

# Habitsourcing

Sensing the Environment Through Immersive,  
Habitbuilding Experiences

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Northwestern

 @DeltaLabNU

# Citizen science and communitysensing apps



The screenshot shows the eBird website interface. At the top left is the eBird logo. Below it are navigation tabs: Home, About, Submit Observations, Explore Data, and My eBird. There are links for Sign In and Register, and a translation menu for English, Español, Français, and Português. The main heading is "View and Explore Data". Below this are three sections: "Range and Point Maps" with a map of North America, "Bar Charts" with a monthly bar chart, and "Line Graphs" with a line graph. On the right side, there are three summary boxes: "Your Totals" (Track your totals and compare with other eBirders), "Yard Totals" (How many species and checklists have you submitted for your yard?), and "Patch Totals" (How many have you submitted for your favorite birding patches?). A "Top 100" section is also visible, comparing users with the top eBirders in their region.



# Citizen science and communitysensing apps



The screenshot shows the eBird website interface. At the top left is the eBird logo. Below it are navigation tabs: Home, About, Submit Observations, Explore Data, and My eBird. There are also links for Sign In and Register, and a language selection menu (English, Español, Français, Português). The main content area is titled "View and Explore Data" and features several data visualization options:

- Range and Point Maps:** Explore interactive range maps by species or subspecies — zoom in for details.
- Bar Charts:** Find out what birds to expect throughout the year in a region or location.
- Line Graphs:** Explore different metrics of species occurrence in a region or location.
- Your Totals:** Track your totals and compare with other eBirders.
- Yard Totals:** How many species and checklists have you submitted for your yard?
- Patch Totals:** How many have you submitted for your favorite birding patches?
- Top 100:** Compare with the top eBirders in your region.



...but we don't always have interested volunteers.

# Leveraging habits

Millions of people experience the environment while practicing a habit



S	M	T	W	R	F	S
Diagonal lines	X	X	X	Red	X	X
X	X	X	X	X	X	X
X	Red	X	X	X	X	X
X	X	X	X	Red	Diagonal lines	Diagonal lines

# Many use mobile apps to support their habit practice



3 million users



200,000 active users

# Many use mobile apps to support their habit practice



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**Leverage these routines to collect data!**

# Many use mobile apps to support their habit practice



3 million users



200,000 active users

**Leverage these routines to collect data!**

**...but users aren't interested in collecting data**

# Habitsourcing

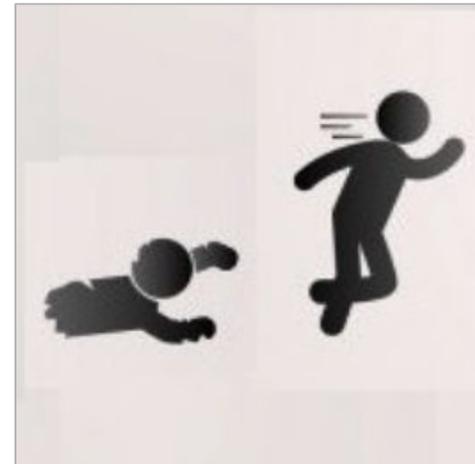
Habitsourcing uses **immersive interactions** embedded within **existing habitbuilding experiences** to collect **sensing data** about the environment



ZenWalk



Zombies Interactive



How can we gather data from people who are not intrinsically interested in collecting it?

# Related Work: Physical Games with a Purpose

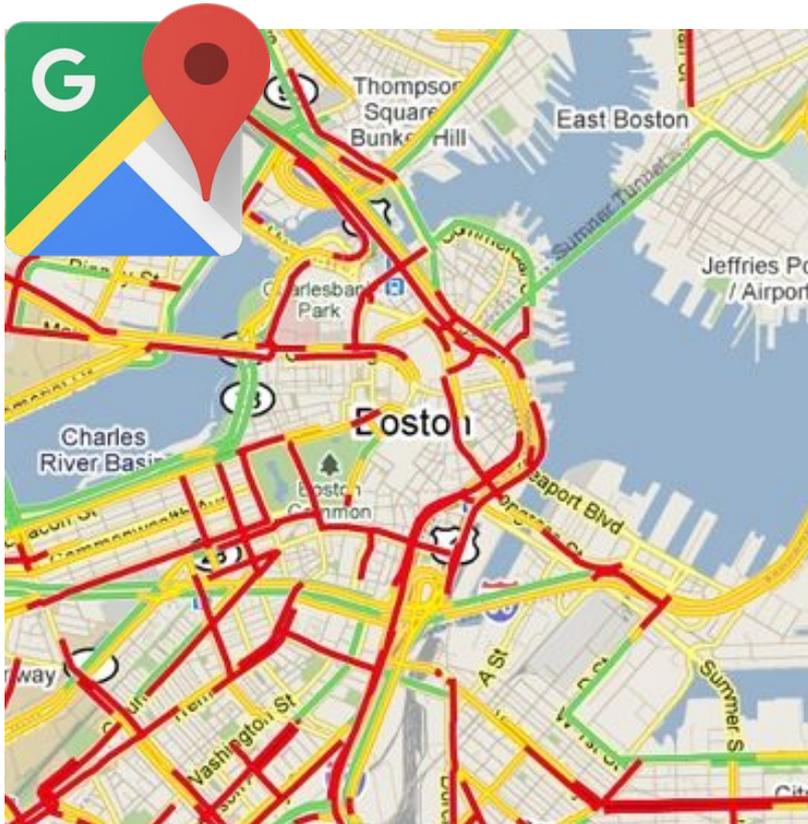


**INGRESS**



Kathleen Tuite et al.,  
CHI 2011

# Related Work: Passive Sensing



# Sensing through actuation

Cue users to **perform physical actions** that are appropriate given their habitbuilding goals and **elicit useful sensing data**

# Placing interactions in experiences

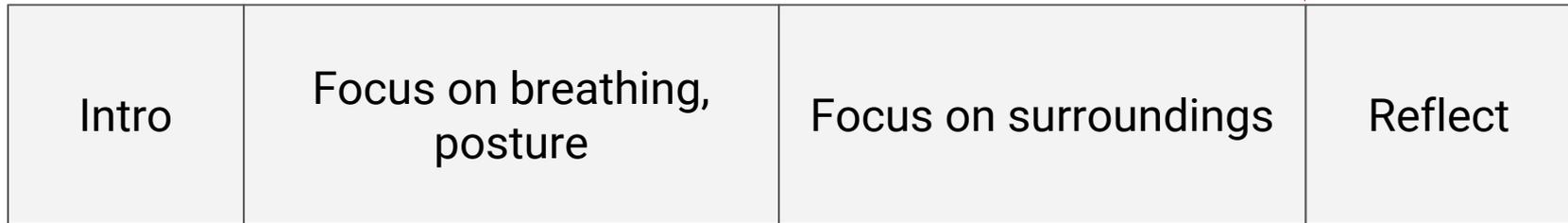
## Headspace

Intro	Focus on breathing, posture	Focus on surroundings	Reflect
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# Placing interactions in experiences

*Sensing Interaction*

## Headspace



# Placing interactions in experiences

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Intro	Focus on breathing, posture	Focus on surroundings	Reflect
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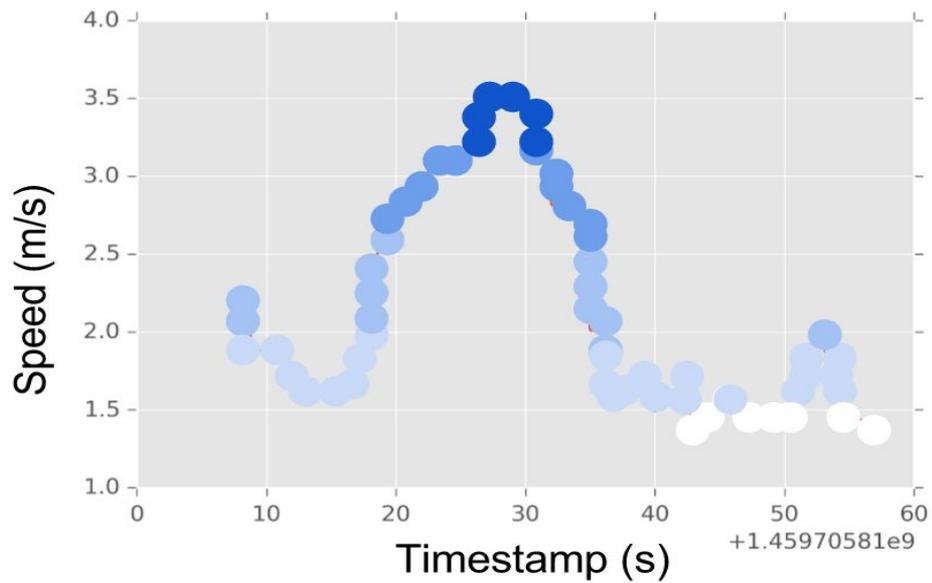
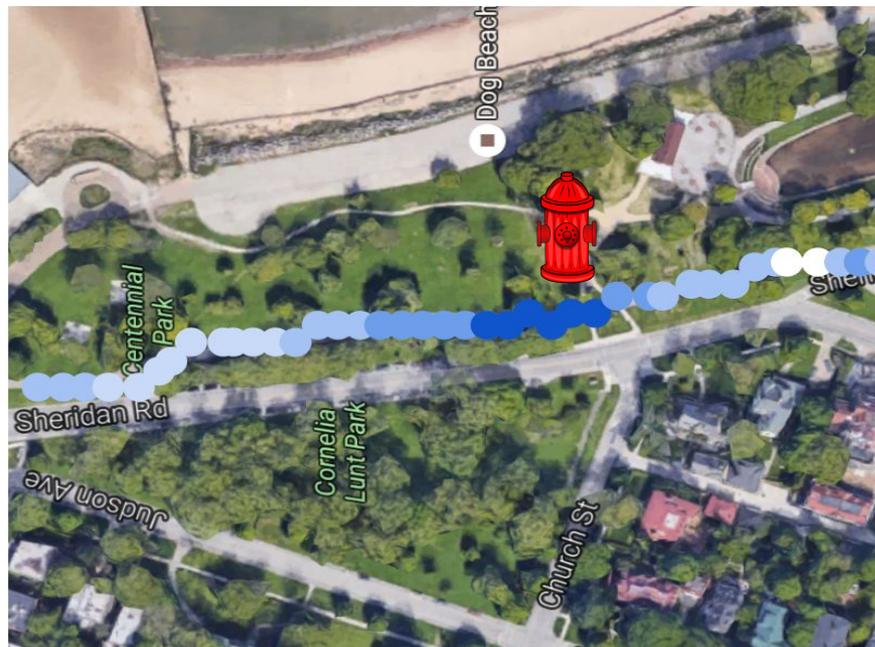
## ZenWalk

