Fatigue & Performance

Team Trackr

problem statement

Physical and mental fatigue have always been a major complication when it comes to basketball. Underperformance and injuries could result when players are pushing themselves too far. The **current substitution system is subjective**, and it lacks awareness to efficiently track players' fatigue levels.

fatigue

/fəˈtēg/
extreme tiredness, typically resulting from mental or physical exertion or illness.

results of fatigue

physical

- Muscle activity
- EMG amplitude
- Force production

&

mental

- Decreased concentration
- Mental errors
- Sluggishness

fatigue at highest level

Lebron James

NBA Finals ‘17	Speed (mph)	Distance (mi)	Drives
1st Quarter	4.17	0.78	7
4th Quarter	3.76	0.56	4
Loss in Efficiency	15% slower	30% less distance	43% less drives

Primary Research

Todd Kelly

Head Coach for Men's Basketball

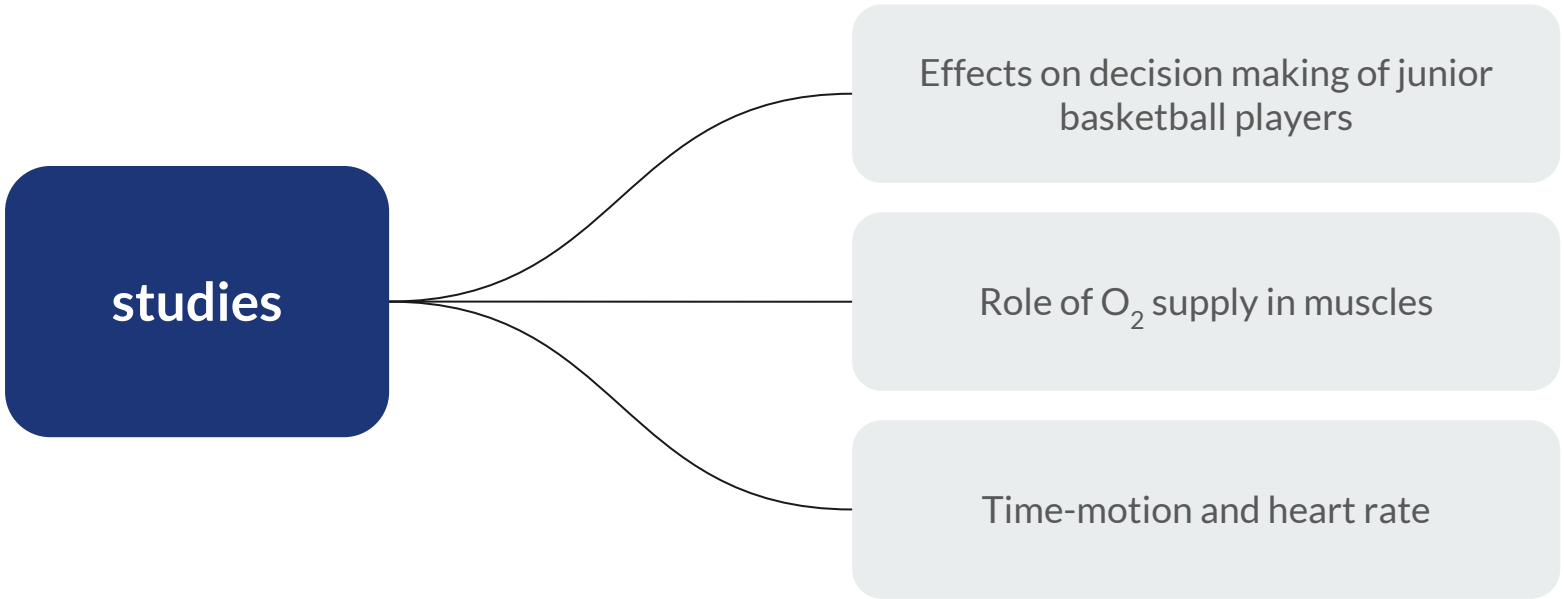
"... the best player's 75% may be better than the fifth player's 100%"

