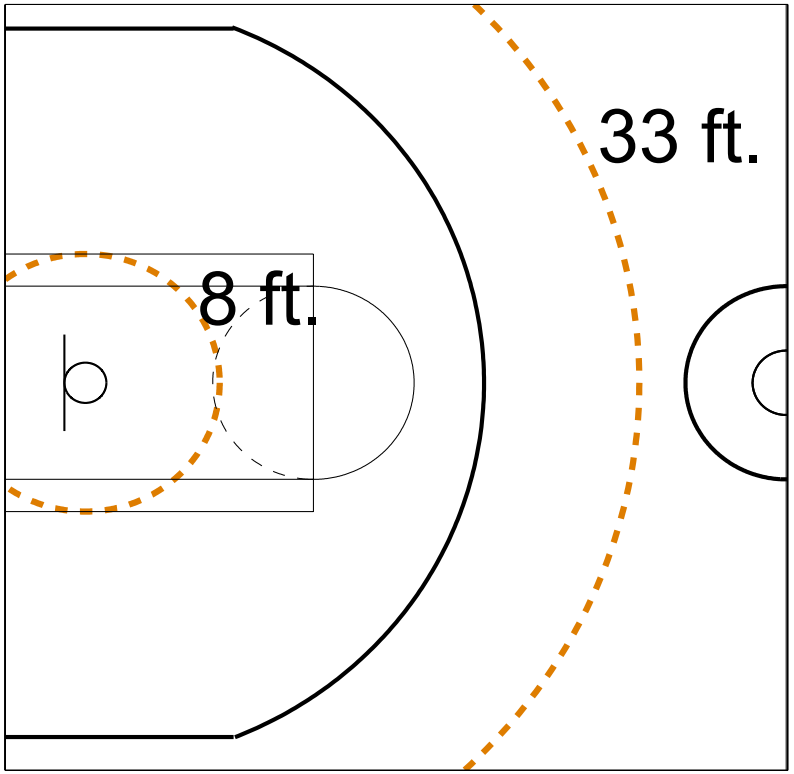
Retreat $\stackrel{?}{=}$ move away from basket

Too simplistic!

SPALDING

Defining Crash and Retreat Indices

InsideZone: <8ft
NeutralZone: 8-33ft
OutsideZone: >33ft



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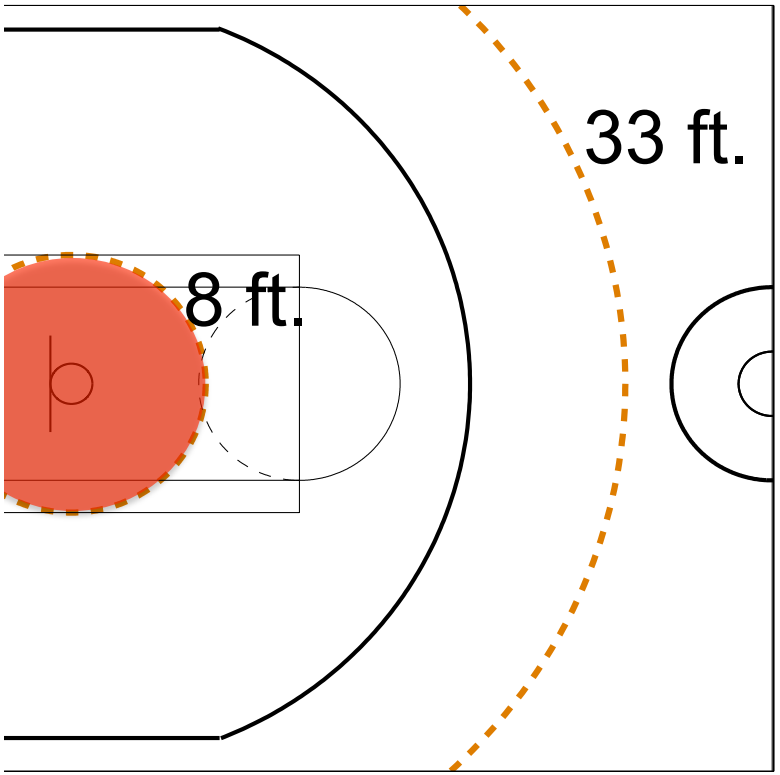

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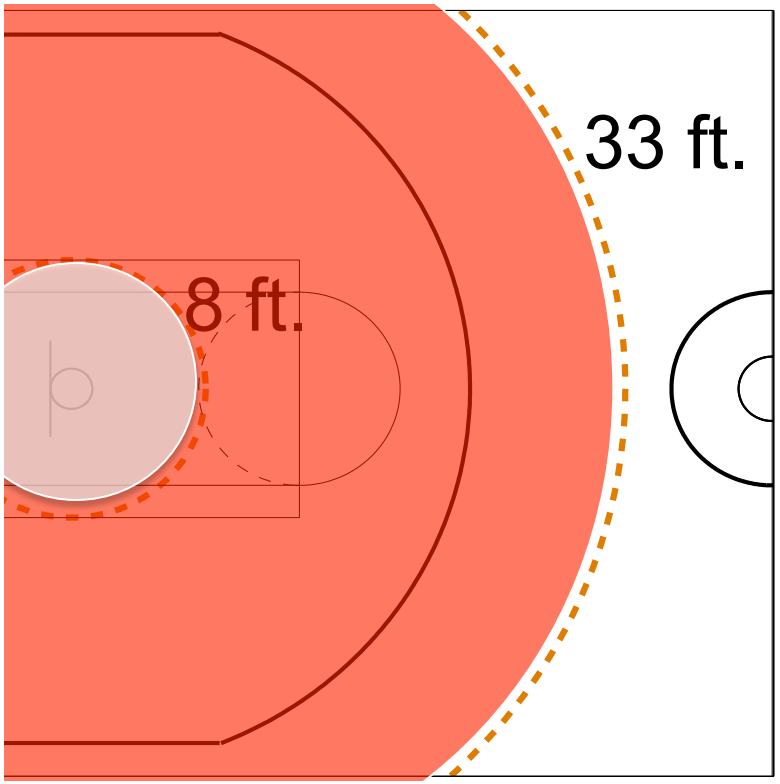