Intro	Focus on breathing, posture	Focus on surroundings	<i>Sensing Interaction</i>	Reflect
-------	--------------------------------	-----------------------	--------------------------------	---------

# Sensing through actuation in **Zombies Interactive**

VIDEO

# Sprint detection



# Sensing through actuation in ZenWalk

VIDEO

How can we make sensing through actuation interactions enjoyable in a particular habitbuilding experience?

# Designing Interactions

## **ZenWalk**

*“Observe the tree...”*

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*“Observe the tree...”*



Interaction needs more  
guidance

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*“Observe the tree...”*



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*“Focus on the texture of  
the tree bark...observe the  
shape of the leaves...”*

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## Zombies Interactive

*“They’re all around you...go take  
cover by that tree”*

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Interaction unnatural to habit

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*“They’re all around you...go take  
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Interaction unnatural to habit



*“Sprint to that building...”*

# User Studies

Study 1: Would people use habitsourcing apps?

Study 2: Can habitsourcing interactions yield accurate data?

# User Studies

## Study 1: Would people use habitsourcing apps?

Within-subject

Non-interactive



Warm up

Interactive



Warm up

Sprint to...

# User Studies

Study 1: Would people use habitsourcing apps?

Recruited via Reddit

9

ZenWalk participants

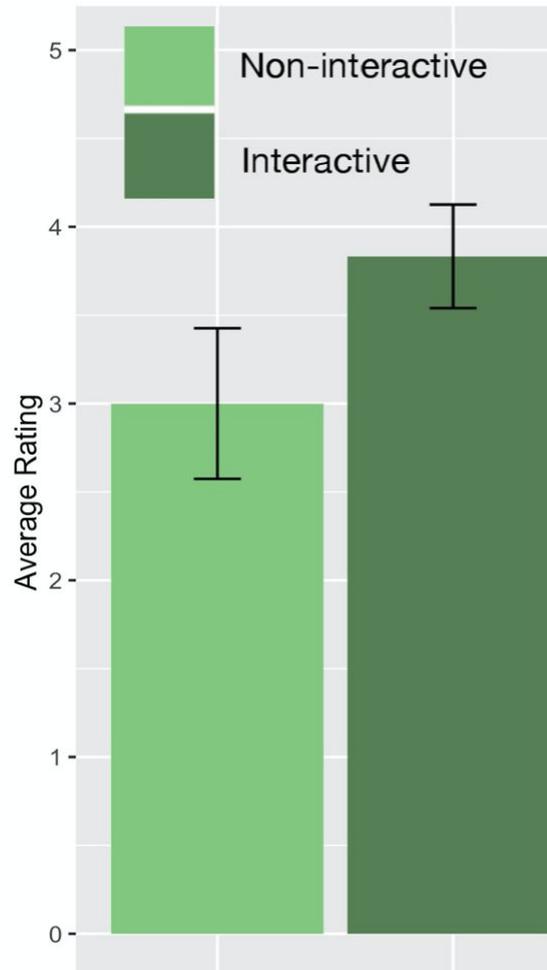
(5F)

12

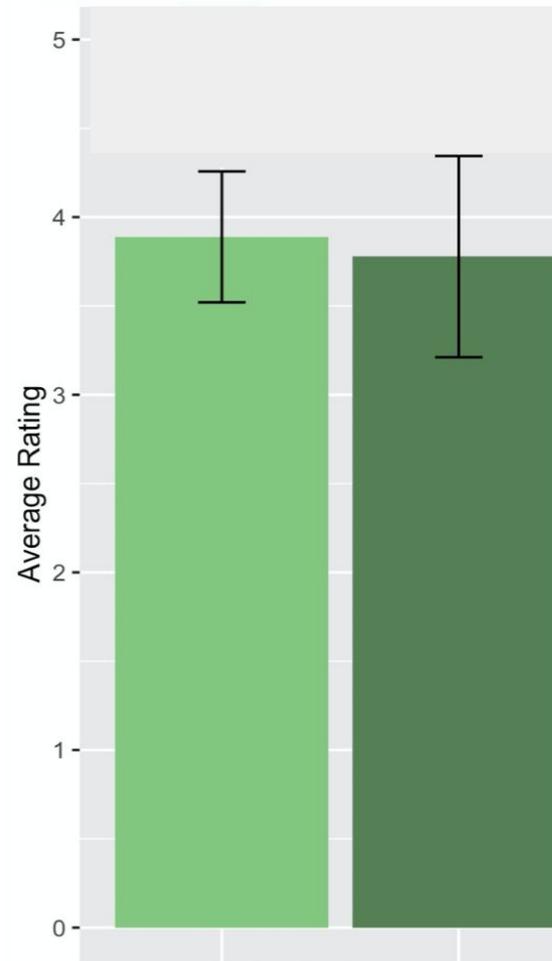
Zombies Interactive participants

(2F)

Users preferred the interactive version more than or as much as the non-interactive version



**Zombies Interactive**



**ZenWalk**

# Interactions increase immersion

“I like the prompts to speed up at various places in the run. Made the experience seem more personalized and interactive. **I felt more like a part of the storyline**”

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“I like the prompts to speed up at various places in the run. Made the experience seem more personalized and interactive. **I felt more like a part of the storyline**”

“It was nice to focus on trees and **notice things I might not otherwise have.**”

# Users dislike contextual mismatches

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“The **instructions were a little weird**, saying that I might see a tall building (I’m in NYC, tall buildings are everywhere)”

“Being surrounded by people that I know (that might be judging me if I’m focusing on a tree) **tended to halt the effects of the meditation**”

# User Studies

Study 2: Can habitsourcing interactions yield accurate data?

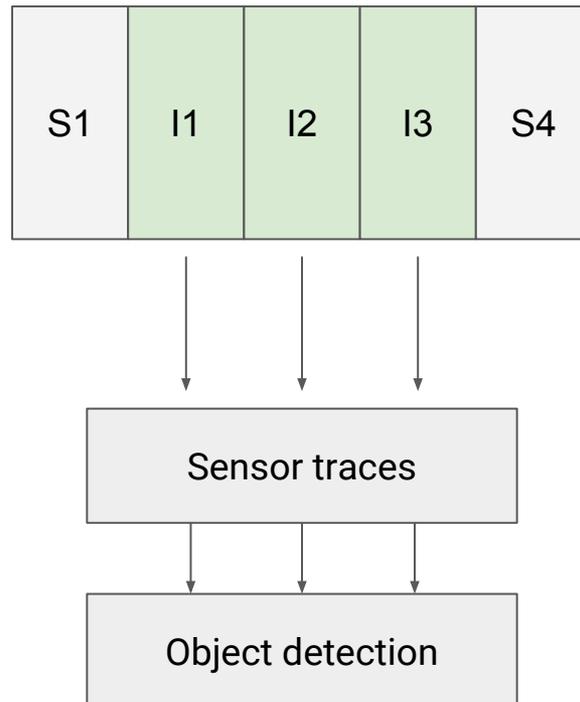
Can we accurately detect when a user performs an interaction?

Can we accurately detect objects from an interaction's data trace?

# User Studies

Study 2: Can habitsourcing interactions yield accurate data?

