Habitsourcing
Sensing the Environment Through Immersive, Habitbuilding Experiences

Katherine Lin, Henry Spindell, Scott Cambo, Yongsung Kim, Haoqi Zhang
Citizen science and communitysensing apps
Citizen science and community sensing apps

...but we don’t always have interested volunteers.
Leveraging habits

Millions of people experience the environment while practicing a habit
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

Leverage these routines to collect data!

3 million users

200,000 active users
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 uses immersive interactions embedded within existing habitbuilding experiences to collect sensing data about the environment.
How can we gather data from people who are not intrinsically interested in collecting it?
Related Work: Physical Games with a Purpose

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

<table>
<thead>
<tr>
<th>Intro</th>
<th>Focus on breathing, posture</th>
<th>Focus on surroundings</th>
<th>Reflect</th>
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Headspace
Placing interactions in experiences

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Sensing Interaction
Placing interactions in experiences

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**ZenWalk**

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Sensing through actuation in Zombies Interactive

VIDEO
Sprint detection
Sensing through actuation in ZenWalk
How can we make sensing through actuation interactions enjoyable in a particular habitbuilding experience?
Designing Interactions

ZenWalk

“Observe the tree...”
Designing Interactions

ZenWalk

“Observe the tree...”

Interaction needs more guidance
Designing Interactions

ZenWalk

“Observe the tree...”

Interaction needs more guidance

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

ZenWalk

“Observe the tree...”

Interaction needs more guidance

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

Zombies Interactive

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

**ZenWalk**

“Observe the tree...”

Interaction needs more guidance

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

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

Interaction unnatural to habit
Designing Interactions

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“Observe the tree...”

Interaction needs more guidance

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

**Zombies Interactive**

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

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

S1  S2  S3  S4

Warm up

Interactive

S1  I1  S2  I2  S3  I3  S4

Warm up  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.
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”
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”

“It was nice to focus on trees and notice things I might not otherwise have.”
Users dislike contextual mismatches

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

“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

Sensor traces

Object detection
User Studies

Study 2: Can habitsourcing interactions yield accurate data?

9 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
Design Principles

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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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● Can we scaffold collected data to achieve accuracy, coverage, and detail?

● How do we design new immersive experiences within the physical world?
Conclusion

● We can provide a habitbuilding experience that’s at least as enjoyable as existing ones

● It’s possible to collect accurate data

● We can reach a broader population of people not interested in contributing data
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Thank You
Appendix
Questions
Questions
Algorithm for sprint detection
Algorithm for circle detection

numLocations = 3
Algorithm for circle detection

numLocations = 0
Algorithm for circle detection

\[ \text{numLocations} = 0 \]
Algorithm for circle detection

numLocations = 0
Algorithm for circle detection

\[
\text{numLocations} = 0
\]
Algorithm for circle detection

numLocations = 0
Algorithm for circle detection

numLocations = 0
Algorithm for circle detection

\[
\text{numLocations} = 4
\]
Algorithm for circle detection

numLocations = 9
Algorithm for circle detection

\[ \text{numLocations} = 27 \]
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

S1  S2  S3  S4

Warm up

Version Y

S1  I1  S2  I2  S3  I3  S4

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

Recruited locally via university Facebook groups and mailing lists

9 ZenWalk participants (7F)  9 Zombies Interactive participants (5F)
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

Abbreviated experience

Warm Up

35 minutes

10 minutes