

# Designing to Help People Find Insights & Experiences in Personal Data

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YARDS  
ABERCROMBIE & FITCH CO  
NEW YORK

MILES

MILES

MADE IN FRANCE





# Manpokei 万歩計

## MANPO-METER

◎ 日本万歩クラブ推薦



交通巡査  
11260歩＝6.7<sup>キ</sup> (8時間)



さん (20) 東京・有楽町のビヤホール  
客席は約五百 大体二十人前後でサービスに当る  
満員になれば ちよつと立止る暇もない

ビヤホールのウェイトレス  
12550歩＝5.5<sup>キ</sup> (8時間)

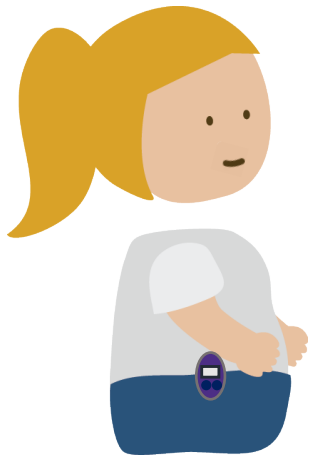


さん (22) 東京―大阪の幹線を二往復 タバコや飲み物のサービスで機内を動き回る乗客は少なく楽だったという

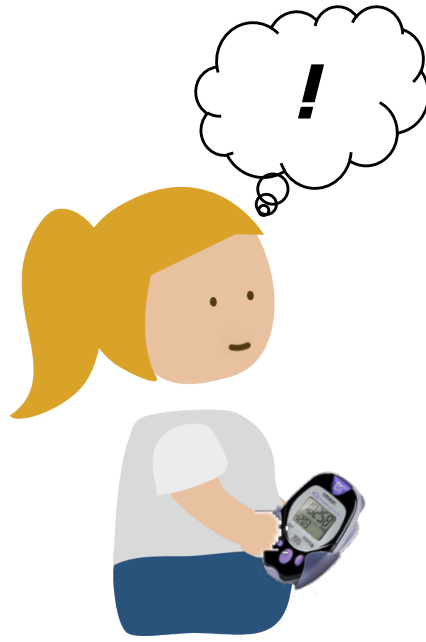
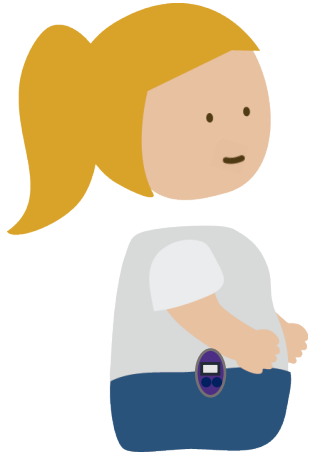
エアホステス  
9000歩＝4.1<sup>キ</sup> (6時間半)

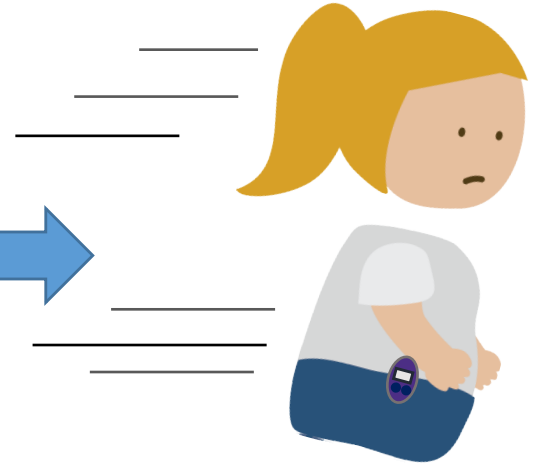
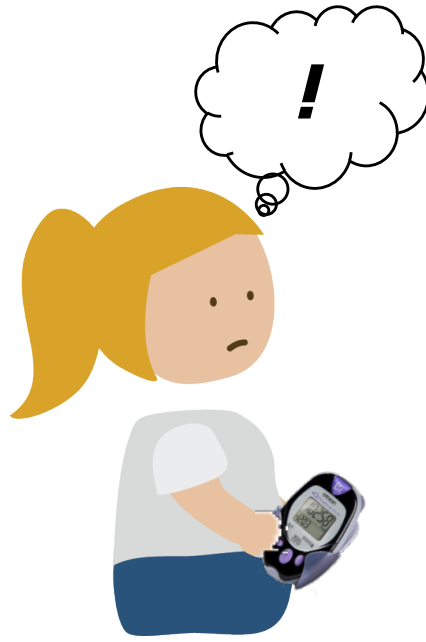
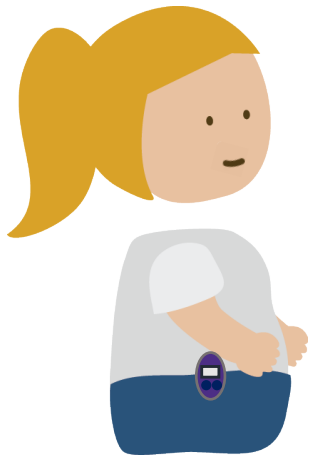




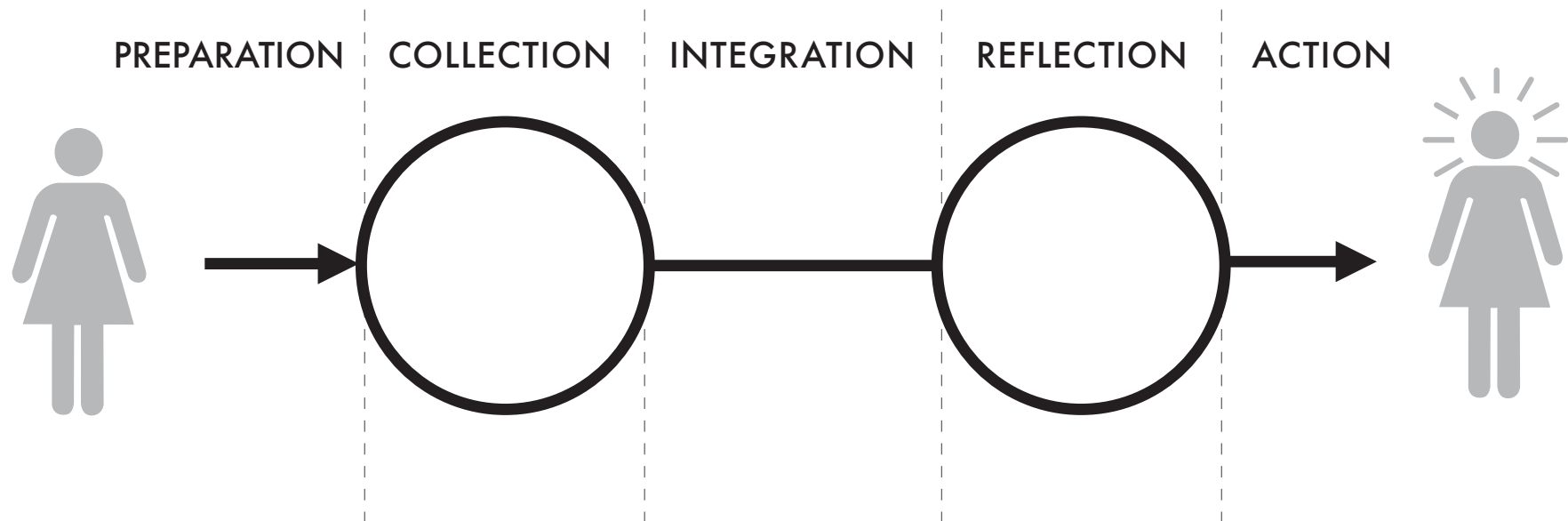






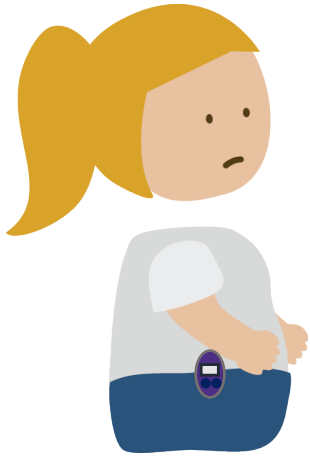


# Five-Stage Model of Personal Informatics





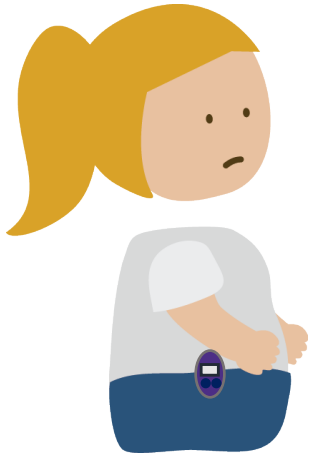
# Five-Stage Model of Personal Informatics



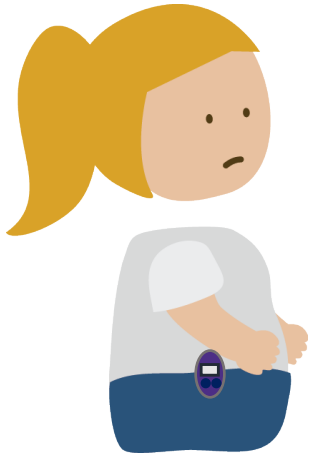
Alice

- 20 years old
- Has a family history of heart disease
- Wants to be more active
- Does not know how, because she is busy

# Preparation

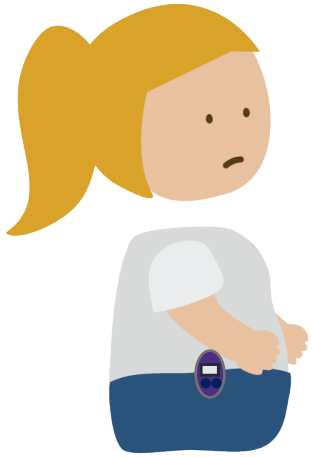


# Preparation

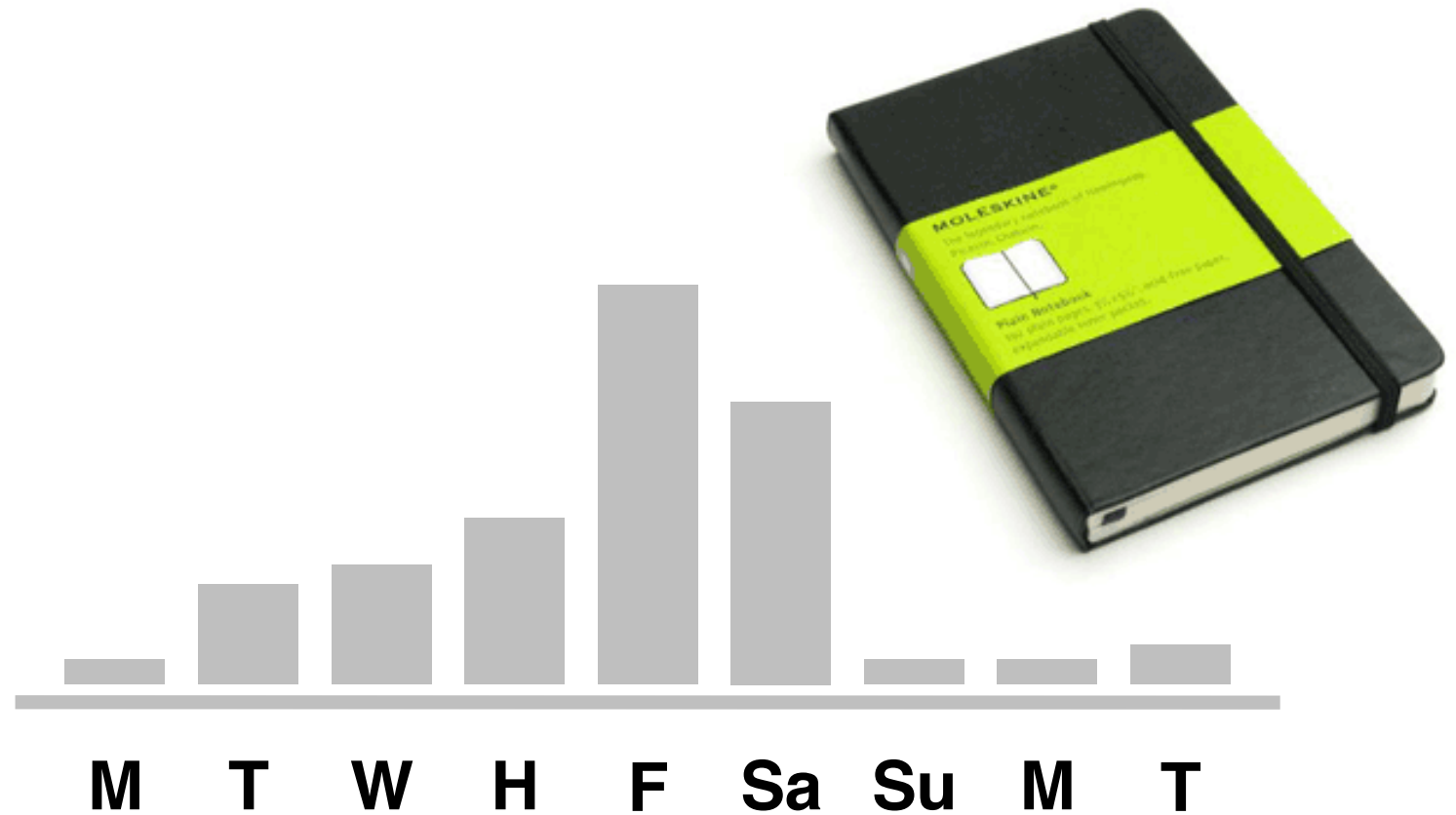
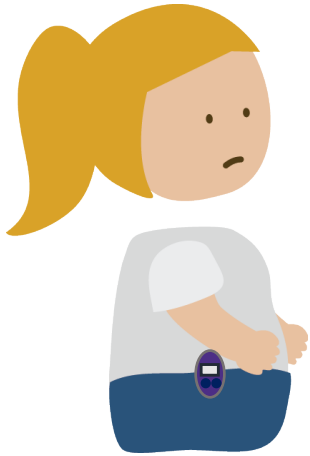




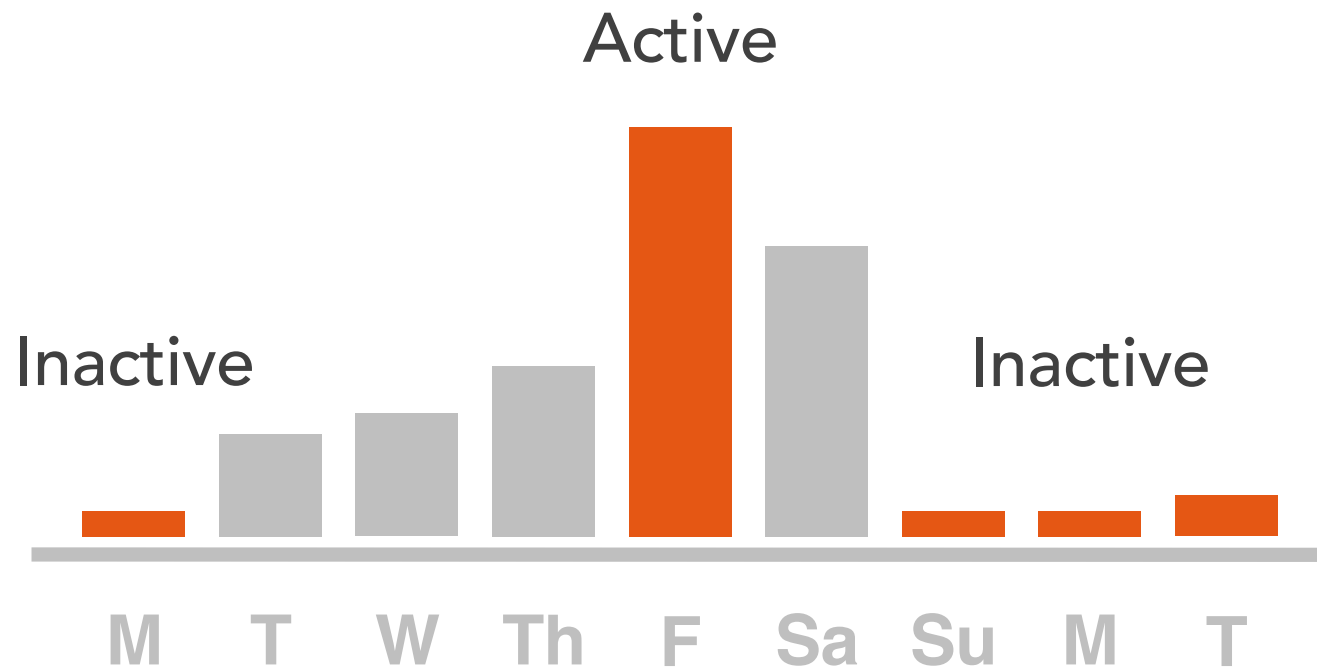
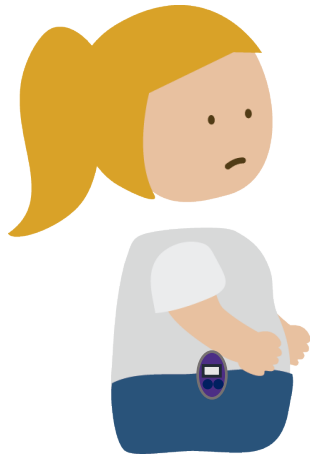
# Preparation



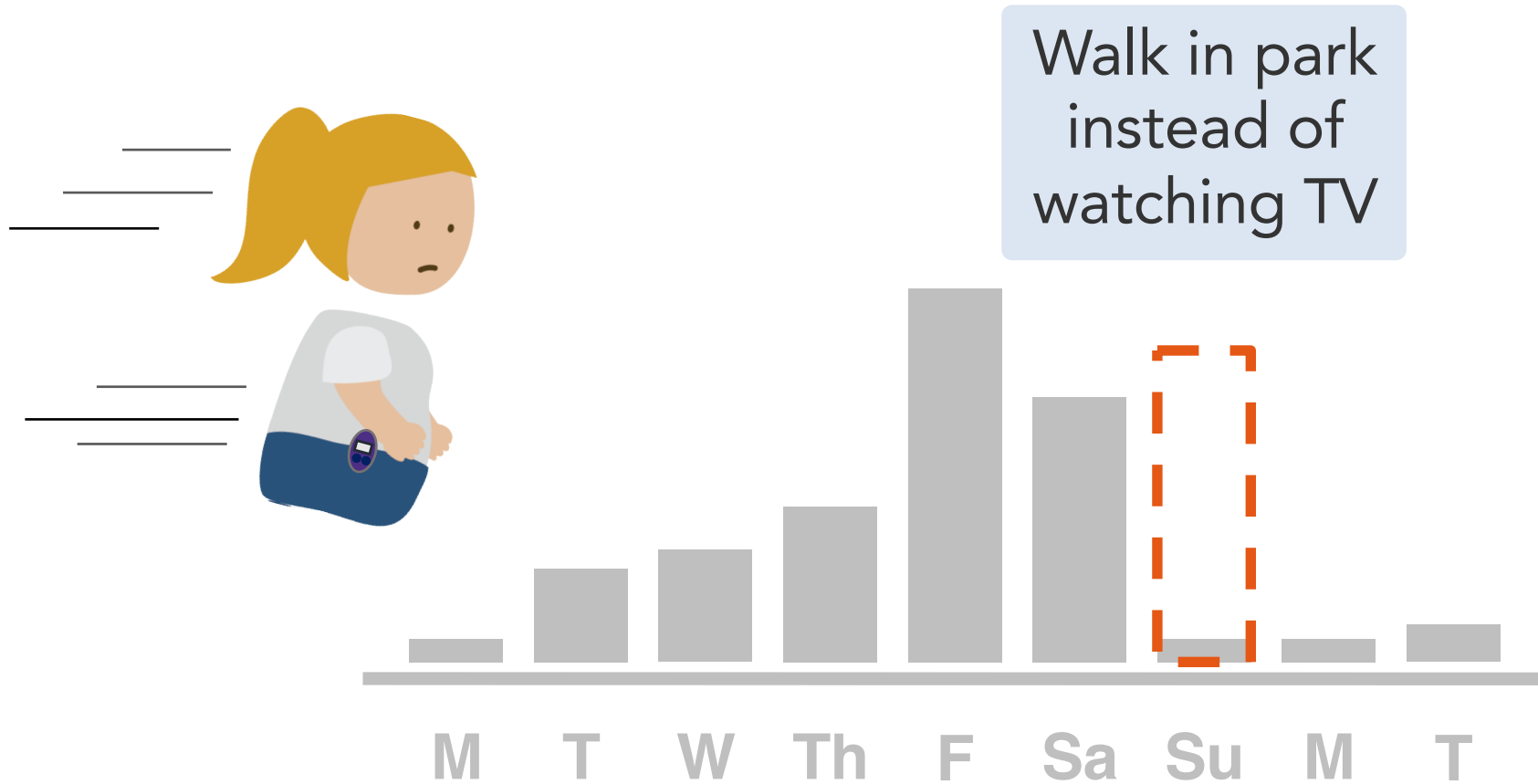
# Integration

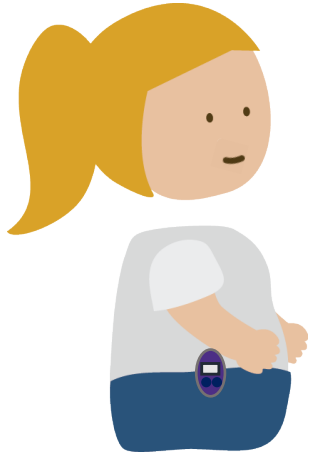


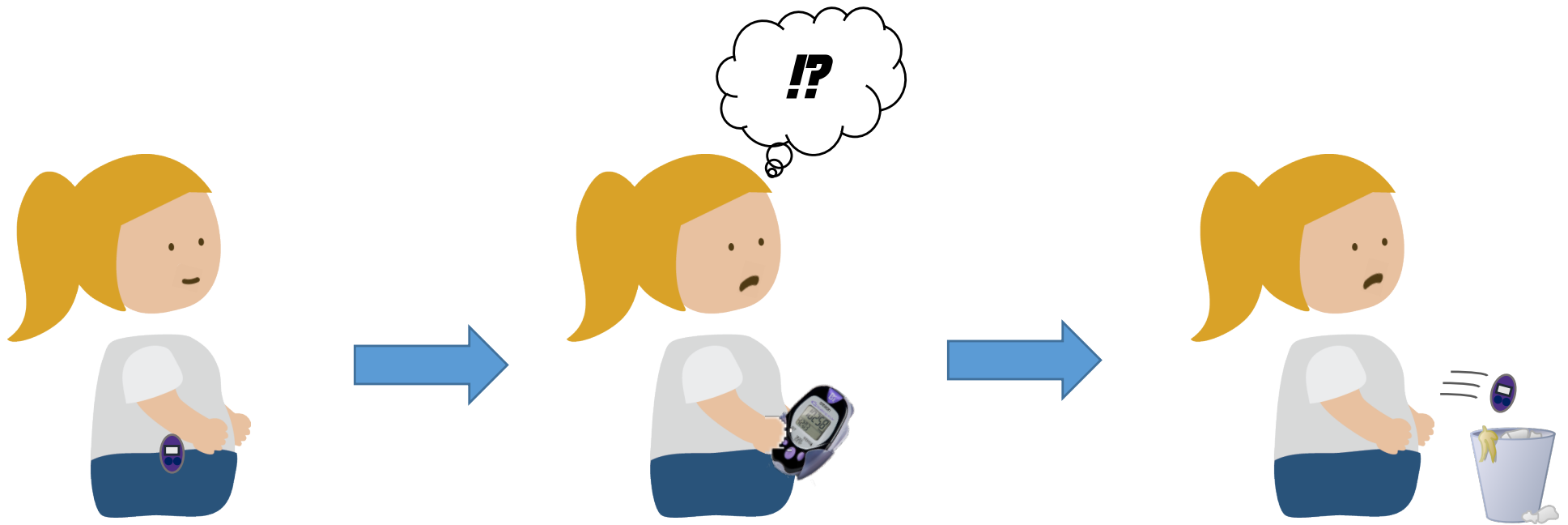
# Reflection



# Action







Epstein DA, Ping A, Fogarty J, Munson SA. *UbiComp* 2015.  
A Lived Informatics Model of Personal Informatics.