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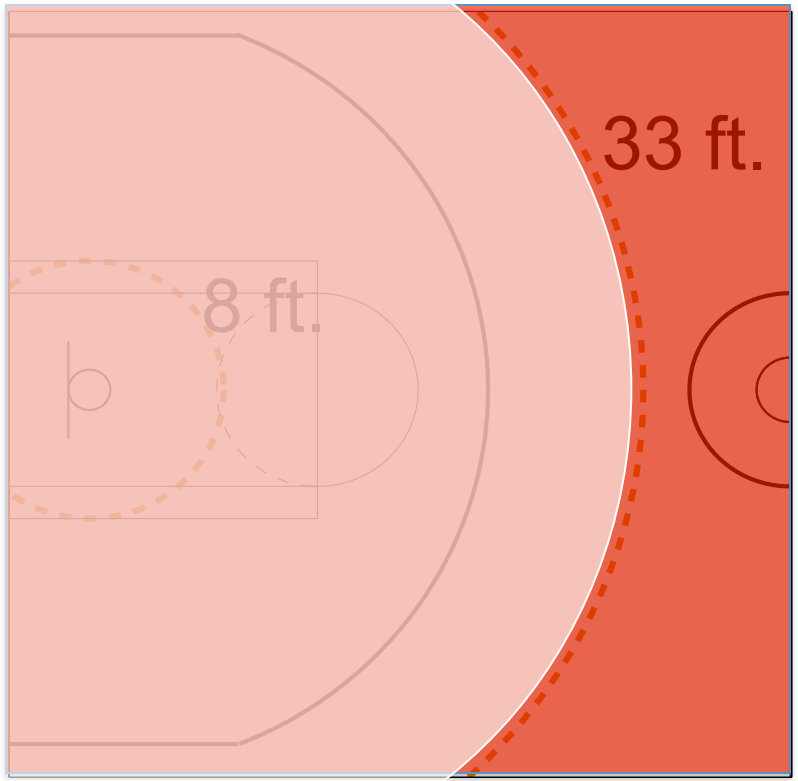

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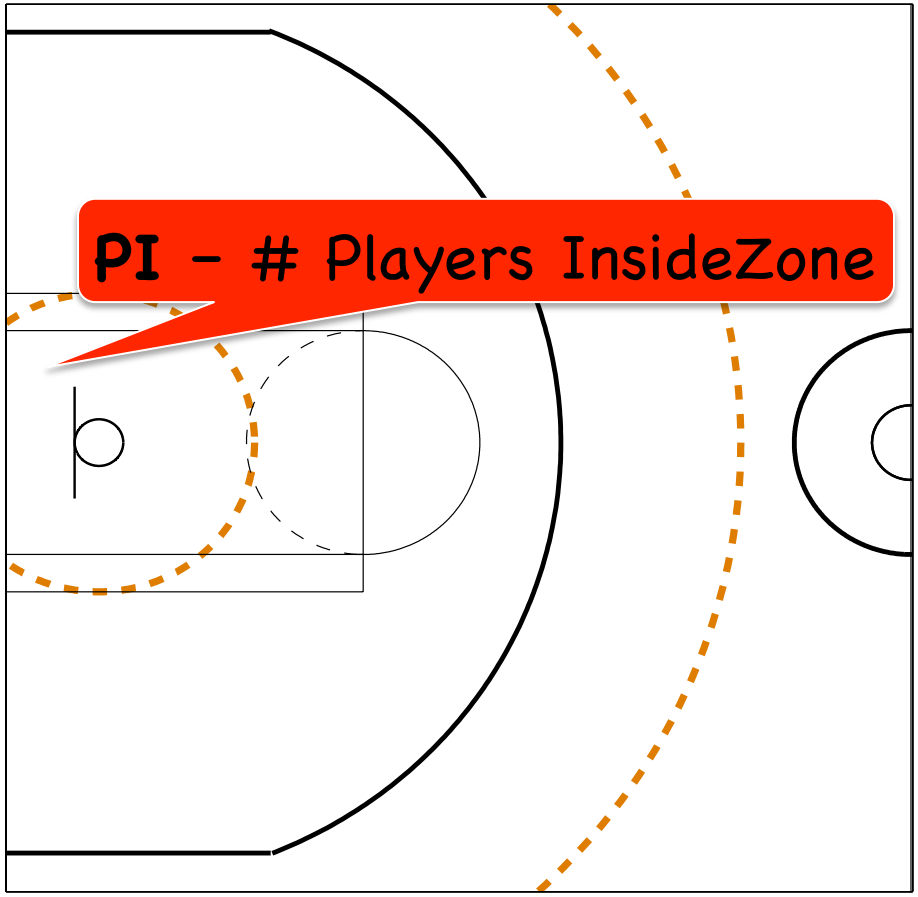