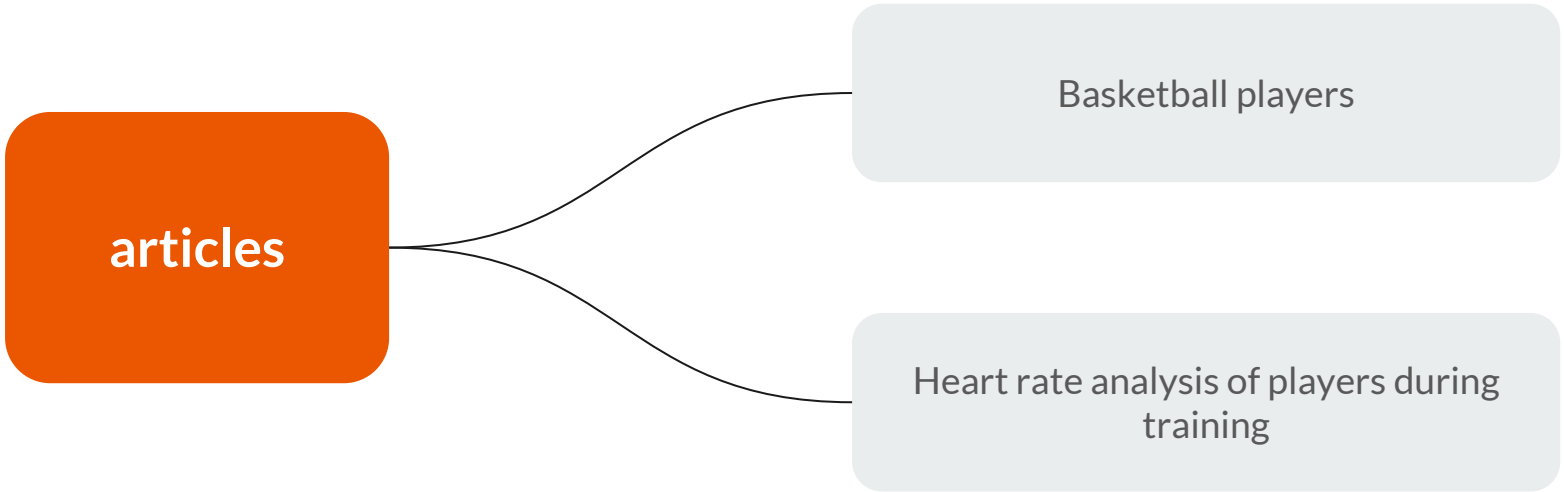
Joe Rekruciak

Head Athletic Trainer

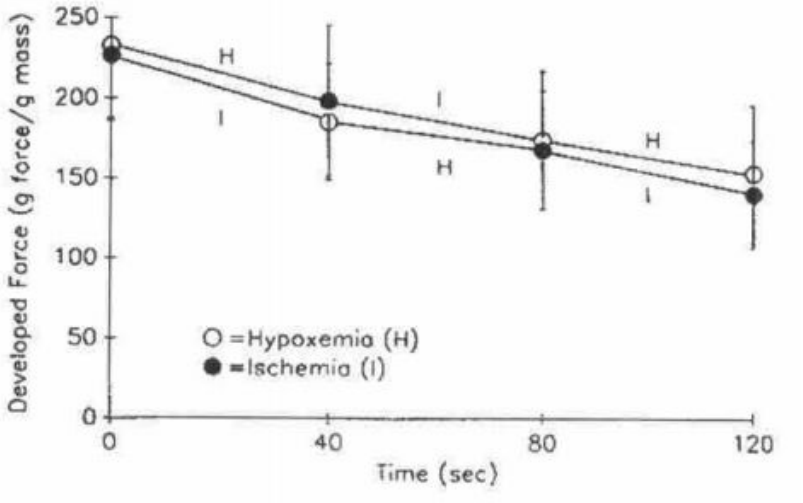
"... measuring the actual strength that the muscles puts out."

