

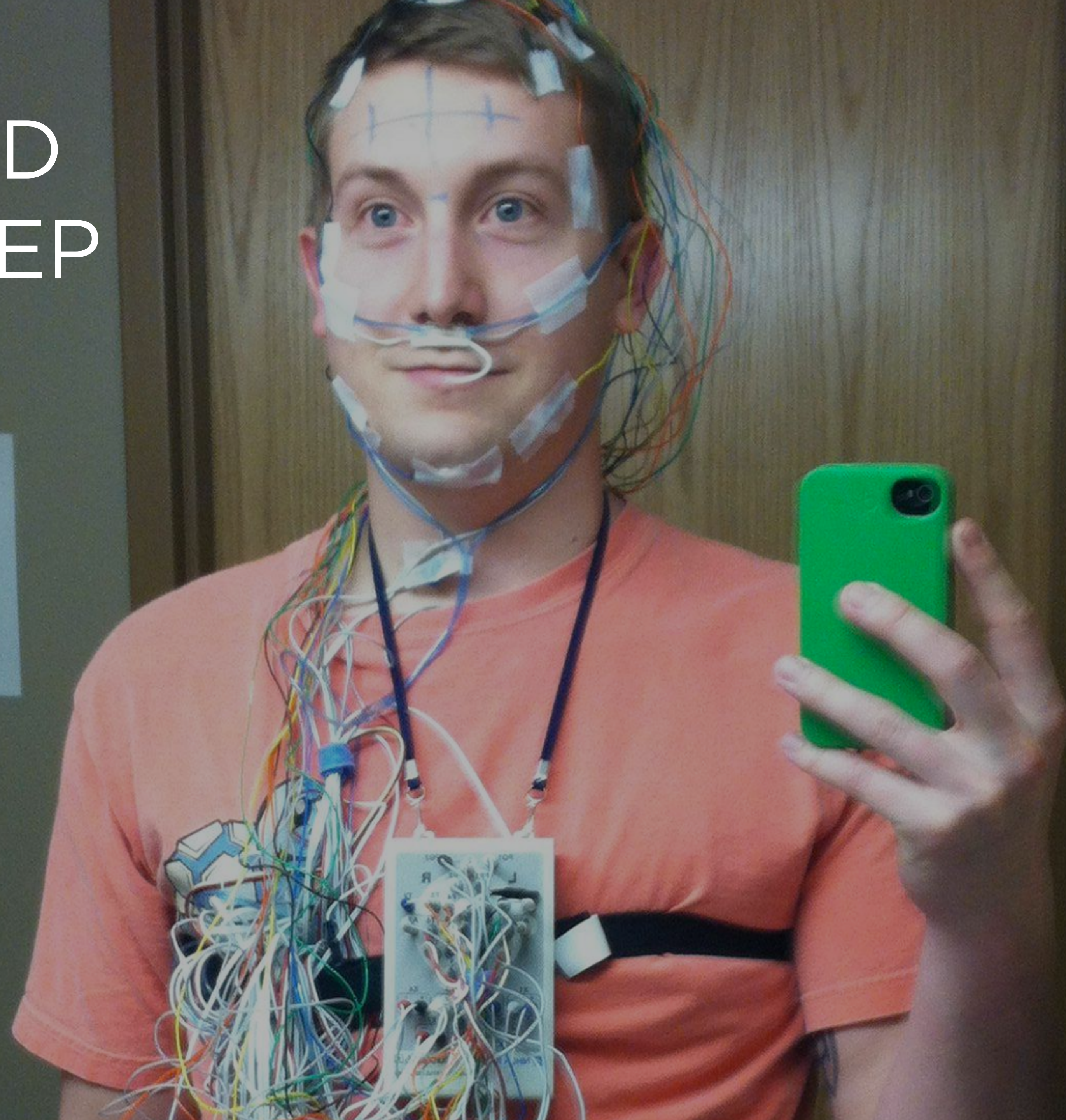
BINGO! DINO DNA!

HEALTH IDENTITY FROM THE WRIST

BRIAN WILT HEAD OF DATA SCIENCE AND ANALYTICS
 @BRIANWILT

NOV 18 2015

“THEY TOLD
ME TO SLEEP
NORMAL”







**BRIDGING
SCIENCE AND
ENGINEERING**





UP 3

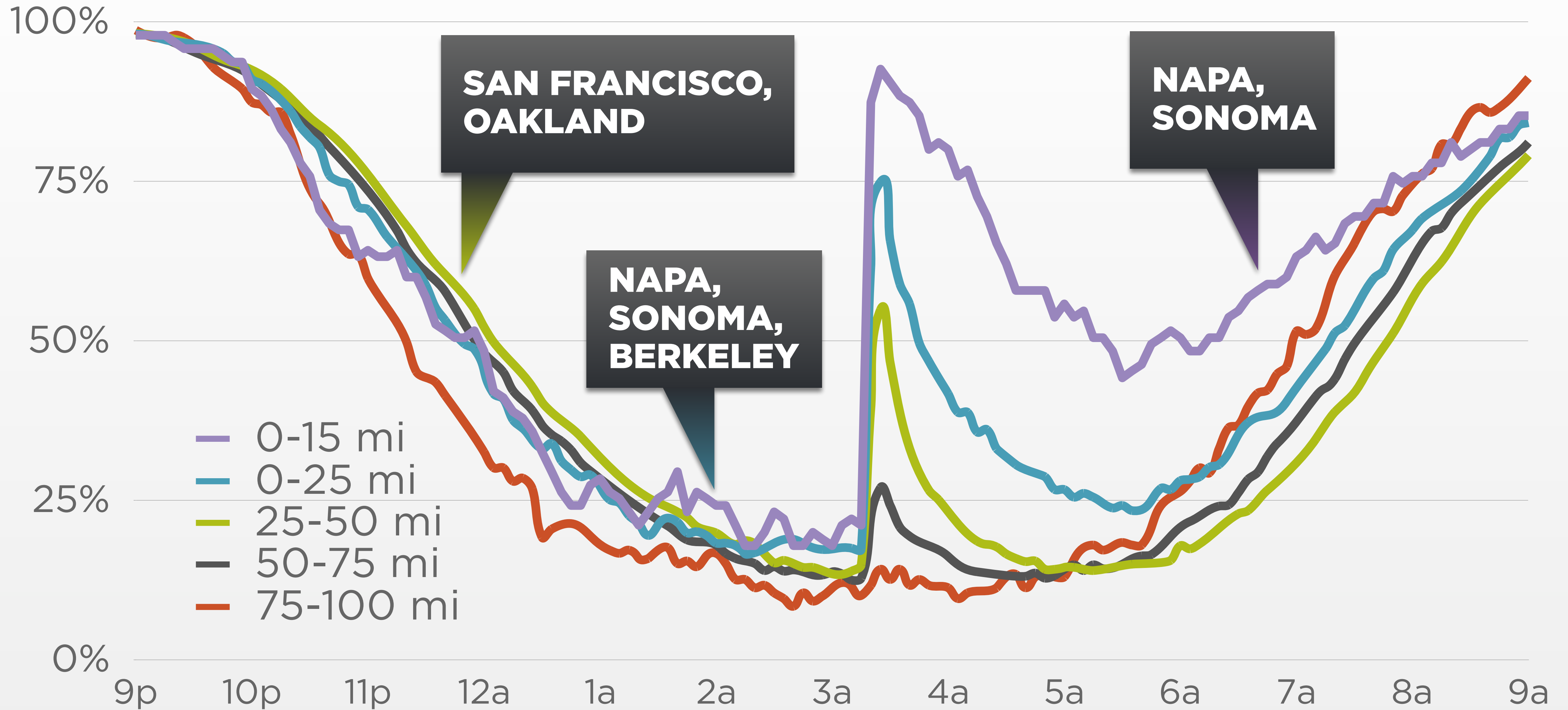
ROLE OF DATA+ML AT **JAWBONE**

- SCIENCE
- PERSONALIZATION
- MOTIVATION



**SCIENCE: UNDERSTANDING
THINGS NEVER BEFORE SEEN**

SOUTH NAPA EARTHQUAKE



HEALTH WITH SHARED CONTEXT IN REAL TIME



A photograph of a modern building's exterior. In the foreground, a concrete planter box is filled with lush green plants. To the right, a tree trunk is visible. In the background, a yellow taxi cab is parked on a paved area. The overall scene is brightly lit, suggesting daytime.

**PERSONALIZATION: AN
EXPERIENCE THAT KNOWS YOU**

<re/code>

RISE OF THE DATA NATIVES

MONICA ROGATI

YouTube was abuzz with viral videos of small children — yet to speak, read or write — “pinching” magazine articles with their fingers as they would an iPad. These children were heralded as [...] **“digital natives”**.

[Now is a] new revolution, this time of **“data natives”** who **expect their world to be “smart”** and **seamlessly adapt to them and their taste** and habits.





Johnny V @johhnnyv · 10m

By far my favorite app is #UP by @Jawbone. It's insights like these from #smartcoach that help me stay on track.

SMART COACH

Routine Strong

Smart Coach noticed that you've been consistently working out on Mondays. **Today's 34m** was no exception. Way to build on a healthy habit. Reward yourself.

You are close to maintaining your 7-day, 5,827 step average! Another 263 steps, or a 3m walk, will take you there.

33m ago

7h 40m 34min 1,690 cal to go

TODAY NOV 16

Put Through the Paces

Over the past 7 days your 40,793 steps covered 20.40mi. You averaged 5,827 steps per day. Wednesday was an especially big day for you, clocking in 13,167 steps.

All Activities +

2:04 PM - 16 Nov 2015 · Details



Michael Goodwin @michaelgdwn · Nov 13

Right on cue. Every time I go out #drinking @Jawbone #smartcoach catches me. Time to hit the water tank

SMART COACH

Start with Hydration

This morning's resting heart rate was higher than 58bpm, your 30-day average. Dehydration may be the cause. If you think you were dehydrated last night, make up for it today with 8 glasses of water.



Larry Taylor @lgt41 · 2h

Love this insight from my #SmartCoach! Smart Coach Remembers via UP by @Jawbone jawbone.com/up/insight/rzT...

SMART COACH

Smart Coach Remembers

Remember how you took 13068 steps on Nov 2? Smart Coach remembers! On your health journey, don't forget to stop and celebrate. Tap the Share icon so your friends can send congratulations.

[Learn more](#)



Paul Ritchie @crossderry · Nov 11

An unsurprising insight on the perils of conference life from my #SmartCoach! Sleep Deficit via UP by @Jawbone jawbone.com/up/insight/rzT...

SMART COACH

Sleep Deficit

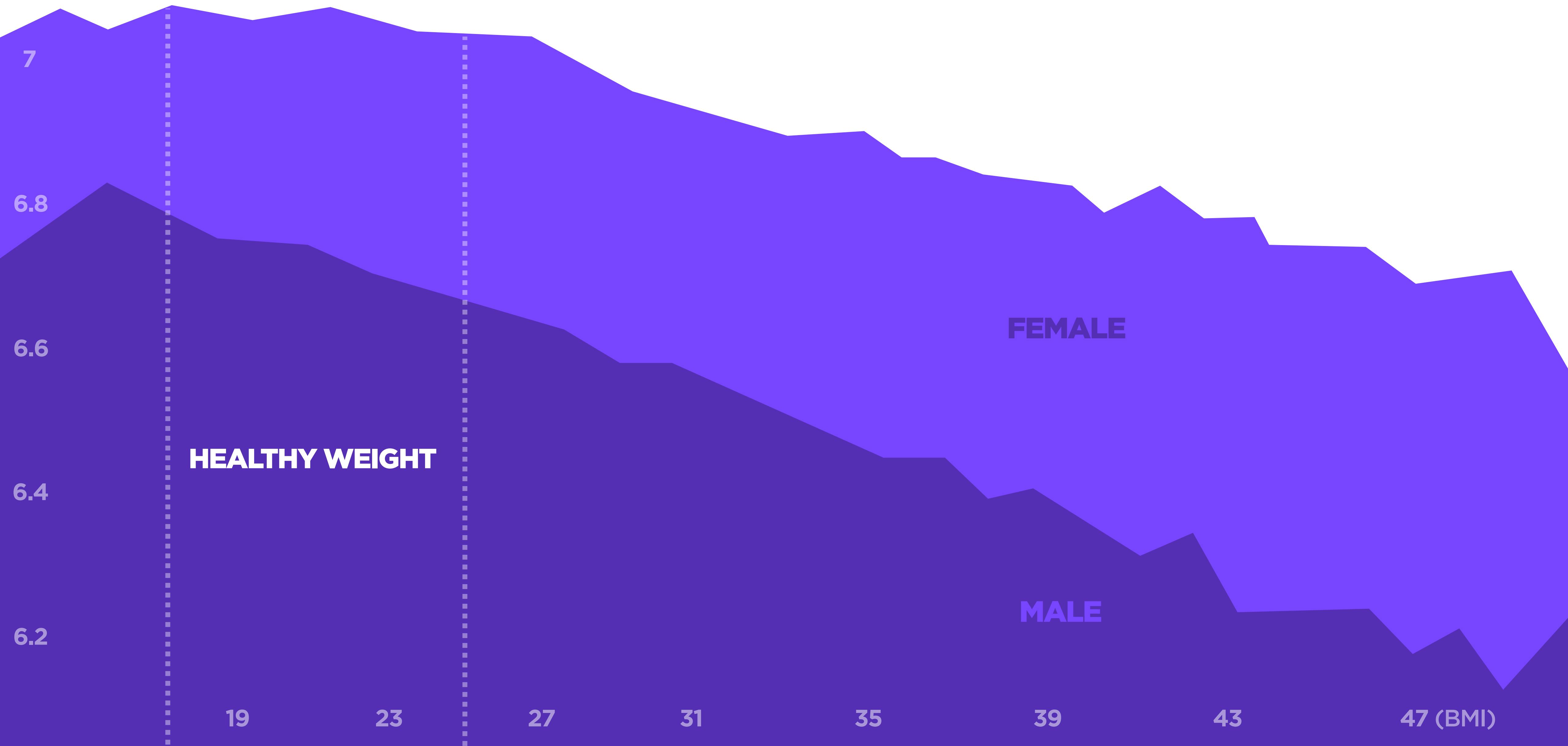
Smart Coach noticed that you haven't slept enough lately, with a 7d average of 4h 58m. Sleeping 4-5 hours for 4 days in a row reduces cognitive function and is equivalent to being legally drunk. For more about how sleep deficit impacts your ability to focus, react and make