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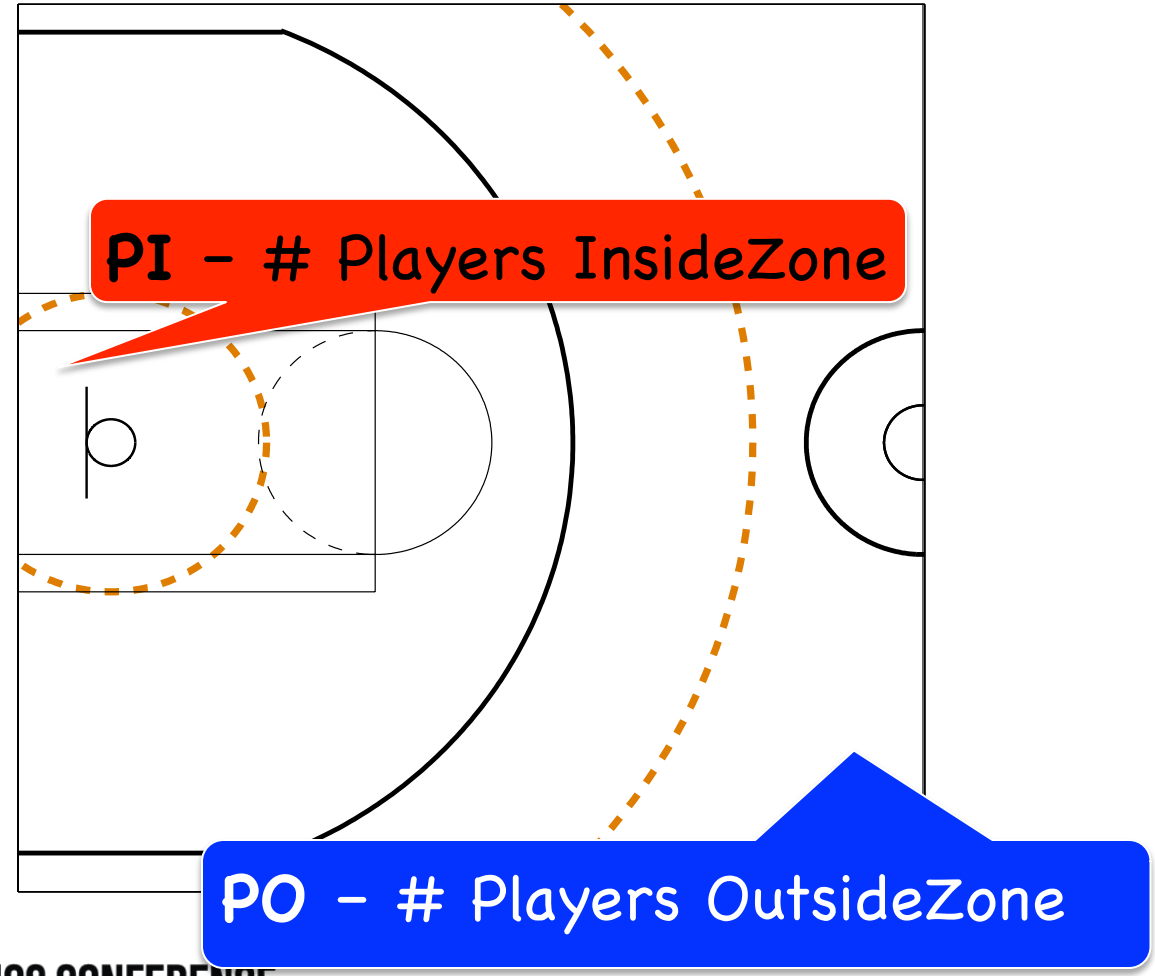

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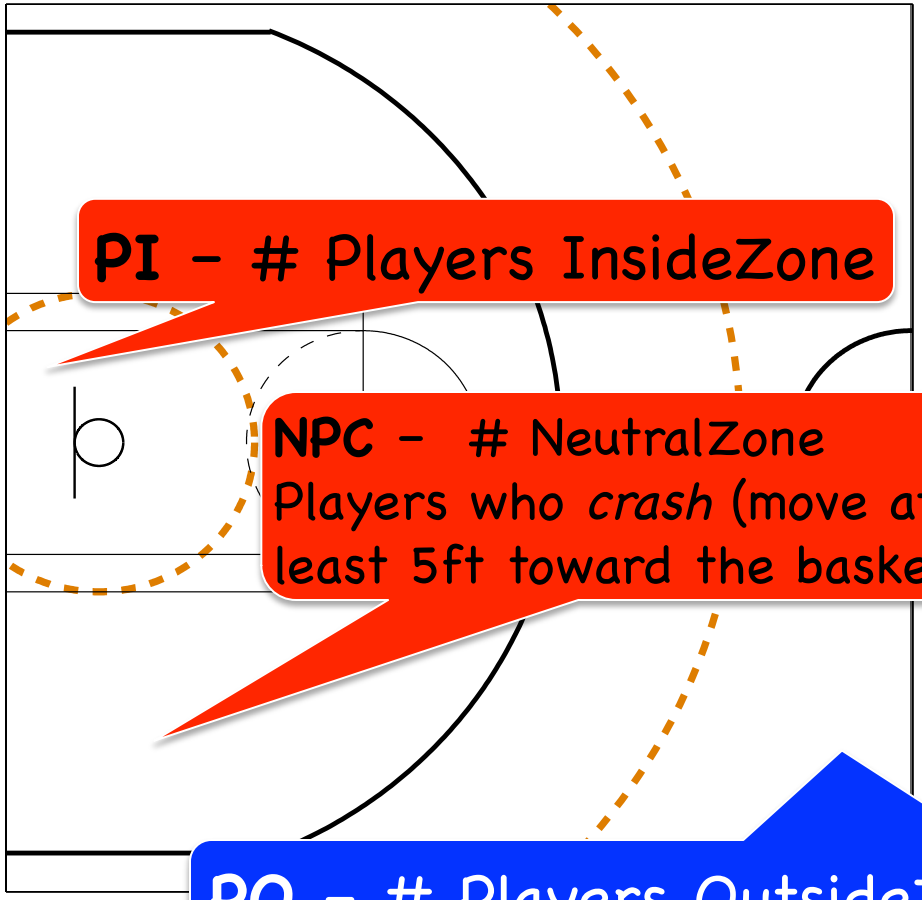
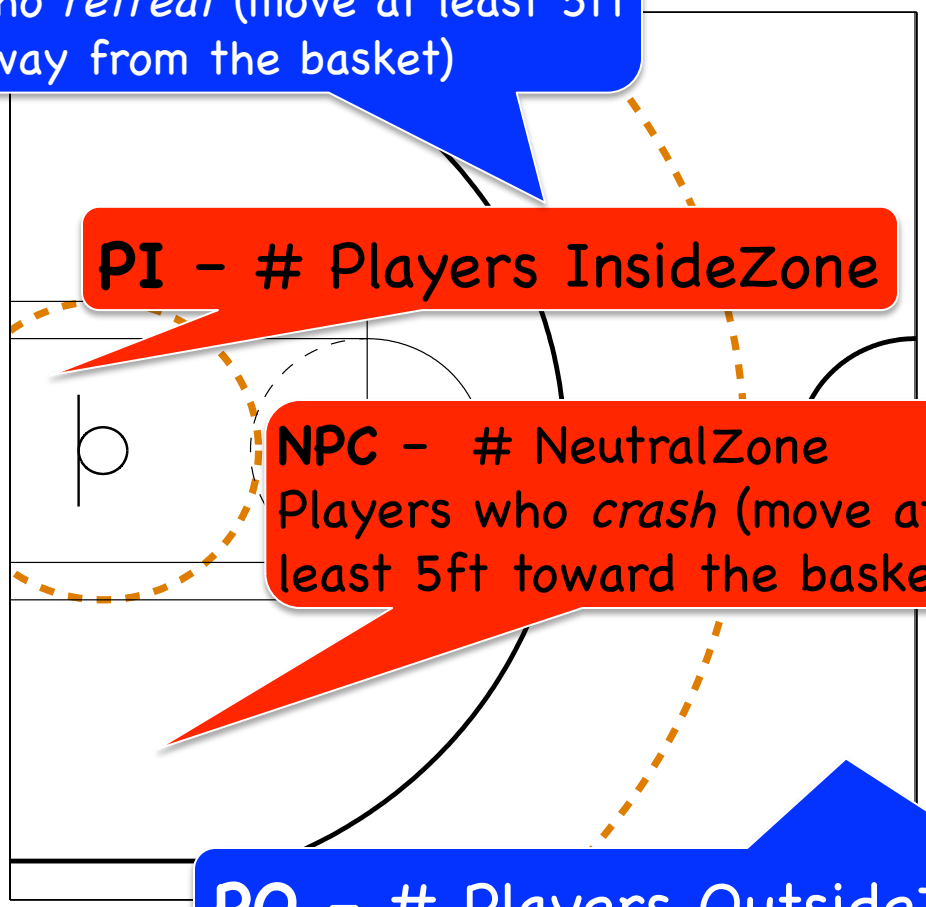