Epstein DA, Ping A, Caraway M, Johnston C, Fogarty J, Munson SA. *CHI* 2016.  
Beyond Abandonment to Next Steps:  
Understanding and Designing for Life after Personal Informatics Tool Use.









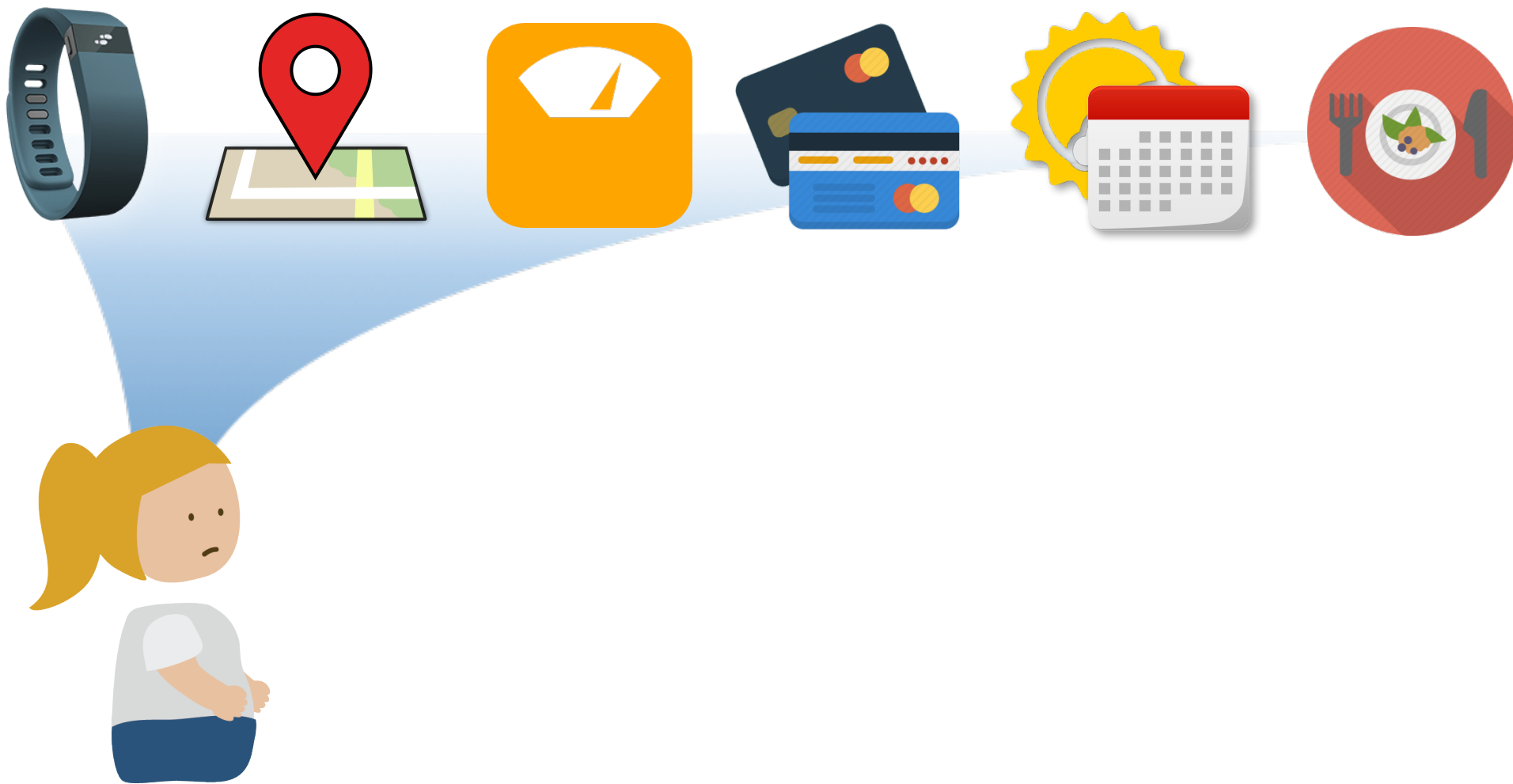
A wealth of information creates a poverty of attention, and a need to allocate that attention efficiently among the overabundance of information sources that might consume it.

- Herbert Simon



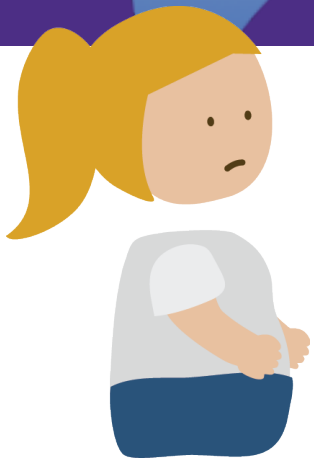
Unanalyzed data are  
worse than no data.

- Margaret Mead





## tonight



- Working through data alone
- Working through data together
  - ... with experts
  - ... with support of friends and family

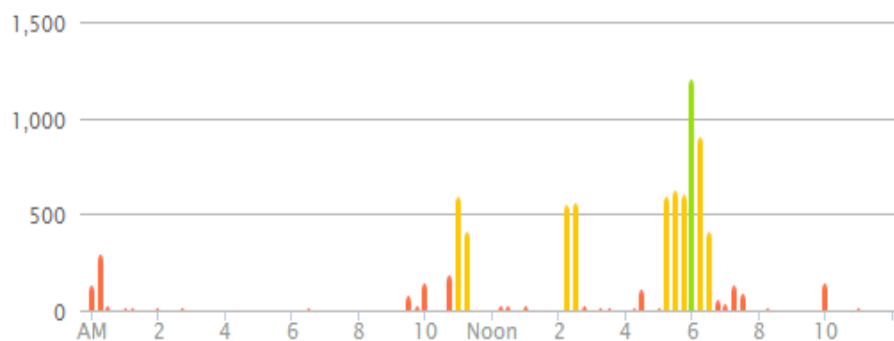


## Activity

STEPS

CALORIES

FLOORS



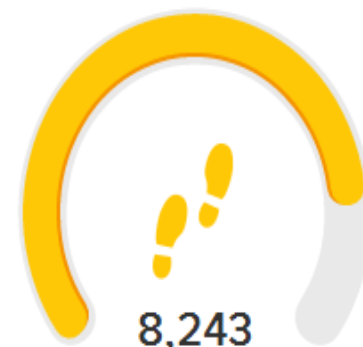
## Top Badges



30,000 steps

Best in A Day

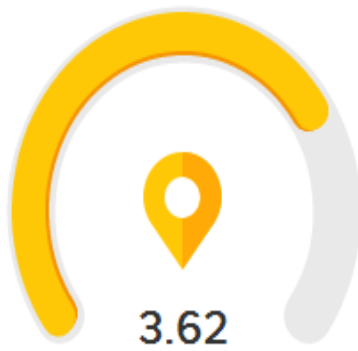
## Steps



## Calories



## Distance / miles



## Very Active Mins



Champ!

## Floors

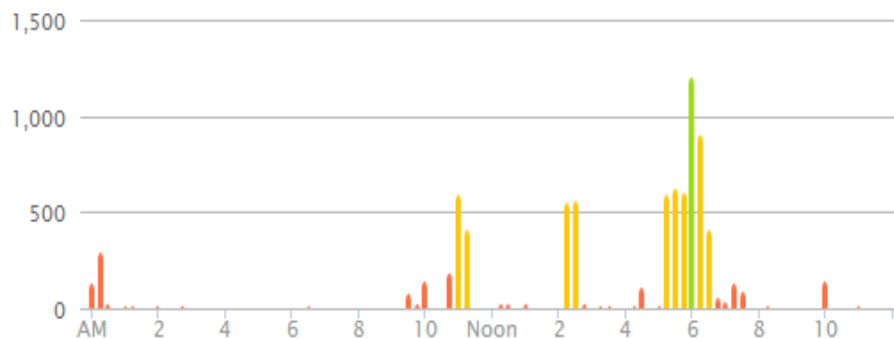


## Activity

STEPS

CALORIES

FLOORS



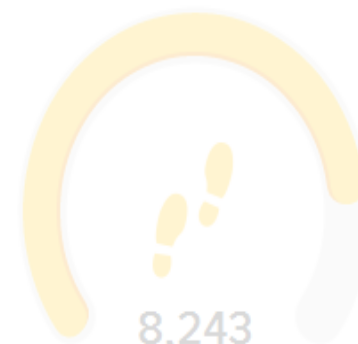
## Top Badges



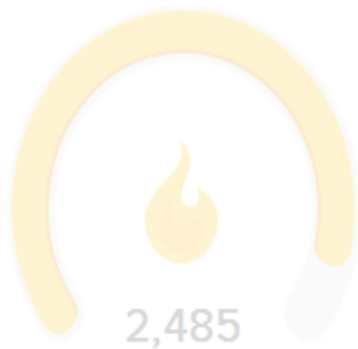
30,000 steps

Best in A Day

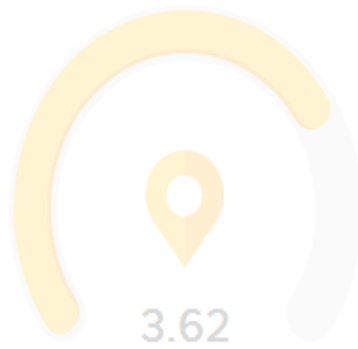
## Steps



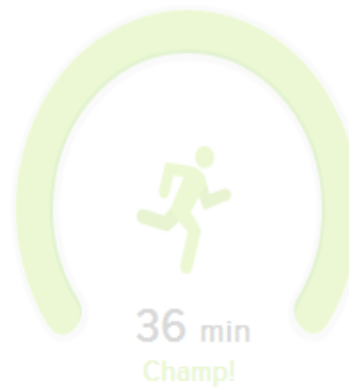
## Calories



## Distance / miles



## Very Active Mins



Champ!

## Floors



Activity

STEPS

CALORIES

FLOORS



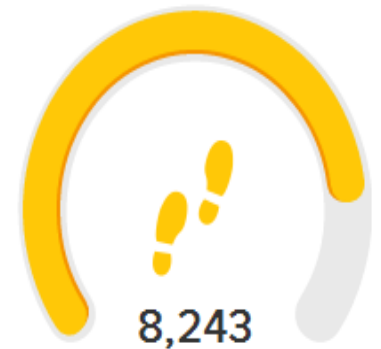
Top Badges



30,000 steps

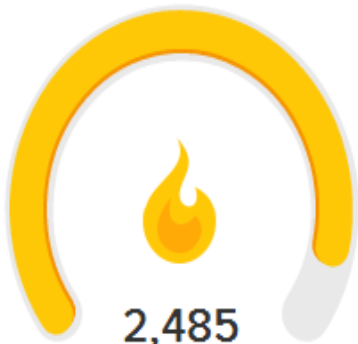
Best in A Day

Steps



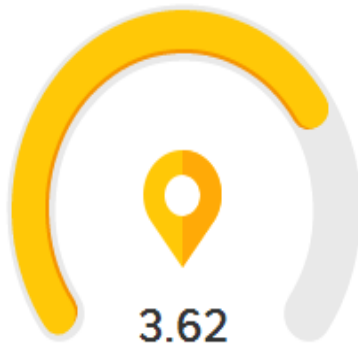
8,243

Calories



2,485

Distance / miles



3.62

Very Active Mins



36 min  
Champ!

Floors



2

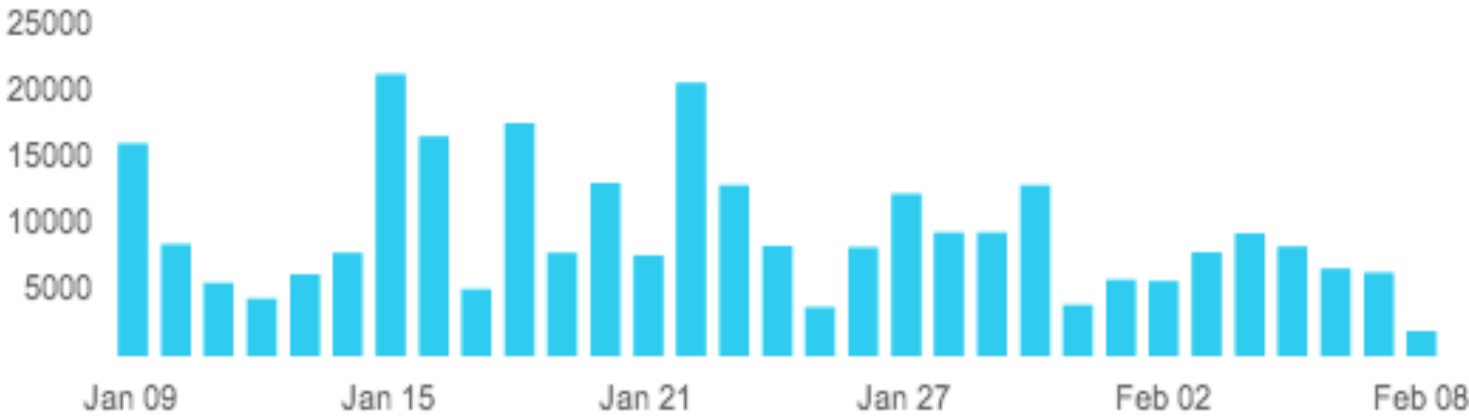


Steps

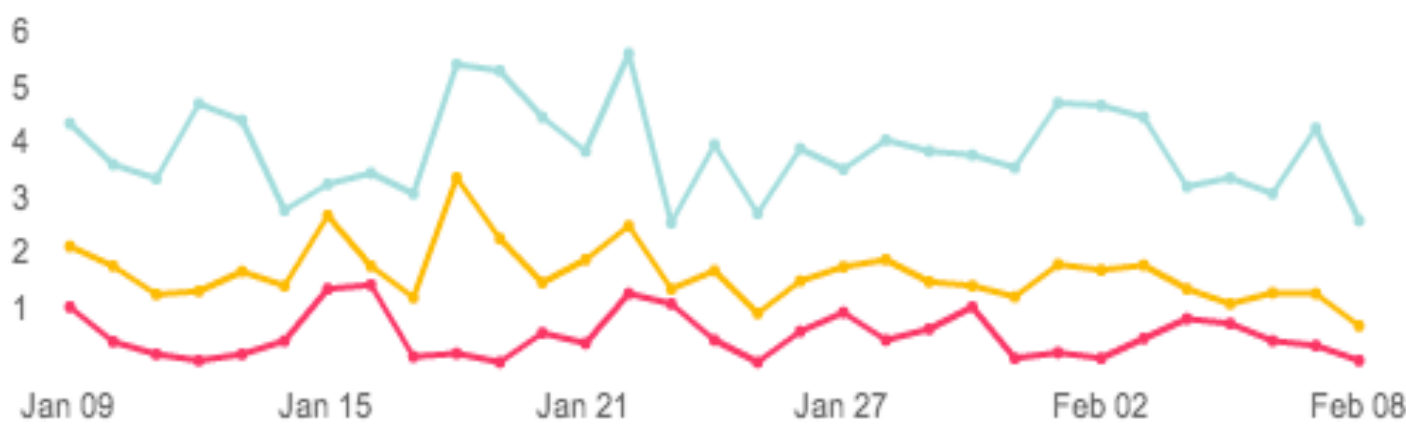
Distance

Floors

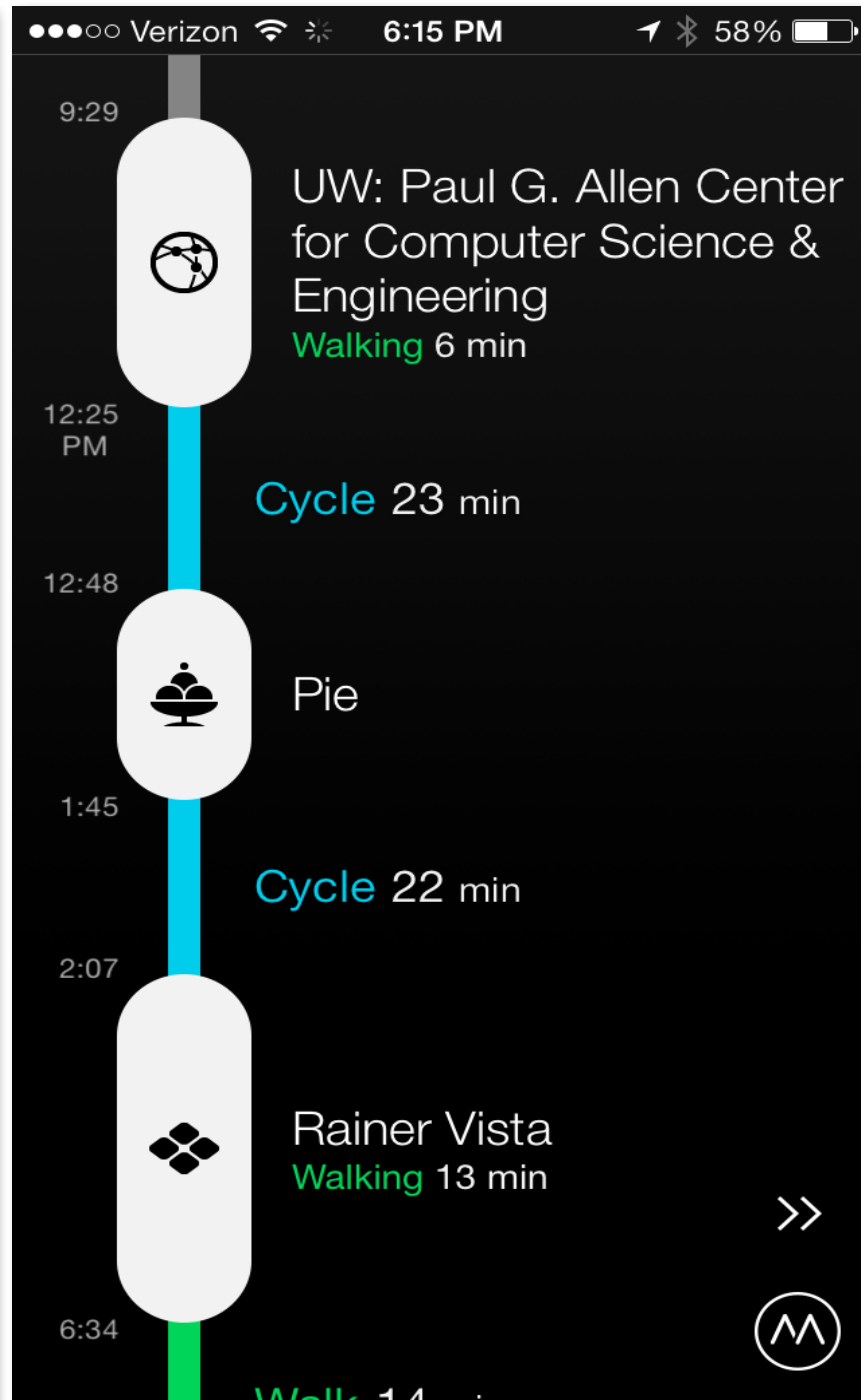
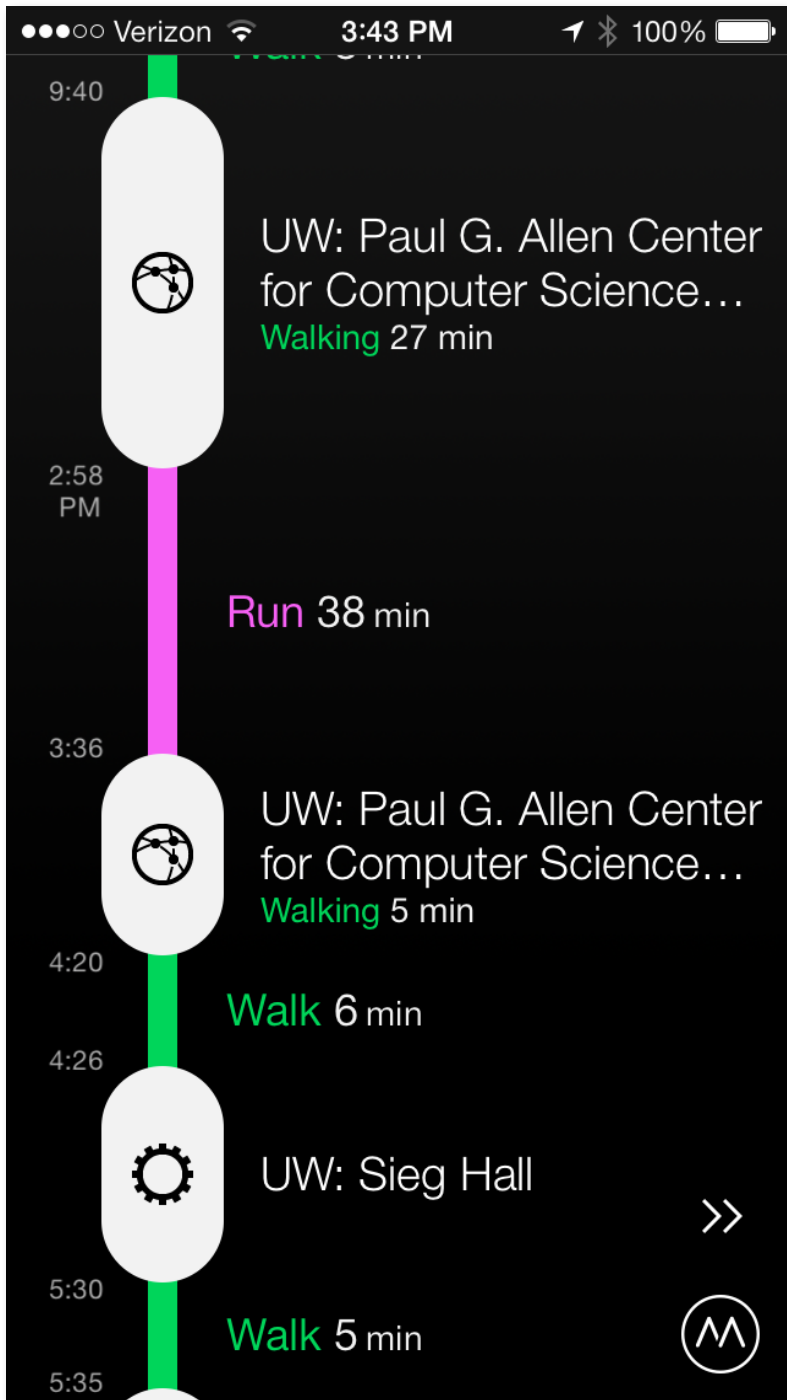
30 day graph