**MOTIVATION: A SMART COACH
HELPING YOU LIVE HEALTHIER**

7.2 HRS SLEEP

WEIGHT AFFECTS SLEEP



7

6.8

6.6

6.4

6.2

HEALTHY WEIGHT

FEMALE

MALE

19

23

27

31

35

39

43

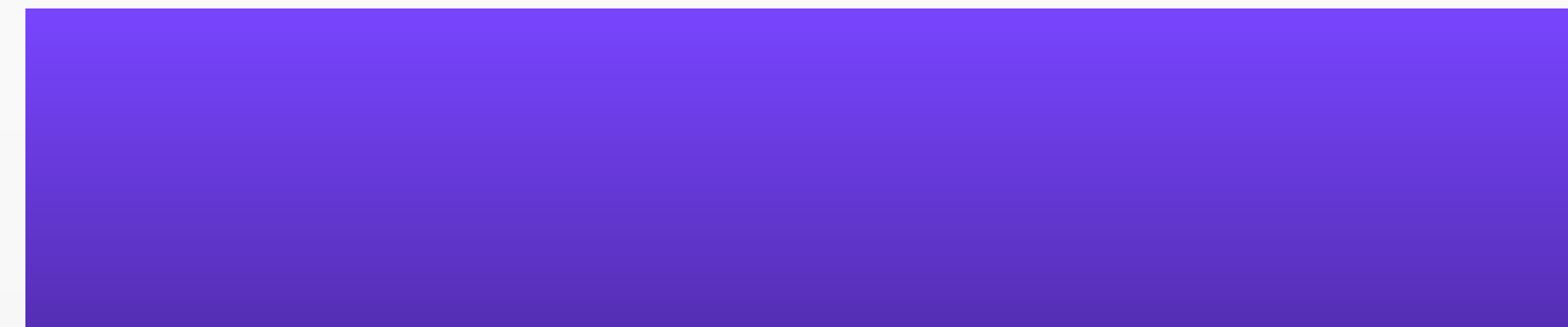
47 (BMI)

UP USERS WITH MAJOR WEIGHT LOSS

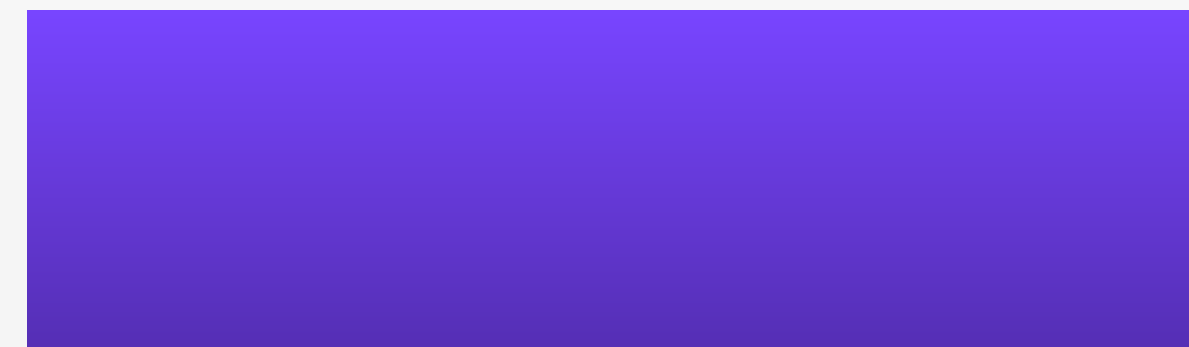
logged 75% more **meals**
per week



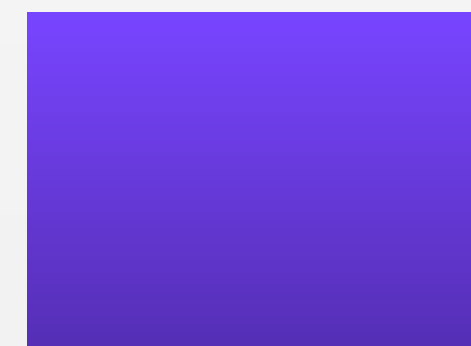
logged 60% more **workouts**
per week



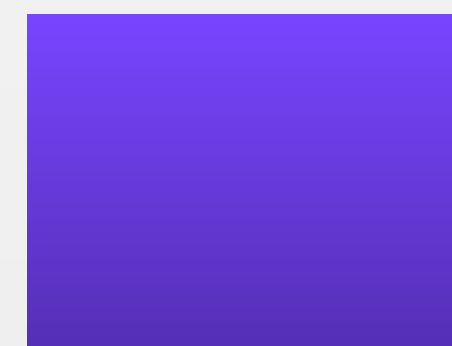
beat their **step goal**
43% more often



averaged 17% more **steps**
per day

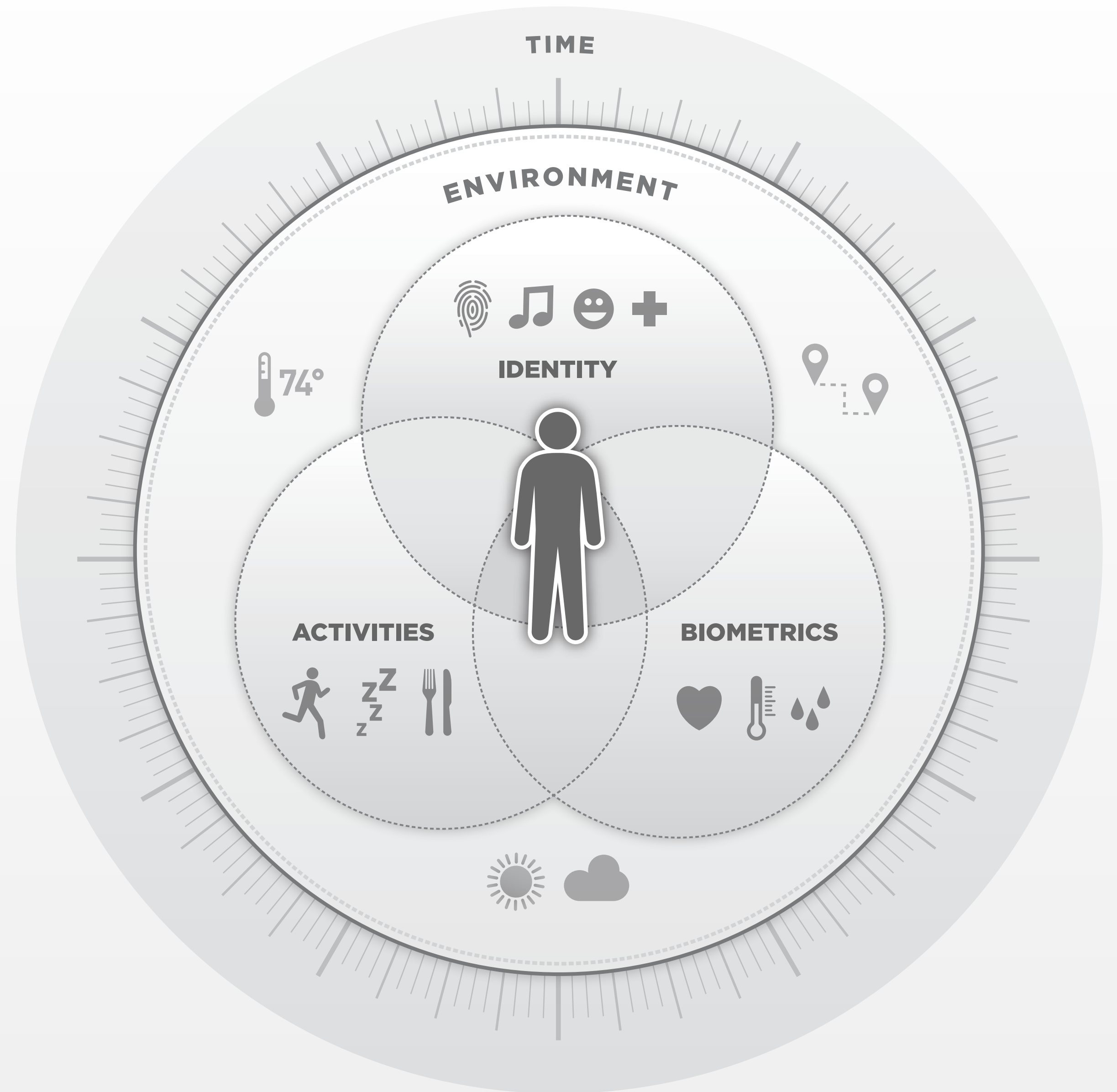


logged 16% more **weigh-ins**
per week



24/7 DATA

A COMPLETE PICTURE OF YOU
FULLY CONTEXTUALIZED



HOW DO WE MAKE THIS HAPPEN?

DATA PRODUCT ALL-STARS

DATA PRODUCT **ALL-STARS**

**PEOPLE YOU
MAY KNOW**



NEWS FEED



PAGERANK



RELATED ITEMS



DATA PRODUCT **ALL-STARS**

**PEOPLE YOU
MAY KNOW**



NEWS FEED



PAGERANK



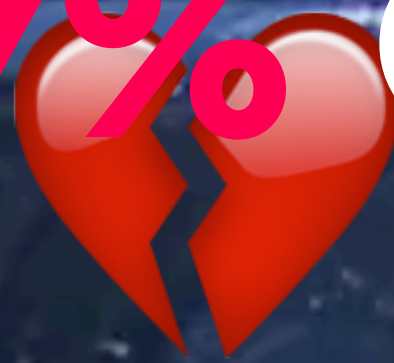
RELATED ITEMS



CTR

CHRONIC DISEASE CARE IS 86% OF US HEALTHCARE COSTS

CARDIOVASCULAR DIABETES
67% OF GYM MEMBERSHIPS



\$193 BN

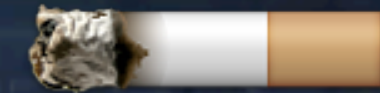


\$176 BN

GO UNUSED
OBESITY CANCER



\$147 BN



\$157 BN

KPCB





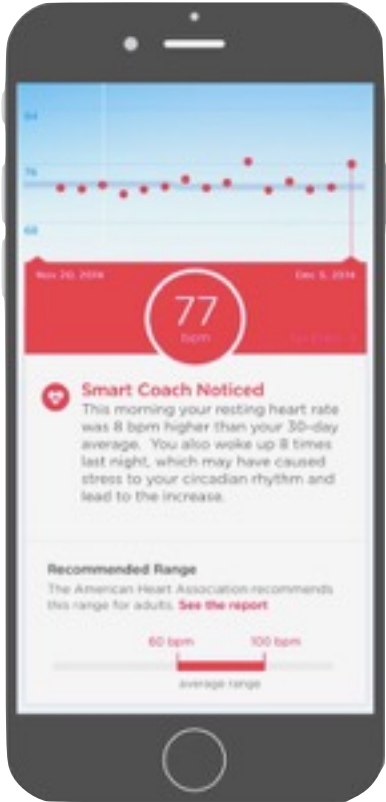
**HOW WILL WE MAKE
HEALTH DATA PRODUCTS?**

**DATA SCIENCE FOR
THE LITTLE GUY**

DATA SCIENCE FOR THE **LITTLE GUY**

PROBLEM	LARGE COMPANY	SMALL COMPANY
PEOPLE	Where do I put my data science team? Vertical/horizontal organization?	Only one or two people LOL
PRODUCT	Established	Nascent
DATA	A mess	A mess
ML	Deep on solving a problem, predictive	Understanding and interpreting

DATA SCIENCE FOR **HARDWARE**



SIGNALS	Raw + Rich	Compressed	Limited
CONTEXT	Limited	Sensor fusion	Historical + Population
USERS	Single	Single	Aggregate
LATENCY	Seconds	Minutes	Slow
COMPUTE	Limited	Powerful	HAL 9000
DEPLOYMENT	Months	Weeks	Hours

ACTIVITY CLASSIFICATION

VERSION 0

MOST COMMON WORKOUT

58% ACCURACY

VERSION 1

LAST WORKOUT

65% ACCURACY

VERSION 2

SERVER-SIDE MODEL

85% ACCURACY

VERSION 3

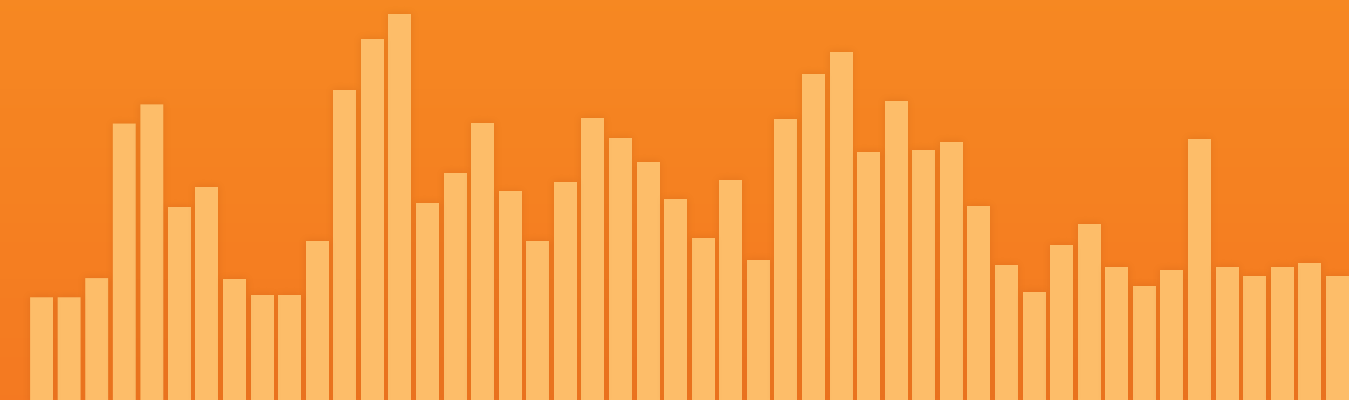
BAND-BASED MODEL

99% ACCURACY



54m activity

+5,972 steps | +50% of goal



Awesome! Looks like you racked up some steps. What were you up to?

