GeoRich Workshop 2016

An Empirical Study of Workers' Behavior in Spatial Crowdsourcing

Hien To

Joint work with

University of Southern California

Cyrus Shahabi,

Seon Ho Kim

&

National Institute of Informatics, Japan

Rúben Geraldes

Helmut Prendinger

Outline

- **Introduction**
- Campaigns
- Results
- Conclusion

Spatial Crowdsourcing

Crowdsourcing: outsourcing a set of tasks to a set of workers. amazon mechanical turk™ Artificial Artificial Intelligence

Spatial crowdsourcing (SC)*:* requires workers to ***physically*** travel to the task's location in order to execute the task

SC Applications

Ubiquity of mobile users — **6.5 billion** mobile subscriptions, 93.5% of the world population [1]

Technology advances on mobiles — Smartphone's **sensors**. e.g., video cameras

Network bandwidth improvements — From 2.5G (up to 384Kbps) to 3G (up to 14.7Mbps) and recently **4G** (up to 100 Mbps)

[1] http://www.gartner.com/newsroom/id/2665715

Studies in Spatial Crowdsourcing

Task Assignment (w/o Privacy)

- **[Kazemi and Shahabi. SIGSPATIAL'12]**
- **[Kazemi et al. SIGSPATIAL'13]**
- **[Dang et al. IIWAS '13]**
- [Pournajaf et al. ICCS'14]
- [Hassan and Curry. UCI'14]
- **[To et al. TSAS'15]**
- **[To et al. PerCom'16]**
- [Tong et al. ICDE'16]
- [Hassan and Curry'16]

Task Scheduling

- **[Deng and Shahabi. SIGSPATIAL'13]**
- **[Deng et al. SIGSPATIAL'15]**
- [Li et al. SSTD'15]
- **[Deng et al. GeoInformatica'16]**

Incentives

- [Musthag et al. CHI'13]
- [Teodoro et al. CSCW'14]
- [Thebault-Spieker et al. CSCW'15]
- **[To et al. GeoRich'16]**

Task Assignment (with Privacy)

- **[To et al. VLDB'14]**
- [Pournajaf et al. MDM'14]
- **[To et al. ICDE'15]**
- [Gong et al. TETC'15]
- [Gong et al. IoT'15]
- [Li et al. TMC'15]
- **[To et al. TMC'16]**

Trust

- [Kazemi et al. ACMGIS'13]
- [Cheng et al. VLDB'15]

Scalability

- **[Alfarrarjeh et al. MDM'15]**

Applications

- [Kim et al. MMSys'14]
- [Chen et al. VLDB'14]
- **[To et al. IEEE BigData'15]**
- **[To et al. CROWDBENCH'16]**

Problem Focus

- Location-dependent factors influence workers' behavior
  - e.g., population density, worker mobility

- Understand workers' behavior using real systems and users

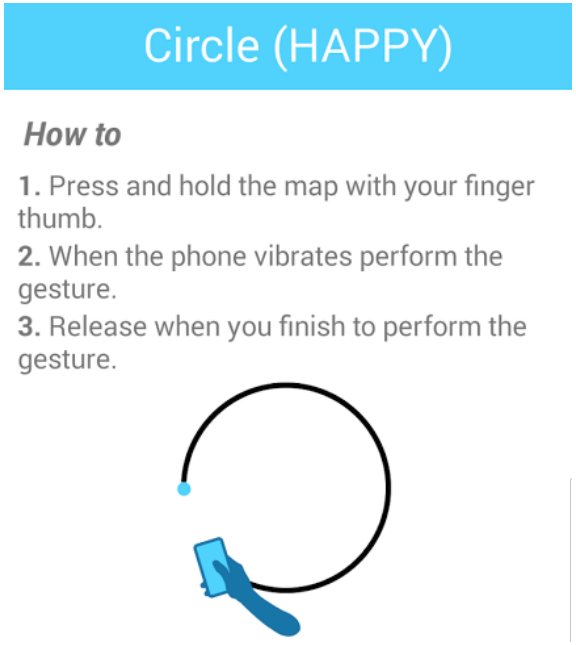
Outline

- Introduction
- **Campaigns**
- Results
- Conclusion

Genkii Mobile App

- Enable users report their moods (i.e., Happy, OK, Dull)
- Organize two campaigns and give users rewards for reporting moods

Mood maps of users



Performing gesture

Two Reward Strategies

- Fixed Reward (FR) vs. Increasing Reward (IR)
  - 20 Japanese Yen = 20 cents

Task	1	2	3	4	5	6	7	8	9	10
FR	20	20	20	20	20	20	20	20	20	20
IR	2	3	5	10	15	20	25	30	40	50