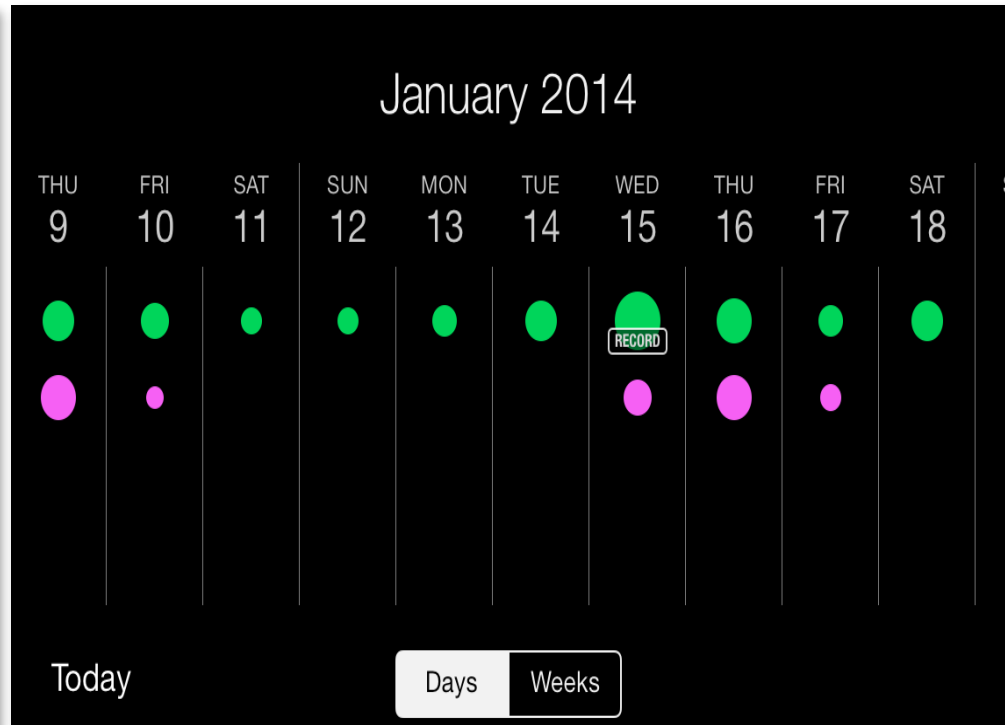
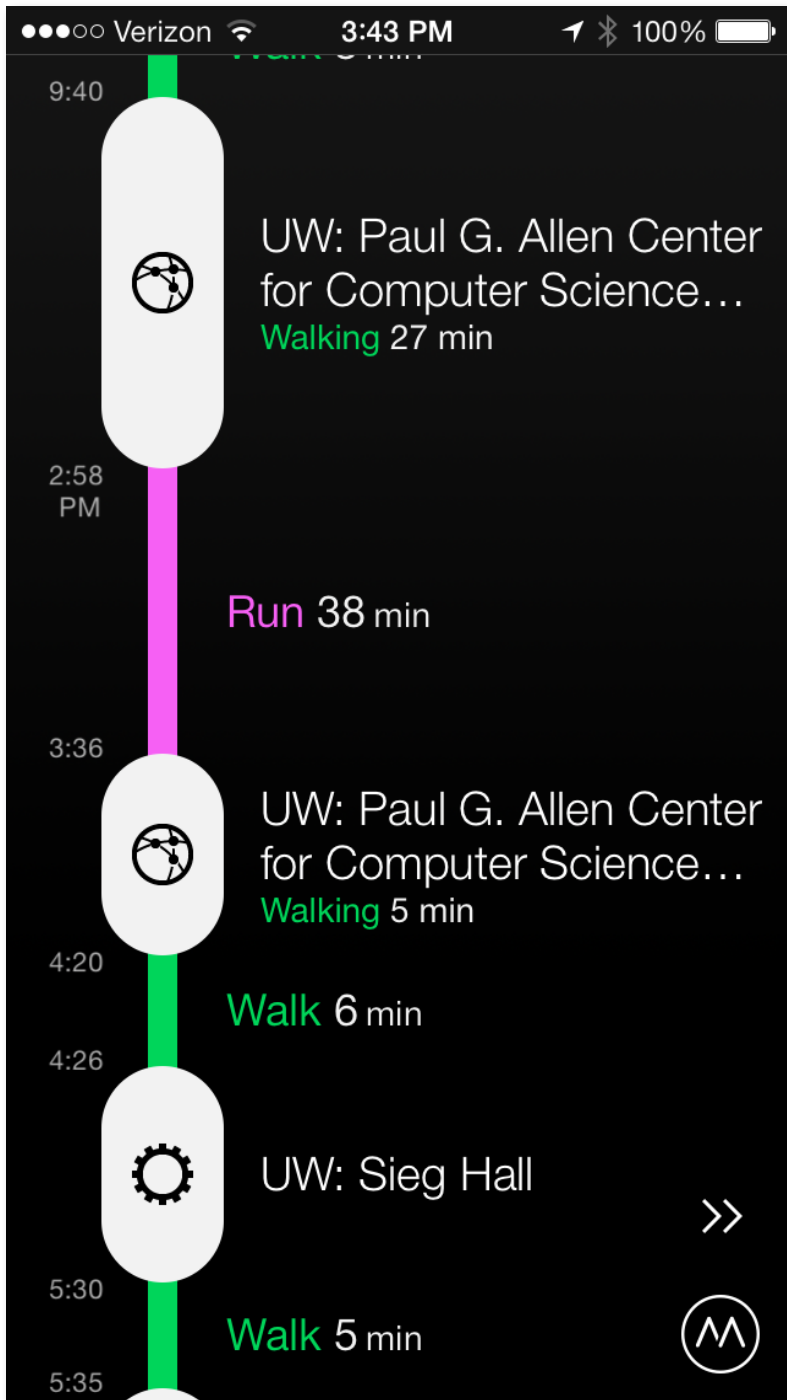
30 day graph of time active (in hours)



sedentary
lightly active
fairly active
very active



Moves, commercial lifelogging application developed by ProtoGeo and acquired by Facebook.



Moves, commercial lifelogging application developed by ProtoGeo and acquired by Facebook.

1. Collect data
2. Look at it by time
3. ???
4. Insight!



# YOU ARE JUST A NUMBER

Can you make yourself healthier and happier by logging every snore, step and mood swing? As a Californian trend for obsessional data-tracking makes its way over here, **Tim Chester** covers his body in gadgets to find out if self-knowledge is power. Photograph by Paul Stuart

**T**oday I have climbed the equivalent of a tall giraffe. Coffee is my most frequent food. On average, I walk 11,726 steps a day, burning 3,089 calories, over 2.4 hours of activity. I sleep for 6 hours and 9 minutes a night. This week, my sleep efficiency is 72% and my food is 77% healthy. My BMI of 23.5 is 14 percentage points below the median for men my age, and my average daily Met score is 1.71, although I have no idea what a Met score is.

I am, it seems, nothing more than a bundle of numbers and milestones, spurred on by LEDs and chided by pop-up messages. A wireless accessory for the iPhone; perhaps its most sophisticated yet.

My arms are covered in bands, my pockets augmented with accelerometers, my eyes numb from all the charts, my heart pumping to the beat of a heart-rate monitor and forcing its ventricles to keep up with the national average. My head is about to implode from all the positive affirmation and gentle nudging, but it's OK because my memories are being saved to my hard drive and my mood swings are earning me "hugs" from strangers.

I am producing, analysing and socially sharing personal data. I am becoming fitter, happier, and more productive. I am staying motivated by earning badges. I have become a Quantified Self (QS).

The QS movement that I've temporarily joined began, as these things tend to do, in San Francisco's Bay Area in 2007. Two Wired magazine editors, Gary Wolf and Kevin ➤➤➤

 **369 MINS**  
Sleep per night

 **73**  
bpm heart rate

 **3,324**  
Nike FuelBand score

 **582**  
photos logged

 **11,726**  
steps walked

 **3,089**  
Calories burnt

Chester, T. *The Sunday Times* 2013.  
"You Are Just a Number"





**APARTMENT ADDICT** Saga has determined that you live in an apartment or condo.



**CAMPUS CREEPER** Saga has detected that your workplace is a college.



**NIGHT SCHOOL** Saga has detected that you visit a college campus in the evening.



**BUS BANDIT** Saga has noticed that you visit bus stations.

# Can we do better?



**APARTMENT ADDICT** Saga has determined that you live in an apartment or condo.



**CAMPUS CREEPER** Saga has detected that your workplace is a college.



**NIGHT SCHOOL** Saga has detected that you visit a college campus in the evening.



**BUS BANDIT** Saga has noticed that you visit bus stations.



# What do Trackers Want

They want to use lifelogs to:

- Increase awareness of activity
- Increase their motivation
- Find patterns in their behavior
- Identify opportunities for change





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*Where do I eat?*

*How can I walk more?*

*How do I travel?*

*What do my inactive days look like?*



# What do Trackers Want

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- Increase their motivation
- Find patterns in their behavior
- Identify opportunities for change

*Where do I eat?*

*How can I walk more?*

*How do I travel?*

*What do my inactive days look like?*

**Aggregation, but also  
reduction and focus.**

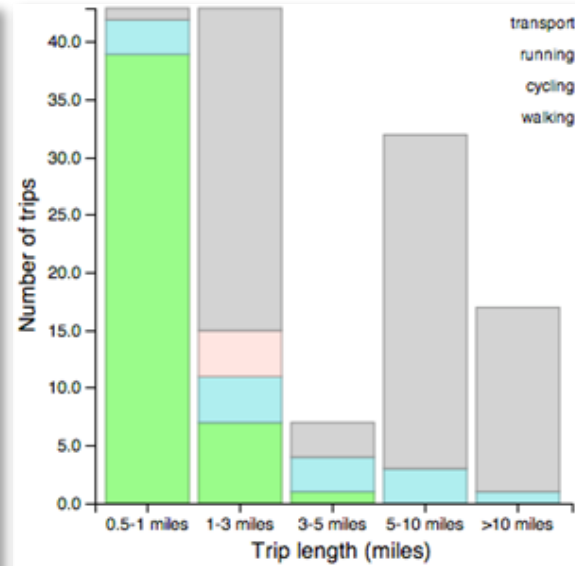
# selecting data: cuts

- A subset of data with a common feature:
  - Temporal cuts
  - Visit a particular type of location
  - Follow a transit pattern
- To enable people to query their data to identify opportunities for change or successes to repeat.

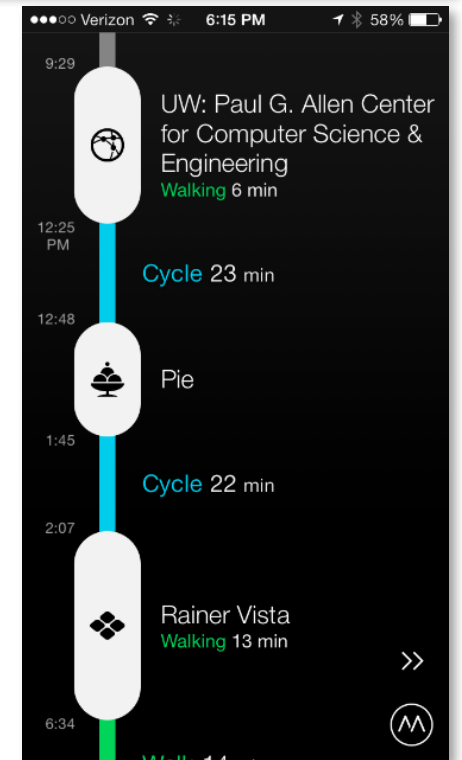
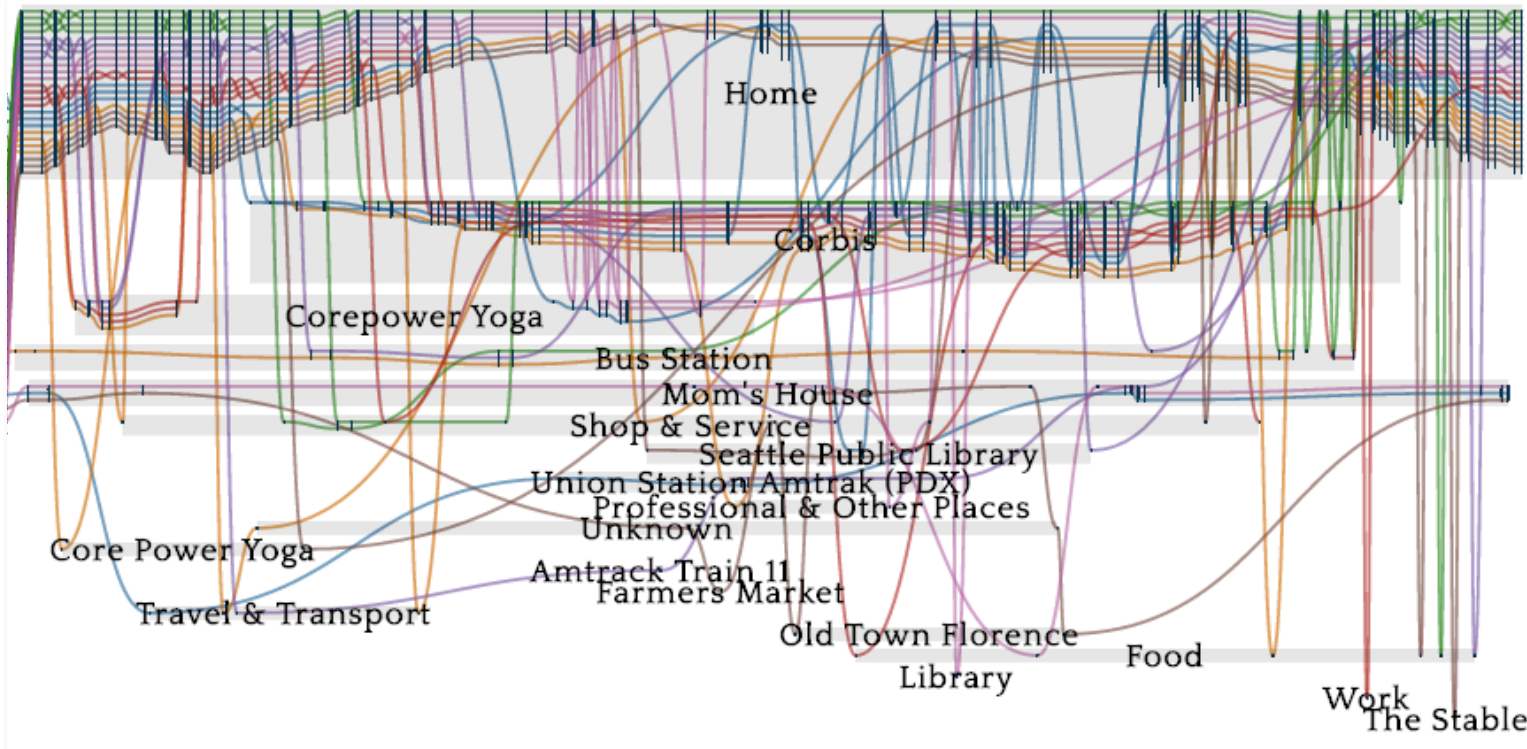
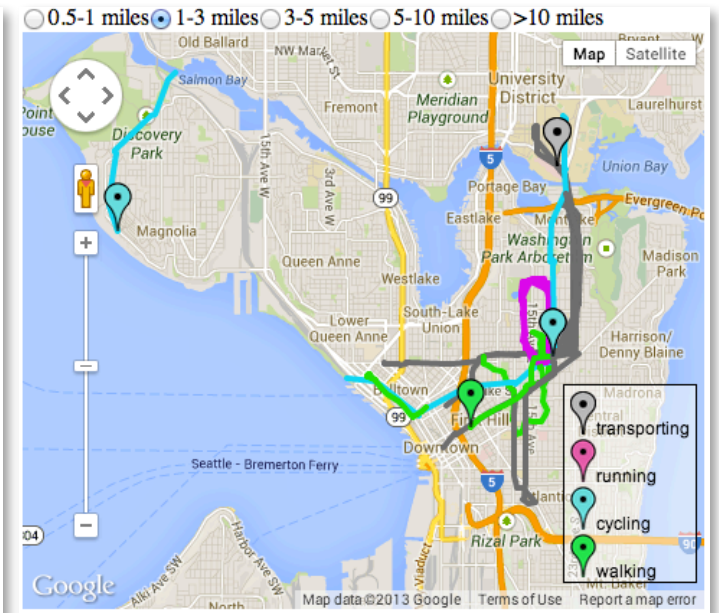
## Day of week Time (in hours)

Sunday (0 days)	--
Monday (2 days)	8 hours, 21 minutes
Tuesday (2 days)	7 hours, 49 minutes
Wednesday (4 days)	7 hours, 10 minutes
Thursday (4 days)	7 hours, 48 minutes
Friday (3 days)	5 hours, 47 minutes
Saturday (0 days)	--

On average, you spend 1.6 fewer hours at work on Fridays.



You transport 2% of the time you travel less than 1 miles.



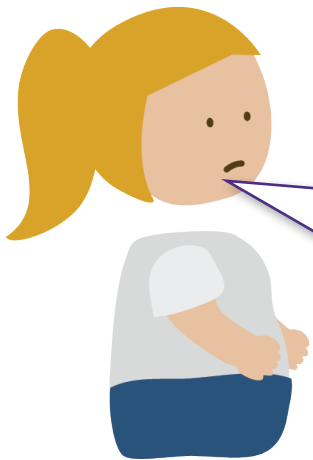
Epstein D.A., Cordeiro F., Bales E., Fogarty J., Munson S.A. *DIS 2014*.  
 "Taming Data Complexity in Lifelogs: Exploring Visual Cuts of Personal Informatics Data"



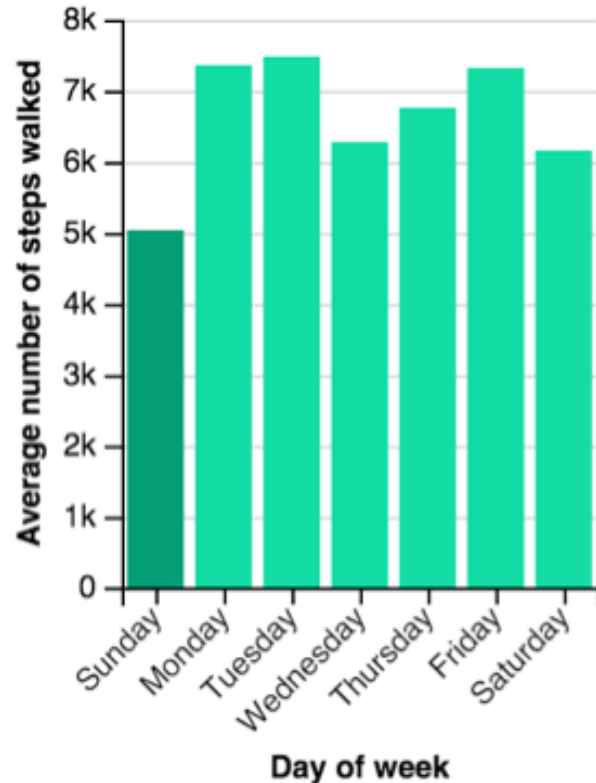
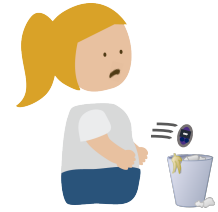
Maybe on average on Tuesdays I don't cycle much. Maybe there was a day that I did. To be able to **think about why that was** so I could maybe think about how to change what I was doing.



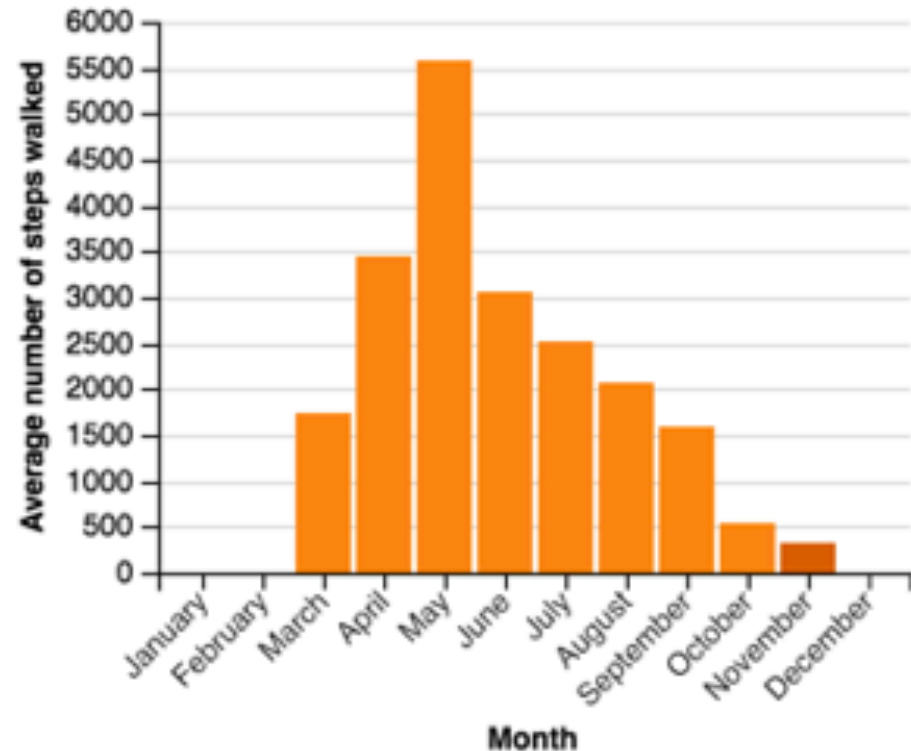
If I notice that I'm most active on Tuesdays, then obviously there's something about Tuesdays that I should start doing on other days. **That's actionable data.**



# People can find cuts valuable even after they quit using the tool.



You walked an average of 5,055 steps on Sundays. What prevents you from walking more?