PI – # Players InsideZone

NPC – # NeutralZone
Players who *crash* (move at least 5ft toward the basket)

PO – # Players OutsideZone

Defining Crash and Retreat Indices



NPR – # NeutralZone Players who *retreat* (move at least 5ft away from the basket)

PI – # Players InsideZone

NPC – # NeutralZone Players who *crash* (move at least 5ft toward the basket)

PO – # Players OutsideZone

Defining Crash and Retreat Indices

Crash Index (CI) = PI+NPC
Retreat Index (RI) = PO+NPR

Defining Crash and Retreat Indices

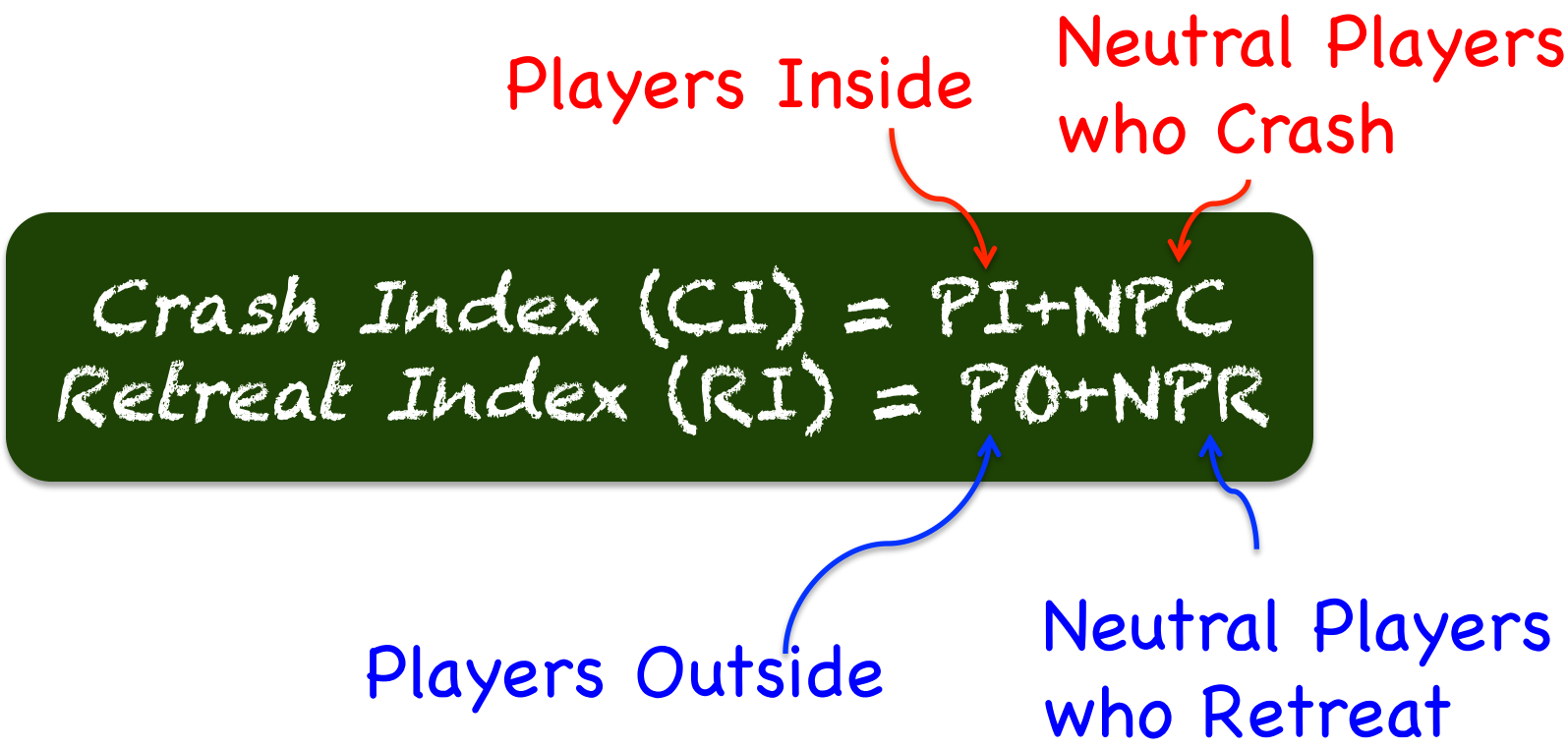
Players Inside

Neutral Players who Crash

Crash Index (CI) = PI+NPC

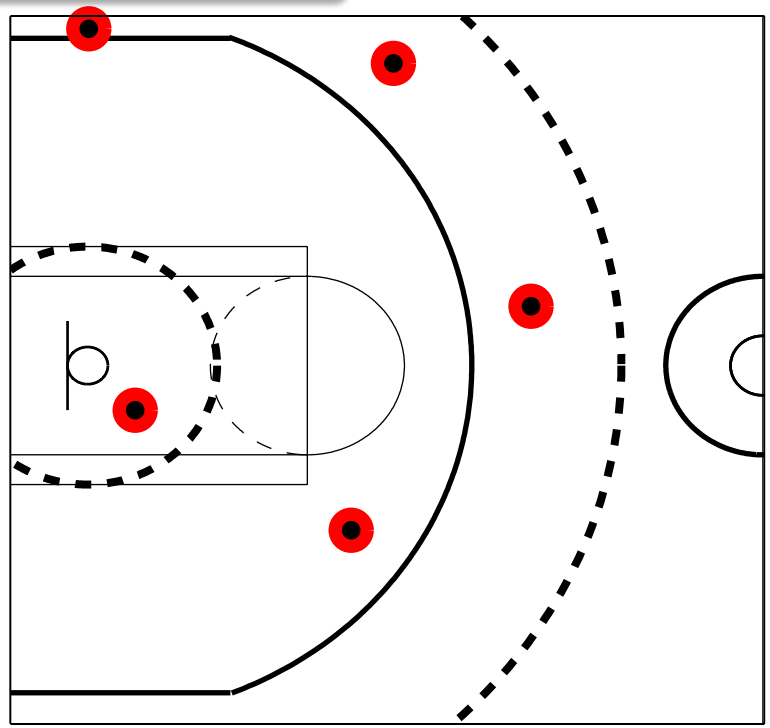
Retreat Index (RI) = PO+NPR

Defining Crash and Retreat Indices



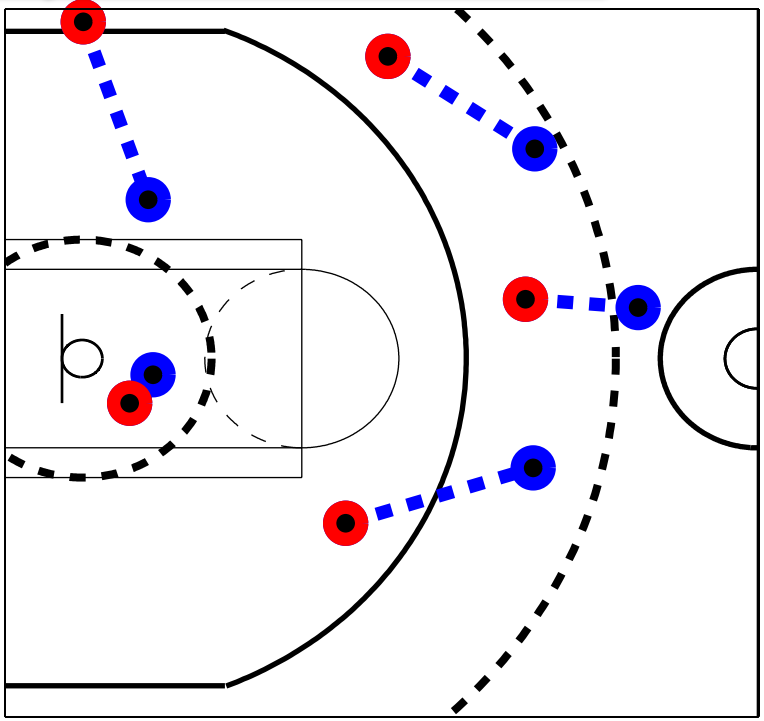
An Example

At the time the shot is released:



An Example

Movement immediately following the shot:



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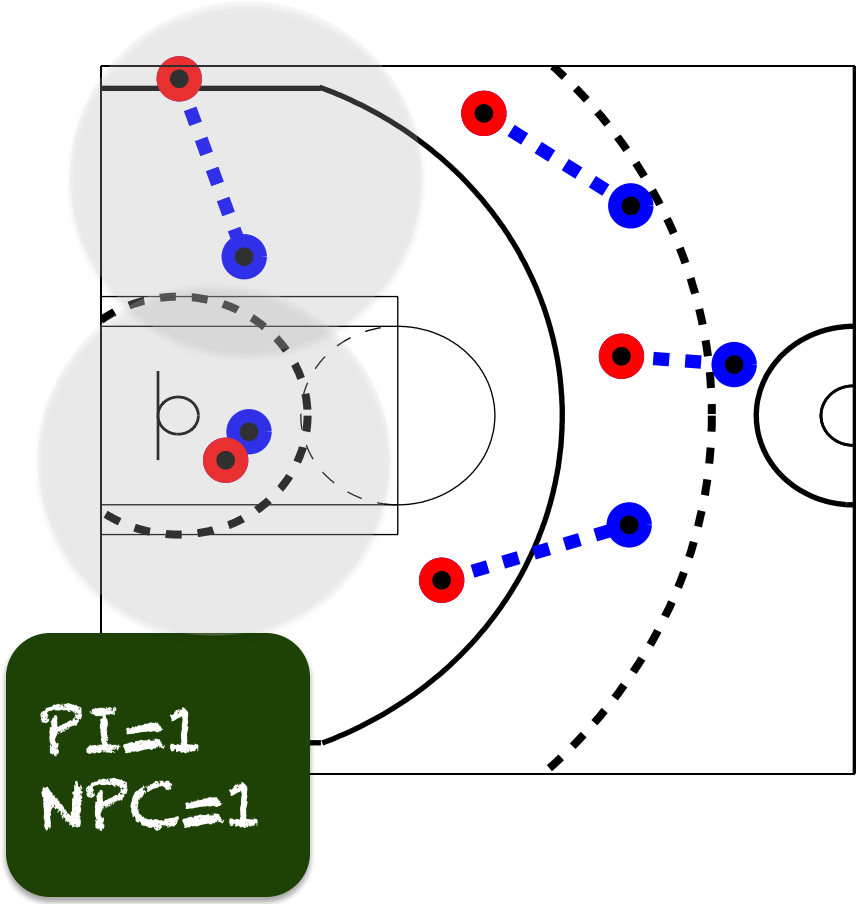