Abbreviated experience



# User Studies

Study 2: Can habitsourcing interactions yield accurate data?

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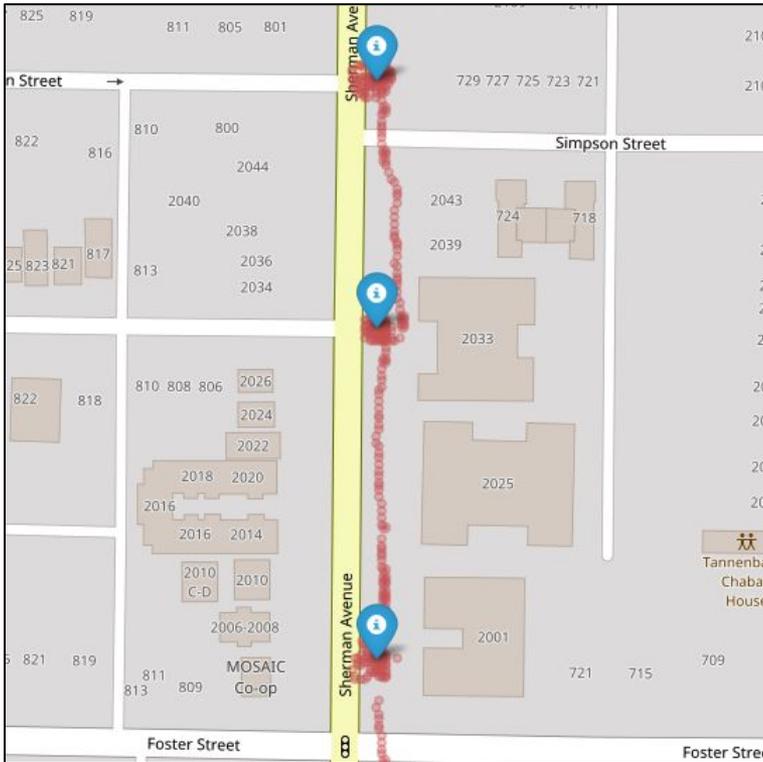
ZenWalk participants  
(7F)

9

Zombies Interactive participants  
(5F)

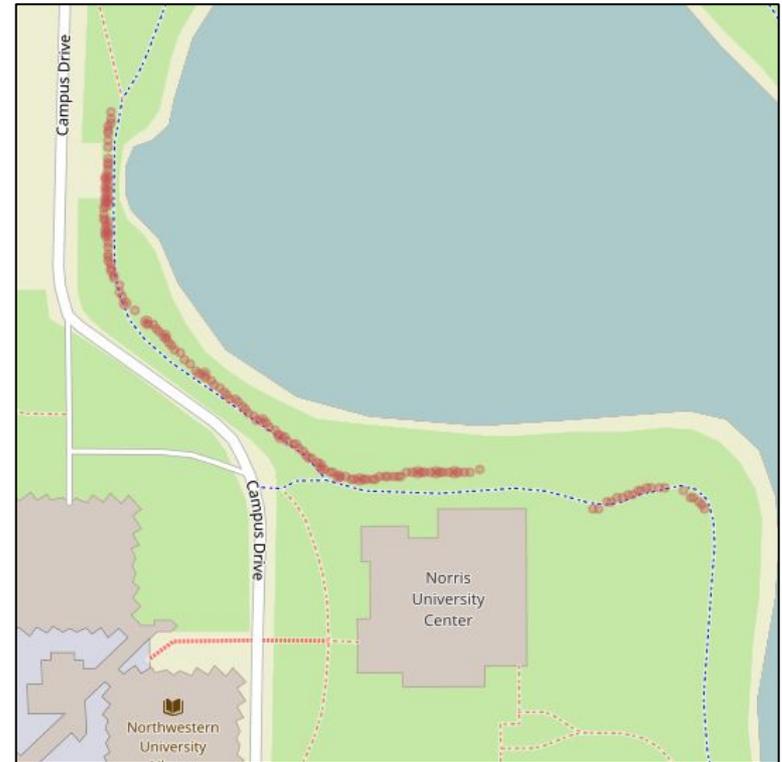
Recruited locally via university Facebook groups and mailing

# Good at detecting if a user performed an action



34/36

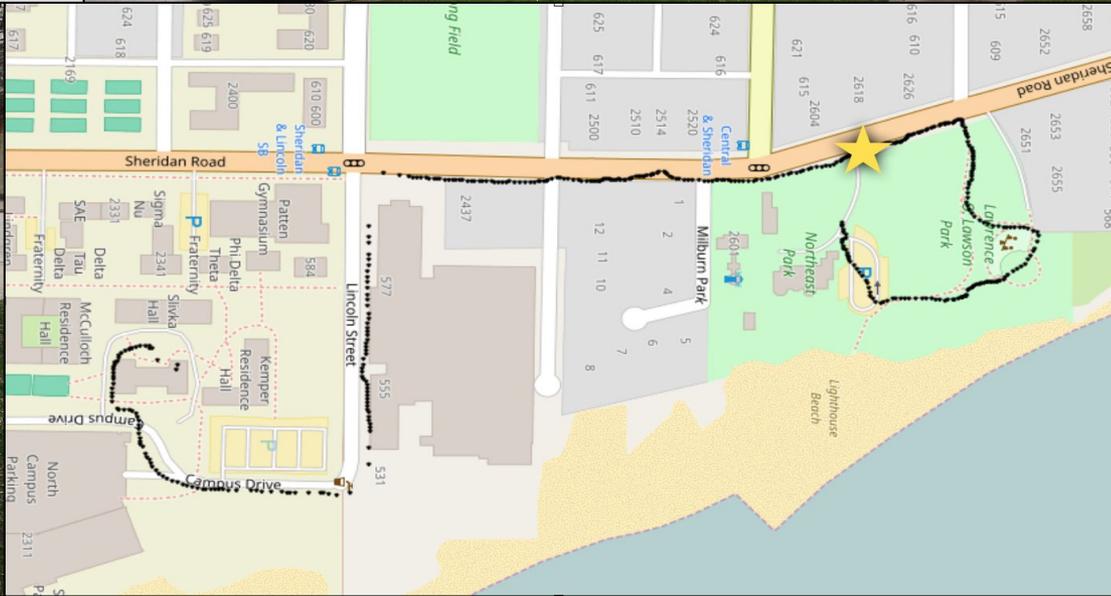
user actions accurately  
detected



7/8

user non-actions  
accurately detected

# Success cases



# Failure case: object not in environment



# Failure case: instructions not specific enough



# Design Principles

- Prioritize habitbuilding
- Consider social context
- Provide feedback
- Keep interactions relevant and provide guidance / fallback

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# Future Work

- What kind of interaction techniques can provide more enjoyment and yield better data?
- Can we scaffold collected data to achieve accuracy, coverage, and detail?
- How do we design new immersive experiences within the physical world?

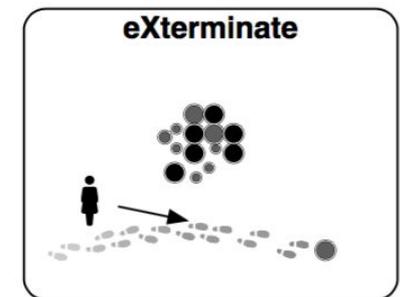
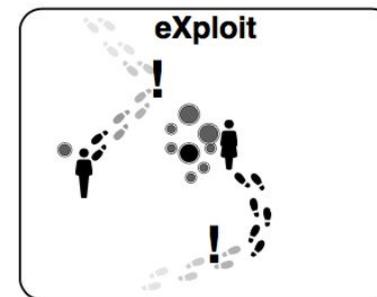
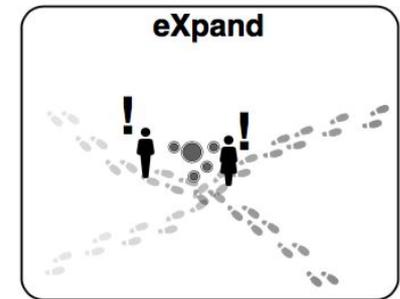
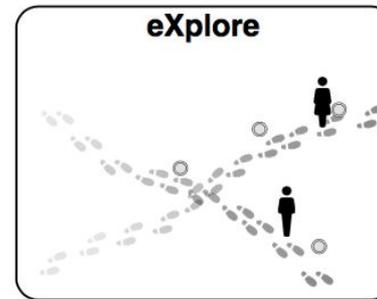
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# Conclusion

- We can provide a habitbuilding experience that's at least as enjoyable as existing ones
- It's possible to collect accurate data
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# Thank You