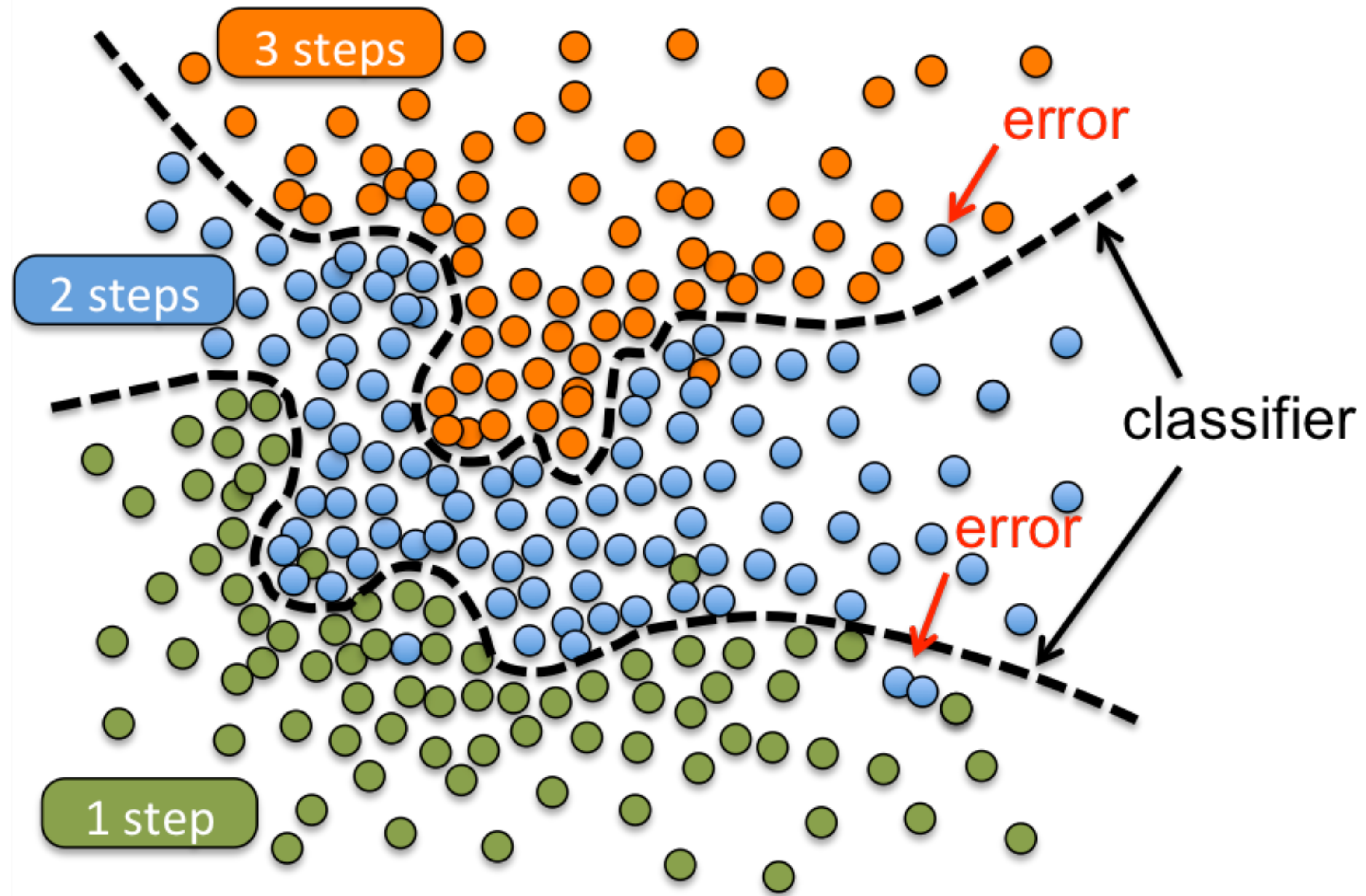
BASKETBALL

TENNIS

ZUMBA

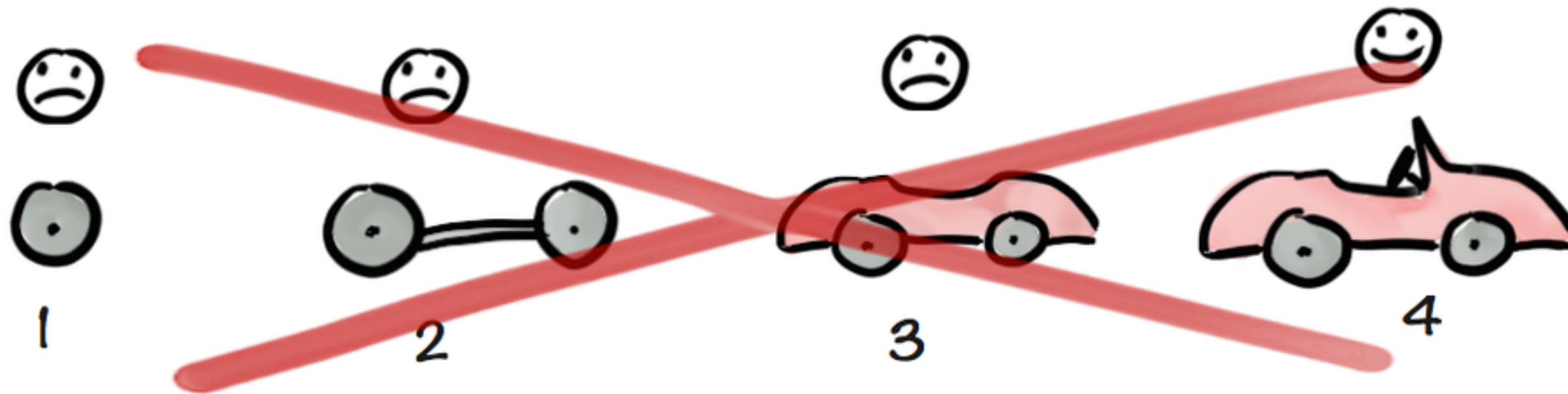
Edit

THE FIRMWARE HAS TO WORK THE **FIRST TIME**

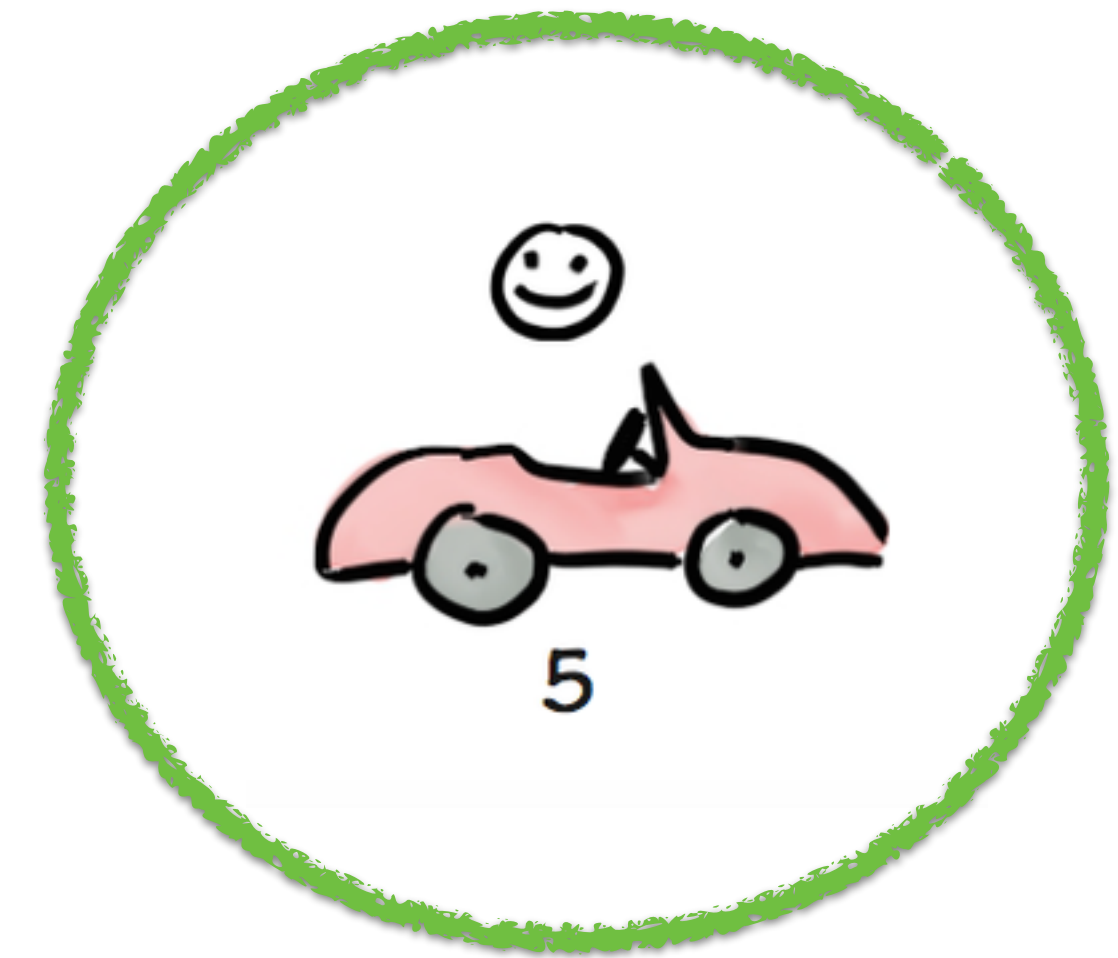
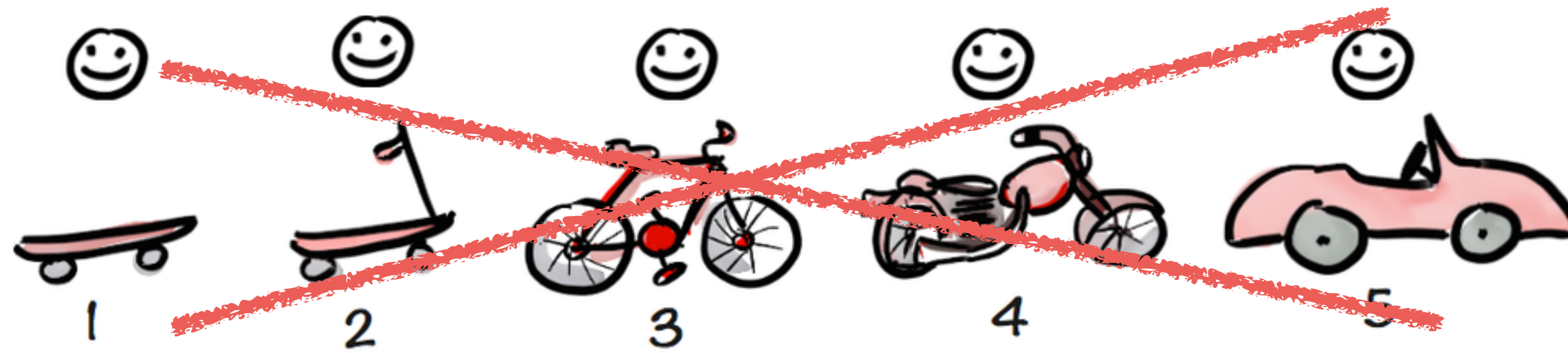


TESLA HAS TO DELIVER THE CAR **FIRST**

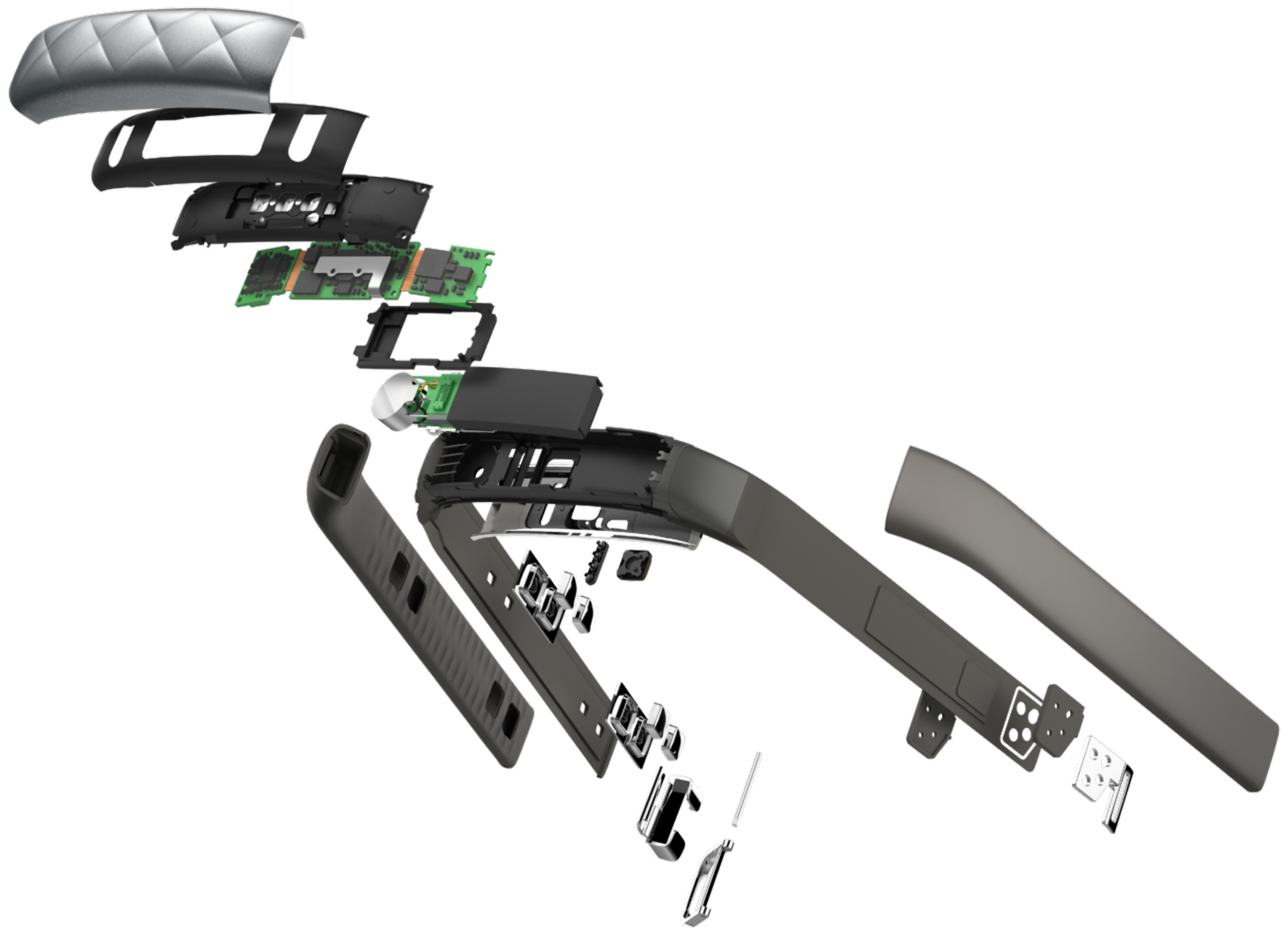
Not like this....