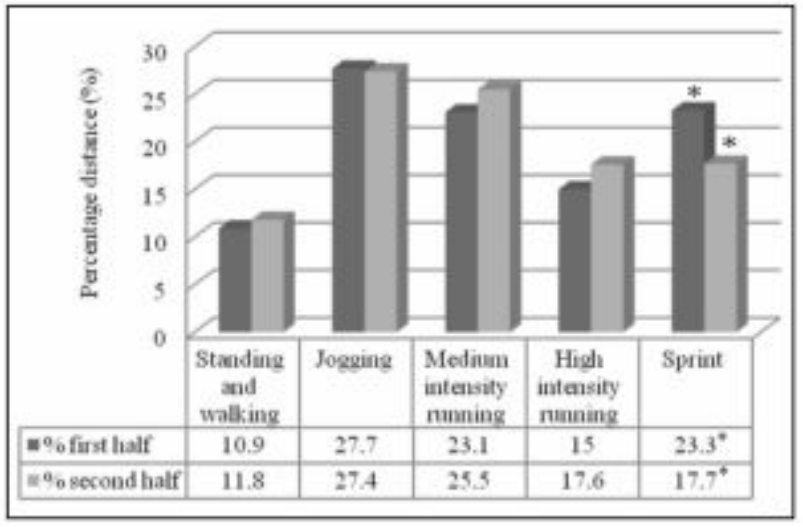
Secondary Research


studies
Effects on decision making of junior basketball players
Role of O_2 supply in muscles
Time-motion and heart rate


articles
Basketball players
Heart rate analysis of players during training

statistics



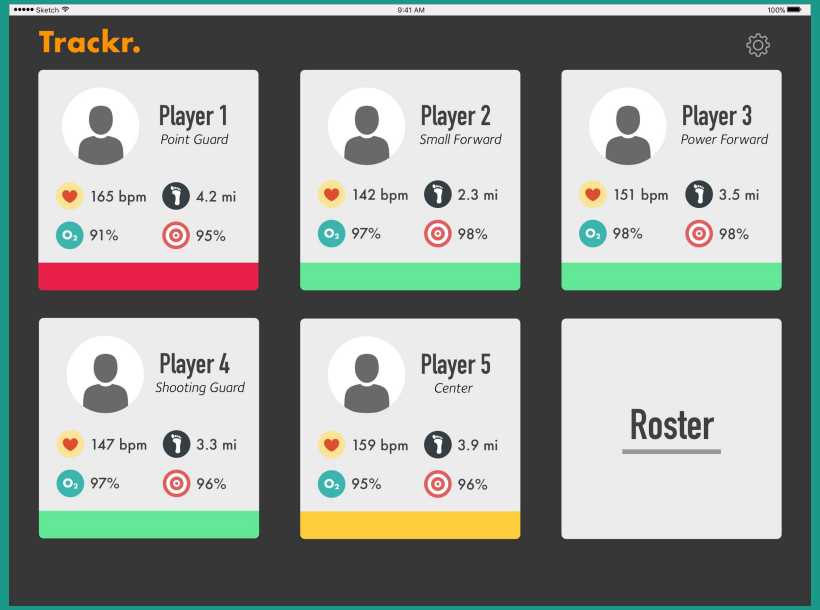


	Standing and walking	Jogging	Medium intensity running	High intensity running	Sprint
■% first half	10.9	27.7	23.1	15	23.3*
■% second half	11.8	27.4	25.5	17.6	17.7*