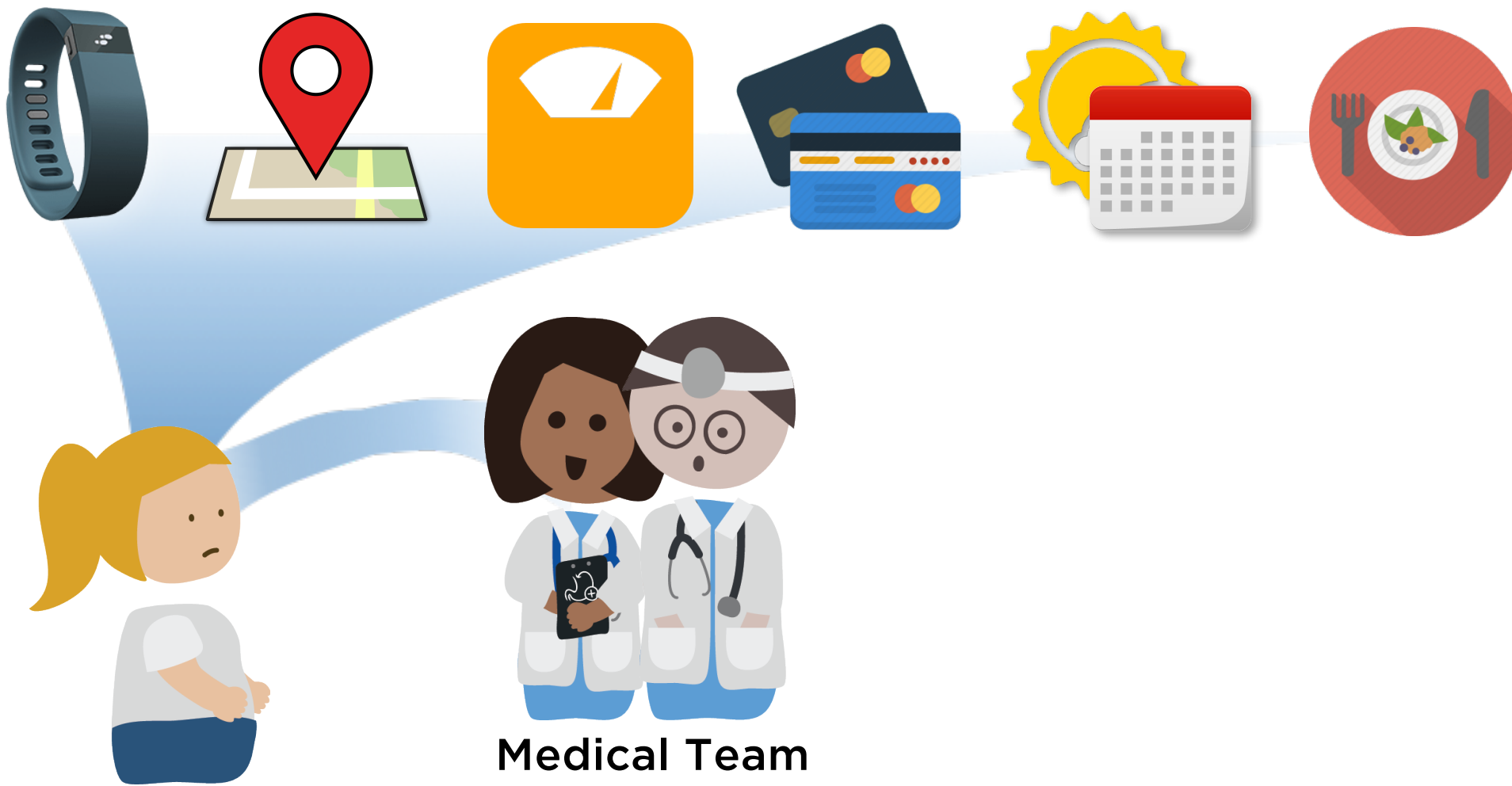
You walked an average of 321 steps per day during November. Would you consider starting to use your Fitbit again?



Reduction and focus can work for many personal questions.

Lots of need to study the role of framing effects and to match the right cut to the right person.





**Individuals**

**Medical Team**

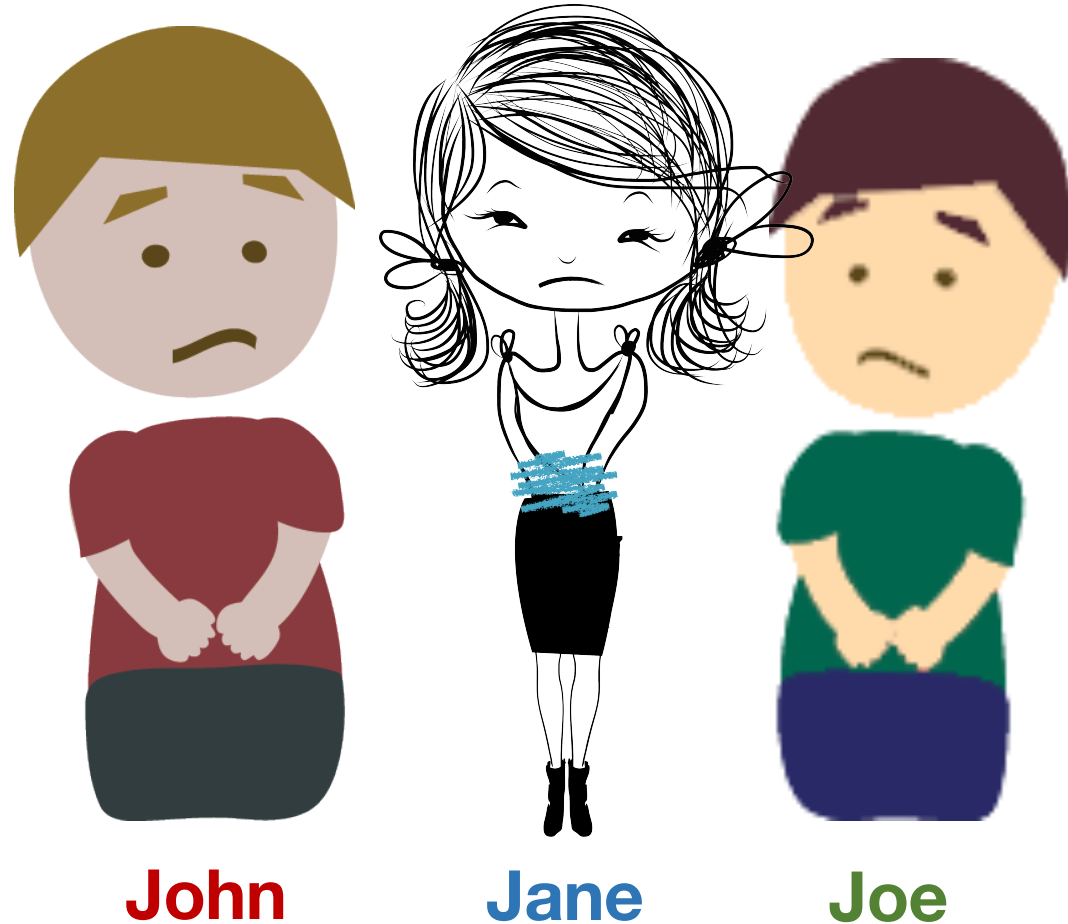
# Irritable Bowel Syndrome (IBS)

Characterized by episodic gastrointestinal symptoms.

Affects up to 20% of the US population.

Potential individualized triggers:

- certain nutrients
- eating behaviors
- stress
- sleep disturbances
- menstruation







Pain management



Gastroenterologist



Primary care

How do patients  
& providers  
collaborate  
during the  
tracking process?

# How do patients & providers collaborate during the tracking process?

## Patient Survey

211 overweight & IBS patients

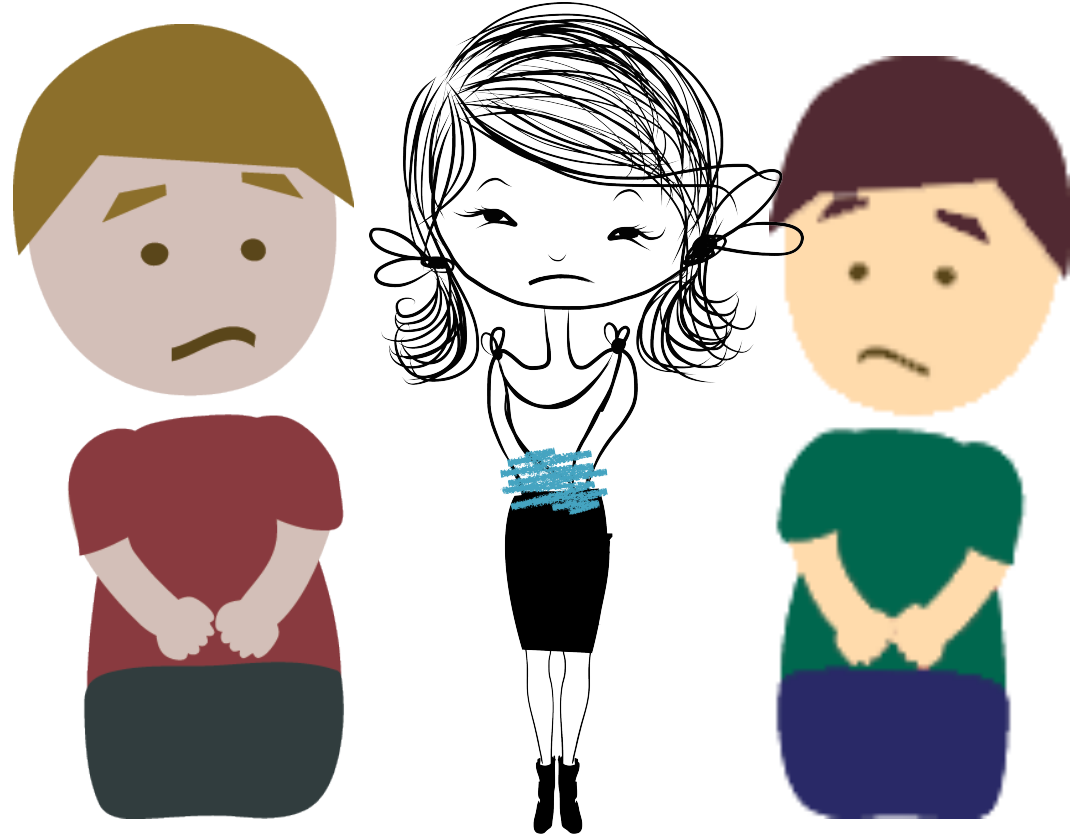
## Patient Interviews

18 patients who had experience sharing data with providers

## Provider Interviews

21 providers working with IBS and overweight patients

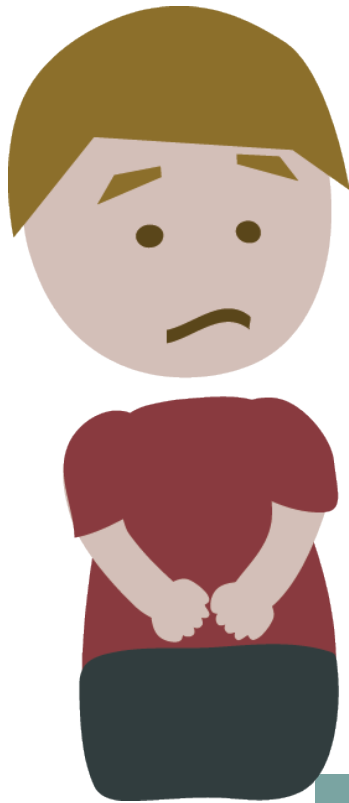
How do patients  
& providers  
collaborate  
during the  
tracking process?



**John**

**Jane**

**Joe**



**John**

**John**

34 years old

Overweight

Irritable Bowel Syndrome (IBS)

Abdominal pain associated with  
diarrhea and/or constipation

Preparation

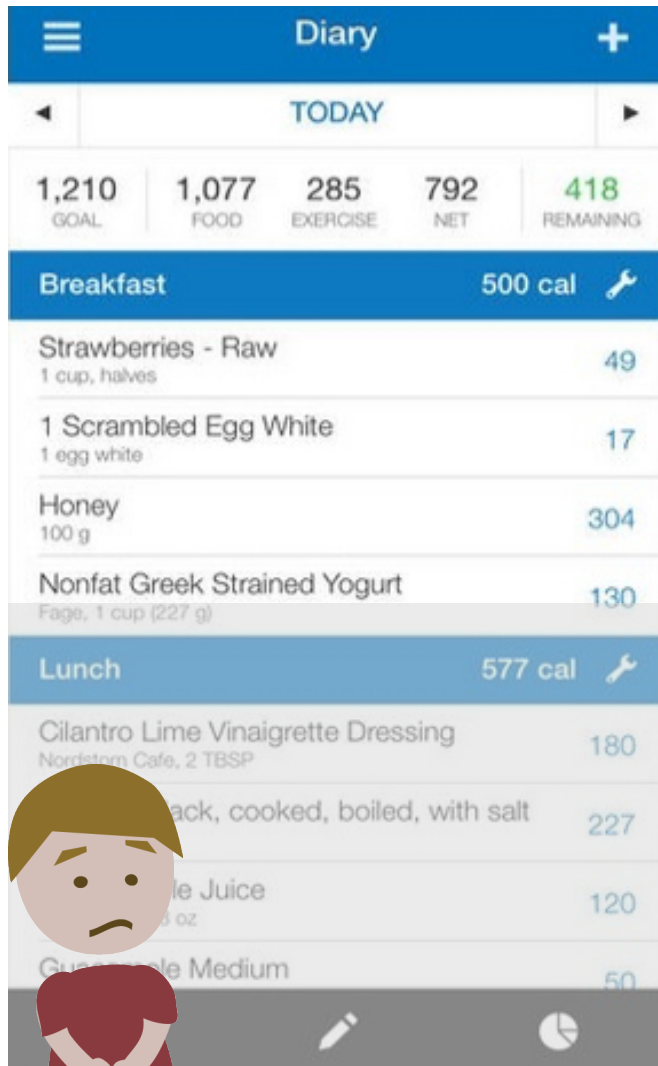
Collection

Integration

Reflection

Action





Diary	
TODAY	
1,210	GOAL
1,077	FOOD
285	EXERCISE
792	NET
418	REMAINING
<b>Breakfast</b> 500 cal	
Strawberries - Raw	49
1 cup, halves	
1 Scrambled Egg White	17
1 egg white	
Honey	304
100 g	
Nonfat Greek Strained Yogurt	130
1 cup (227 g)	
<b>Lunch</b> 577 cal	
Cilantro Lime Vinaigrette Dressing	180
Nordstrom Cafe, 2 TBSP	
Chicken, cooked, boiled, with salt	227
Apple Juice	120
8 oz	
Guacamole Medium	50

Begins keeping food and symptom diary

John's goal

Provide evidence that he was not responding to the treatment

Support for diagnosis and treatment

Support for affection needs

Preparation

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Diary	
TODAY	
1,210 GOAL	1,077 FOOD
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<b>Breakfast</b> 500 cal	
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Honey 100 g	304
Nonfat Greek Strained Yogurt Fage, 1 cup (227 g)	130
<b>Lunch</b> 577 cal	
Cilantro Lime Vinaigrette Dressing Nordstrom Cafe, 2 TBSP	180
Black, cooked, boiled, with salt	227
Apple Juice 3 oz	120
Guacamole Medium	50

John was motivated because he expected provider review

Increase motivation & accountability

Preparation

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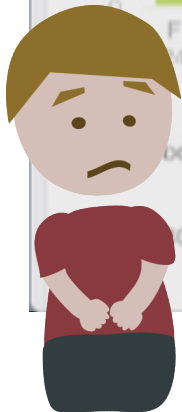
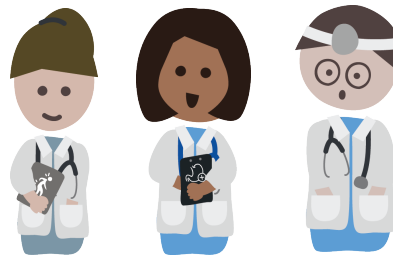
Action



John integrated data using his app and expected it to help his providers

Limitation of tools

Difficulty anticipating provider use



Preparation

Collection

Integration

Reflection

Action

# John and his providers tried to make sense of the data together

25% visit time  
( $< 5$  mins / 20-min visit)



6/21 - after large coffee - caffeine - MSG  
fructan (oligosaccharide),  
fat

dinner - fast foods

brandy - fructose

sauces - fructose

lemon  
? caffeine?

dinner - no MSG - no fructose  
no caffeine  
beer - ? gas not much fructose

6/22 -

- less solid (fructose) - symptoms

- low lactose

- low fat

4:25 - smoothie - sl. pain  
fructose

dinner - low lactose  
low fructose  
also - xy - good!

Preparation

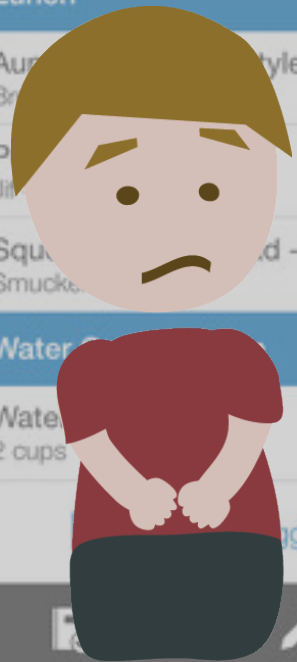
Collection

Integration

Reflection

Action

I'm working very hard. This should be helpful. My doctors can probably help me figure out what to do.



Diary	Diary	Diary
TODAY	TUE   Nov 19, 2013	TODAY
1,210 GOAL	1,800	1,210
+490	1,753	1,077
-0	240	285
490	1,513	792
720	287	418
Breakfast		500 cal
Greek 100%		49
Yoplait, 1 co		
Lunch	1 serving(s)	17
Auntie's Style 100% Whole...	Wine	Honey
Br...	Red Table Wine, 5 oz	100 g
180	118	304
P...	Snacks	260 cal
Ji...	260	130
Squ...	Aged White Cheddar Puffs	577 cal
Smucke...	Pirate's Booty, 2 oz (about 36 pieces)	180
20	260	227
Water	Cardio Exercise	120
2 cups	240 cal	50
	Fitbit calorie adjustment	
	6,996 Steps	
	Finished logging for today	



Diary

TODAY

1,210

GOAL

+490

FOOD

-0

EXERCISE

490

NET

720

REMAINING

Breakfast

100 cal

Greek 100 Calories Blended Strawbe...

100

Aunt Millie's Homestyle 100% Whole...

180

Peanut Butter 16oz

190

Squeeze Fruit Spread

20

Water Consumption

Water

2 cups

Finished logg

Diary

TUE | Nov 19, 2013

1,800

GOAL

1,753

FOOD

240

EXERCISE

1,513

NET

287

REMAINING

Dinner

514 cal

Briney Caesar Salad Dressing

Quinoa Casar Salad

Snacks

260 cal

Aged White Chedd

260

Cardio Exercise

240 cal

Fitbit calorie ad

240

Finished lo

day

Diary

TODAY

1,210

GOAL

1,077

FOOD

285

EXERCISE

792

NET

418

REMAINING

Breakfast

500 cal

1 Scrambled Egg White

17

Honey

304

Nonfat Greek Strained Y

130

Lunch

577 cal

Cilantro Lime Vinaigr

180

Beans - Black, cookr

227

100% Apple Juice

120

Guacamole Medium

50

I don't have time for this!

I'm not trained for this!

How do I deal with that many data?

## Introducing the FODMAPs

The nature of each type of FODMAP and which foods contain them is outlined below. On pages 44–45, we'll tell you which foods contain a small enough amount of FODMAPs overall to be suitable on the low-FODMAP diet, and on pages 46–47 we'll explain how to test your tolerance for each category of FODMAP.

### OLIGOSACCHARIDES

The major types of oligosaccharides found in food that are FODMAPs are fructans and galacto-oligosaccharides (GOS).

#### Fructans

Fructans are chains of fructose molecules with a glucose molecule at the end. The main dietary

sources of fructans include wheat products (breads, cereals, and pasta) and some vegetables, such as onions. Additional sources of fructans are fructo-oligosaccharides (also called oligofructose and FOS) and inulins, which are added to some foods, such as certain yogurts and milk, as a prebiotic (see page 21).

No one is able to digest fructans, and if you have IBS you should minimize your intake of them. Fructans are probably the most common FODMAP to cause symptoms of IBS, probably because most people eat a lot of them. They occur in a wide variety of foods and in large amounts in our food supply.

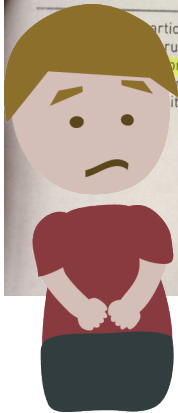
Foods are considered a problem for sufferers of IBS if they contain more than 0.2 gram of fructans per serving of food for cereals and grains, and 0.3 gram of fructans per serving of food for other foods. The main food sources of fructans are some vegetables and grains, as well as a small number of nuts and fruits.

	HIGH-FRUCTAN FOODS (not suitable)	MODERATE-FRUCTAN FOODS (suitable up to amounts given in parentheses)	LOW-FRUCTAN FOODS (suitable)
FRUITS	nectarines, persimmon, tamarillo, watermelon, white peaches	pomegranate (seeds from ½ small), rambutan (3 whole)	all others
	artichokes (globe and Jerusalem), <b>garlic, leeks,</b> <b>onions</b> (yellow, red, white, onion powder), scallions (white part), shallots	asparagus (3 spears), beet (½ medium), broc- coli (½ cup), Brussels sprouts (½ cup), butternut squash (¼ cup), savoy cabbage (1 cup), fennel (½ cup), green peas (½ cup), snow peas (10 pods), sweet corn (½ cob)	alfalfa sprouts, avocados, bamboo shoots, bean shoots, bok choy, bell peppers, carrots, cauliflower, celery, Chinese cabbage, chives, cucumber, eggplant, endive, ginger, green beans, lettuce, mushrooms, olives, parsnips, potatoes, pumpkin, Swiss chard, spinach,

John's provider gave him instructions for new diet and tracking plan

Incorporating instructions into tracking process is difficult

Not confident that the recommendations are correct



Preparation

Collection

Integration

Reflection

Action



Severe Symptoms

Missing Work

Needs Help

Preparation

Collection

Integration

Reflection

Action

Jane



unsure what to do

Consults Brother

Had Similar Symptoms

Shares his Triggers

Stress & Exercise



## tracks stress & physical activity

Buys a Fitness Band

Tracks Mood

Tracks Physical Activity

Preparation

Collection

Integration

Reflection

Action





(tries to) make  
sense of the data

Lots of Data  
Mood Over Time  
Activity Over Time

But No Understanding

Preparation

Collection

Integration

Reflection

Action



maybe her doctor  
can help?