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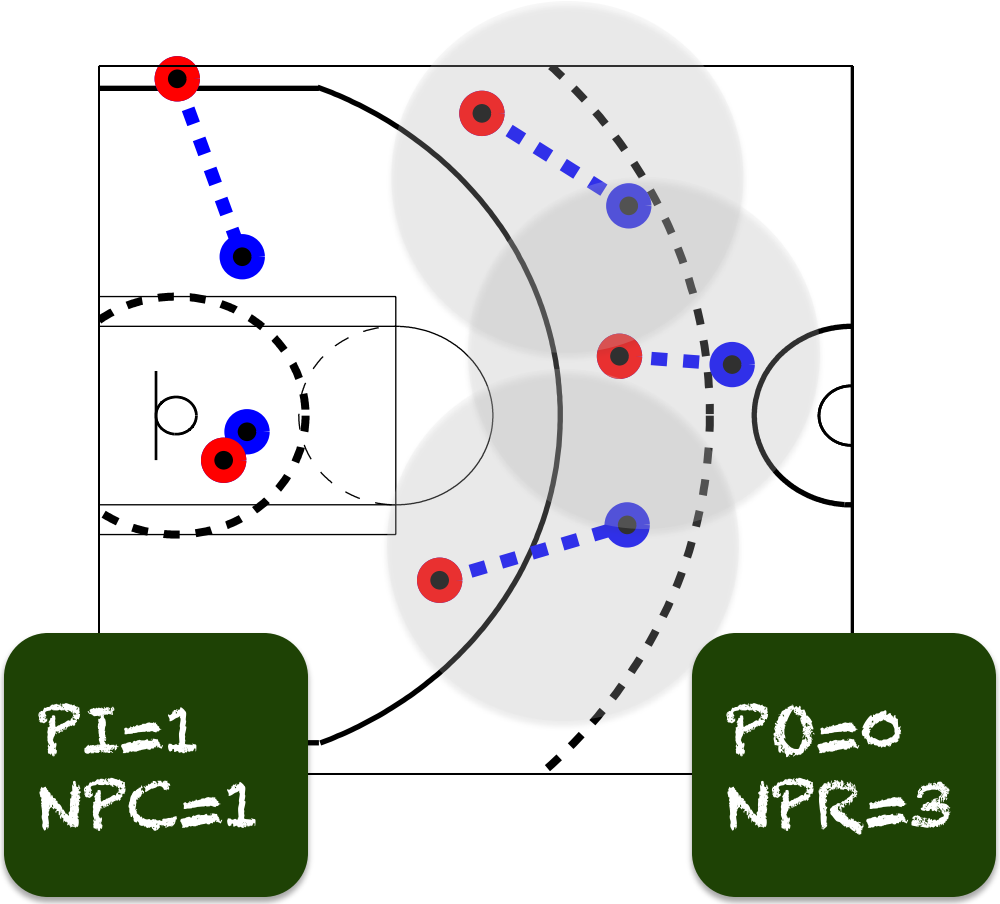

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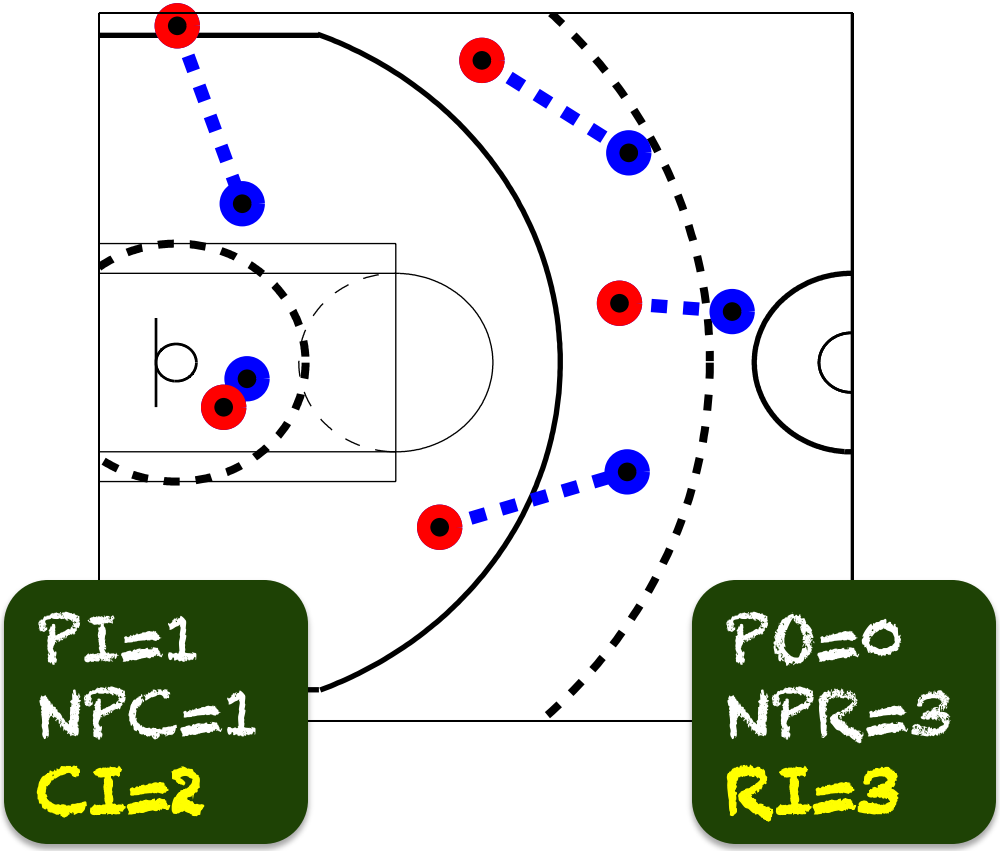
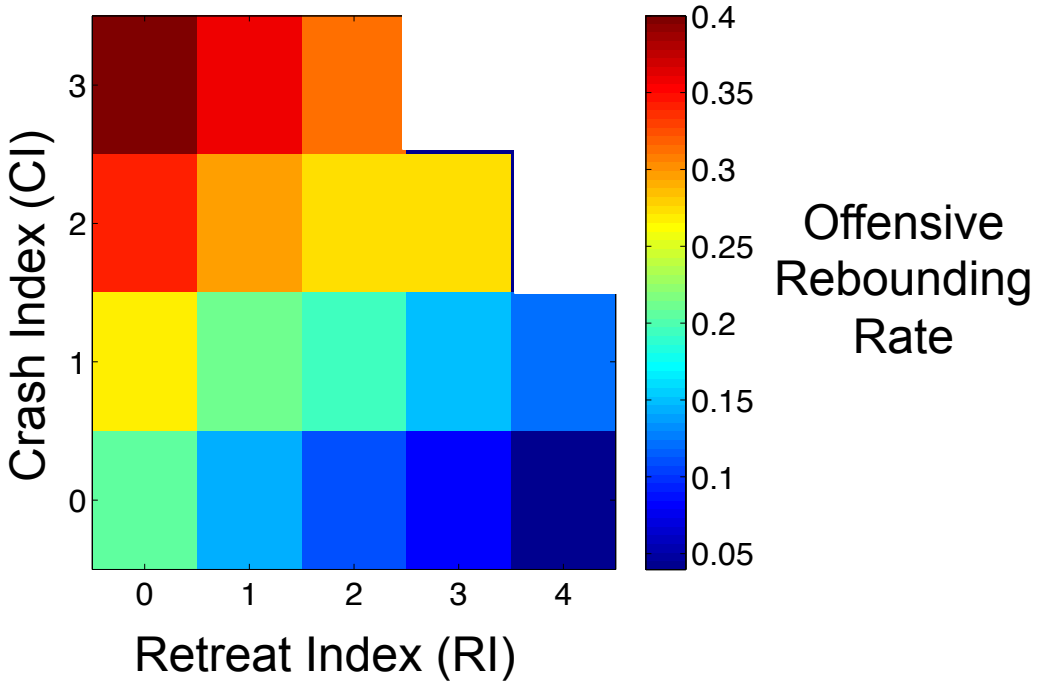
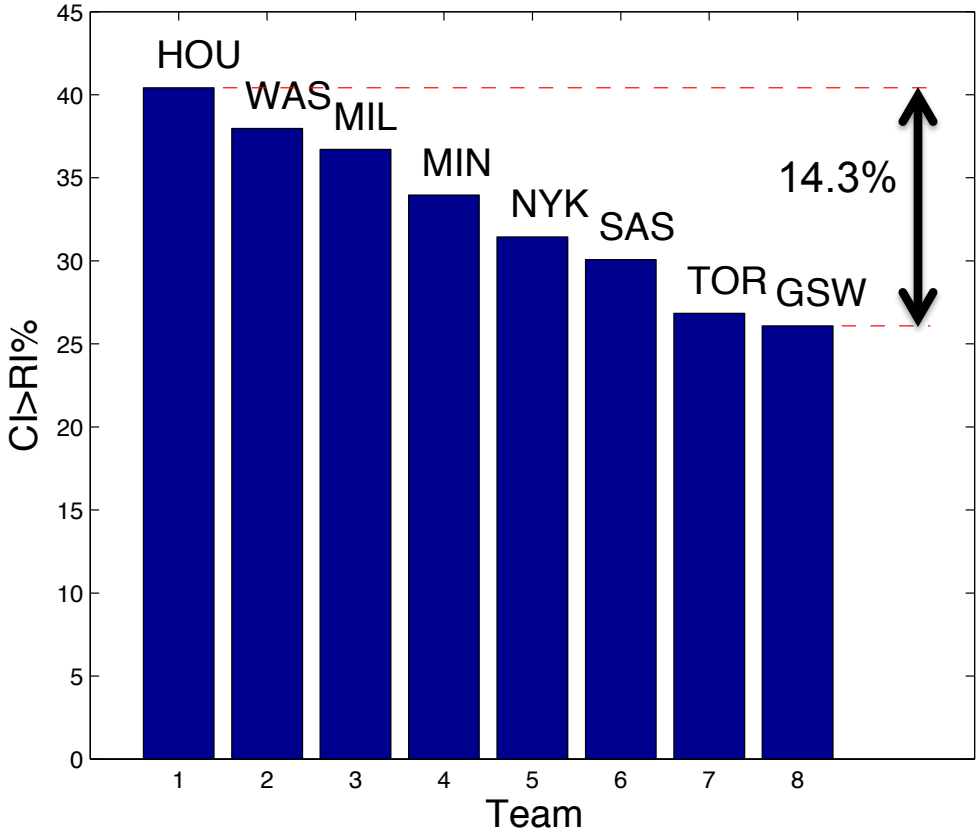