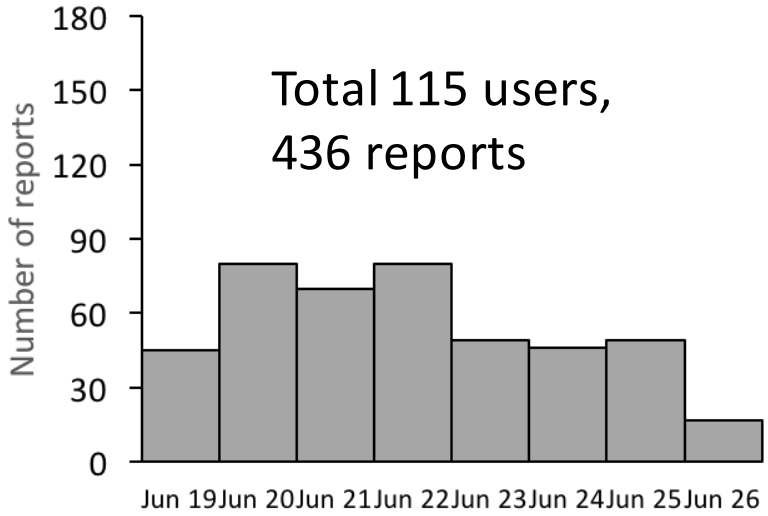
- Using Yahoo! Japan Crowdsourcing as payment platform
- User reports mood at specific location and time
  - Report is rewarded only if posted at least 4 hours after the most recent rewarded report
  - Genkii does not allow users to report consecutively at the same location
  - Each user can receive rewards for maximum 10 reports

Outline

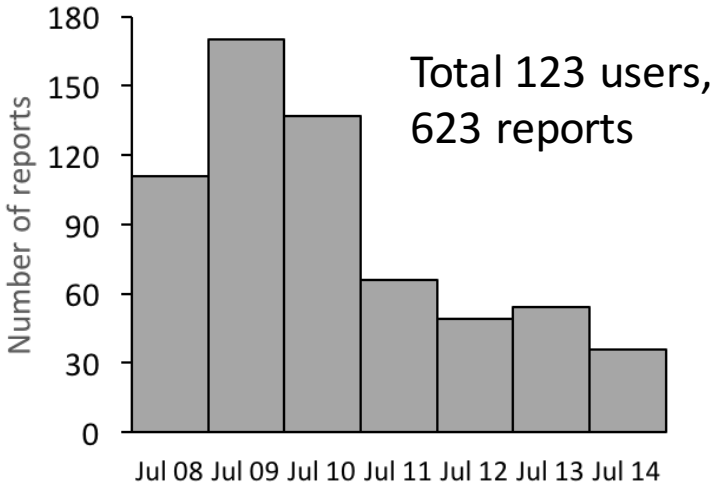
- Introduction
- Campaigns
- **Results**
  - **Worker Performance**
  - Impacts of Rewards
  - Worker Mobility
- Conclusion

Worker Performance

- Number of Reports
  - Both campaigns quickly took off and significantly drop in the last four days due to the 4-hour time constraint between two consecutive rewarding reports



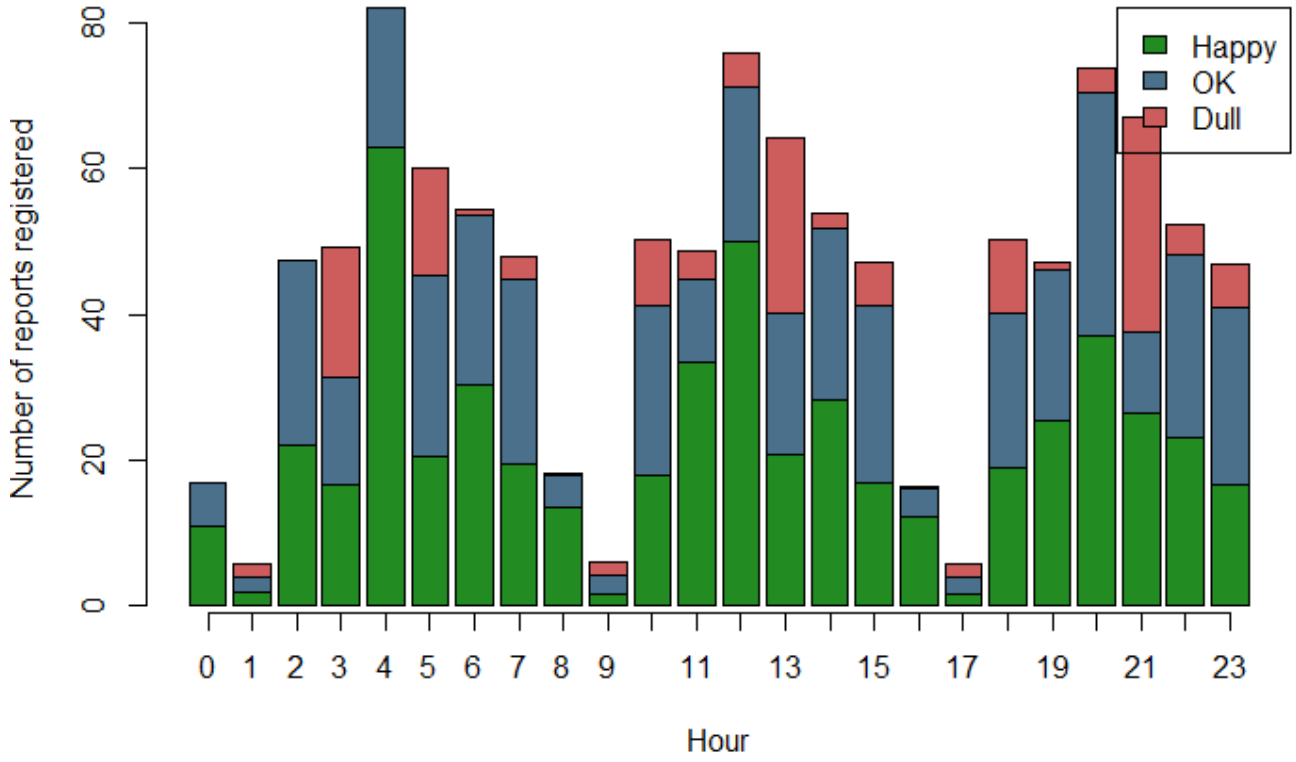
Fixed Reward (FR)