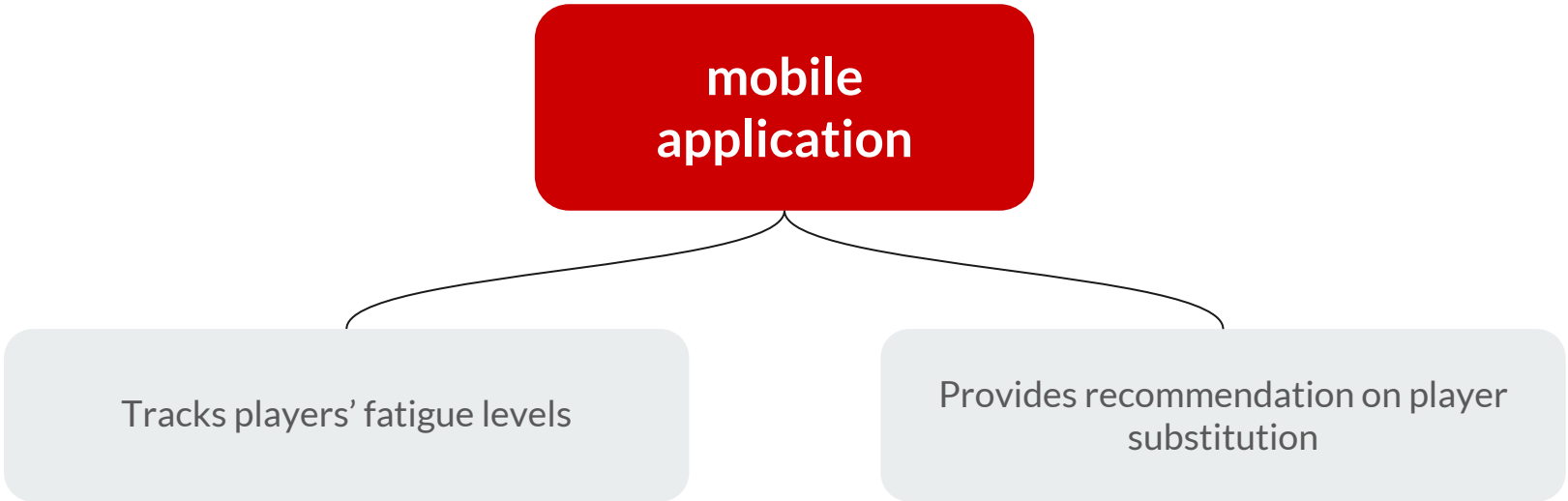
stakeholders

- Coaching staff
- School’s athletic reputation
- Player’s long term career
- Player’s families

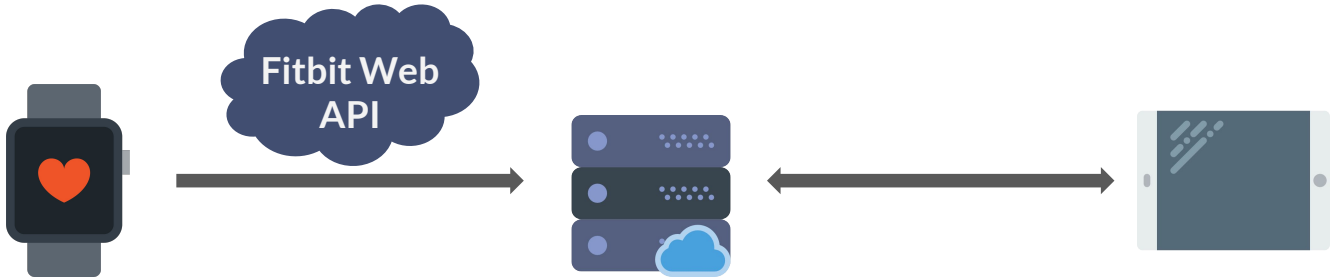
Our Solution – Trackr



What is it?


mobile application
Tracks players' fatigue levels
Provides recommendation on player substitution

Application Architecture



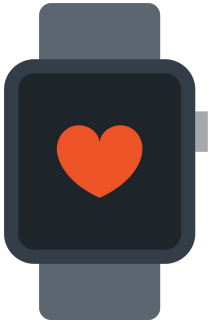
Data Collection

Data Processing & Modeling

Application

Data Collection – Why Fitbit?

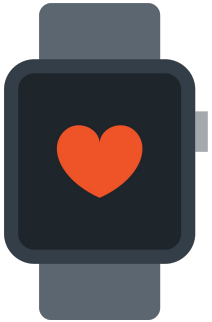
- Syncs every time you open the app or;
  Periodically throughout the day
- Provides down to minute-by-minute or even second level data
- Also, because we had one 😅