How CI & RI relate to the Offensive Rebounding Rate



Different Teams Had Different Philosophies



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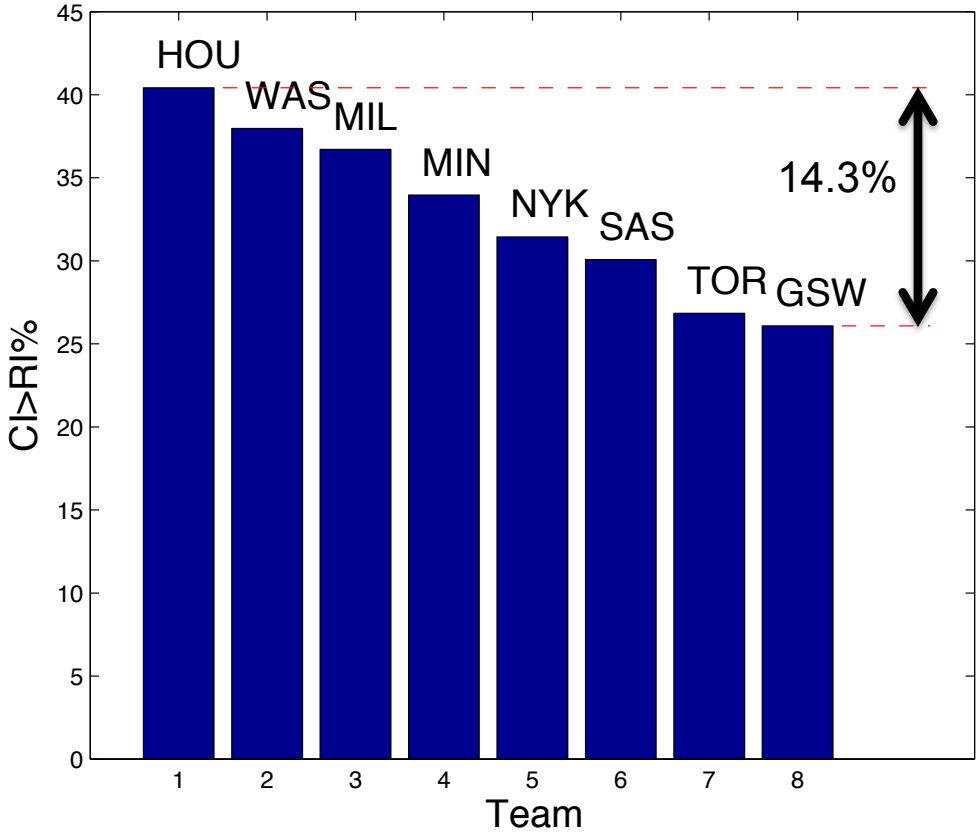

The data show that more often than not teams send more players to retreat than to crash—despite adverse impact on offensive rebounding.