Did not Track Symptoms

Did not Track Food

Elimination Diet

Difficult to Follow

Difficult to Interpret

Lengthy Process

Possibly Inconclusive

Preparation

Collection

Integration

Reflection

Action



current standard of care

Some FoodMAPs

Not watery. loose

Stanford Hospital and Clinics  
Digestive Health

Food/GI Symptoms Record

Instructions: Please record everything you eat and drink (including ice and water taken with your medications). Circle your symptoms if any as they occur after meals and snacks.

Circle your symptoms if any as they occur after meals and snacks.

Name: Ruth Fisher

Intolerable: doe own looking

Date: <u>6/22</u>	Food & Beverages and Amount	Symptoms if any (circle).
Breakfast Time: <u>11:00</u>	<u>1/4 c oatmeal w/ 1/2 Trice milk</u> <u>CA fortified - 1/4t sugar</u> <u>1/2 Tr. Joes wheat free waffle</u> <u>100z. peppermint tea</u>	Nausea Vomiting Heartburn Stomach Pain <u>Diarrhea</u> Constipation Sense of Urgency Gas Bloating Cramping Other: <u>before breakfast</u>
Snack Time: <u>11:00</u>	<u>1 slice French toast egg white, milk</u>	
Lunch Time: <u>12:30</u>	<u>3 oz fresh cold broiled salmon</u> <u>4oz cranberry juice</u> <u>5 flour tortilla, toasted - avocado, olives</u> <u>1/2 c. onion, lowfat dressing - warm rice 1T.</u> <u>1/2 ginger cookie whole foods</u>	Nausea Vomiting Heartburn Stomach Pain Diarrhea Constipation Sense of Urgency Gas Bloating Cramping Other:
Snack Time: <u>3:00</u>	<u>rice crispies, rice milk, blueberries</u>	
Dinner Time: <u>6:00</u>	<u>1c. chicken broth 1T. rice</u> <u>4oz organic broiled chicken breast</u> <u>Baked sweet yam, steamed carrots,</u> <u>Zucchini, cranberry sauce, tea, raspberry</u> <u>sorbet, homemade cake</u>	Nausea Vomiting Heartburn Stomach Pain Diarrhea Constipation Sense of Urgency Gas <u>Bloating</u> Cramping Other: <u>after dinner</u>
Snack Time: <u>8:30</u>	<u>crackers, reduced sugar jam</u>	

Date: <u>6/25</u>	Food & Beverages and Amount	Symptoms if any (circle).
Breakfast Time: <u>9:30</u>	<u>1/4 c oatmeal w/ Trice cereal,</u> <u>3T rice milk - CA enriched - Tradents</u> <u>wheat free waffle, maple syrup 1T.</u> <u>Peppermint tea</u>	Nausea Vomiting Heartburn Stomach Pain Diarrhea Constipation Sense of Urgency Gas Bloating Cramping Other:
Snack Time: <u>11:00</u>	<u>1/4 c Soy Yogurt, fr blueberries,</u> <u>mashed strawberries (yellow) cracker</u>	
Lunch Time: <u>1:00</u>	<u>Toast. 3oz Roast Turkey Breast</u> <u>1/4 avocado, mustard, romaine</u> <u>hard boiled egg white, baked potato</u> <u>chips - tea, 2oz cranberry juice</u>	Nausea Vomiting Heartburn Stomach Pain Diarrhea Constipation Sense of Urgency Gas Bloating Cramping Other:
Snack Time: <u>4:00</u>	<u>pretzels, 1/4t peanut butter, crackers</u>	
Dinner Time: <u>6:30</u>	<u>Flour tortilla - 4oz Tilapia pan</u> <u>scared, lemon, olive oil, couscous</u> <u>Israeli, green beans fresh, carrots +</u> <u>peas, apple sauce 1/4cup, blueberries</u> <u>1/2 ginger cookie</u> <u>raspberry sorbet, small piece yellow cake (I baked)</u>	Nausea Vomiting Heartburn Stomach Pain Diarrhea Constipation Sense of Urgency Gas Bloating Cramping Other:

Bedtime - water 600mg gabapentin - every night  
align probiotic - 4-6 times a week after lunch

P:\Food Diary.doc

5/21/12 - Woke at 6:30  
- BM at 6:32  
(low back ache)  
(wake with low back ache through the night)  
- BM at 7:10  
- BREAKFAST at 8:00  
  
- SNACK at 9:30  
  
- SNACK at 11:15  
  
- SNACK at 1:45  
(all symptoms passed)  
- SNACK at 3:00  
- DINNER at 5:30

5/22/12 - Awoke at 12:30  
(low back pain, abdominal cramps,  
right knee ache, right foot tingling, gas,  
mild nausea)  
- SNACK at 2:00  
- Woke at 6:30  
- BM at 6:35  
- BM at 6:40  
- BM at 6:50  
- BM at 7:30  
- BREAKFAST at 8:00  
(still have low back pain)  
  
- BM at 10:45

5/21/12 - TOOK SYNTHROID  
  
- TOOK M.V.  
- 2 EGGS POACHED  
- WATER  
- 3 MEDJOL DATES w/  
NATURAL PEANUT BUTTER  
- KEFIR  
- HAND FULL OF SESAME STICKS  
- WATER  
- APRICOT  
- 3 MEDJOL DATES w/  
NATURAL PEANUT BUTTER  
- HANDFUL OF MIXED NUTS  
- LASAGNA w/ ARTICHOKE & AVOCADO  
- 1 STICK APPLE CHEW  
- WATER

5/22/12 - KEFIR  
  
- BROWN RICE CRISPS  
- RICE MILK  
- HALF BANANA  
- KEFIR  
- 2 MEDJOL DATES w/  
NATURAL PEANUT BUTTER



# inconsistent results

- Study: show same patient diaries to different providers
- Same patient, different providers: completely different recommendations
- Same provider, different patient: same recommendations

Some FODMAPs  
do not look like  
Not watery, loose

Name: *Rene Fisher*  
*"Holeable"*

Stanford Hospital and Clinics  
Digestive Health  
Food/GI Symptoms Record

Instructions: Please record everything you eat and drink (including ice and water taken with your medications). Circle your symptoms if any as they occur after meals and snacks.

Date:	Food & Beverages and Amount	Symptoms if any (circle):
6/22	Breakfast Time: 11/4 c. oatmeal w/ 1/2 T rice milk, 1/2 c. fruit, 1/2 c. sugar 1/2 T. T. wheat-free waffle 100% peppermint tea Snack Time: 11:40 - 1 slice French toast w/ white, milk Lunch Time: 12:30 3 oz fresh cold broiled salmon 4oz. Raspberry juice 1/2 flour tortilla, toasted - avocado, olives 1/2 c. lemon, low-fat dressing - warm rice 1T. 1/2 c. pepperoni, whole bread Snack Time: 2:00 Rice Krispies, rice milk, blueberries Dinner Time: 6:00 1 c. chicken broth 1 T. rice 4oz organic broiled chicken breast Baked sweet yam, steamed carrots, zucchini, cranberry sauce, tea, raspberry sorbet, homemade cake Snack Time: 8:30 crackers, reduced sugar jam	Nausea Vomiting Heartburn Stomach Pain Diarrhea Constipation Sense of Urgency Gas Bloating Cramping Other: <i>before breakfast</i>
6/25	Breakfast Time: 11/4 c. oatmeal w/ 1 T rice cereal, 2 T rice milk - CA enriched - Truents wheat-free waffle, maple syrup 1T. Peppermint tea Snack Time: 11:00 1/4 c. Soy Yogurt - 1/2 blueberries Lunch Time: 1:00 Toast - 3oz Roast Turkey Breast 1/4 avocado, mustard, romaine hard-boiled egg white, baked potato chips - tea, 2oz cranberry juice Snack Time: 4:00 pretzels, 1/2 T peanut butter, crackers Dinner Time: 6:30 Flour tortilla - 4oz Tilapia pan seared, lemon, olive oil, avocado Israeli, green beans fresh, carrots + peas, apple sauce 1/2 cup, blueberries Snack Time: 8:30 1/2 c. sugar-coated rice raspberry sorbet, small rice w/ blueberries	Nausea Vomiting Heartburn Stomach Pain Diarrhea Constipation Sense of Urgency Gas Bloating Cramping Other: <i>after dinner</i>
5/21/12	- WORK AT 6:30 - BM AT 6:32 (low back ache) (w/ with low back ache through the night) - BM AT 7:10 - BREAKFAST AT 8:00 - SNACK AT 9:30 - SNACK AT 11:15 - SNACK AT 1:45 (all symptoms passed) - SNACK AT 3:00 - DINNER AT 5:30	- TOOK SYNTHROID - TOOK M.V. - 2 EGGS POACHED - WATER - 3 MEDJOL DATES w/ NATURAL PEANUT BUTTER - KEFIR - HANDFUL OF SESAME STICKS - WATER - APPLE - 3 MEDJOL DATES w/ NATURAL PEANUT BUTTER - HANDFUL OF MIXED NUTS - ASAXUM w/ ARTICHOKE & AVOCADO - 1 STICK APPLE CHEW - WATER
5/22/12	- WORK AT 12:30 (low back pain, abdominal cramps, right knee ache, right foot tingling, gas, mild nausea) - SNACK AT 2:00 - WORK AT 6:30 - BM AT 6:35 - BM AT 6:40 - BM AT 6:50 - BM AT 7:30 - BREAKFAST AT 8:00 (still have low back pain) - BM AT 10:45	- KEFIR - BROWN RICE CRISPS - RICE MILK - HALF BANANA - KEFIR - 2 MEDJOL DATES w/ NATURAL PEANUT BUTTER



**Joe**

## Joe

Wonders if alcohol or wheat might be a trigger for his GI symptoms.

Doesn't have a doctor who he feels he can turn to to help him answer this question.

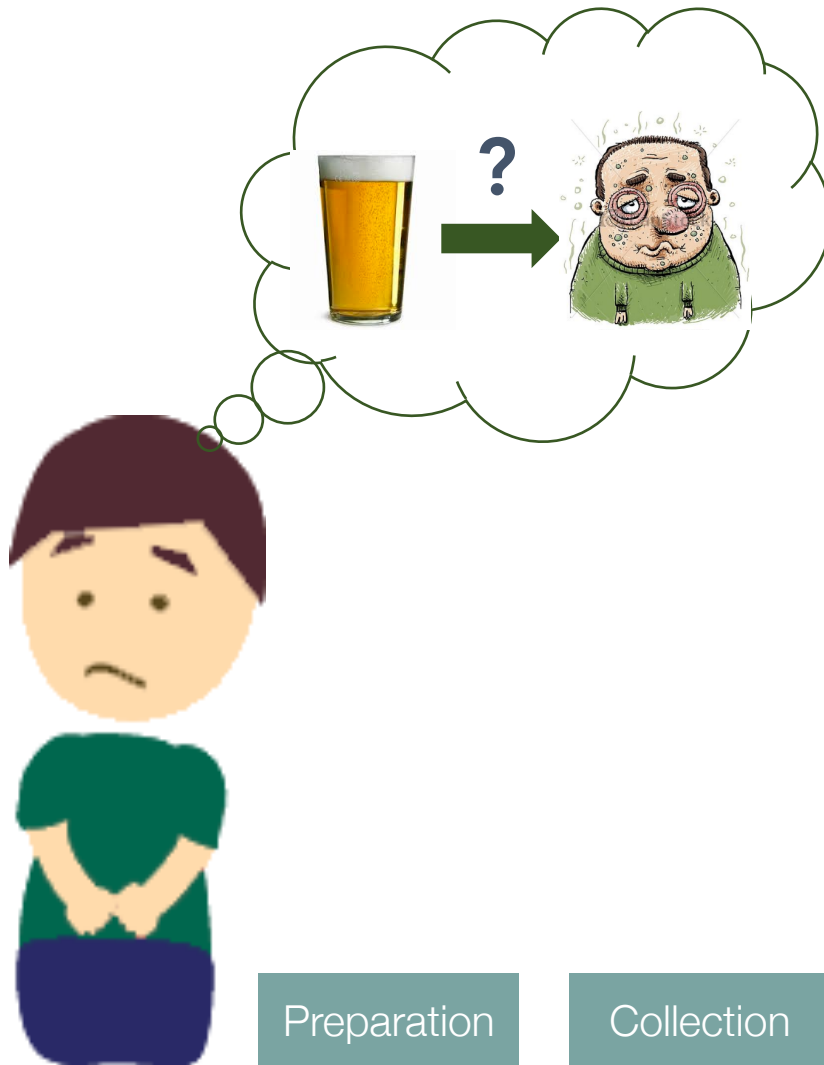
Preparation

Collection

Integration

Reflection

Action



**Joe**

## Joe

Wonders if alcohol or wheat might be a trigger for his GI symptoms.

Doesn't have a doctor who he feels he can turn to to help him answer this question.

Preparation

Collection

Integration

Reflection

Action





+



Decides to conduct  
an experiment

Wants a conclusive  
answer fast.

Preparation

Collection

Integration

Reflection

Action



Decides to conduct  
an experiment

Sure enough, he gets sick.

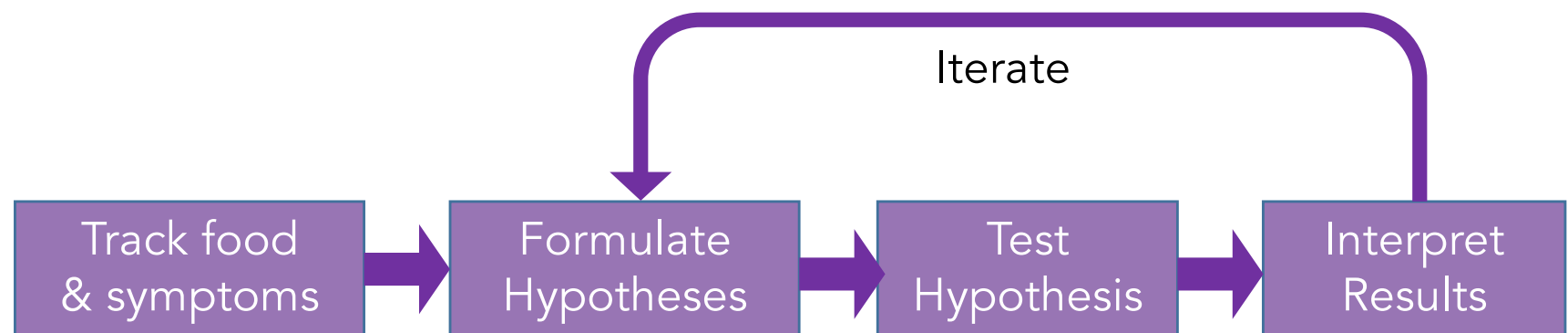
But so would anyone.

Providers and patients  
collaborate in every tracking stage  
and need better support in these collaborations



# recasting self-tracking

- Hypothesis formation based on journals
- Rethinking trigger detection to rigorously test hypotheses while reducing patient and provider burden.



# recasting self-tracking

- **Hypothesis formation based on journals**
- Rethinking trigger detection to rigorously test hypotheses while reducing patient and provider burden

a new process



## new analysis tools

**BEFORE YOUR NEXT MEAL/SNACK  
& BEFORE BEDTIME:**

Circle the number that best describes how severe each **symptom** was since you last ate or drank anything:

Did it last  
> 1 hour?

Abdominal Pain 0 1 2 3 Y / N

Bloating	0	1	2	3	Y / N
----------	---	---	---	---	-------

Constipation	0	1	2	3	Y / N
--------------	---	---	---	---	-------

Diarrhea	0	1	2	3	Y / N
----------	---	---	---	---	-------

Circle the number that best describes how severe your **stress level** was since you last ate or drank anything:

Stress	0	1	2	3
--------	---	---	---	---

**SYMPTOM KEY:**

0 = not present

1 = mild  
2 = med.

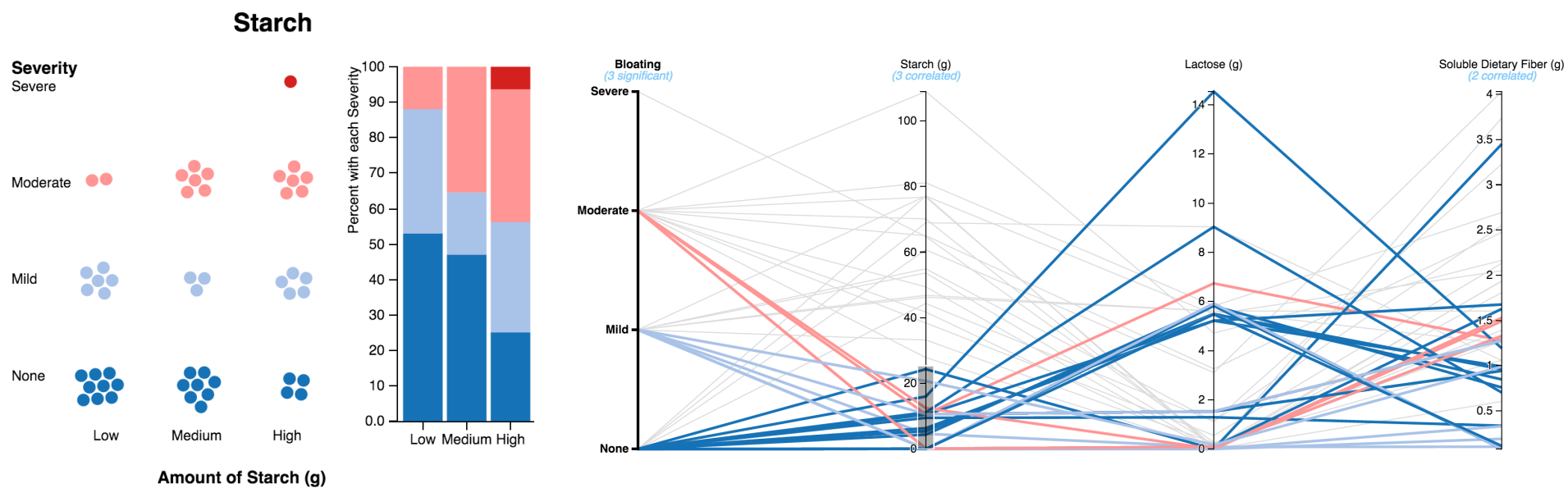
2 = moderate  
3 = severe

**DATE/TIME:** \_\_\_\_\_ **LOCATION:** \_\_\_\_\_

[illegible]

Time of Logged Symptoms	Lactose (g)	Total Dietary Fiber (g)
▼ 7/18/14 12:23PM	4.62	0.03
frozen strawberries (1 cup)	0.00	0.02
ice cream (0.25 cups)	4.62	0.01
▼ 7/18/14 1:30PM	3.63	0.50
cheese pizza (3 slices)	3.63	0.50
▼ 7/18/14 5:00PM	2.53	3.31
roasted cashews (0.5 cup)	0.00	2.02
milk chocolate (0.25 bar)	2.53	1.33
▼ 7/18/14 10:30PM	1.30	7.17
baked potato (1 potato)	0.00	6.77
shredded cheese (0.25 cups)	1.30	0.10
ketchup (1 tbs)	0.00	0.30
▼ 7/19/14 12:23PM	0.02	13.16
donut (1)	0.02	13.16

# visualizing results



# visualizing results: bubble and bar chart



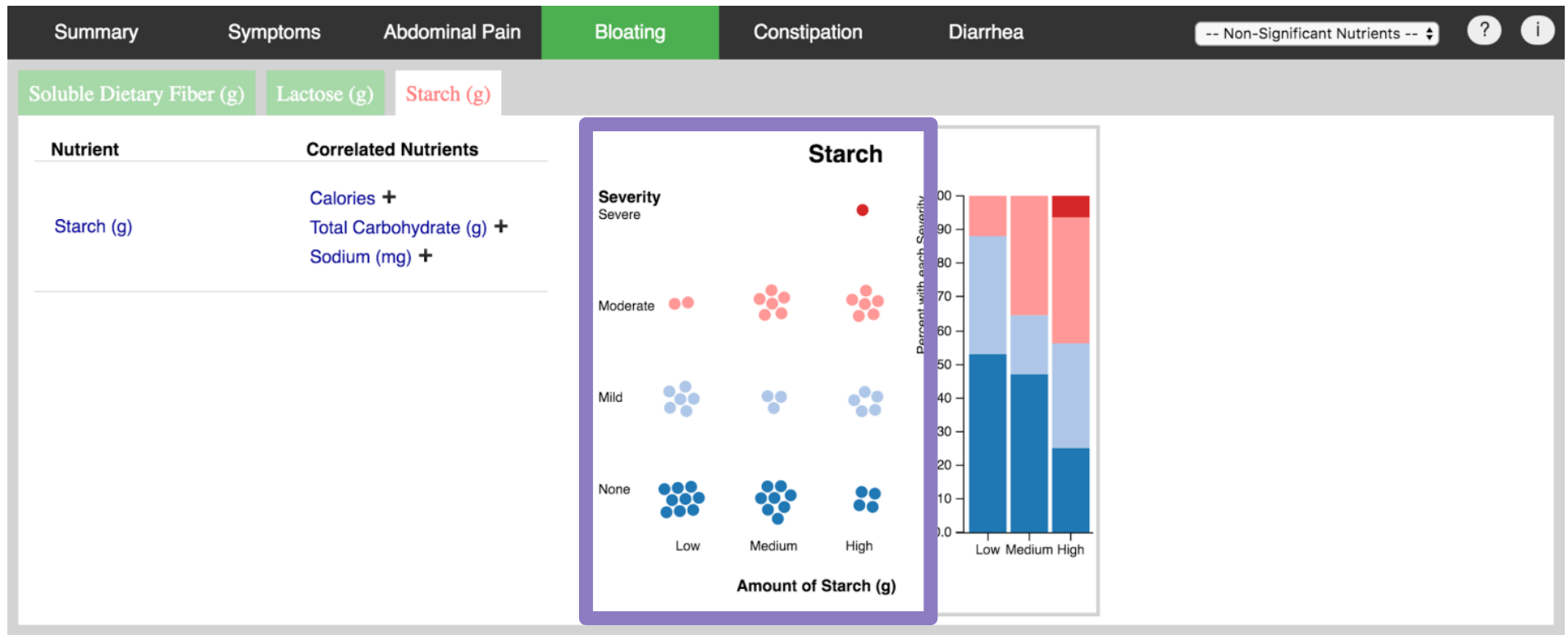
# visualizing results: bubble and bar chart