Northwestern

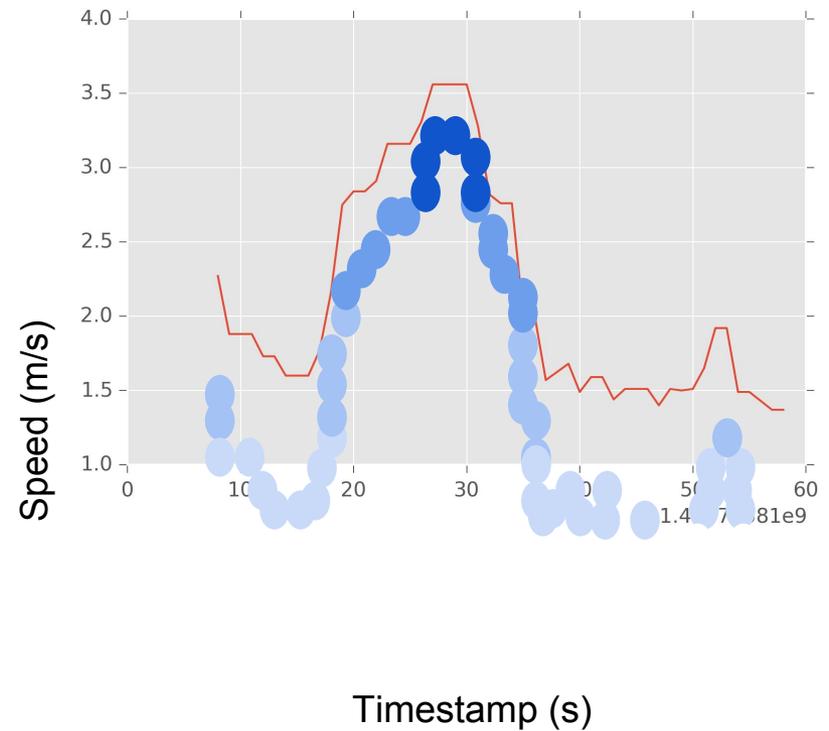
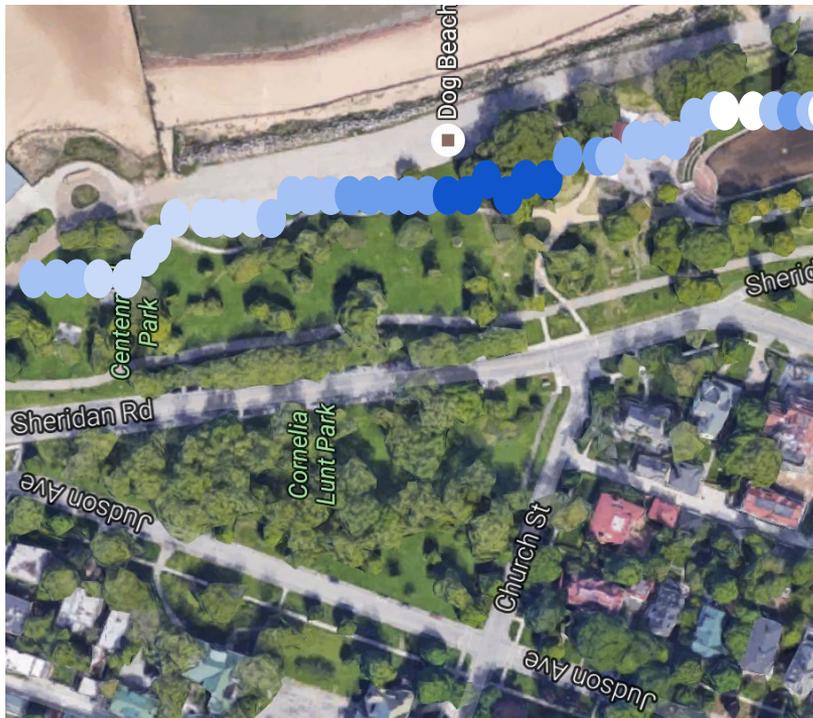
 @DeltaLabNU

# Appendix

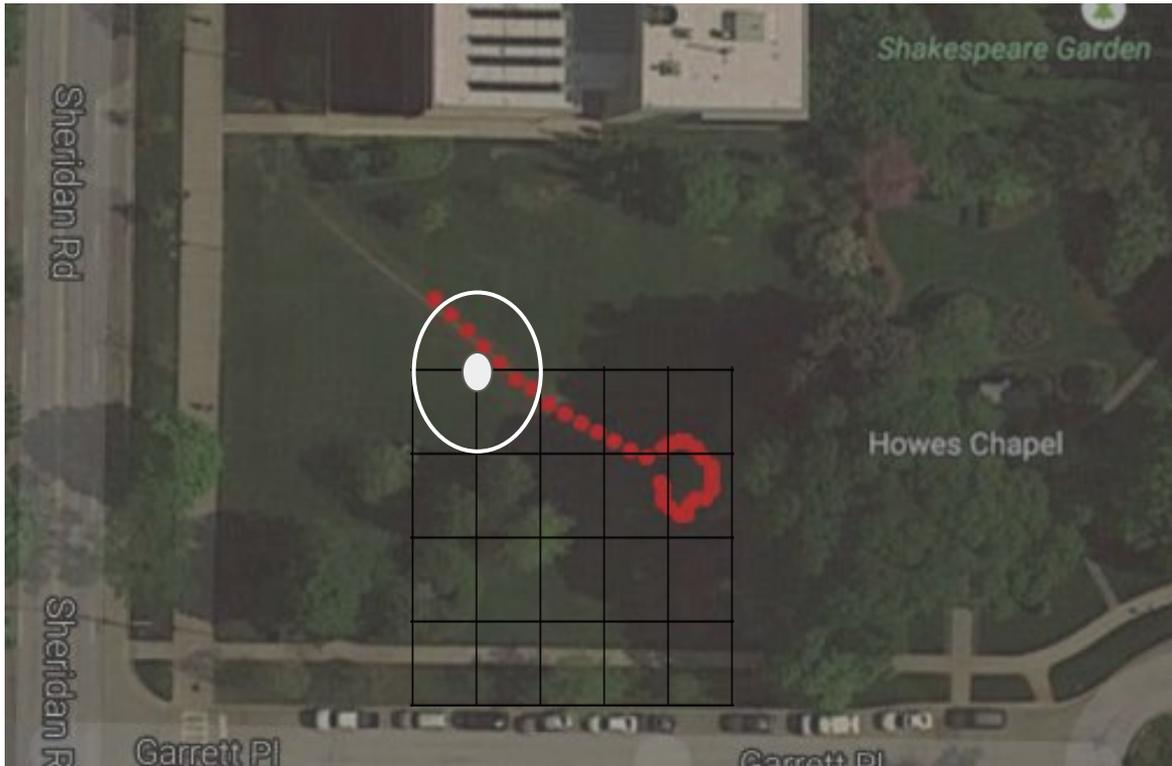
# Questions

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# Algorithm for sprint detection