What are teams gaining by getting back on D?

We consider all missed shots that result in a defensive rebound by the other team, and the outcome of the **ensuing** possession:

Yes, retreating helps.

We consider all missed shots that result in a defensive rebound by the other team, and the outcome of the **ensuing** possession:

Possessions where *RI*≥*2* have **4 times the odds** of preventing a *transition* score compared to possessions where *RI*<*2*.

Net Gain on a missed jump shot

Net Gain on a missed jump shot

$$= P(\text{off reb}) \times E[\text{pts for}] - P(\text{def reb}) \times E[\text{pts against}]$$

Net Gain Broken Down by CI/RI

Net Gain = P(off reb)×E[pts for] – P(def reb) ×E[pts against]

Retreat Index \ Crash Index	1	2
1	-0.53	-0.45
2	-0.62	-0.46

Net Gain Broken Down by CI/RI

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Retreat Index \ Crash Index	1	2
1	-0.53	-0.45
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Gain Per Missed Jump Shot

= -0.45pts - (-0.62pts)

= 0.17pts

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Gain Per Game
= 0.17pts * (# of missed j's)

Gain Per Missed Jump Shot

= -0.45pts - (-0.62pts)

= 0.17pts

Gain Per Game

= 0.17pts * (# of missed j's)

= 0.17pts * 25

= 4.25pts

Gain Per Missed Jump Shot

= -0.45pts - (-0.62pts)

= 0.17pts

Gain Per Game

= 0.17pts * (# of missed j's)

= 0.17pts * 25

= 4.25pts

Net Gain Broken Down by CI/RI

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Swapping the role of a single player from retreat to crash can result in approx. +4pts per game.

Caveat #1 – Personnel Matters

Depending on the personnel on the floor…

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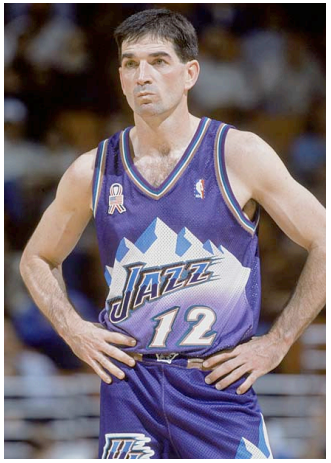

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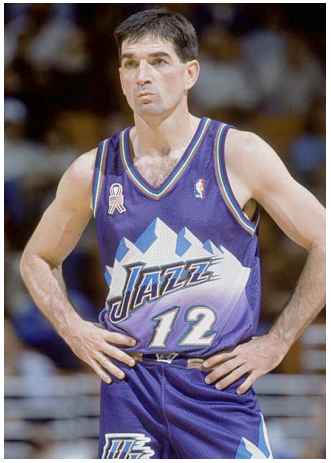
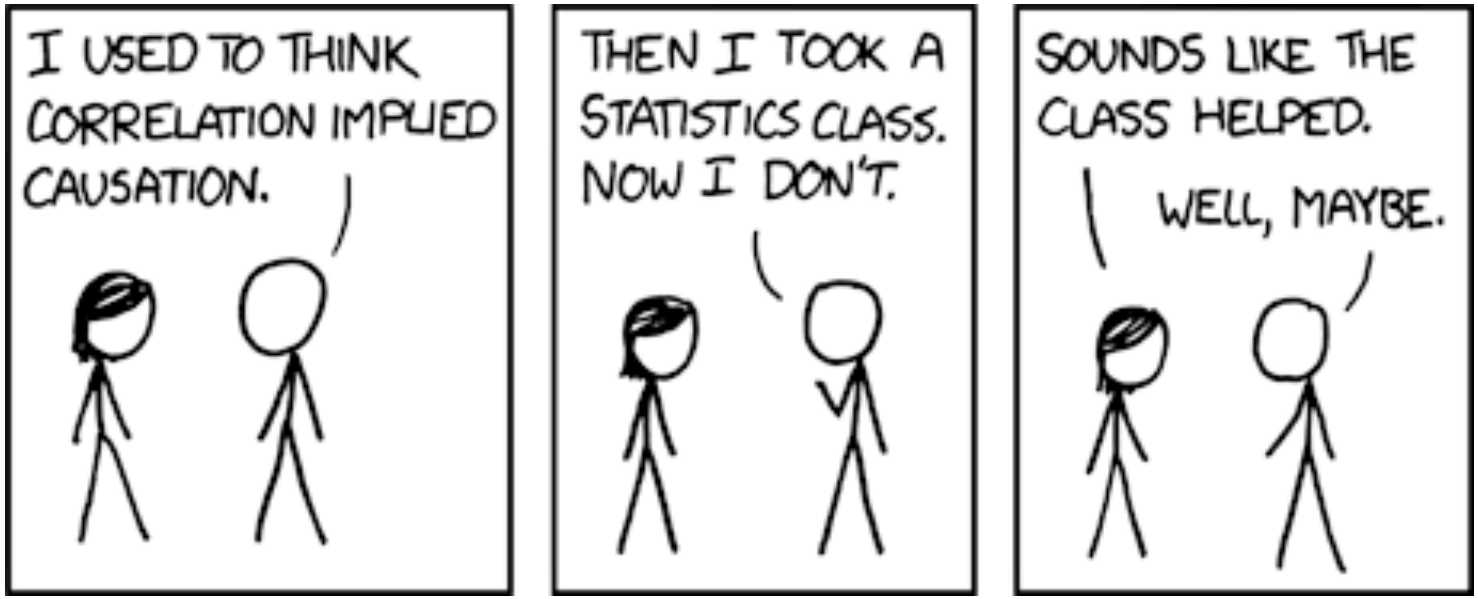


…sending players to crash or retreat may have a different expected outcome.

Caveat #2 – Association not Causation



Credit: xkcd

Backpedaling on D

It’s not enough to just get back…

Backpedaling on D

…you need to be **ready** to neutralize threats!

Maximum Distance to Early Threats

Maximum Distance to Early Threats

See paper for details.

Conclusion

Both philosophies are valid, but attacking the offensive boards aggressively seems to pay off.