# visualizing results: bubble and bar chart



# visualizing results: bubble and bar chart

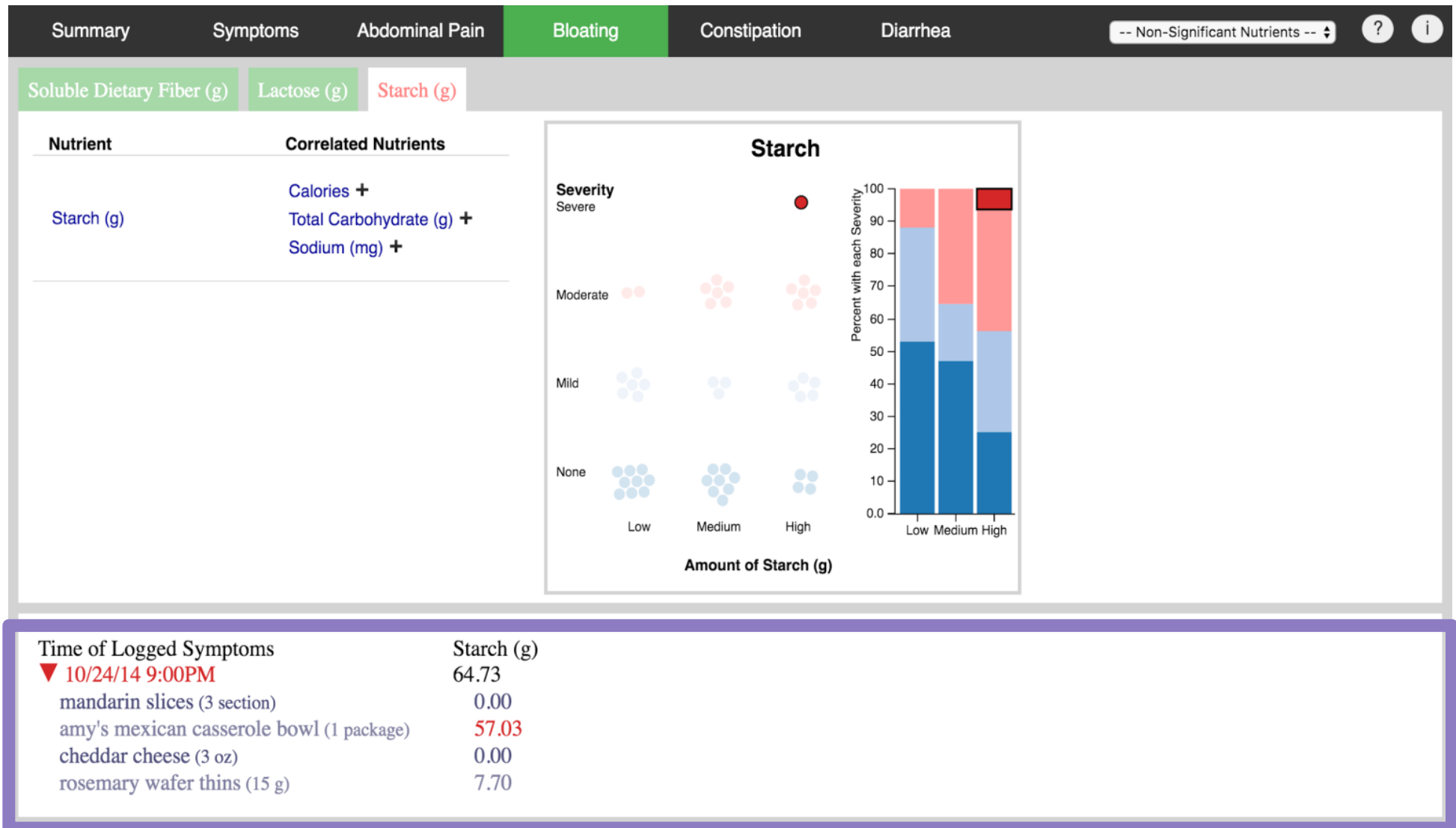




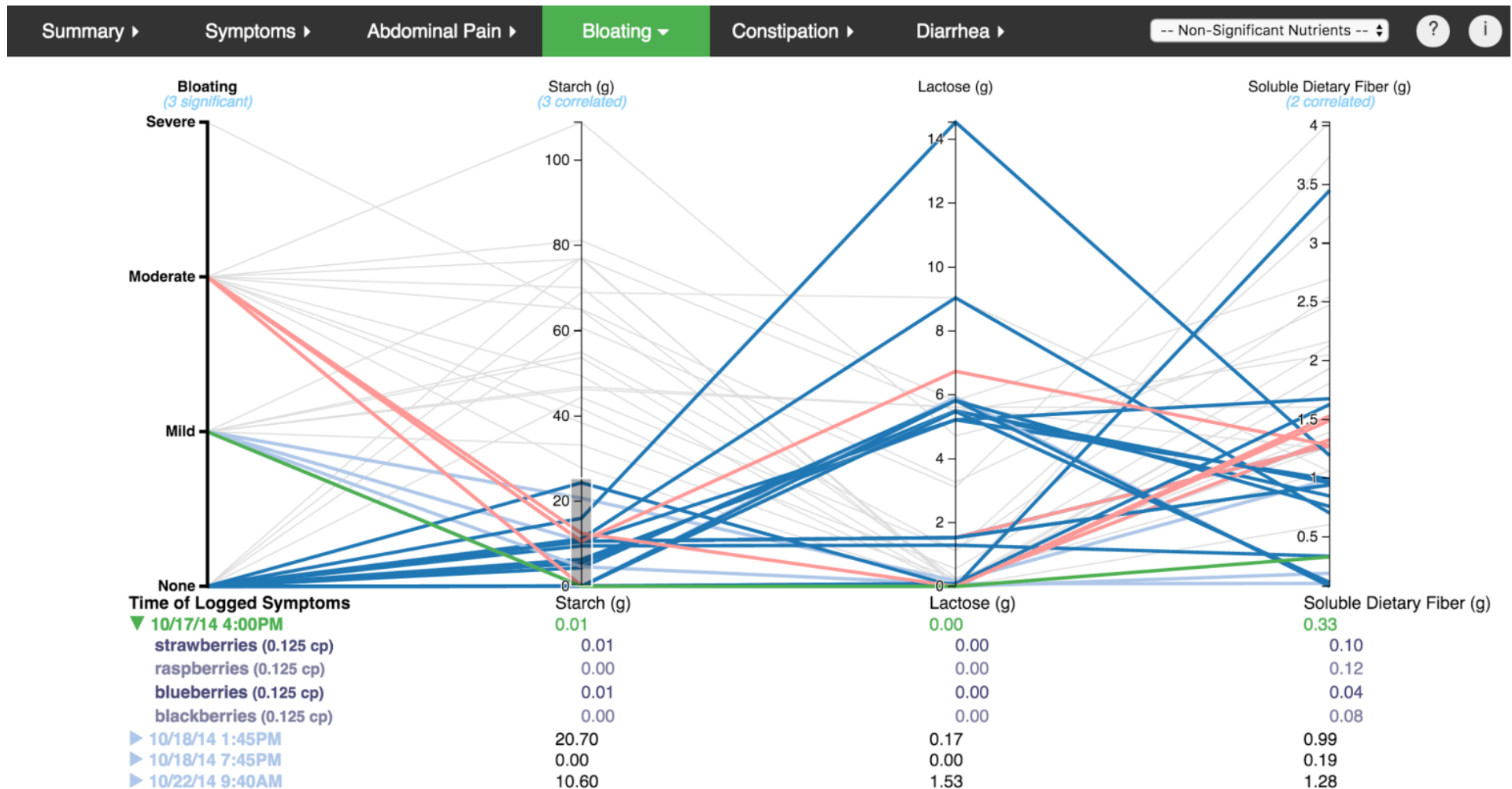
# visualizing results: bubble and bar chart



# visualizing results: bubble and bar chart



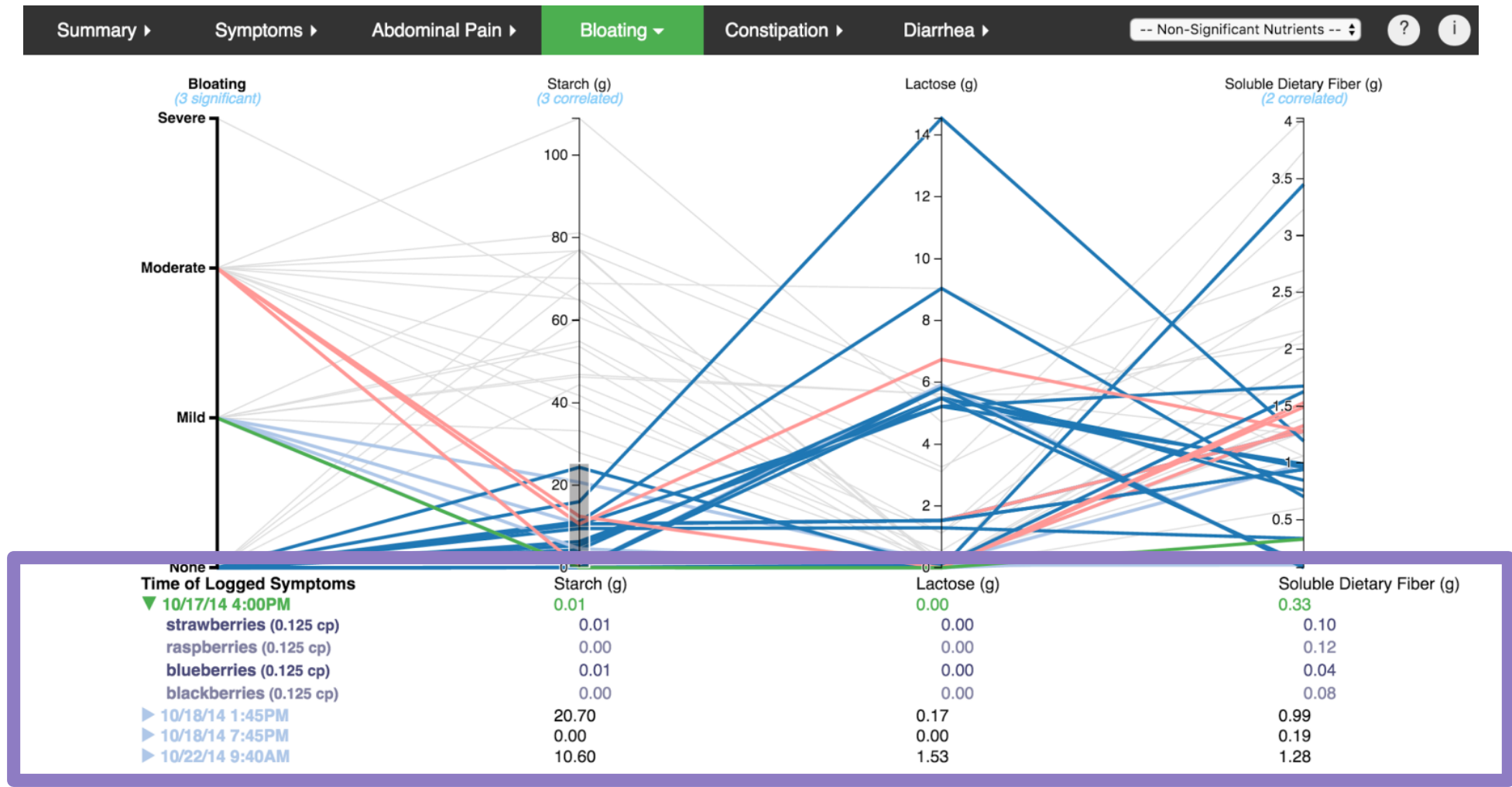
# visualizing results: parallel coordinates plot



# visualizing results: parallel coordinates plot



# visualizing results: parallel coordinates plot



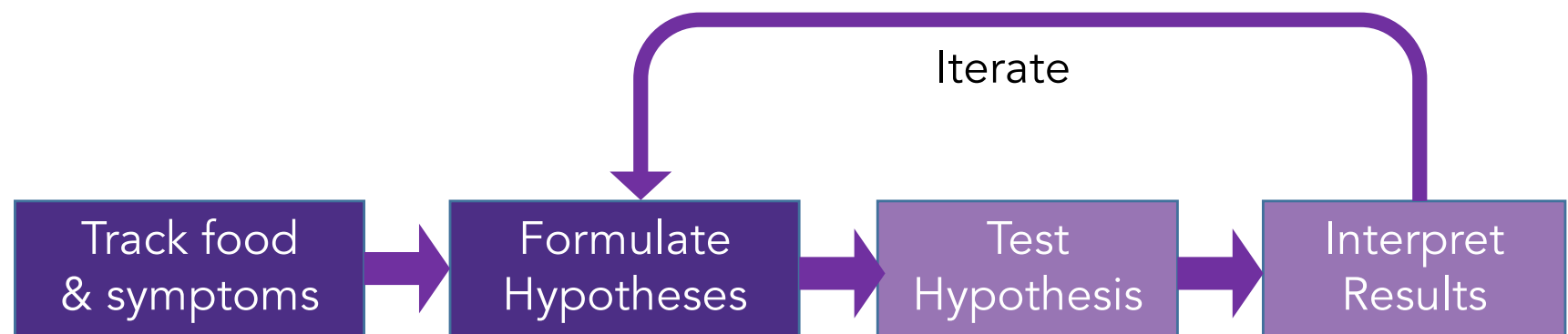
# visualizations facilitated collaboration

- Greatly preferred over analyzing paper diaries; reduced burden of synthesis.
- At least initially, patients and providers had concerns about data and results, but these were generally resolved through collaboration.
- Very different preferences for *how* to use these tools.



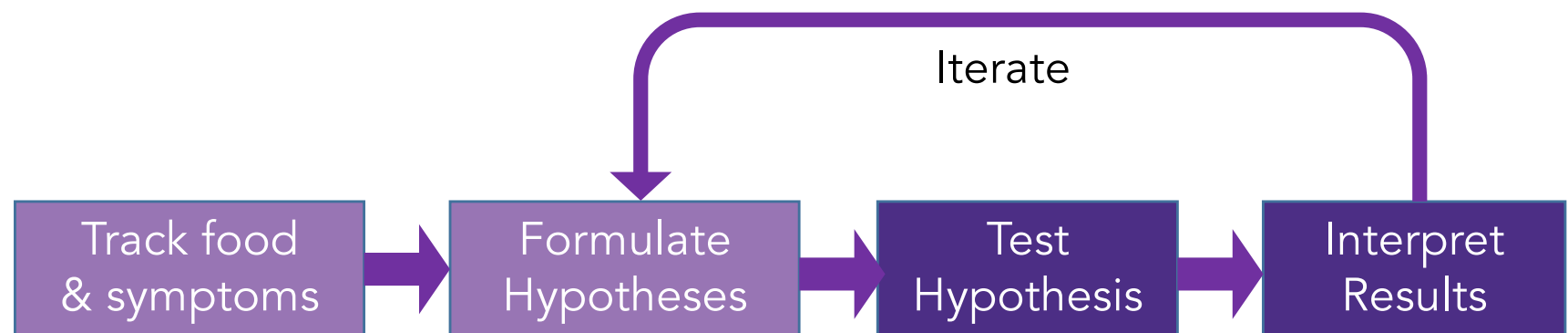
# recasting self-tracking

- Hypothesis formation based on journals
- Rethinking trigger detection to rigorously test hypotheses while reducing patient and provider burden.



# recasting self-tracking

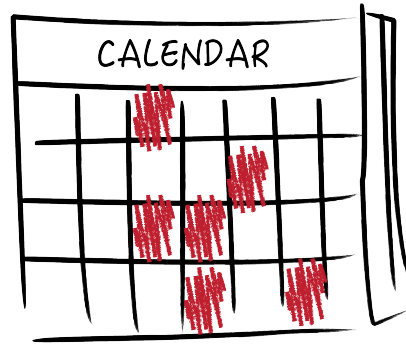
- Hypothesis formation based on journals
- Rethinking trigger detection to rigorously test hypotheses while reducing patient and provider burden.



# rigorous testing of hypotheses for IBS food triggers

Karkar R, Zia J, Vilardaga R, Mishra SR, Fogarty J, Munson SA, Kientz JA. *JAMIA*.  
A Framework for Self-Experimentation in Personalized Health.

# a new process for Jane



Severe Symptoms

Missing Work

Needs Help

Preparation

Collection

Integration

Reflection

Action

# Jane's personal hypotheses



Lactose



?

Caffeine



?

Stress



?

Possible Triggers

Lactose

Caffeine

Stress

Confounding Effect

Preparation

Collection

Integration

Reflection

Action

# designing a self-experiment



< Trial Setup (1 of 4)

**1. Choose Symptoms**  
What symptoms do you want to test? ?

- ☒ Abdominal Pain i
- ☒ Bloating or Gas i
- ☐ Constipation i
- ☐ Diarrhea i
- ☐ Bowel Urgency i
- + Add symptom >

CONTINUE >

Current Trial My Trials FAQs Settings

Collection Integration

< Trial Setup (2 of 4)

**2. Choose a Possible Cause**  
Which possible trigger do you want to test? ?

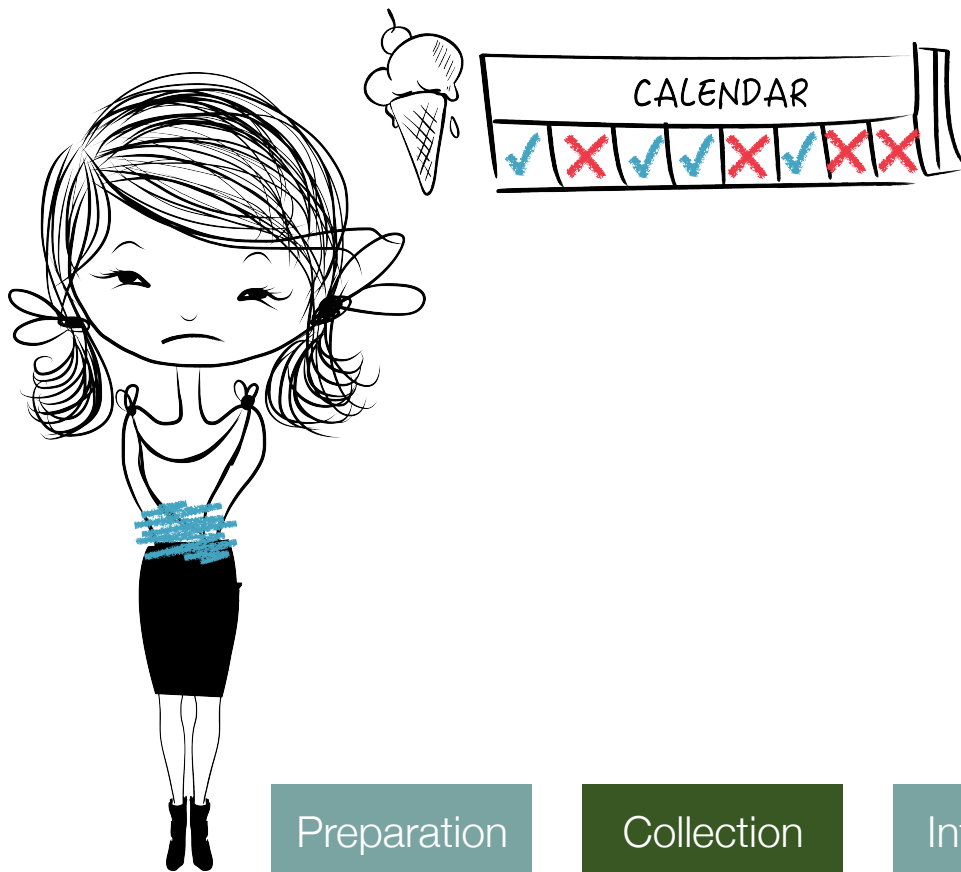
- ☐ Eating Large Meals >
- ☒ Eating Lactose / Dairy >
- ☐ Drinking Caffeine >
- ☐ Eating Gluten >
- ☐ Eating Fructose >
- ☐ Eating Artificial Sweeteners (Sorbitol) >
- ☐ Eating High Fat >

CONTINUE >

Current TrialF My Trials AQsS ettings

Reflection Action

# conducting the self-experiment



<

Input Symptom Severity

DAY 2/8

TU	W	TH	F	S	SU	M	TU
	28	29	30	31	12		3

LACTOSE

Step 2 of 4

At its worse, how much has your symptom impacted your day since you last ate?

**Bloating/Gas Severity** ⓘ

Not at all

Mildly

Moderately

Severely

Extremely

Preparation

Collection

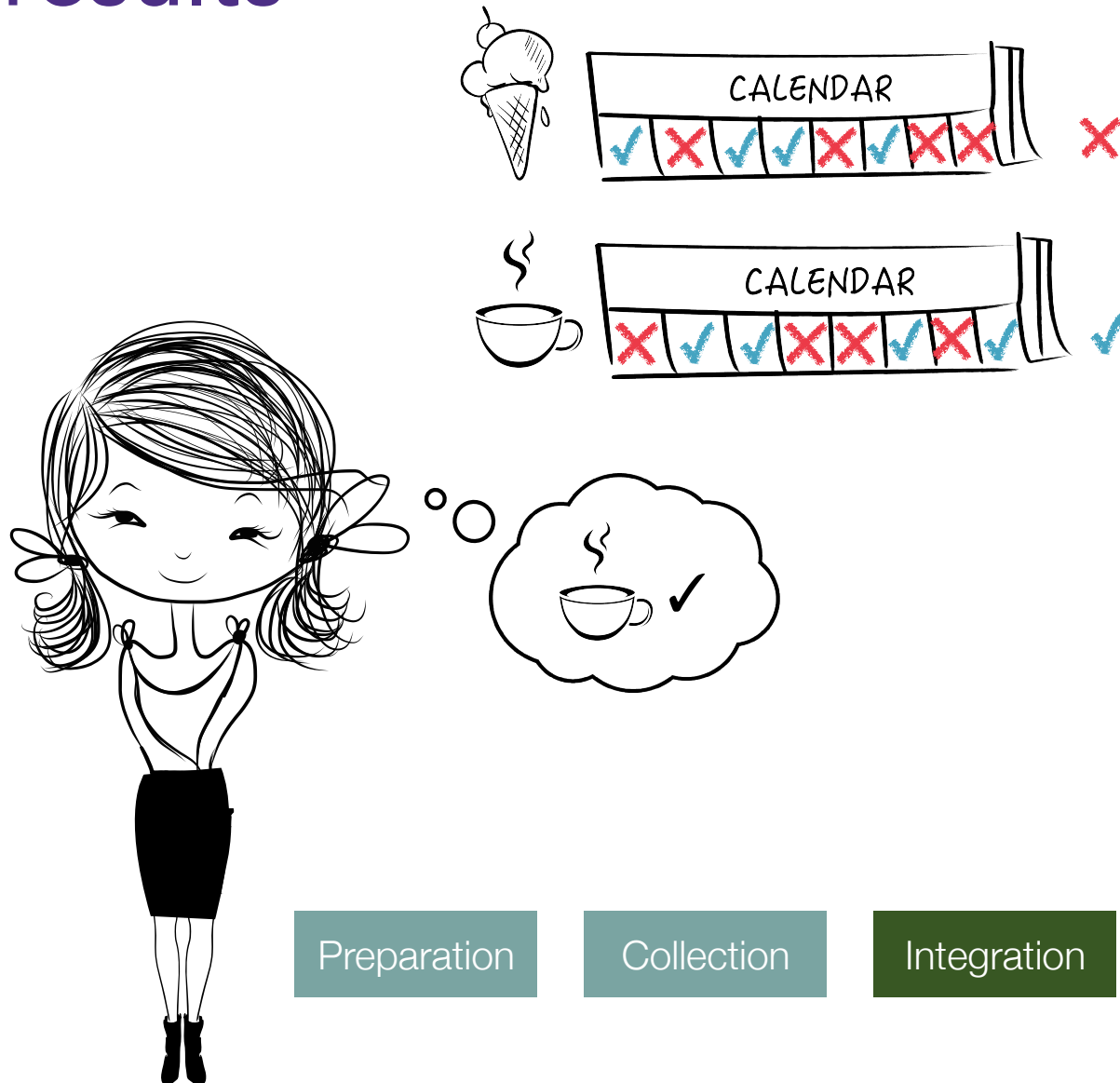
Integration

Reflection

Action



# interpreting results



Preparation

Collection

Integration

Reflection

Action




Past Studies

## Eating Caffeine Study Findings

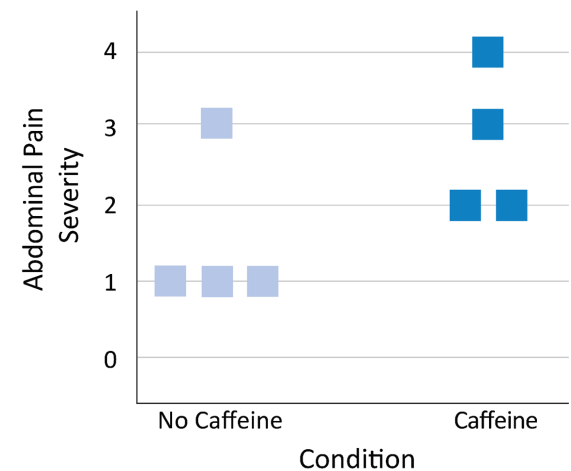
May 27th – June 3rd

### Abdominal Pain

Based on the study, there is a **no evidence** that your abdominal pain decreases when you don't eat caffeine ( $p=0.762$ ). 