Fitbit

Data Collection – Types of Data

- Heart rate
- Speed
- Distance
- Vertical jumps*
- Number of shots**

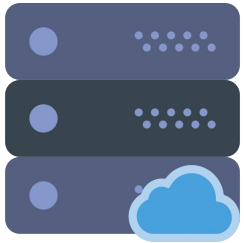


Fitbit

** via third party application*
*** collected manually*

Data Processing

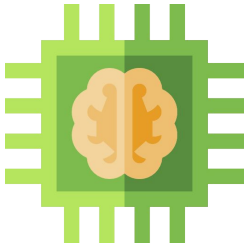
- Amazon Web Service (AWS) Instances
  - AWS S3
  - AWS ML
- Data Pipelining
  - Sanitization
  - Transformation



AWS

Modeling (Initial)

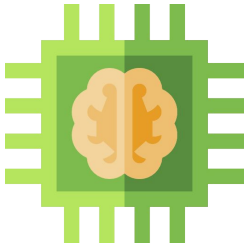
- Threshold setting
  - Manual
  - Inefficient
  - Naive



ML Model

Modeling (Current)

- Logistic Regression
  - Rank similar players together
  - Objective feedback
  - Automation
    - No biasness
- Cron schedule



ML Model

Sketch 9:41 AM 100%

Trackr.