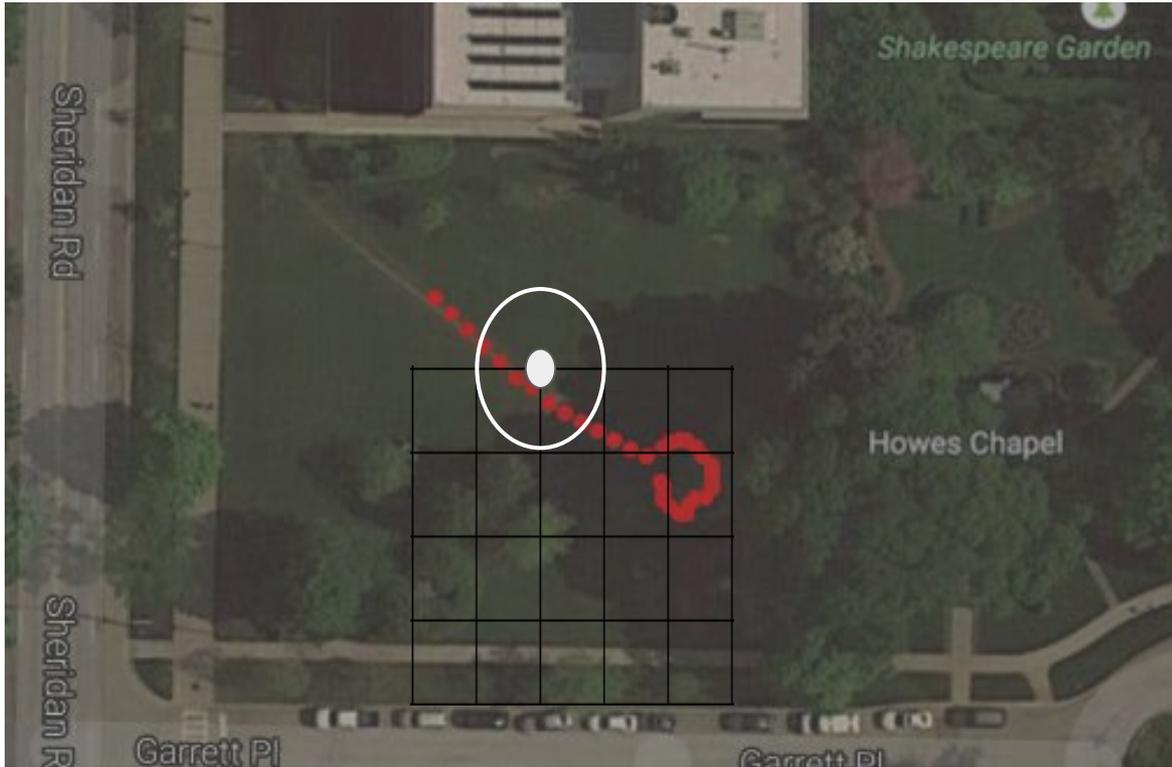


# Algorithm for circle detection



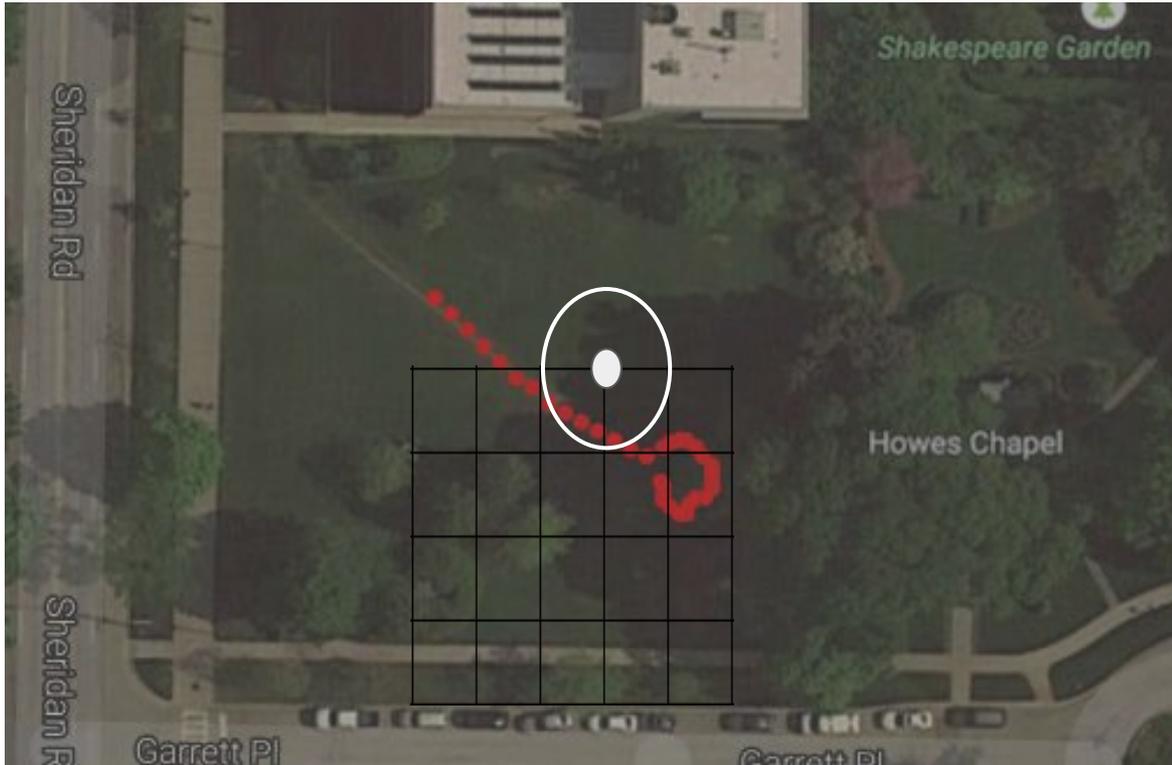
numLocations  
= 3

# Algorithm for circle detection



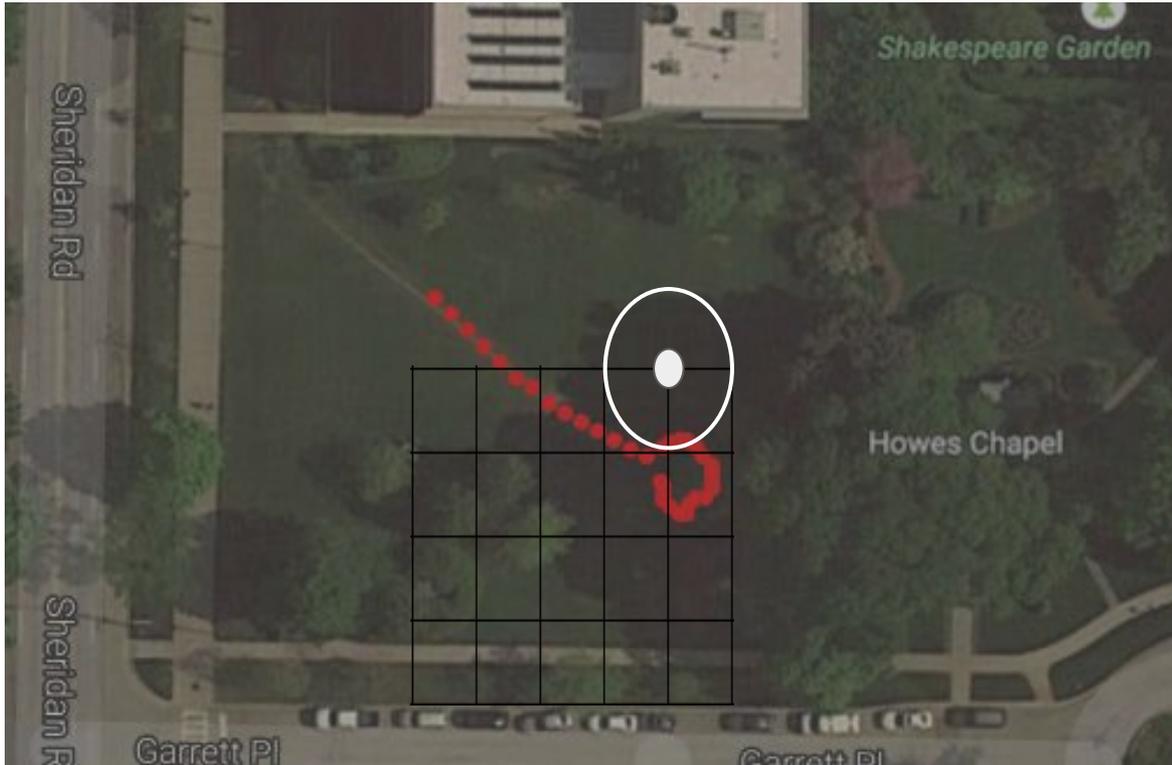
numLocations  
= 0

# Algorithm for circle detection



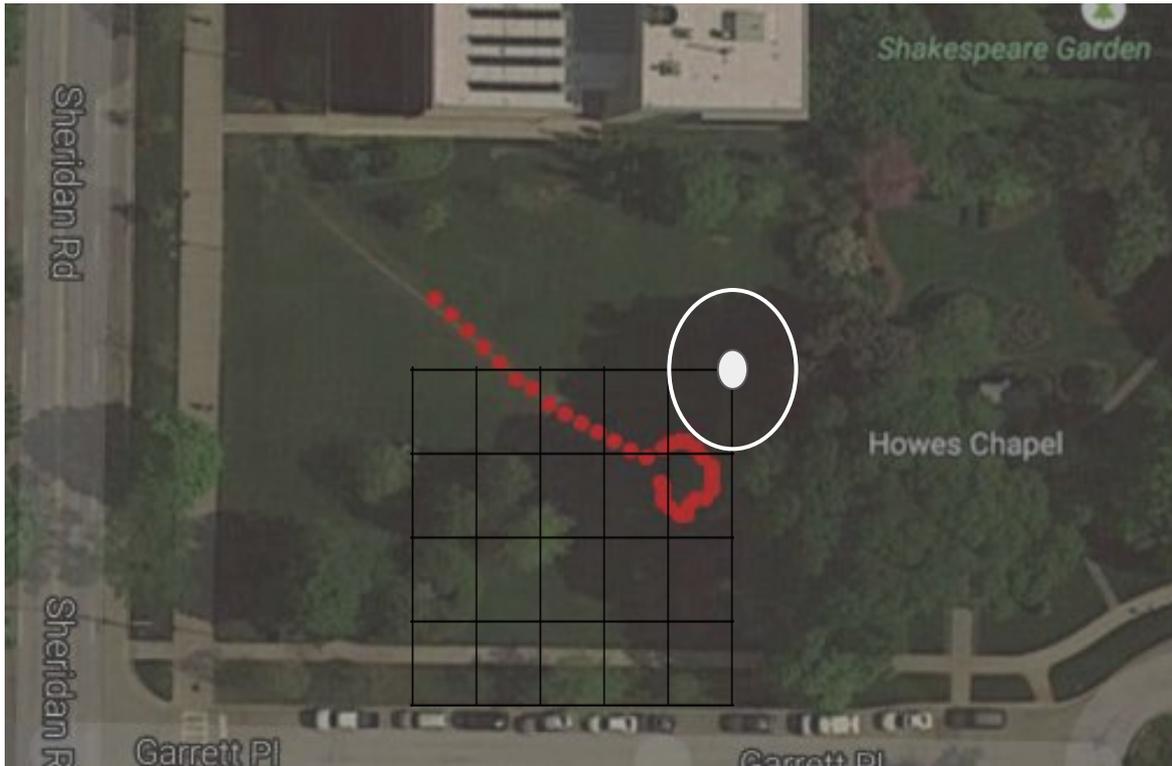
numLocations  
= 0

# Algorithm for circle detection



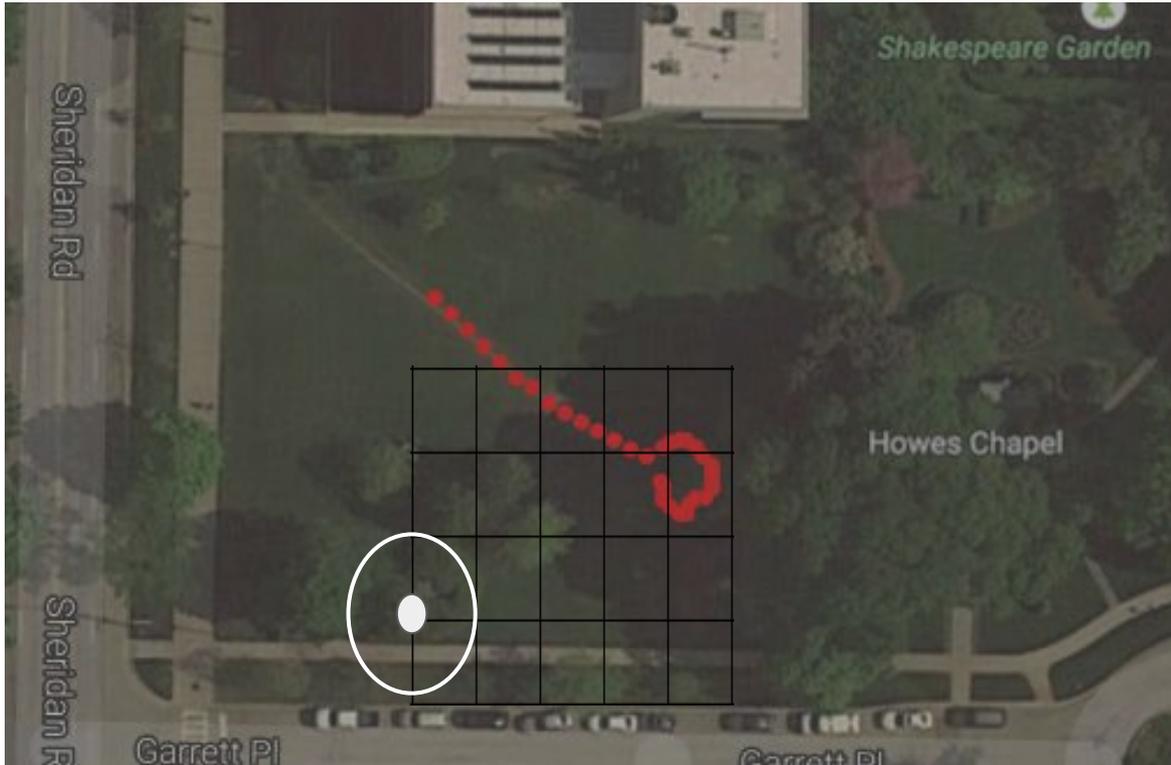
numLocations  
= 0

# Algorithm for circle detection



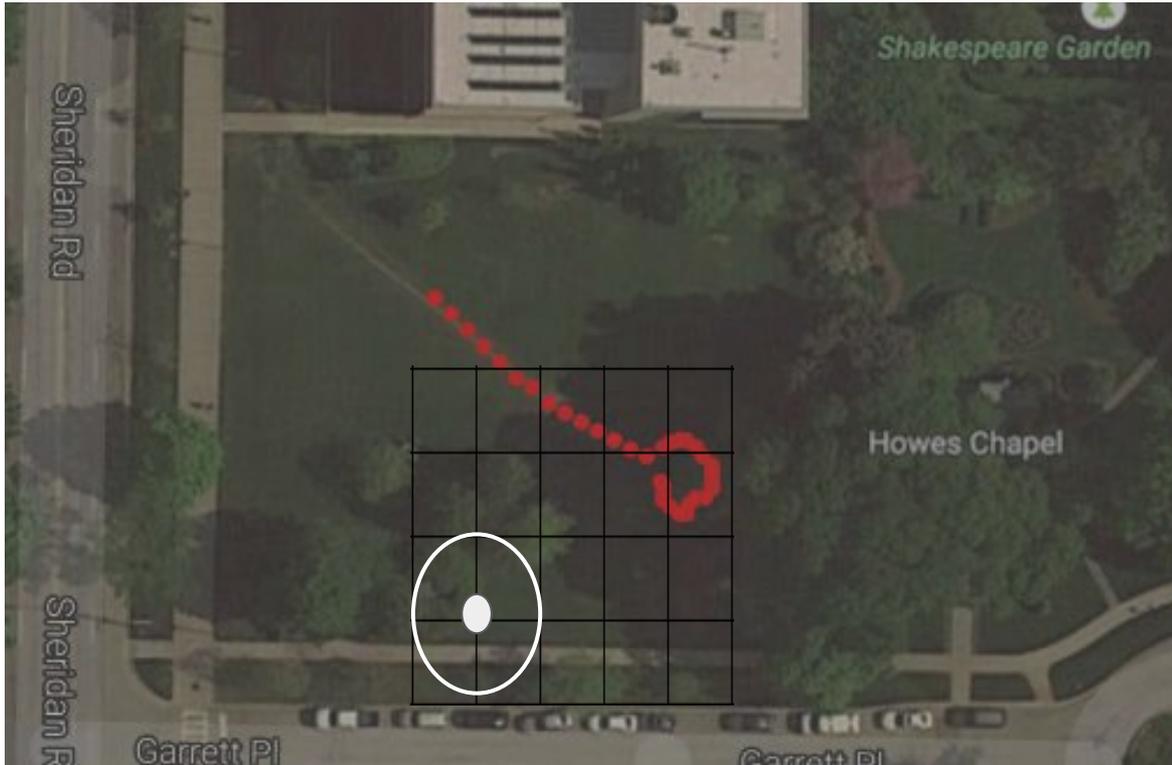
numLocations  
= 0

# Algorithm for circle detection



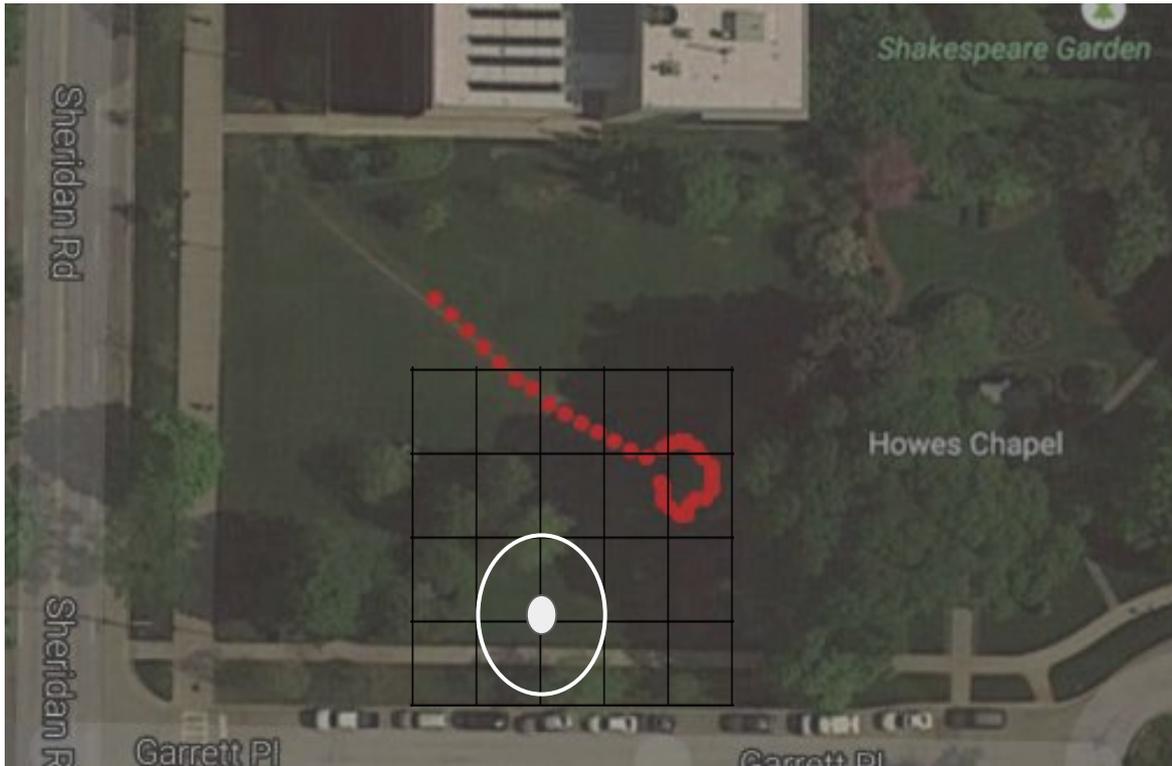