Not like this....



DATA SCIENCE FOR WEARABLES



WE CAN GET **EXPONENTIALLY** MORE FROM THE WRIST



UP
2011

Accelerometer



UP3
2015

Accelerometer
Temperature
GSR
Heart Rate

WE CAN GET **EXPONENTIALLY** MORE FROM THE WRIST



**GERMAN
PEDOMETER**
1590



UP
2011

Accelerometer



UP3
2015

Accelerometer
Temperature
GSR
Heart Rate

Radio Shack AMERICA'S TECHNOLOGY STORE

PRESIDENTS' BIRTHDAY SALE!

 <p>All-Weather Stereo Cut 34% 1188 Reg. 17.95 Realistic STEREO-MATE™ AM/FM personal receiver shrugs off sand, water. #12-142. Headphones extra. See Sale 1/18/91</p>	 <p>AM/FM Clock Radio 30% Off 1388 Reg. 19.95 Chronomatic™-261 clock radio's compact size cuts nightstand clutter. #12-1588. See Sale 1/18/91</p>	 <p>In-Ear Stereo Phones HALF PRICE! 788 Reg. 15.95 Realistic™ in-ear phones weigh just 0.6 ounce! With carry pouch. #33-917. See Sale 1/18/91</p>	 <p>Micro-Thin™ Calculator 39% Off 488 Reg. 7.95 Radio Shack EC-413 is almost the size of a credit card! Solar powered. #65-993. See Sale 1/18/91</p>
--	--	---	--

DON'T DELAY! 3-DAY SPECIALS ABOVE GOOD SATURDAY THRU MONDAY ONLY!

0% INTEREST!
NO PAYMENTS UNTIL MAY!
NO DOWN PAYMENT!
HURRY! OFFER ENDS TUESDAY FEBRUARY 19

COME IN AND TAKE ADVANTAGE OF THESE OTHER FANTASTIC VALUES!

INTRODUCTORY SPECIAL!

Save \$670

\$1599

Low As \$49 Per Month

Reg. Separate Items 2269.95

- 286-Based PC Compatible
- Color Monitor
- 20MB SmartDrive™ Hard Drive
- Easy-to-Use 10-in-1 DeskMate™ Software #25-1803/1043/1045/1338

BONUS PACKAGE

- Lotus Spreadsheet For DeskMate
- DeskMate Q&A Write
- Quicken
- 2-Button Mouse

Mobile Cellular Telephone

Save \$100

\$199*

Low As \$19 Per Month - Reg. 299.00

#17-1076

Deluxe Portable CD Player

Save \$40

15995

Reg. 199.95

Low As \$19 Per Month

Realistic CD-3250 has 15-selection memory. Headphones extra. #42-5017

Tiny Dual-Superhet Radar Detector

Save \$60

7995

Reg. 139.95

Road Patrol™ XX™ detector lets you drive with confidence. Separate X and K-band tones. #22-1421

Compact 10-Channel Desktop Scanner

Save \$30

9995

Reg. 129.95

Low As \$19 Per Month

Realistic PRO-57 lets you catch the news as it happens! Hear police, fire, rail, military, lots more. #30-126

Mobile CB With Channel Controls on Mike

HALF PRICE!

4995

Reg. 99.95

Realistic TRC-430 lets you get highway info or help—you'll never have to drive "alone" again! #21-214

Our Easiest-to-Use Phone Answerer

Cut 17%

4995

Reg. 59.95

DUPHON™ TAD-241 answerer is ready to use—just plug it in. Has built-in announcement. #43-292

VHS Camcorder

Save \$100

\$799

Low As \$29 Per Month - Reg. 899.00

Realistic Model 102 includes video light for indoor shooting. 2-lux sensitivity. With accessories. #16-903

3-Way Speaker With Massive 15" Woofer

Save \$110

14995

Each

Low As \$19 Per Month - Reg. 259.95

Optimus Mach Two™ system pumps out bass you can feel. 4" horn tweeter, 5" midrange. #43-4032

20-Memory Speed-Dial Phone

Cut 33%

2995

Reg. 44.95

Radio Shack ET-292 Bell-Phone™ is ideal for home or office. Tone/pulse. #43-581. Answer. #43-582

Handheld Voice-Actuated Cassette Tape Recorder

40% Off

2995

Reg. 49.95

Realistic CTR-85 makes an excellent "notetaker" for students, secretaries or executives. #14-1056