S. Curry
Point Guard

189 bpm | 4.2 mi
91% | 95%

L. James
Small Forward

142 bpm | 2.3 mi
97% | 98%

T. Duncan
Power Forward

151 bpm | 3.5 mi
98% | 98%

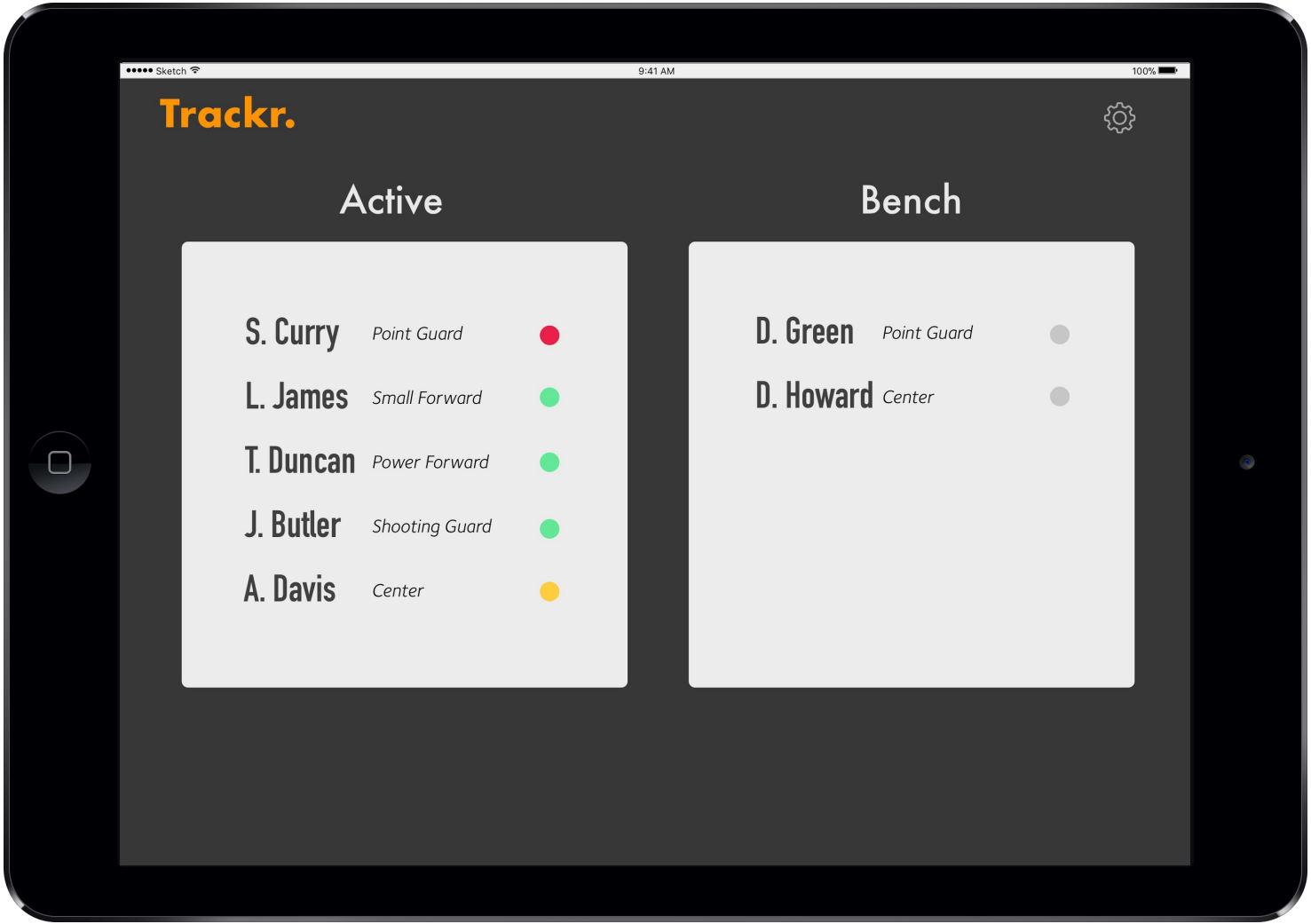
J. Butler
Shooting Guard

147 bpm | 3.3 mi
97% | 96%

A. Davis
Center

159 bpm | 3.9 mi
95% | 96%

Roster


Sketch
9:41 AM
100%
Trackr.
Active
S. Curry Point Guard
L. James Small Forward
T. Duncan Power Forward
J. Butler Shooting Guard
A. Davis Center
Bench
D. Green Point Guard
D. Howard Center

Sketch 9:41 AM 100%

Trackr.

Stephen Curry

Point Guard

Height: 6 ft 3 in (191m)

Weight: 190 lb (86kg)

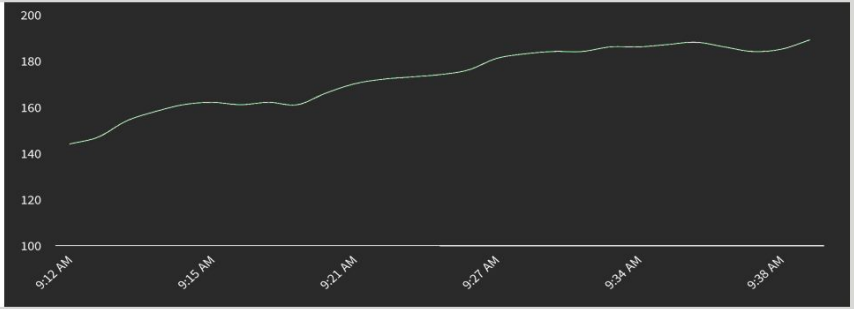
Heart Rate

Current

189 bpm

Average

147 bpm



SWAP PLAYER

Sketch 9:41 AM 100%

Trackr.

Stephen Curry

Point Guard

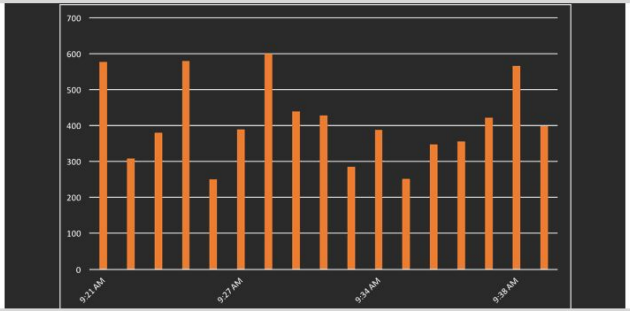
Height: 6 ft 3 in (191m)

Weight: 190 lb (86kg)

Footsteps

Current
5026

Average
3972



Distance Ran

Current
4.2 mi

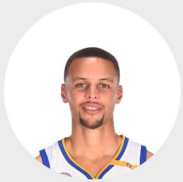
Average
3.4 mi

SWAP PLAYER

Sketch 9:41 AM 100%

Trackr.