### Abdominal Pain Severity

May 27th – June 3rd



Each square represents one day

FREQUENCY VIEW

DAILY VIEW

Reflection

Action

Days without Caffeine was 1.5



Schedule



Symptoms

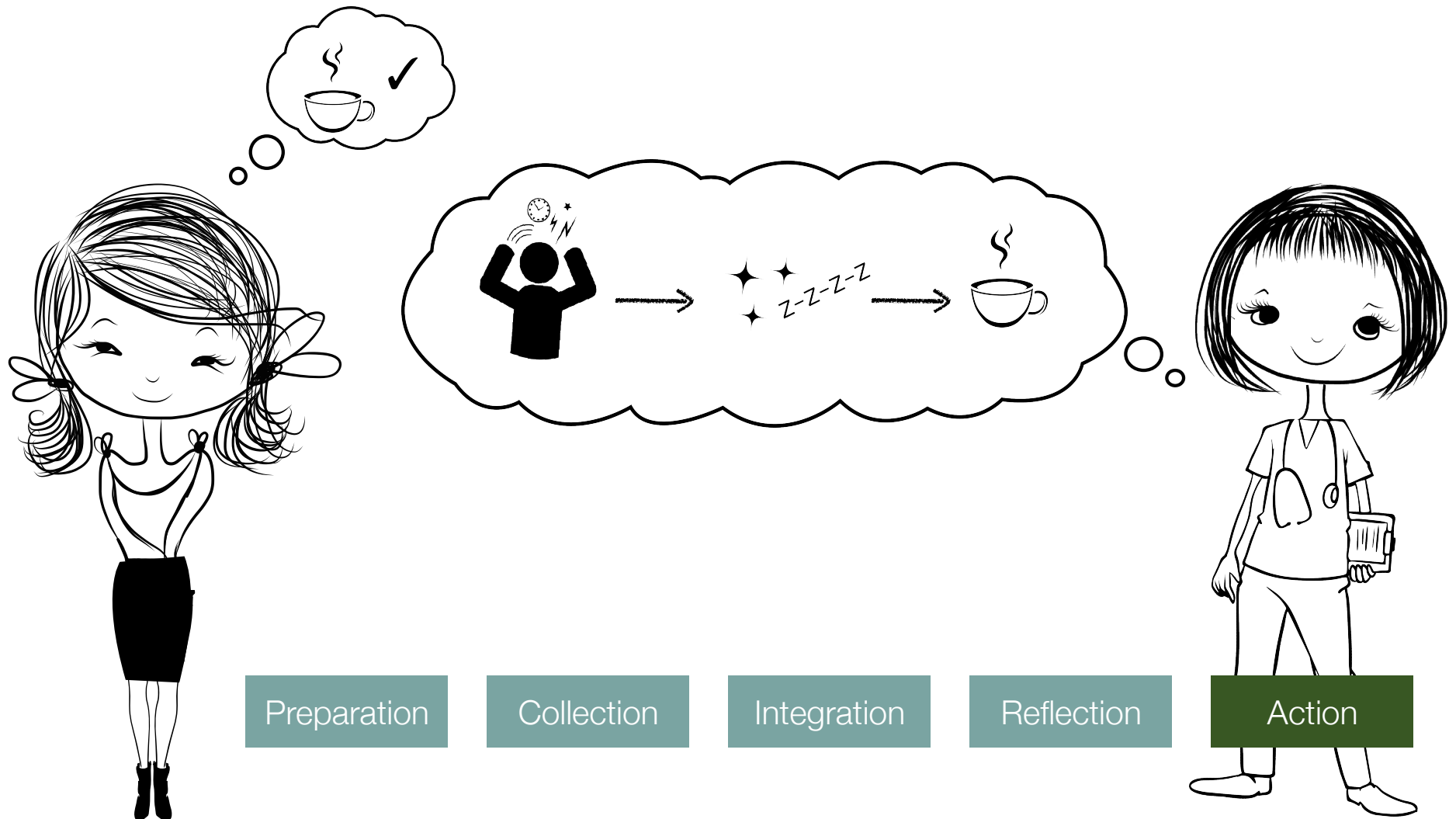


Past Studies



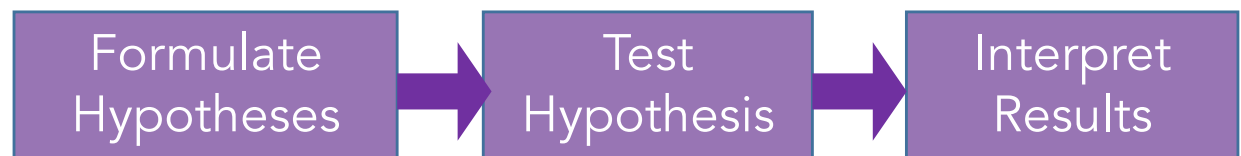
Study Setup

# actionable answers



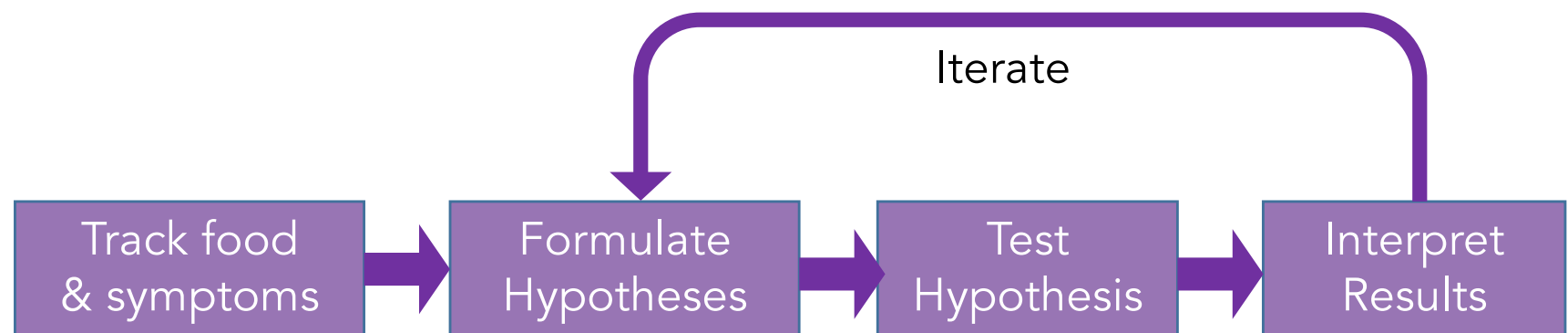
## preliminary evaluation (15 person field study)

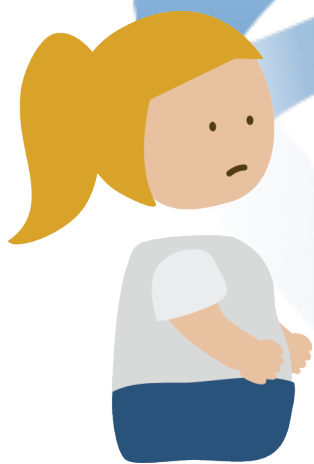
- High completion rate, low reported burden
- People found results valuable:
  - Valued design of controlled experiment
  - Relied on visual analysis much more than statistical analysis
- Rigor: participants were willing to accept and act on less than scientific standards, to better fit study into their lives.



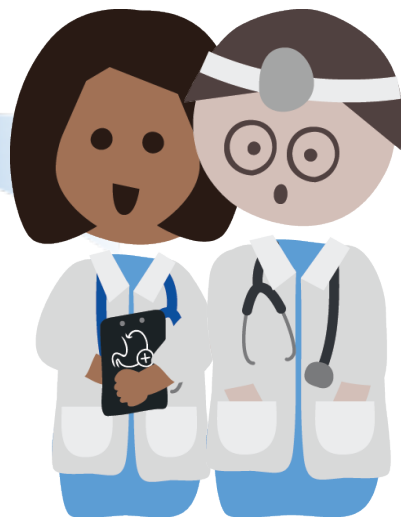
# recasting self-tracking

- Hypothesis formation based on journals
- Rethinking trigger detection to rigorously test hypotheses while reducing patient and provider burden.





**Individuals**



**Medical Team**



**Peers &  
support networks**



**Individuals**



**Medical Team**



**Peers &  
support networks**

## Many apps support sharing to social streams



**Just completed a 8.12 mi run with RunKeeper**

Duration 1:10:46 | Calories Burned 1281

Average Pace 8:43 / mi | Average Speed 6.88 mph | Elevation Climb 544 ft



Like · Comment · Track your fitness · 38 minutes ago via RunKeeper · 



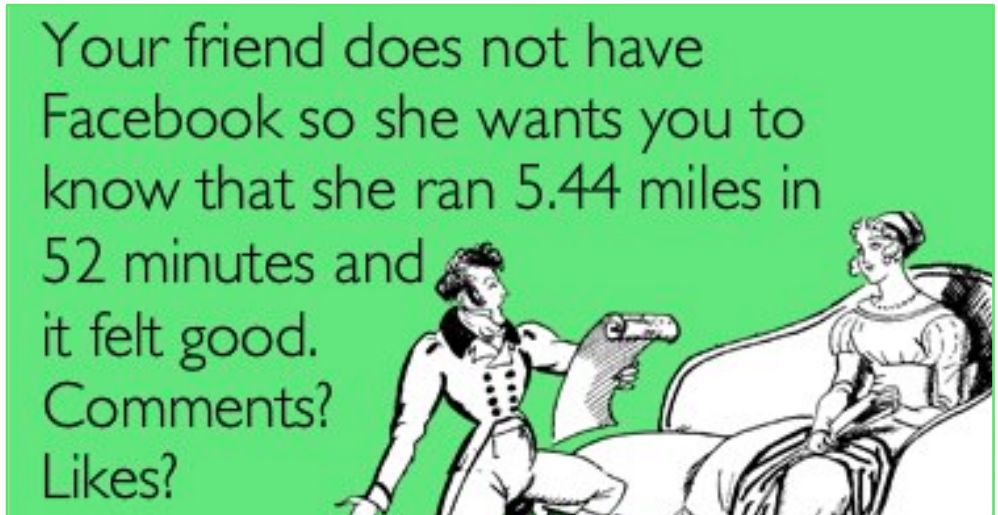


## People seek support from friends & peers

- Accountability
- Emotional support: celebrate successes and commiserate struggles
- Information and advice
- Role models and inspiration

## but shares can antagonize friends

- Bore them
- Seem boastful
- Confuse them about what you want



Really bro,  
no one cares.

Ugh.

Why would someone  
post this?

survey respondents

These are default,  
auto posts.

They are not  
good posts.



Providing even a tiny bit of context can elicit more support.

btw, people seem to like photos of shoes.



**Taylor**  
@taylorr

Watch my run right now with @RunKeeper Live- cheer me on!  
<http://rnkpr.com/a5sjetc> #RunKeeper

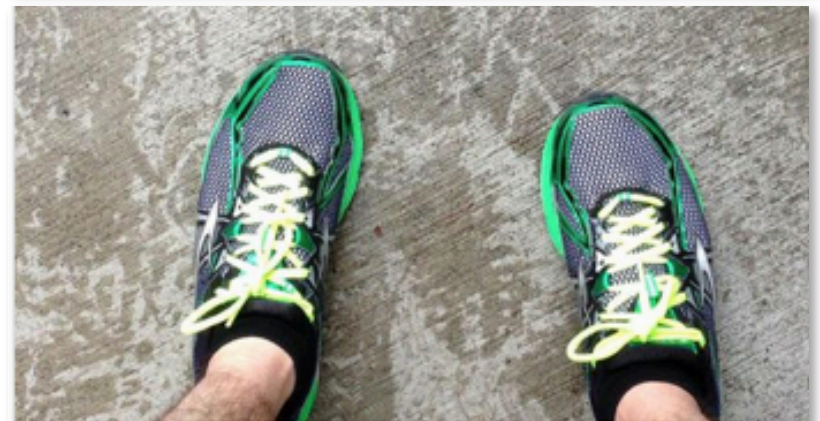
12:17 PM - 8 May 2014



**Kendall**  
@run\_kendall

Just posted a 5.74 mi run - first training run for my half!  
<http://rnkpr.com/a5sjetc> #RunKeeper

12:17 PM - 8 May 2014



**Cameron**  
@run\_cameron

Watch my run right now with @RunKeeper Live- happy to go running!  
<http://rnkpr.com/a5sjetc> #RunKeeper



Can we combine  
goals and monitoring  
to generate support  
and accountability?





## Progress Report

You committed to walk at least 3400 steps per day on at least 4 days this week.

### Your progress

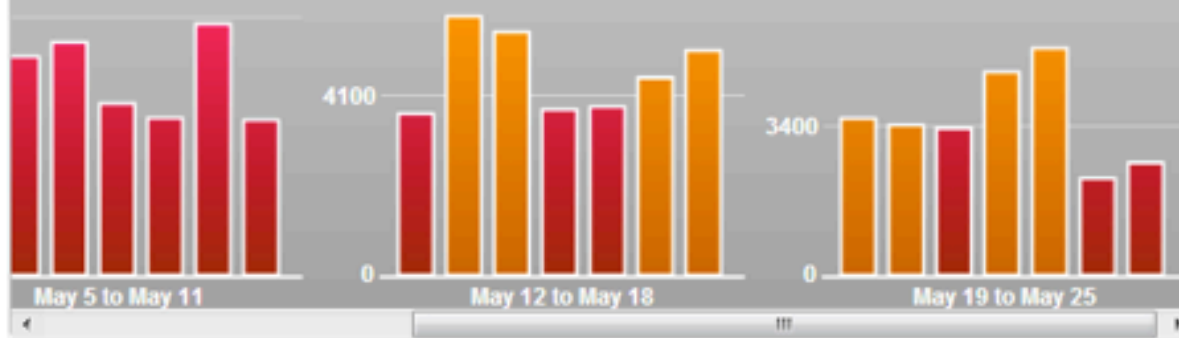
**1** day completed  
3 to go

last upload May 19, 6:10AM

**3591**

steps today  
191 above target!

### Your walking history



### Your commitment history

Week	Daily target	Committed days	Successful days
May 19 - May 25	3400	4	4
May 12 - May 18	4100	0	0



## Progress Report

You committed to walk at least 3400 steps per day on at least 4 days this week.

### Your progress

**1**

day  
completed  
3 to go

**3591**

steps  
today  
191 above target!

last upload May 19, 6:10AM

- Algorithmically set daily target
- Participants optionally commit to how many days that week they will strive to achieve it

### Your commitment history

Week	Daily target	Committed days	Successful days
May 19 - May 25	3400	4	4
May 12 - May 18	3400	0	0





September 23 via Commit to Steps 



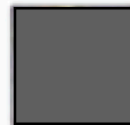
Met my commitment last week. Yay! 5 days over my daily steps target, just like I said I would.

Next week's commitment (week 7): 5 days over 10000 steps. Please encourage me or, better yet, walk with me.

Like · Comment · Promote · Share



and 6 others like this.



Go !

September 24 at 6:31am via mobile · Like



Thanks, everyone! The treadmill desk makes it a lot easier to hit 10K in a day. But I did go running once last week...







September 24 at 4:05pm · Like



Write a comment...



# Three Versions

	Goal	Outcome
Private		
Announce goal		
Announce goal and results		

# Results

- Public posts about goals and outcomes were met with emotional, informational, and instrumental support
- People in the public outcome condition were less likely to set a commitment, but, if they set one, more likely to achieve it
- Novelty wore off over 12 weeks – people received fewer likes and comments with time.



**Individuals**



**Medical Team**



**Peers &  
support networks**



Individuals can benefit from tools that allow reduction and focus in aggregated data.

Medical Team

Individuals

Peers &  
support networks



New tools are needed to support collaboration between people and experts.

These tools must balance scientific rigor with their ability to fit in people's lives.

support networks



Friends and peers benefit from some context or a direct ask – it can turn boredom or a negative reaction into help.



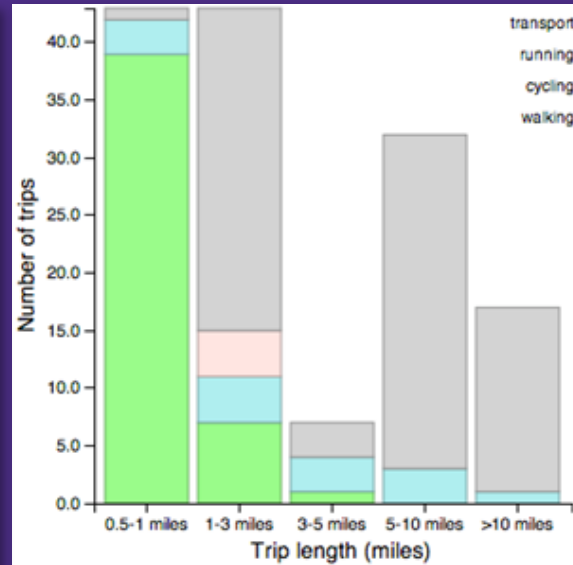
Peers &  
support networks



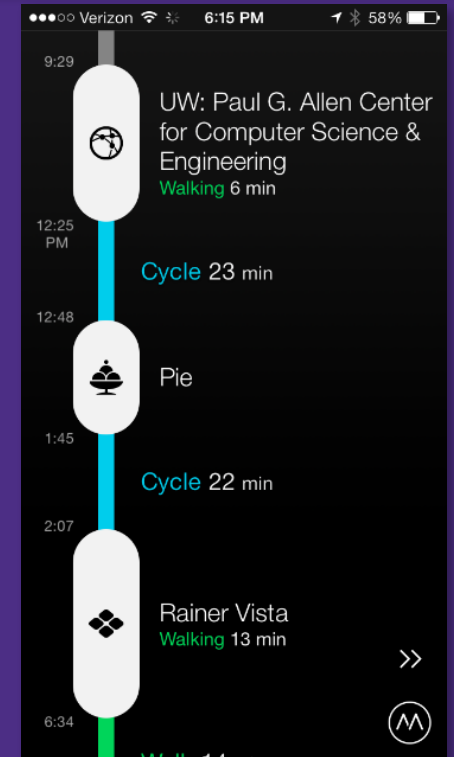
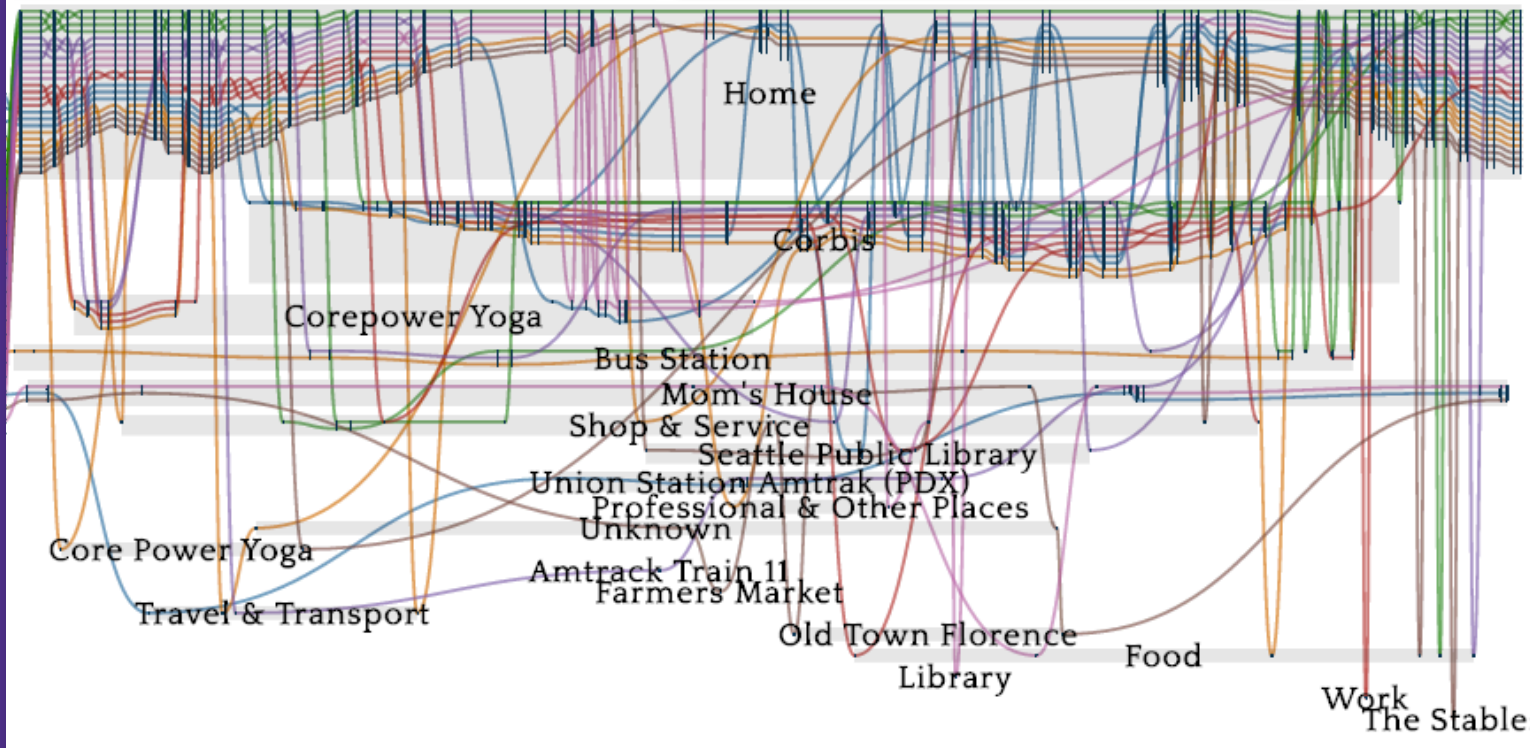
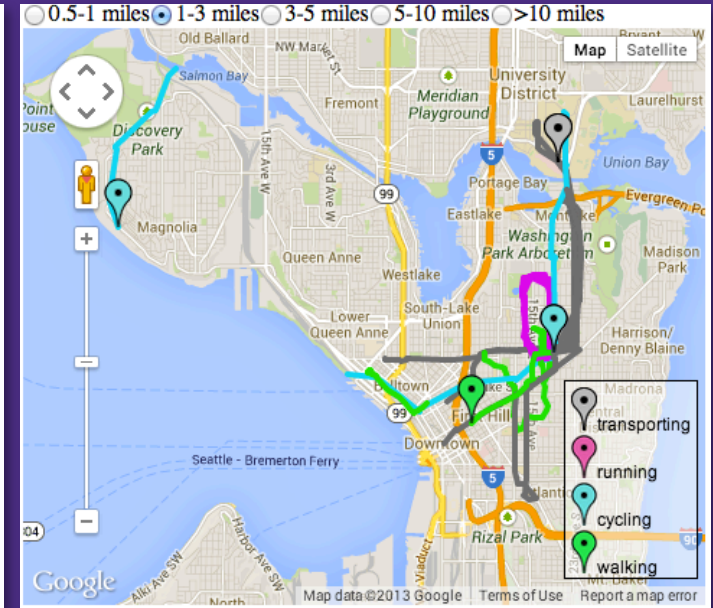
## Day of week Time (in hours)