numLocations  
= 0

# Algorithm for circle detection



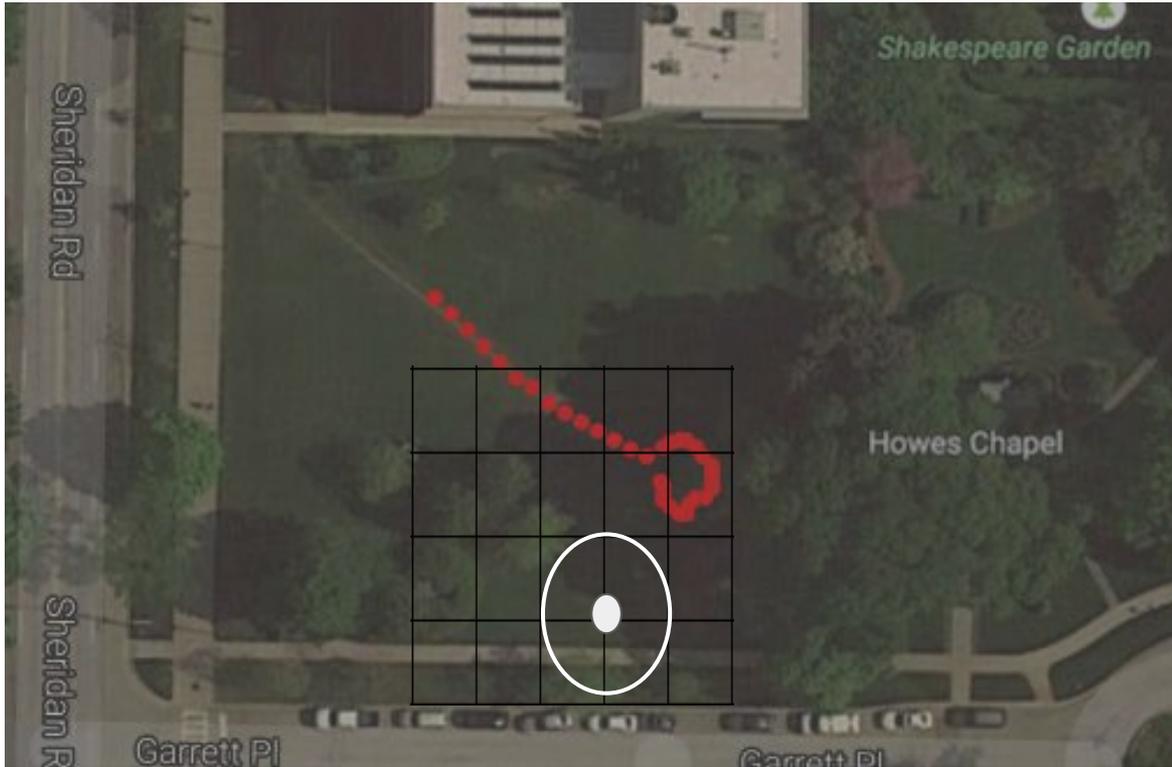
numLocations  
= 0

# Algorithm for circle detection



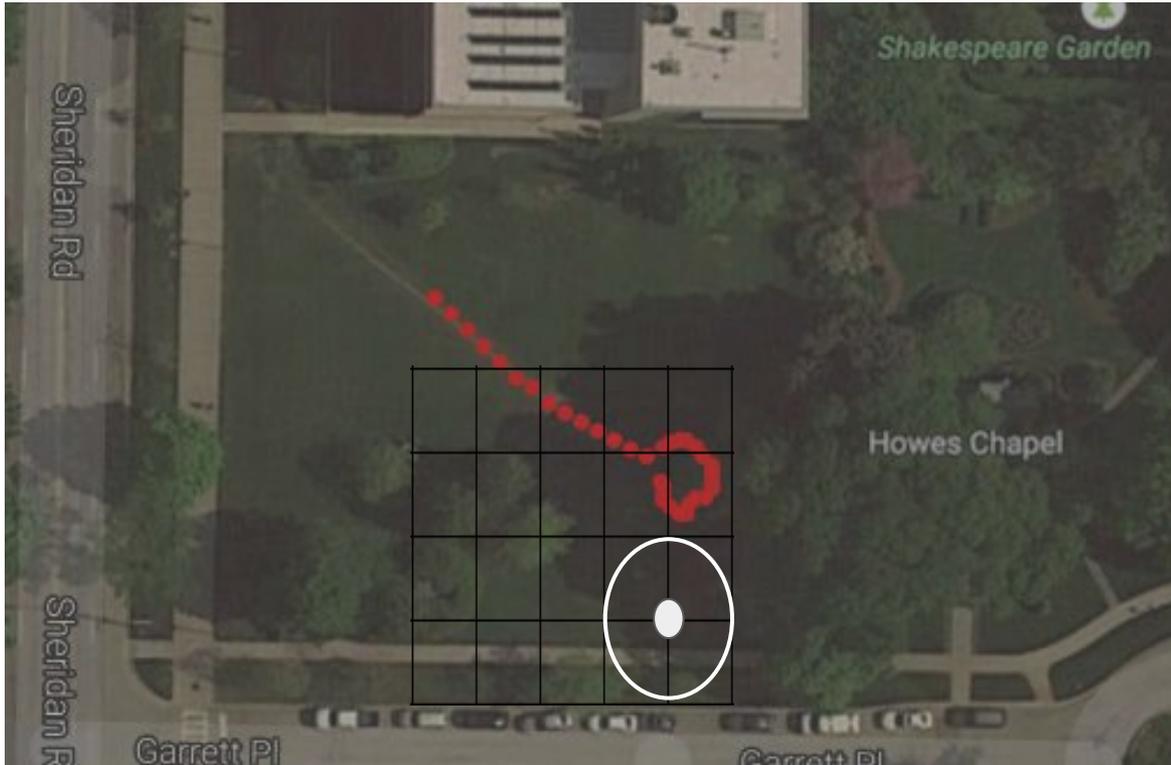
numLocations  
= 4

# Algorithm for circle detection



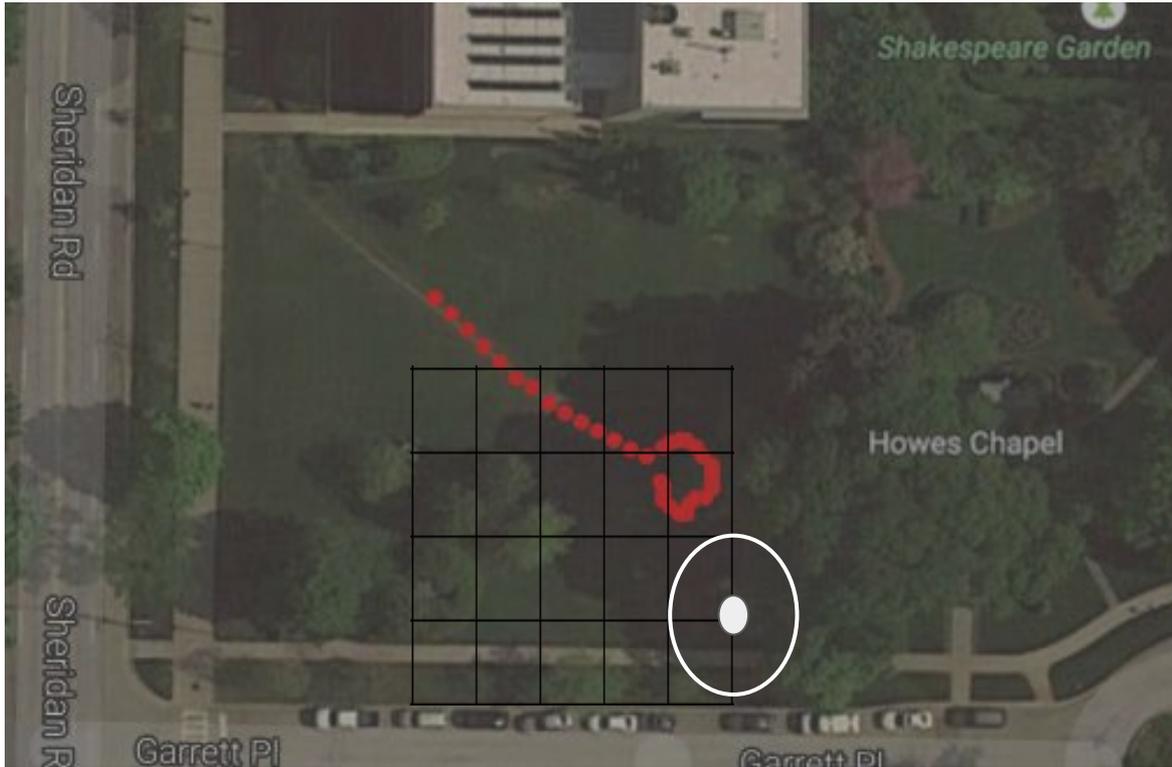
numLocations  
= 9

# Algorithm for circle detection



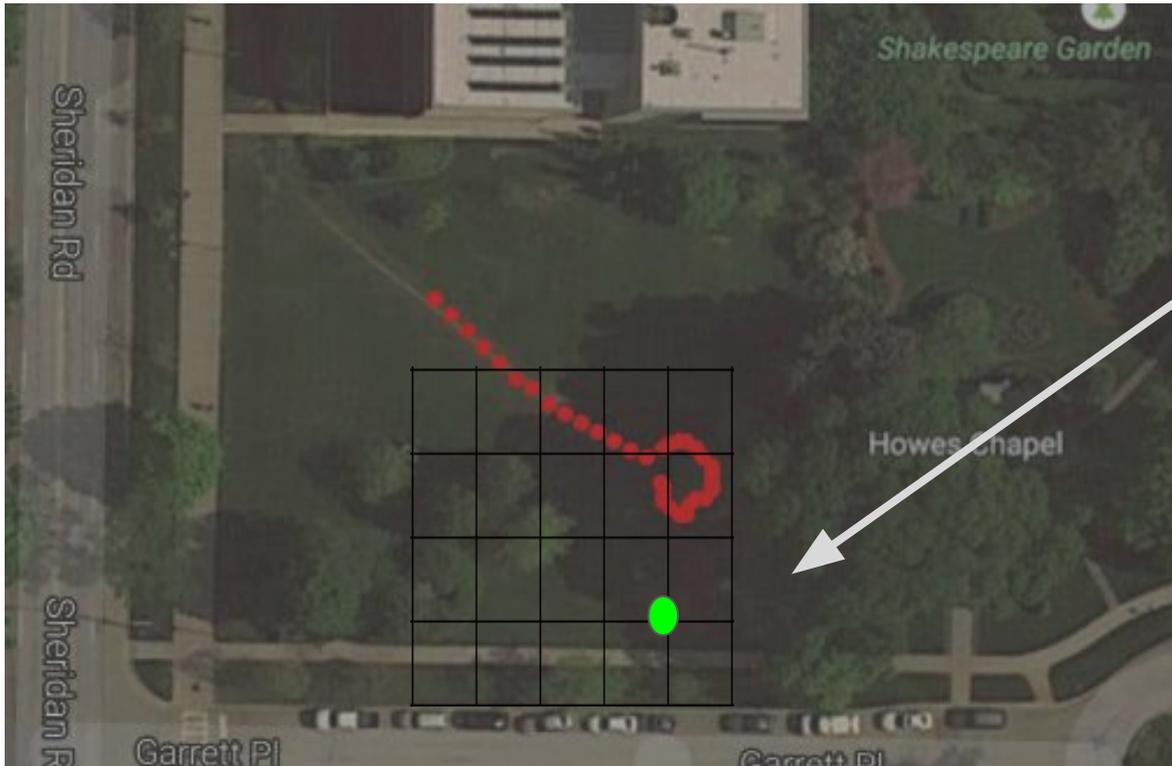
numLocations  
= 27

# Algorithm for circle detection



numLocations  
= 10

# Algorithm for circle detection

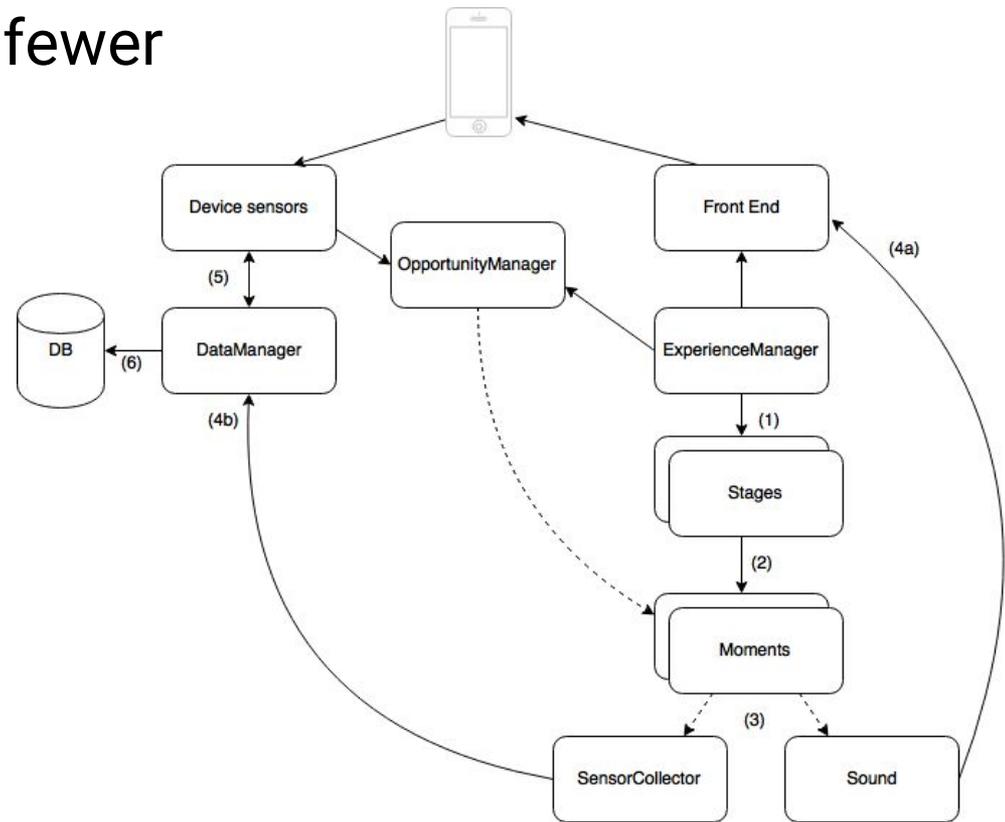