Recommended Substitution



S. Curry

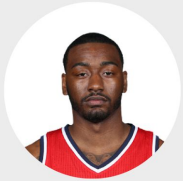
Point Guard

189 bpm

4.2 mi

O_2 91%

95%



J. Wall

Point Forward

80 bpm

0.1 mi

O_2 99%

98%

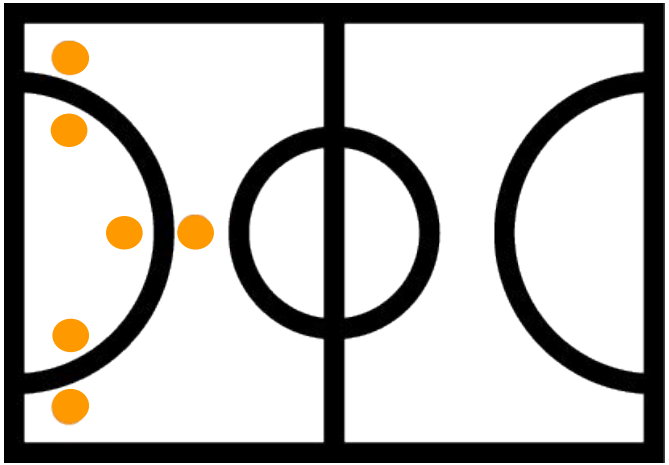
SWAP

Experiment (basketball)

In-game simulation test

1. 6 shooting positions on the basketball court
2. Sprint
3. Measure variables
4. Repeat

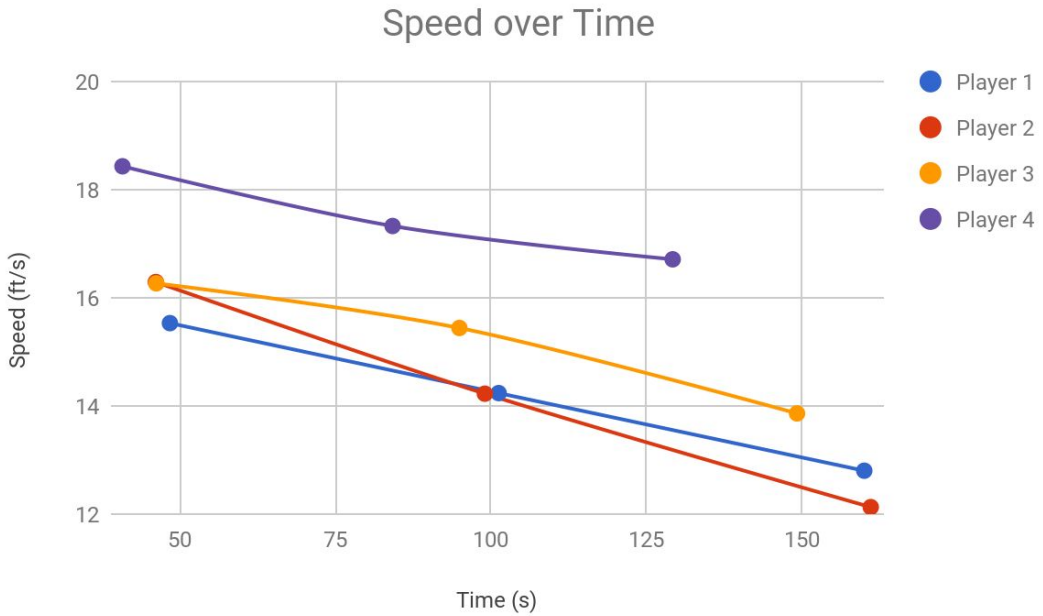
Note:
Each player to do 3 sets.



Shooting positions are colored in orange.