THE IPHONE MOMENT IS COMING



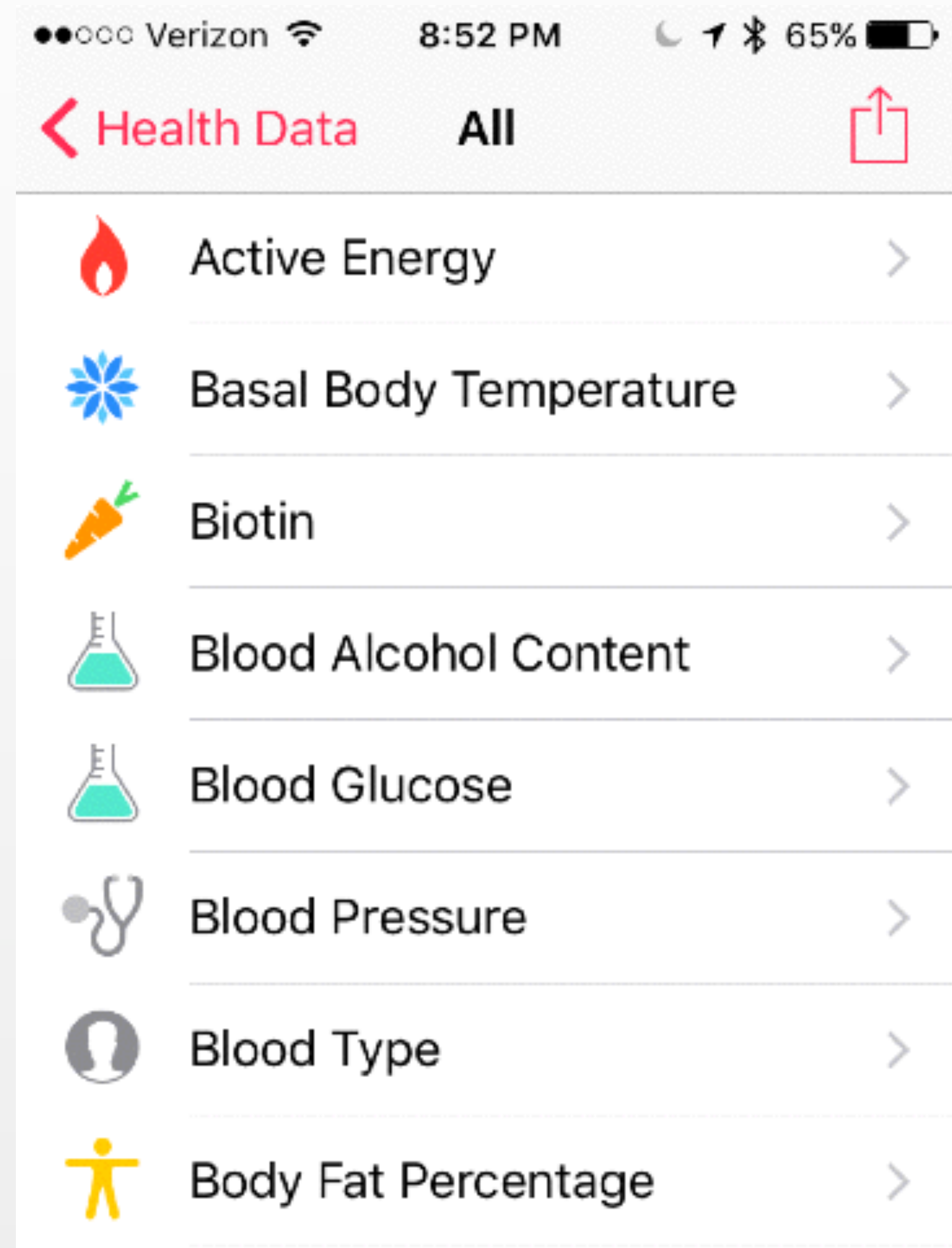
STEPS 4.1T

SLEEP 330M

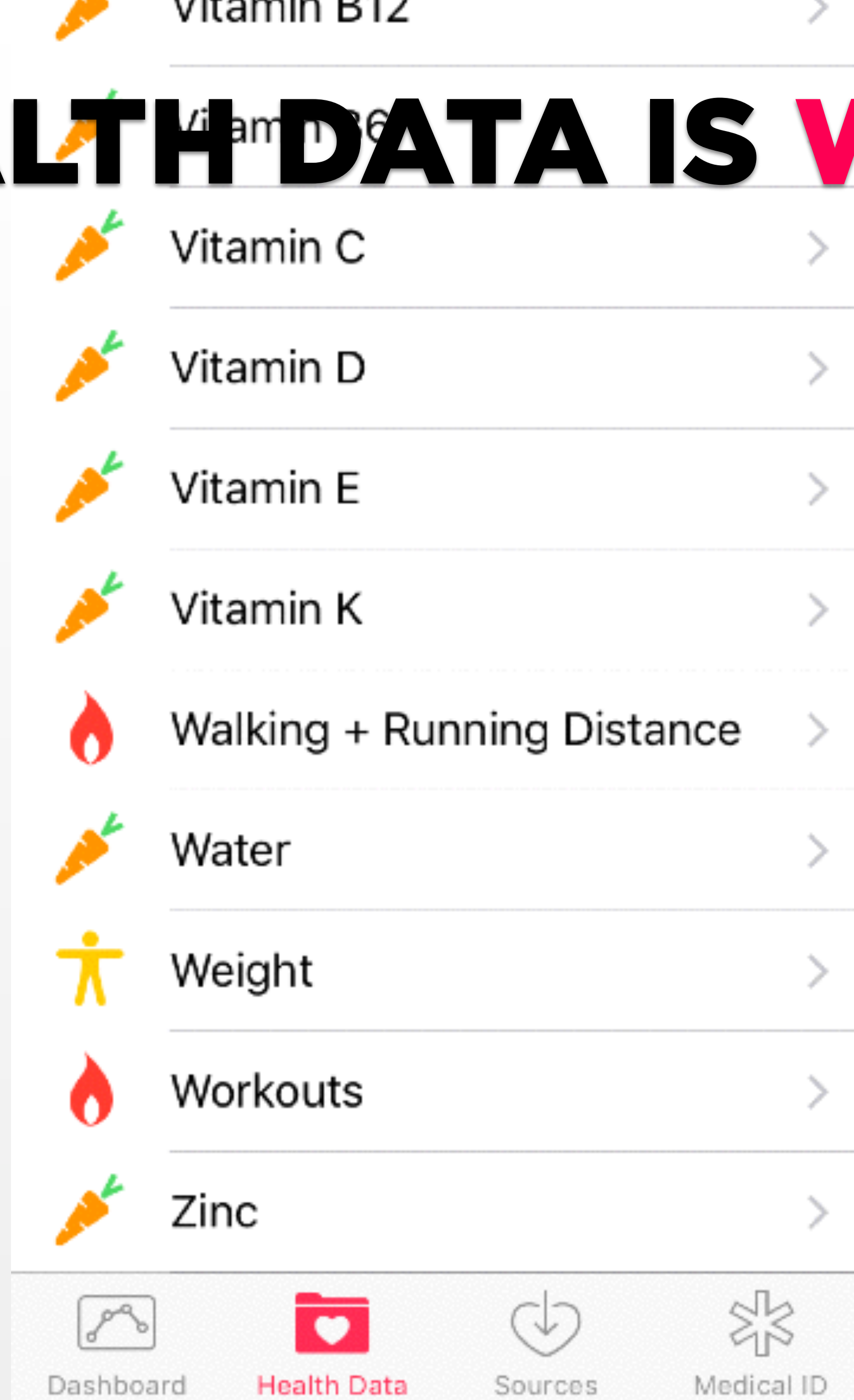
MEALS 270M

WORKOUTS 100M

HEALTH DATA IS WIDE



HEALTH DATA IS WIDE

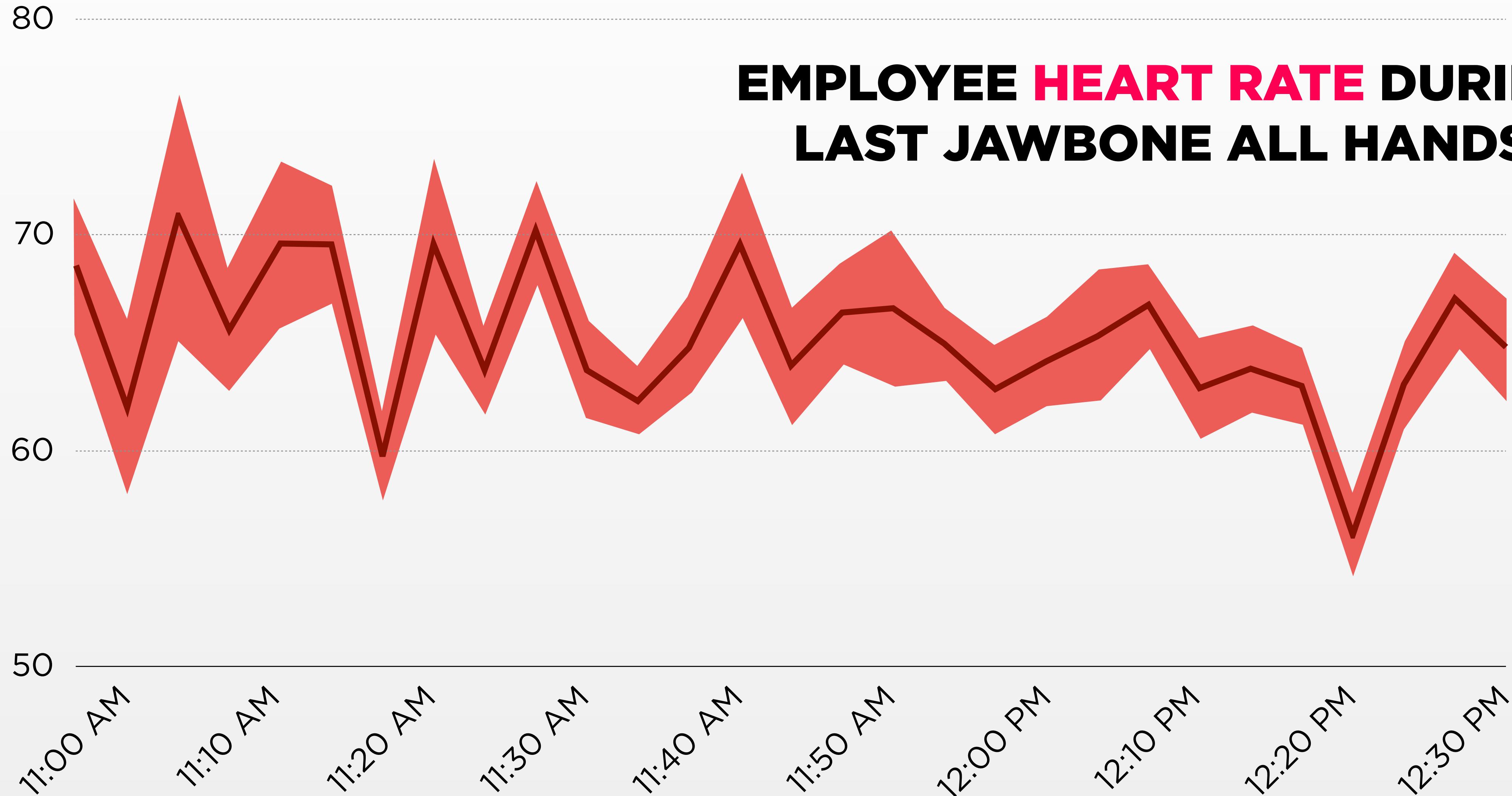


BUT WIDE DATA TAKES MORE CLEANING

- **CLEAN EARLY AND OFTEN**
- **APIS ARE HARD**
- **BETTER TOOLS ARE NEEDED**
- **ML IS NAIVE**

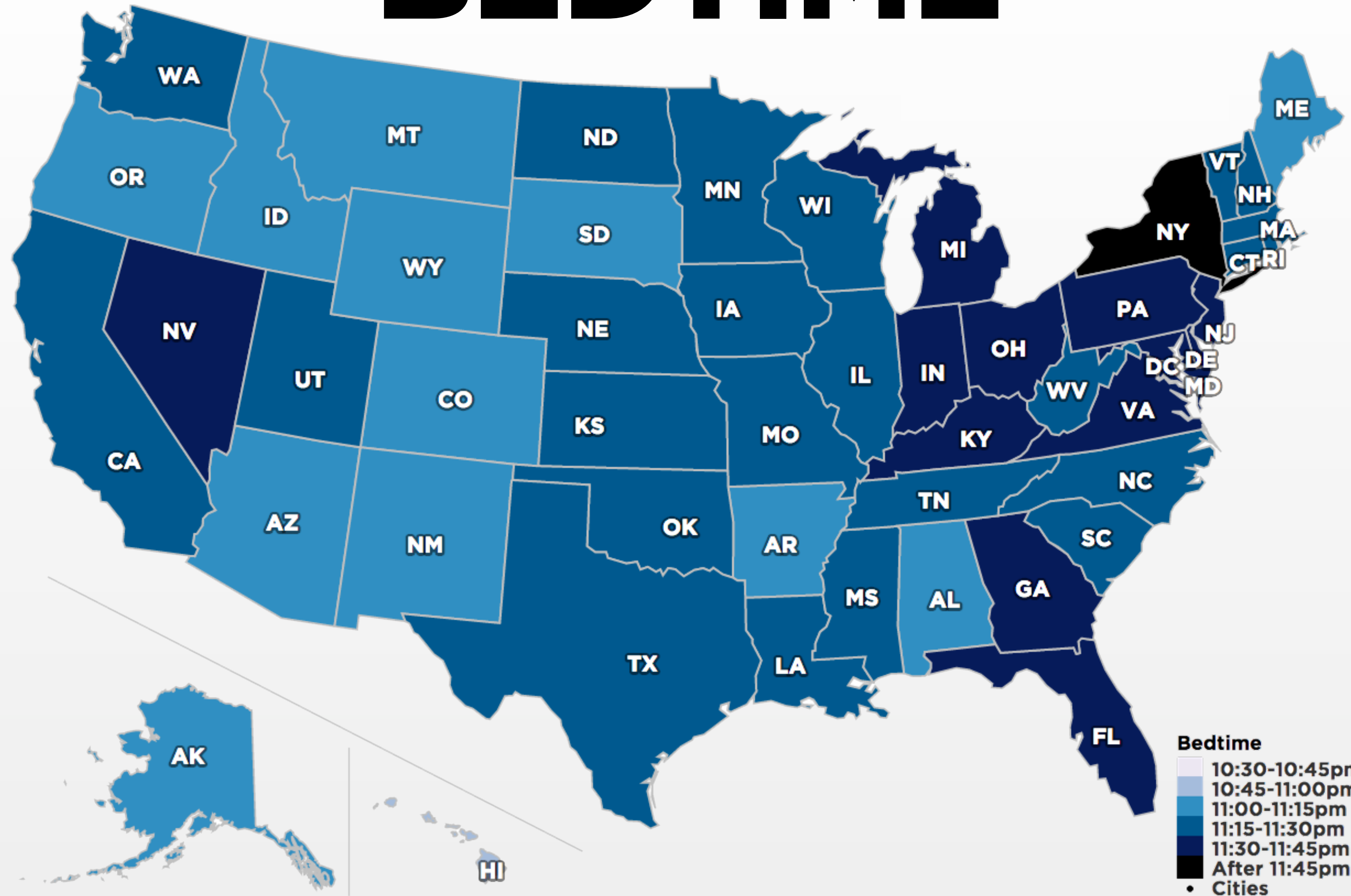
CONTEXT IS KING

EMPLOYEE HEART RATE DURING LAST JAWBONE ALL HANDS

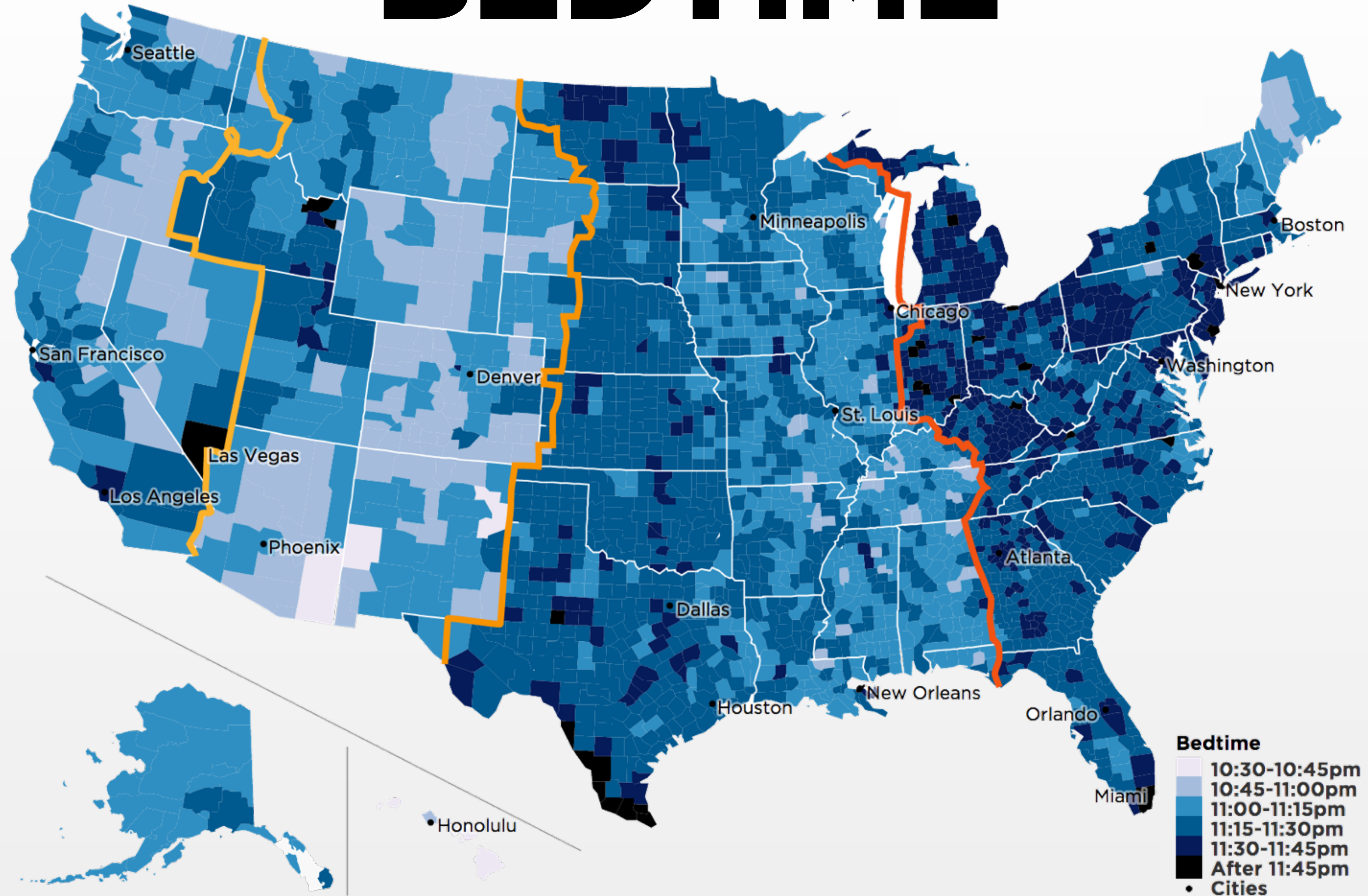


SCALE
GRACEFULLY

BEDTIME

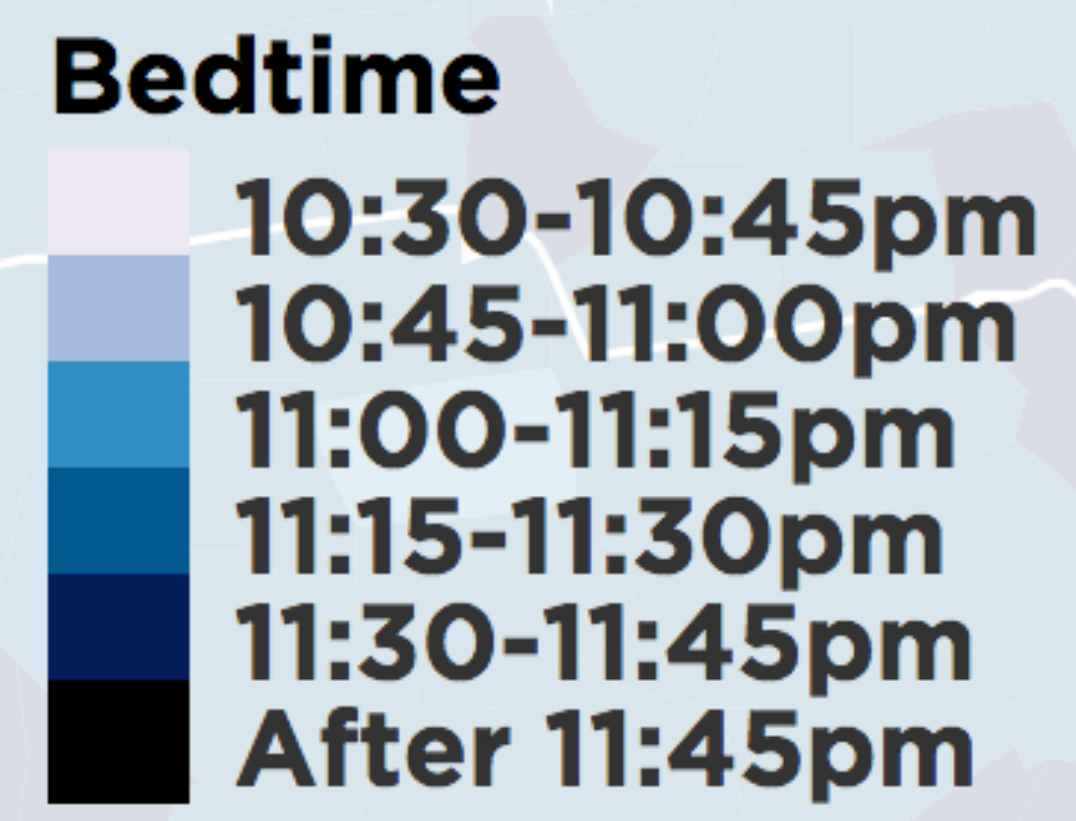


BEDTIME

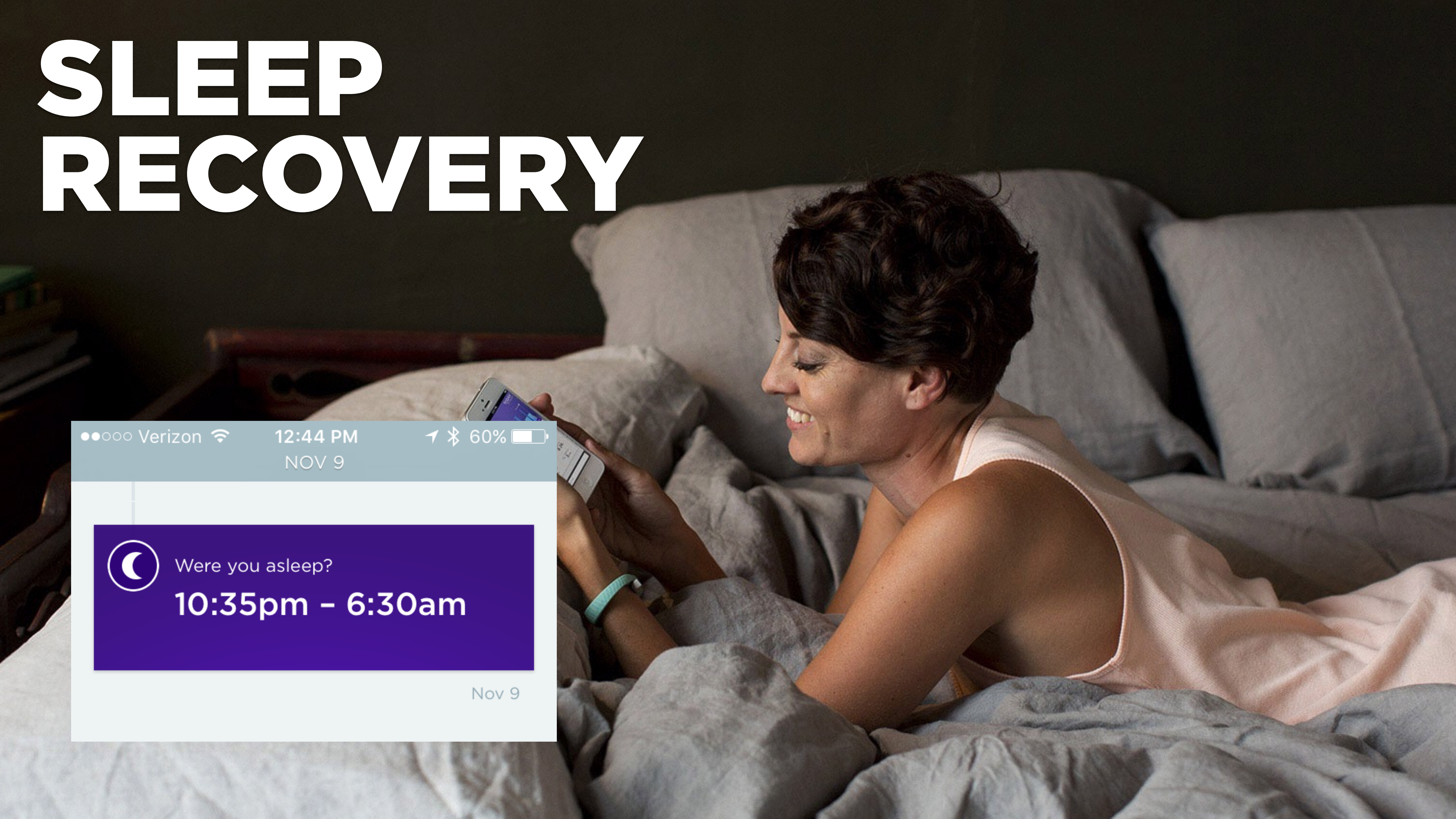


JAWBONE


16 MIN



SLEEP RECOVERY




●●○○ Verizon 12:44 PM 60%
NOV 9

 Were you asleep?
10:35pm – 6:30am

Nov 9

BUT WHAT ABOUT DATA
WE CAN'T GET

- 
- **API INTEGRATIONS**
 - **BAYESIAN INFERENCE**
 - **PUBLIC WHO/CENSUS DATA**
 - **USER DATA**
 - **UNSTRUCTURED TEXT**
 - **CREATIVITY**
 - **HIRING**

A group of people, including a man in a blue shirt and a woman in a red shirt, are gathered around a large, flat rock in a forest. They appear to be looking at a map or a large piece of paper on the rock. The background is filled with trees and sunlight filtering through the leaves.

**DATA PRODUCTS SCALE
HUMAN JUDGMENT.**

THEY ALSO SCALE AND
REINFORCE HUMAN BIAS.

@CLARECORTHELL



Bloomberg

TOKYO'S WORKERS GET LESS SLEEP THAN US, ASIAN COUNTERPARTS

KANOKO MATSUYAMA (2011)

Tokyo office workers slept at least 30 minutes less than their counterparts in New York, Paris, Shanghai and Stockholm each night, averaging six hours, or 14 percent less than the recommended minimum, a study said.

The study surveyed 180 men and women from each of the five cities.

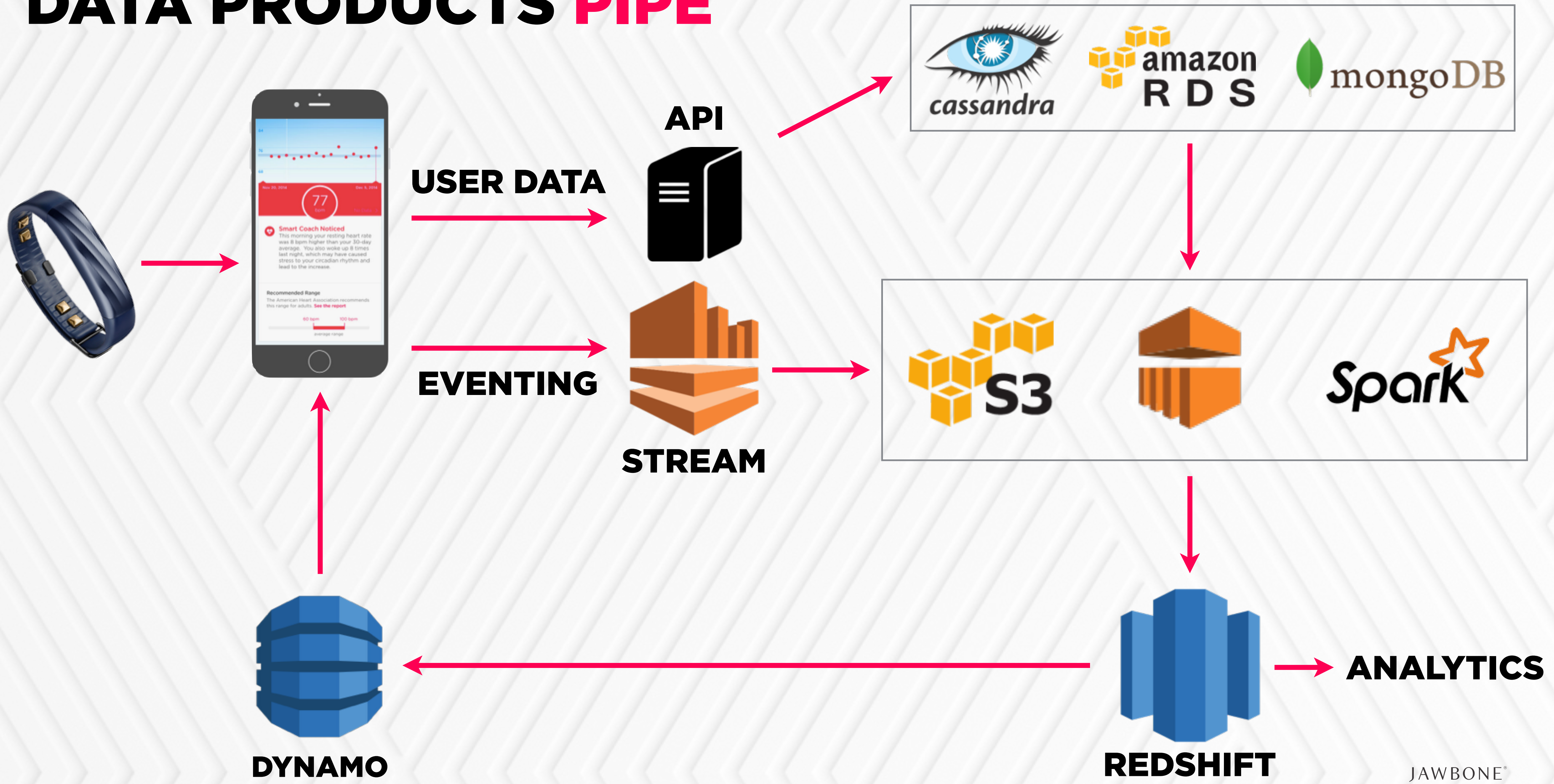
DATA DEMOCRATIZATION IS TABLE STAKES

```
datazoo=# SELECT gender, COUNT(*), AVG(total_hrs)
datazoo-# FROM up_mod.sleep_clean_night
datazoo-# WHERE gender IS NOT NULL GROUP BY gender;
```

gender	count	avg
M	147284397	6.77170
F	165579431	7.11274

Time: 1333.536 ms

DATA PRODUCTS PIPE




```

REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]sick' ) AS sick,
--REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]ill[^\\w]' ) AS ill, -- catching a lot of typo I'll -> ill
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]flu[^\\w]' ) AS flu,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]bronchitis' ) AS bronchitis,
--REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]well' ) AS well, -- mostly "didn't sleep well", etc
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]infect' ) AS infect,
--REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]cold' ) AS cold, -- also has some false positives
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]sore.*throat' ) AS sorethroat,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]sinus' ) AS sinus,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]fever' ) AS fever,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]virus' )+
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]viral' ) AS virus,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]vomit' )+
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]puke' )+
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]thr(e|o)\\w*up' ) AS vomit,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]nause(a|o)' ) AS nausea, -- or nauseous
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]cough' ) AS cough,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]headache' ) AS headache,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]migraine' ) AS migraine,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]h(a|u)ngover' ) AS hangover,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]diarrhea' ) AS diarrhea,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]under.*the.*weather' ) AS undertheweather,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]urgent.*care' ) AS urgentcare, -- emergency room/hospital, clinic, doctor, etc.
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]medication' )+
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]medicine' )+
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]nyquil' )+
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]tylenol' )+
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]codeine' )+
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]ibuprofen' )+
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]advil' )+
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]anti.*biotic' ) AS ed

-- Other conditions
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]diabet' ) AS diabetic, -- wasn't
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]asthma' ) AS asthma,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]apnea' ) AS sleepapnea,
REGEXP_COUNT(LOWER(' | ' | comment), '[^\\w]p[^\\w]*t[^\\w]*s[^\\w]*d' ) AS ptsd,
-- smoker/vaping