Sunday (0 days)	--
Monday (2 days)	8 hours, 21 minutes
Tuesday (2 days)	7 hours, 49 minutes
Wednesday (4 days)	7 hours, 10 minutes
Thursday (4 days)	7 hours, 48 minutes
Friday (3 days)	5 hours, 47 minutes
Saturday (0 days)	--

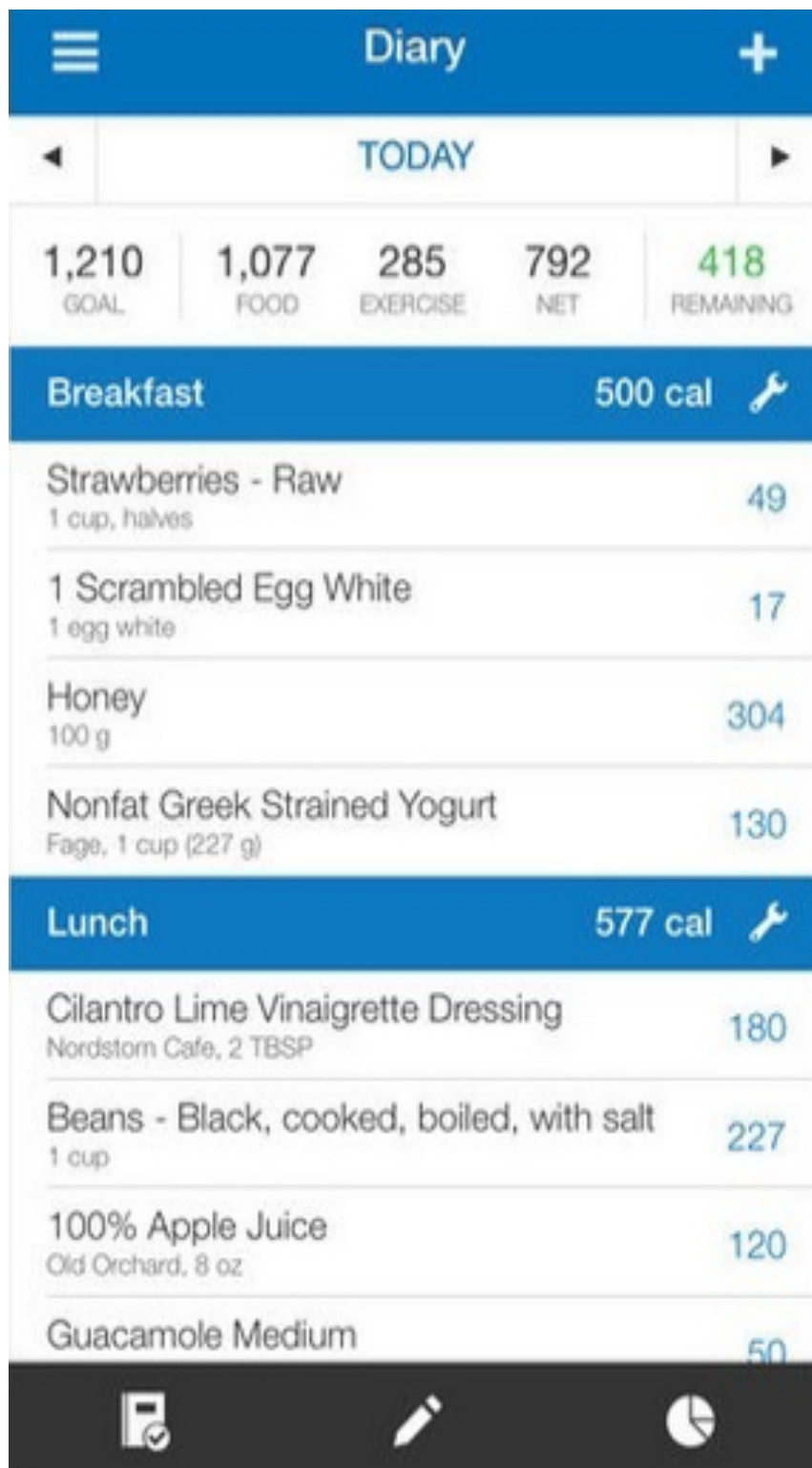
On average, you spend 1.6 fewer hours at work on Fridays.



You transport 2% of the time you travel less than 1 miles.







Food journals can help people eat healthier and tune their diet.



Diary				
TODAY				
1,210 GOAL	1,077 FOOD	285 EXERCISE	792 NET	418 REMAINING
Breakfast		500 cal		
Strawberries - Raw		49		
1 cup, halves				
1 Scrambled Egg White		17		
1 egg white				
Honey		304		
100 g				
Nonfat Greek Strained Yogurt		130		
Fage, 1 cup (227 g)				
Lunch		577 cal		
Cilantro Lime Vinaigrette Dressing		180		
Nordstrom Cafe, 2 TBSP				
Beans - Black, cooked, boiled, with salt		227		
1 cup				
100% Apple Juice		120		
Old Orchard, 8 oz				
Guacamole Medium		50		

Food journals can help people eat healthier and tune their diet.

but...

- they are high-burden
- they can feel judgy
- they can nudge people to eat things that are easier to log.









Diary				
TODAY				
1,210	1,077	285	792	418
GOAL	FOOD	EXERCISE	NET	REMAINING
Breakfast		500 cal		
Strawberries - Raw		49		
1 cup, halves				
1 Scrambled Egg White		17		
1 egg white				

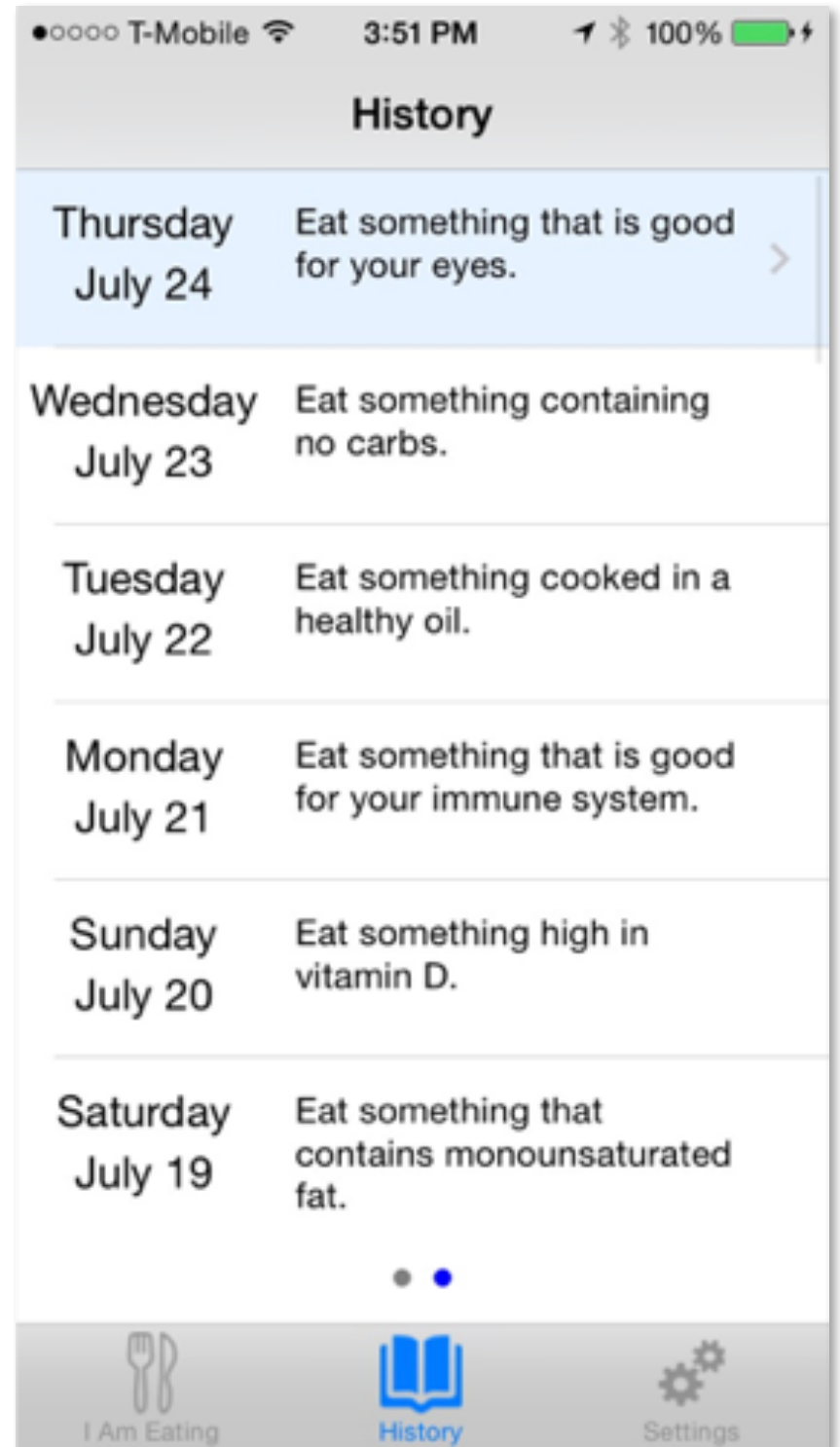
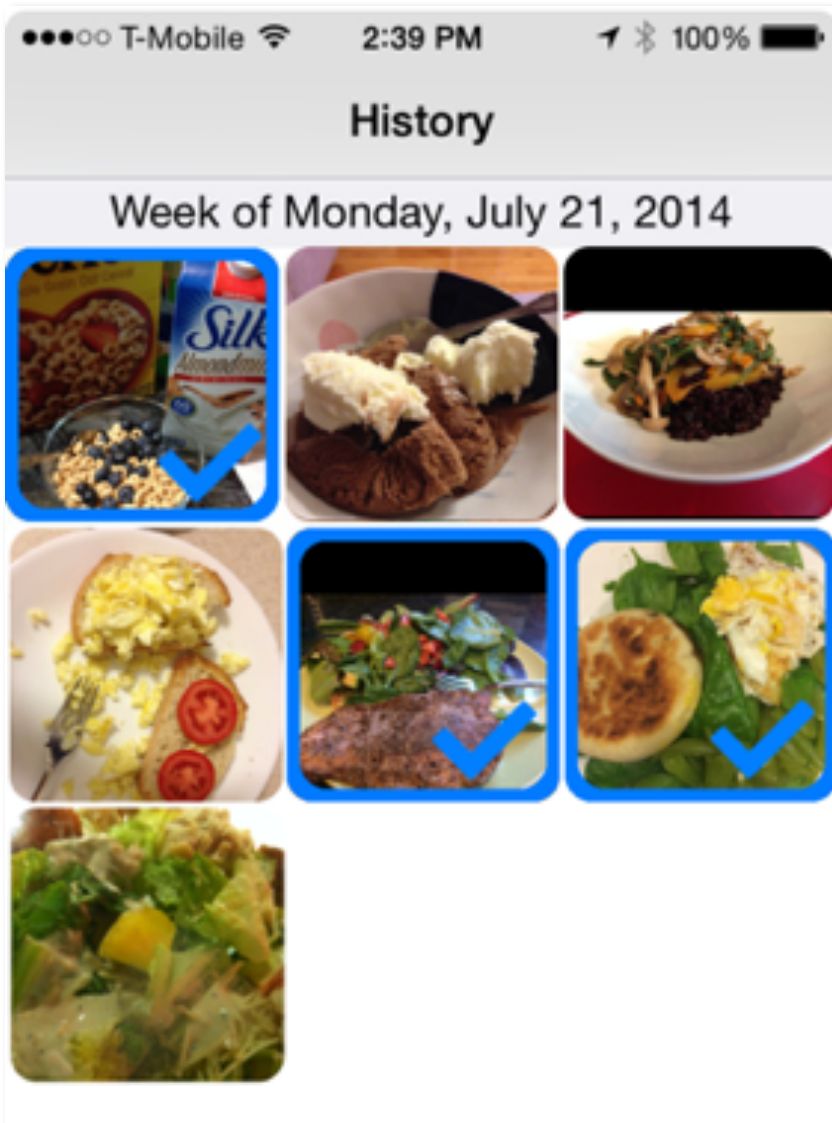


Is there another way?

Lunch		577 cal		
Cilantro Lime Vinaigrette Dressing		180		
Nordstrom Cafe, 2 TBSP				
Beans - Black, cooked, boiled, with salt		227		
1 cup				
100% Apple Juice		120		
Old Orchard, 8 oz				
Guacamole Medium		50		



flickr: Timothy Vollmer



Food4Thought



# Four Versions



Social features



No social features



Nutrition challenges



Non-nutrition challenges




# Nutrition challenges

Nutritionally prescriptive, serious, conventional

- Eat something high in fiber
- Eat something with at least 20 grams of protein
- Eat something that is good for your eyes



## Non-nutrition challenges

fun, curiosity inspiring, random, varied

- Eat something that is yellow
- Eat something that an elephant would eat
- Eat something that reminds you of your high school years



Social features



shared her photo.

Food4Thought

Arugula!



Today's Challenge: Eat something that starts with the letter 'A'.

Like · Comment



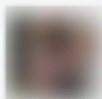
and like this.

✓ Seen by 21



Nice! I was getting bored of the apples 😊 I'm trying to think of something else A-related for my post!

Like



Haha, we (including myself) have all been quite creative with our apple submissions.

Like



## Nutrition challenges

- Higher engagement
- More judgy



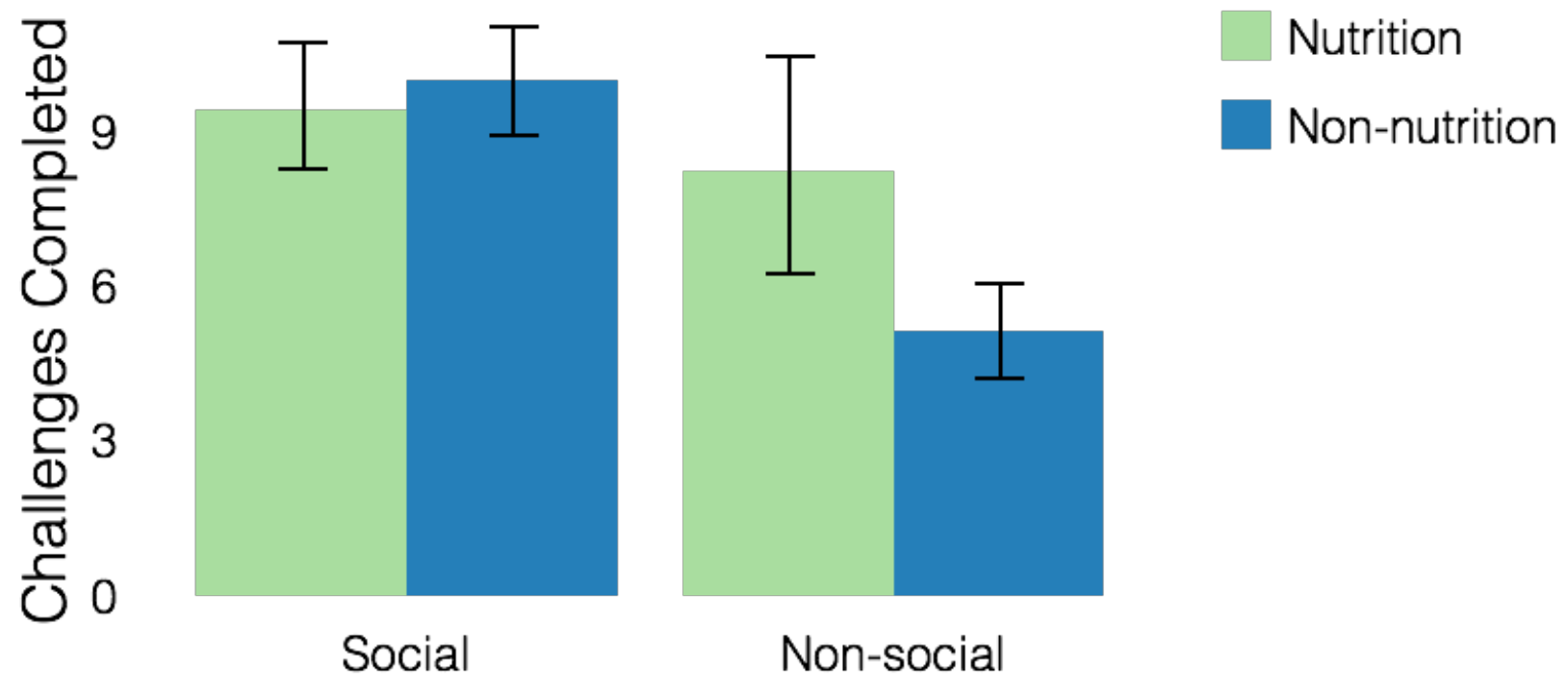
## Non-nutrition challenges

- Greater gains in food mindfulness
- Challenges and activity felt more arbitrary



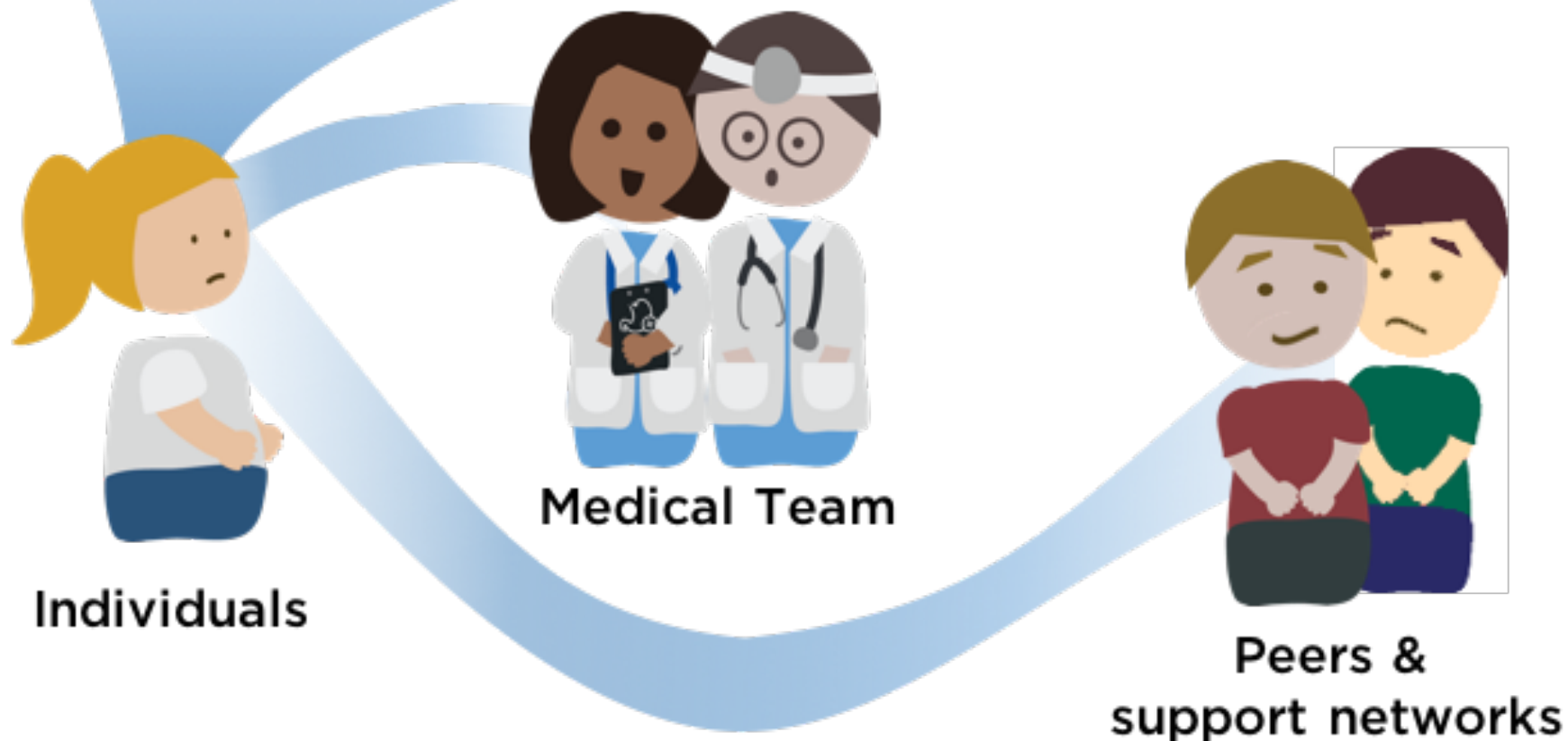
## Social features

- Completed more challenges
- Less likely to use the app to record other foods





It's not all/always about the data.  
It's not always about correction.



# Designing to Help People Find Insights & Experiences in Personal Data

Sean Munson · [smunson.com](http://smunson.com) · [@smunson](https://twitter.com/smunson)

AHRQ#1R21HS023654

NSF# OAI-1028195, IIS-1344613, IIS-1553167

University of Washington Innovation Award

Intel Science and Technology Center for Pervasive Computing

Robert Wood Johnson Foundation



**HUMAN CENTERED DESIGN & ENGINEERING**  
UNIVERSITY of WASHINGTON