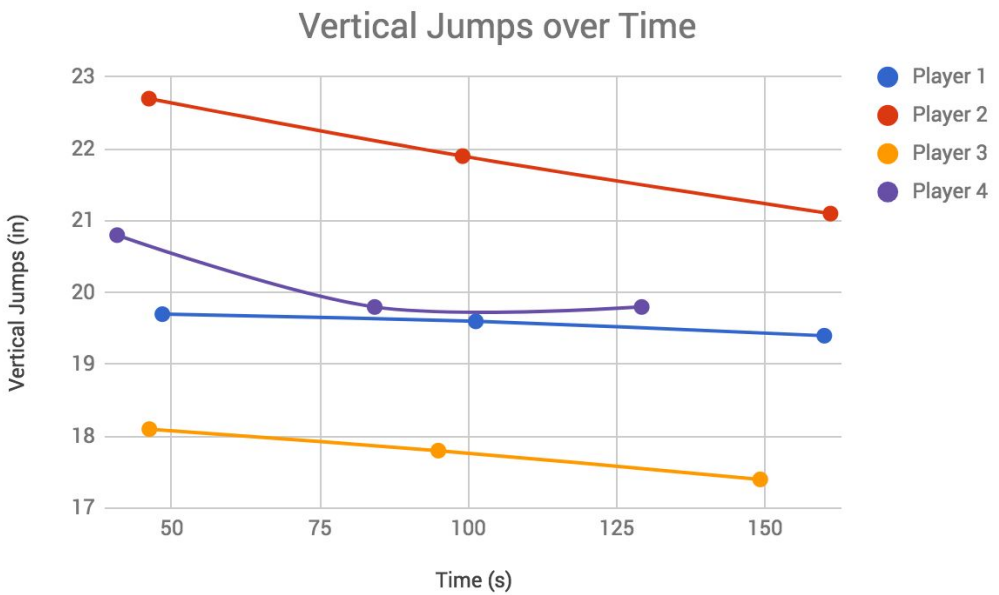
results

- General decline trend
- **Average slower by 17%**



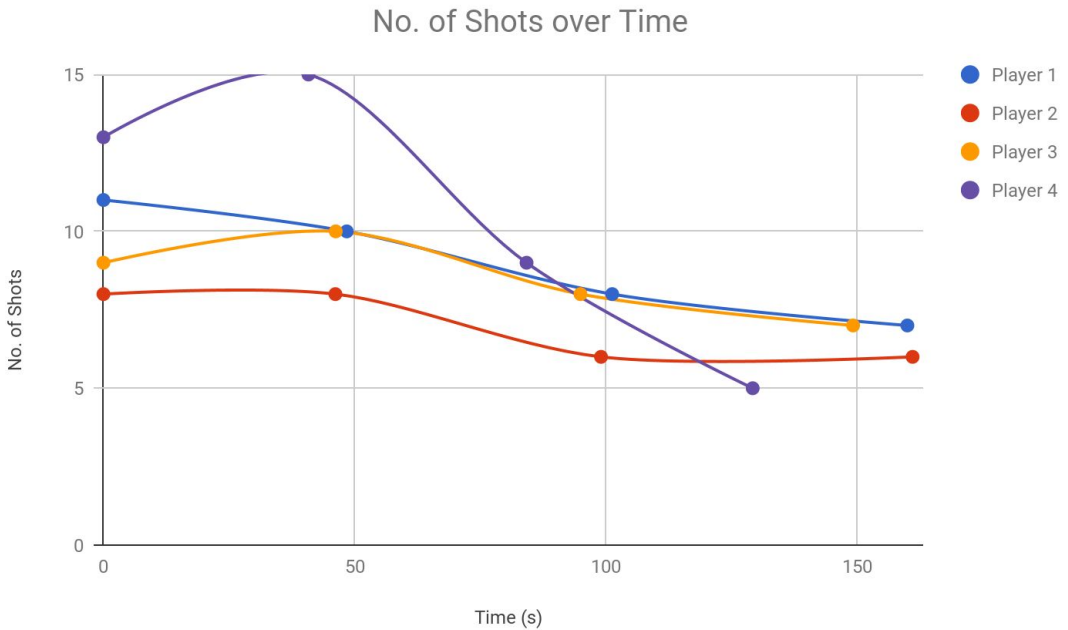
results (cont.)

- **Average vertical jumps decreased 1.5” inches**



results (cont.)

- **Average no. of shots made decreased by 4**



future plans

In-house monitoring device

New features

Partnerships


more available at
github.com/sztoo/trackr
INTERPROFESSIONAL
PROJECTS PROGRAM
Date: November 17, 2017
Pay to the order of: Trackr
$1,000
One Thousand and 0/100
Dollars
Memo: Track 9
IPRO Day Fall 2017
Jeremy Alexis Director of IPRO