```

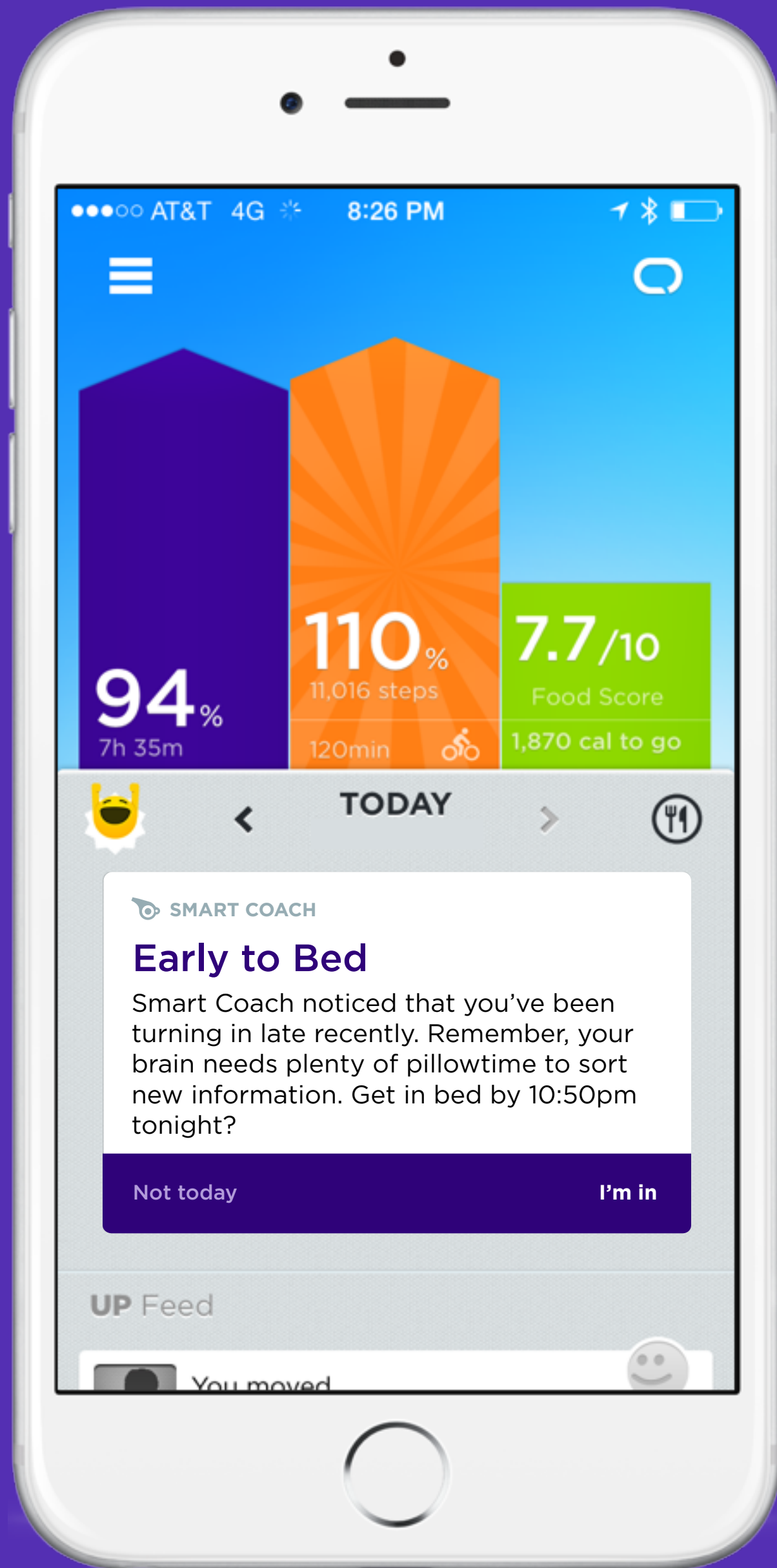
**EXPERIENCE FIRST,
THEN TECH**



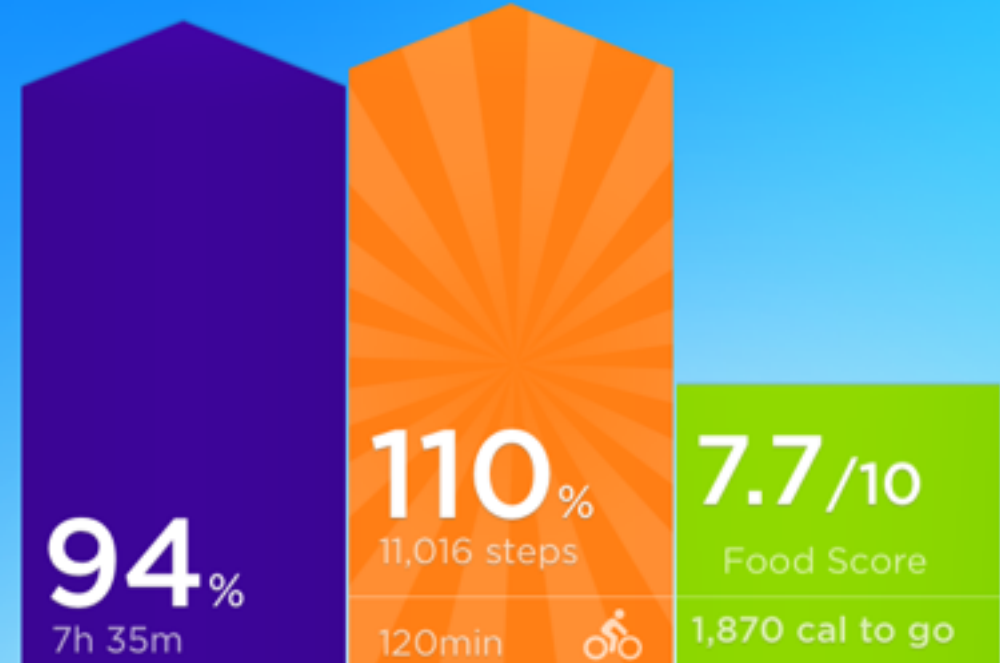
**NOT JUST ANALYTICS —
DEMOCRATIZE
DATA PRODUCTS**

A large, detailed taxidermy of a mammoth or woolly mammoth is the central focus of the image. The mammoth is shown in profile, facing right, with its thick, shaggy fur and large, curved tusks clearly visible. It is mounted on a wooden platform. The background shows a museum interior with wooden beams, a balcony with a railing, and large windows. The lighting is somewhat dim, creating a dramatic atmosphere. The text "NOT TRACKING, BUT COACHING" is overlaid on the lower part of the image in a bold, sans-serif font. "NOT TRACKING," is in white, and "BUT COACHING" is in a bright pink color.

**NOT TRACKING,
BUT COACHING**



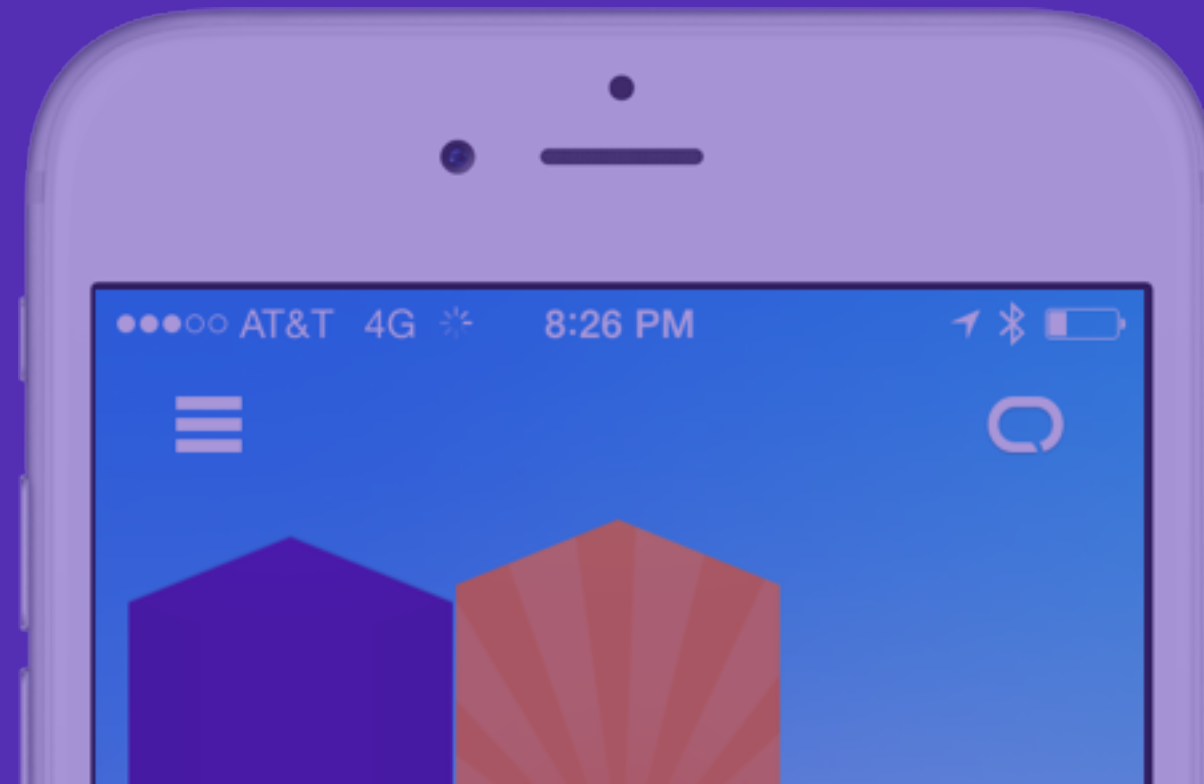
AT&T 4G 8:26 PM



TODAY

SMART COACH
Early to Bed
Smart Coach noticed that you've been turning in late recently. Remember, your brain needs plenty of pillowtime to sort new information. Get in bed by 10:50pm tonight?
Not today I'm in

UP Feed
You moved



 SMART COACH



Early to Bed

Smart Coach noticed that you've been turning in late recently. Remember, your brain needs plenty of pillowtime to sort new information. Get in bed by 10:50pm tonight?

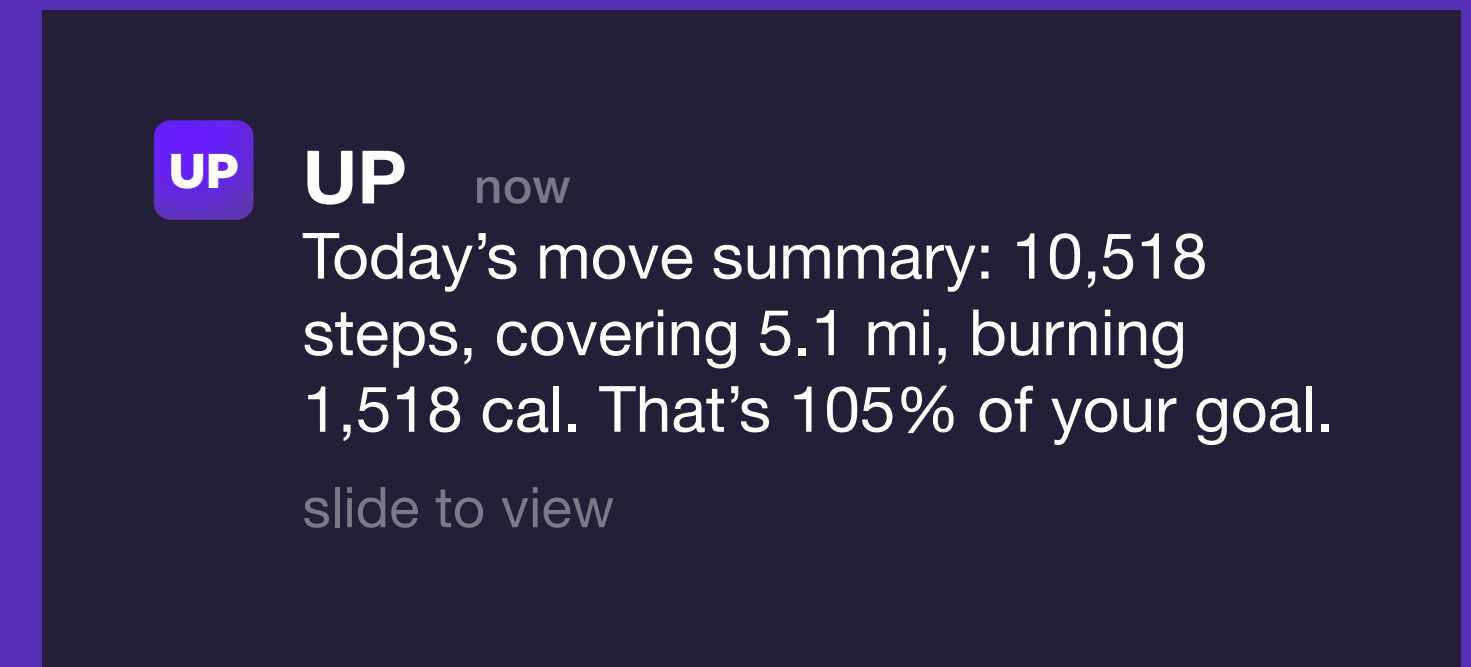
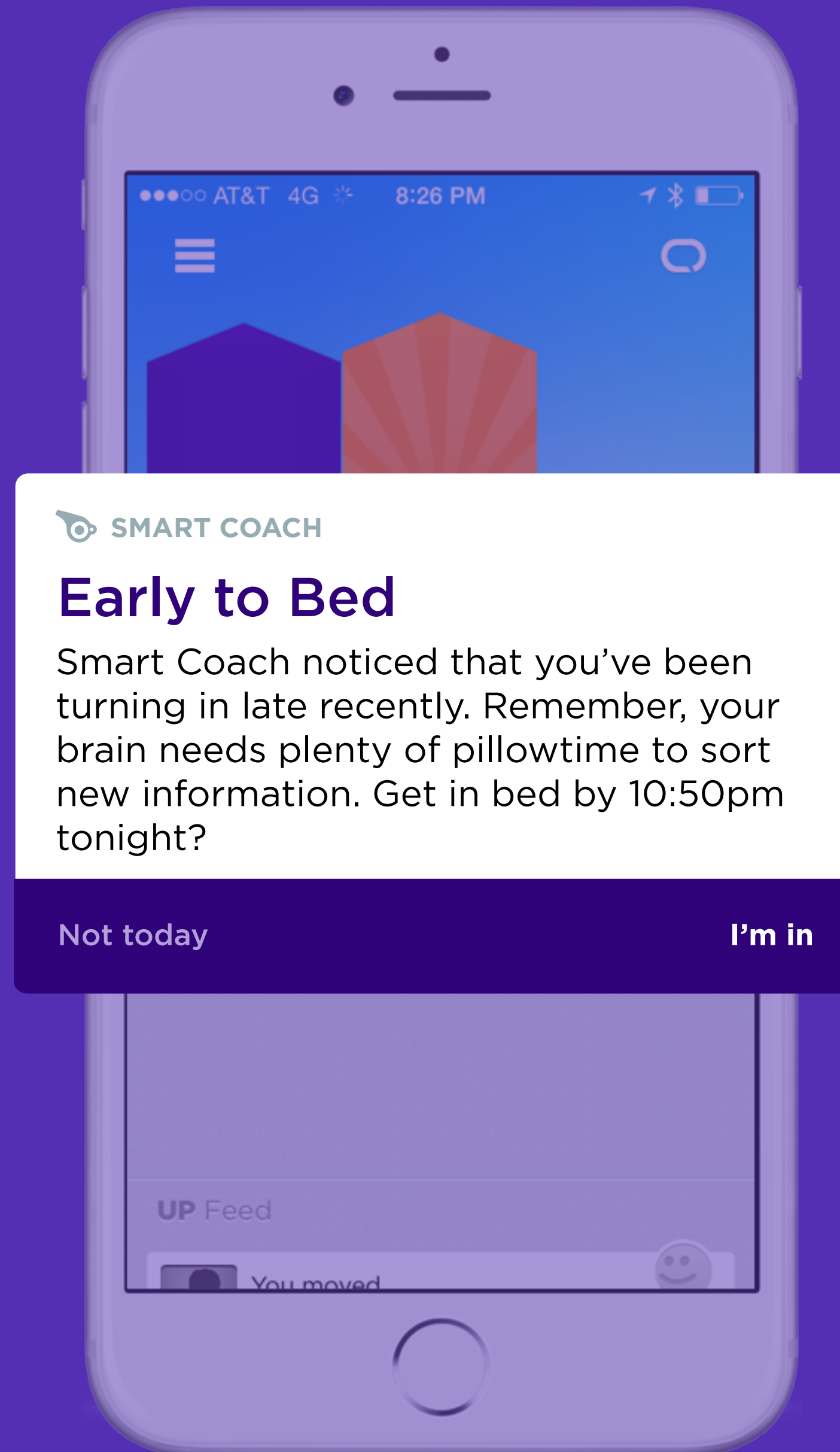
Not today