Detected tree  
location

# ExperienceKit

Implement an experience in fewer than 100 lines of code

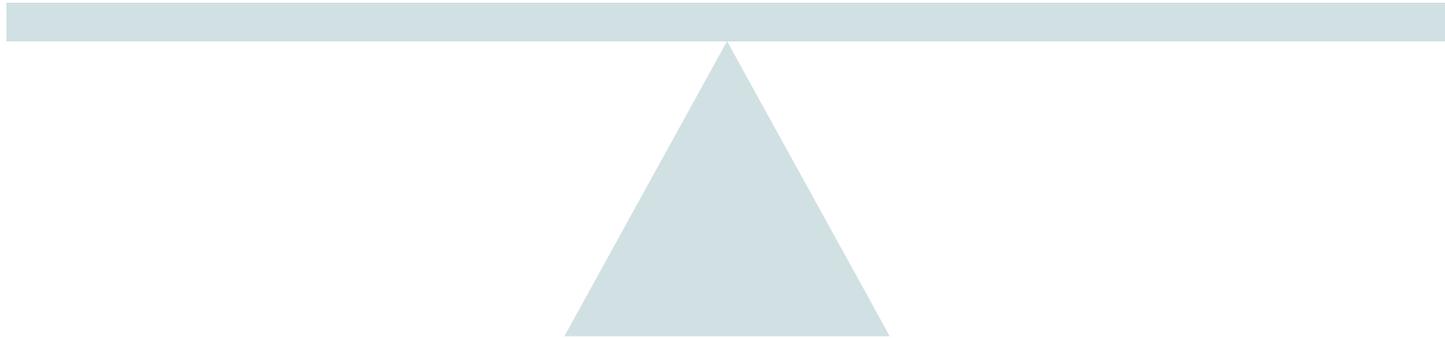
See paper for more details



# Balancing interactions

**Enjoyability**

**Data Quality**



# Study Design

Version X



Warm up

Version Y



Warm up      Sprint to...

# Interaction User Study

How do habitsourcing apps compare to their non-interactive counterparts?

- Enjoyability
- Likelihood of future use

# Interaction User Study

9

ZenWalk participants  
(5F)

12

Zombies Interactive participants  
(2F)

Recruited via Reddit

# Recruitment/demographic

9

ZenWalk participants  
(7F)

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Zombies Interactive participants  
(5F)

Recruited locally via university Facebook  
groups and mailing lists

# Data Study

Can we accurately detect when a person performs an interaction?

Can we accurately detect objects from an interaction's data trace?

# User Studies

Study 2: Can habitsourcing interactions yield accurate data?

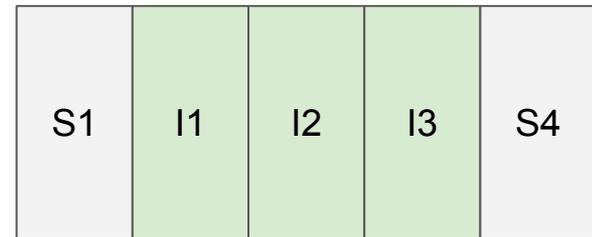
Full experience



35 minutes

Warm Up

Abbreviated experience



10 minutes