I'm in

UP Feed

 You moved 

SMART COACH GUIDES YOUR SLEEP



SMART COACH GUIDES YOUR SLEEP

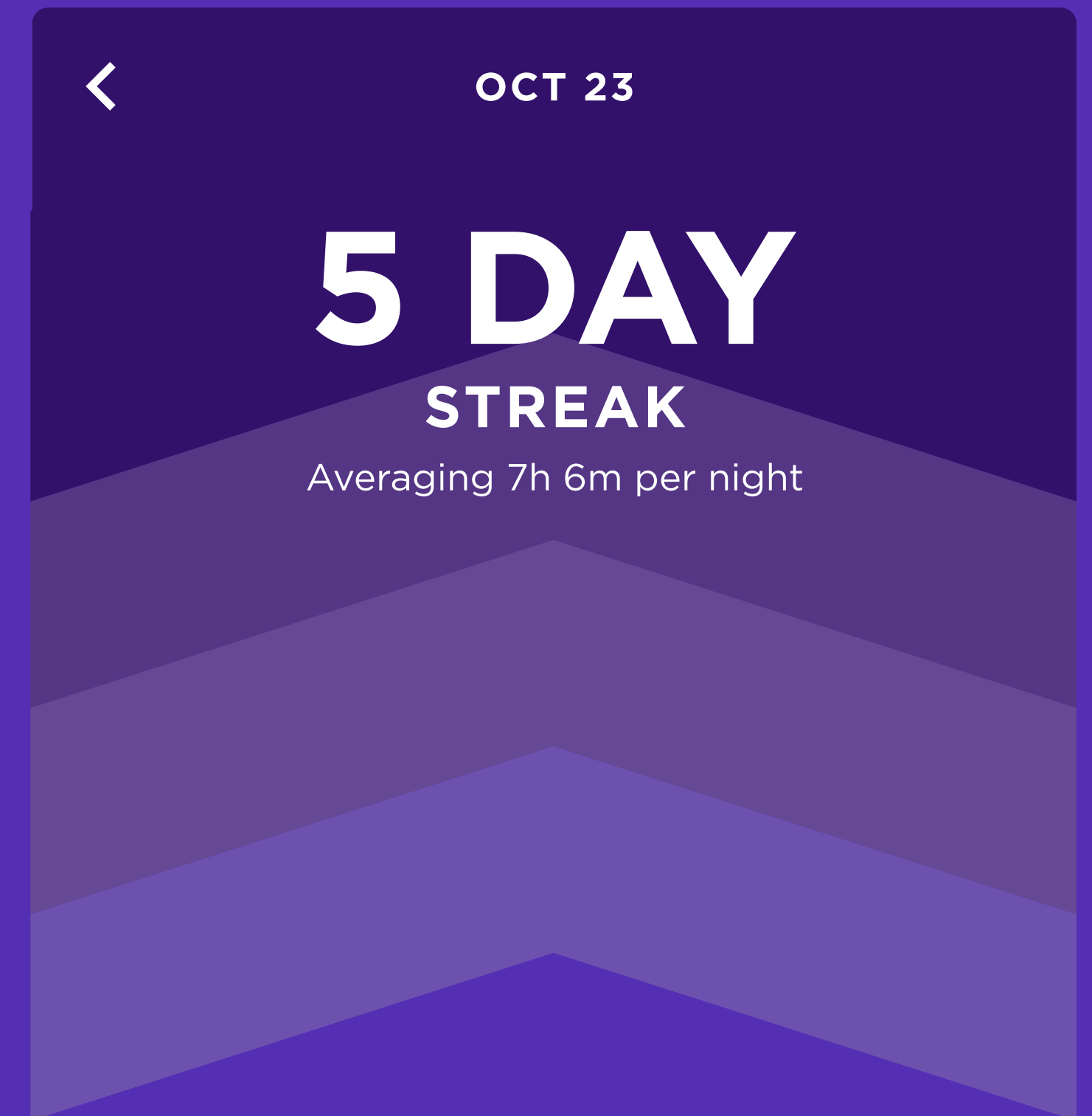
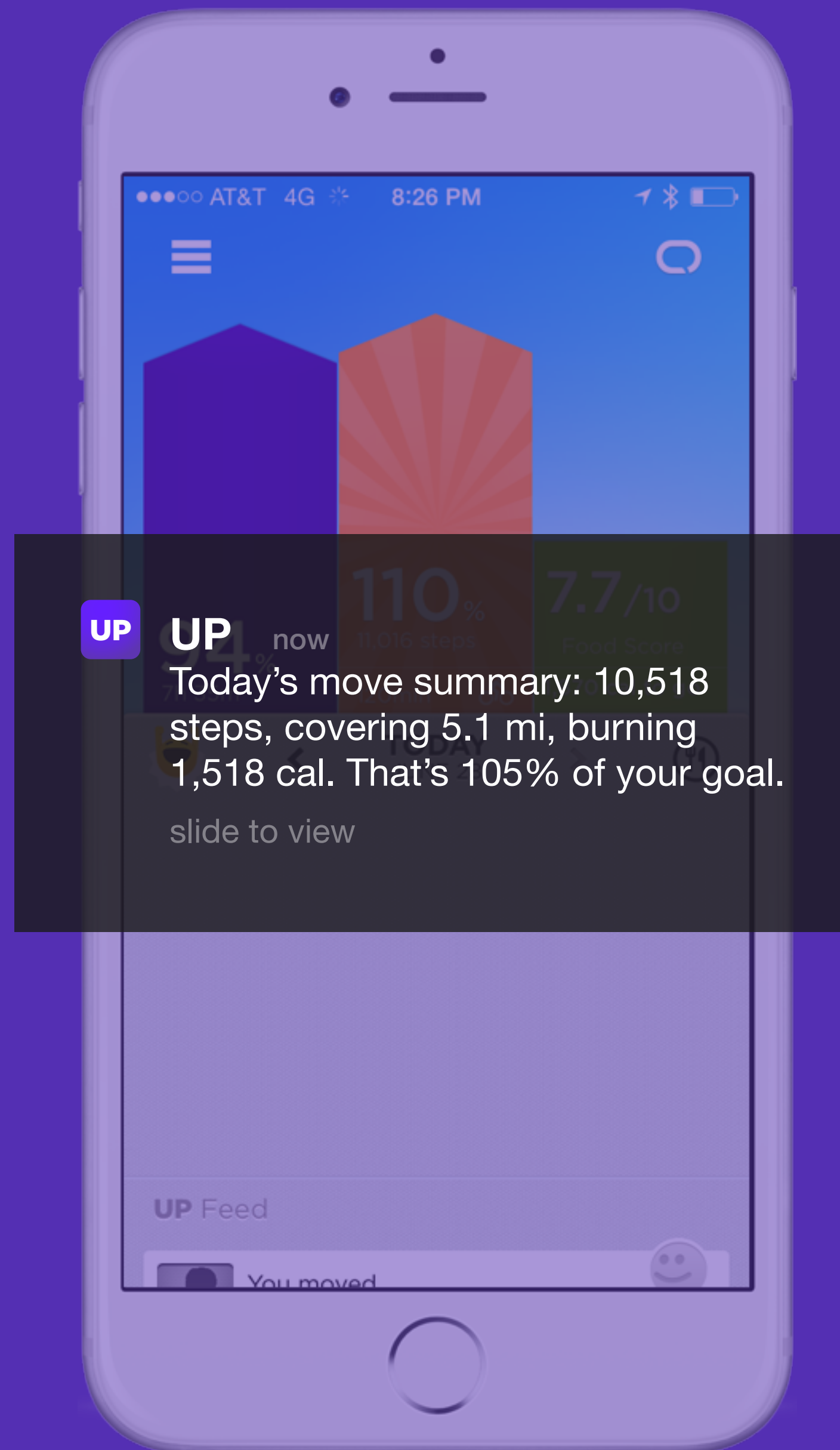
 SMART COACH

Early to Bed

Smart Coach noticed that you've been turning in late recently. Remember, your brain needs plenty of pillowtime to sort new information. Get in bed by 10:50pm tonight?

Not today

I'm in



SMART COACH GUIDES YOUR SLEEP

n
our
ort
pm

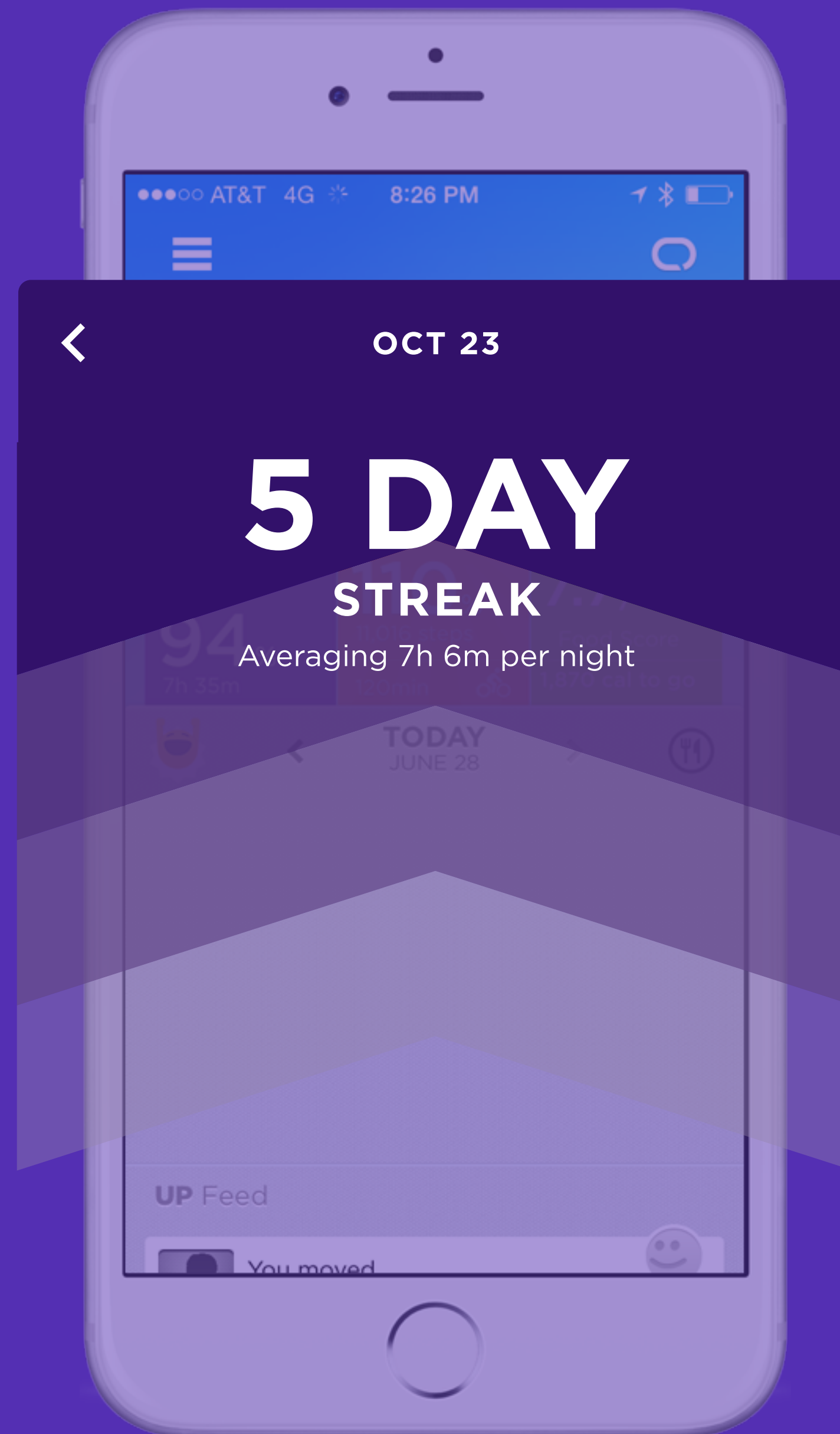
I'm in

UP

UP now

Today's move summary: 10,518 steps, covering 5.1 mi, burning 1,518 cal. That's 105% of your goal.

slide to view



UP HELPS USERS SLEEP MORE

 SMART COACH

Early to Bed

Smart Coach noticed that you've been turning in late recently. Remember, your brain needs plenty of pillowtime to sort new information. Get in bed by 10:50pm tonight?

Not today

I'm in

23M

MORE SLEEP, COMPARED
TO THE CONTROL GROUP

72%

INCREASED LIKELIHOOD OF
BEATING THEIR SLEEP GOAL

ANDRE IGOUDALA

FINALS MVP

SLEEP PROFILE

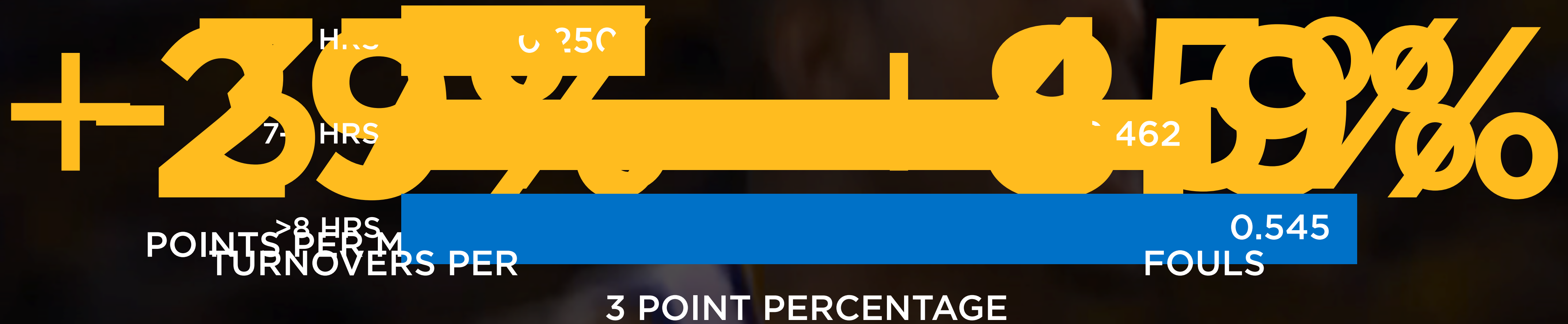
- **HOME:** SLEEPS 5H 48M
- **AWAY:** SLEEPS 6H 15M
- **DIFFICULTIES**
 - FALLING ASLEEP AFTER GAME
 - STAYING ASLEEP
- NAPS SOMETIMES
- DRINKS CAFFEINE BEFORE AND DURING GAMES

SLEEP COACHING

- CONSISTENT BEDTIME
- PUSH FOR LONGER SLEEP DURATION
- TOOLS TO HELP FALL ASLEEP
- STRATEGIC CAFFEINE USAGE
- NAPPING RECOMMENDATIONS



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CONCLUSIONS

- WE DO **BIG THINGS** AT **SMALL COMPANIES**
- MORE IMPORTANT TO FIGURE OUT WHAT TO DO THAN DO IT
- DATA SCIENCE FOR “**GOOD**”
- **IMPROVE HEALTH** WITH BIG DATA TOOLS
- **USER EXPERIENCE** COMES FIRST
- THE FIRST ML MODEL **ISN'T** A MODEL
- DEMOCRATIZE **DATA PRODUCTS**

BINGO! DINO DNA!

HEALTH IDENTITY FROM THE WRIST

BRIAN WILT HEAD OF DATA SCIENCE AND ANALYTICS
 @BRIANWILT