Increasing Reward (IR)

Distribution of Reports

- Lowest #reports made around 1AM, 9AM, and 5PM (common commute times in Japan)
- Higher #reports recorded around 4AM, 12AM and 8PM



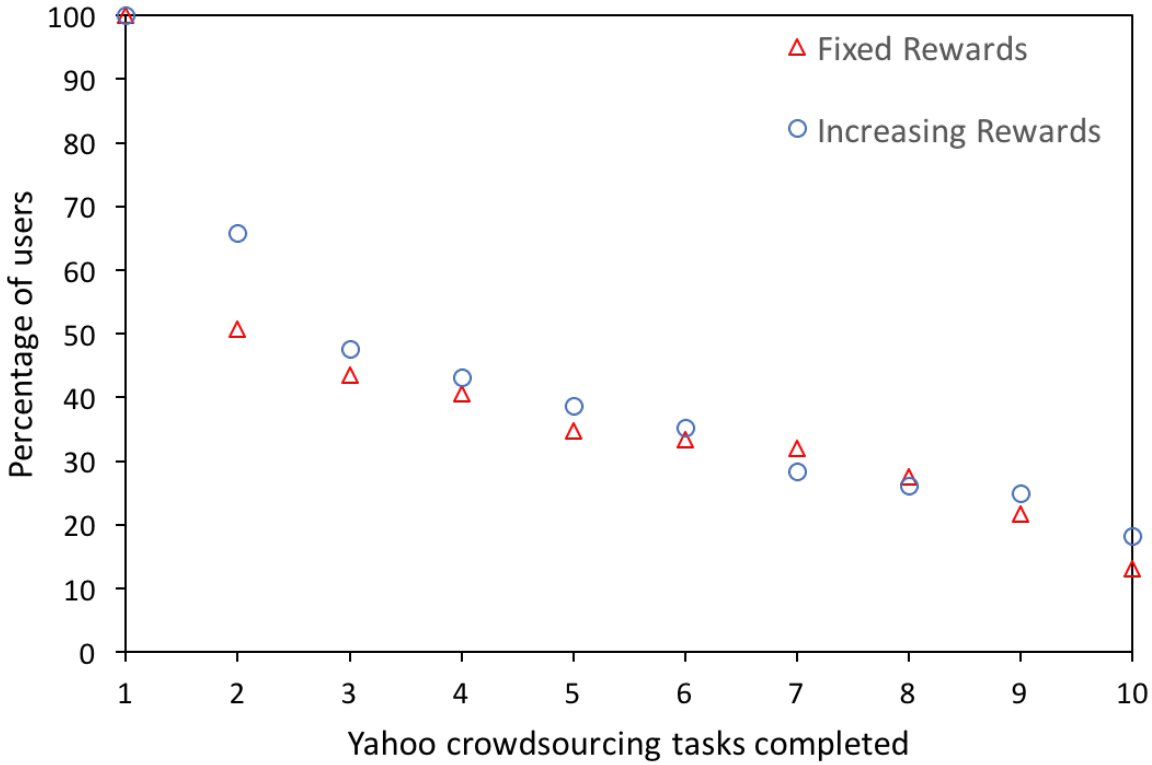
Distribution of reports over a day cycle

Outline

- Introduction
- Campaigns
- **Results**
  - Worker Performance
  - **Impacts of Rewards**
  - Worker Mobility
- Conclusion

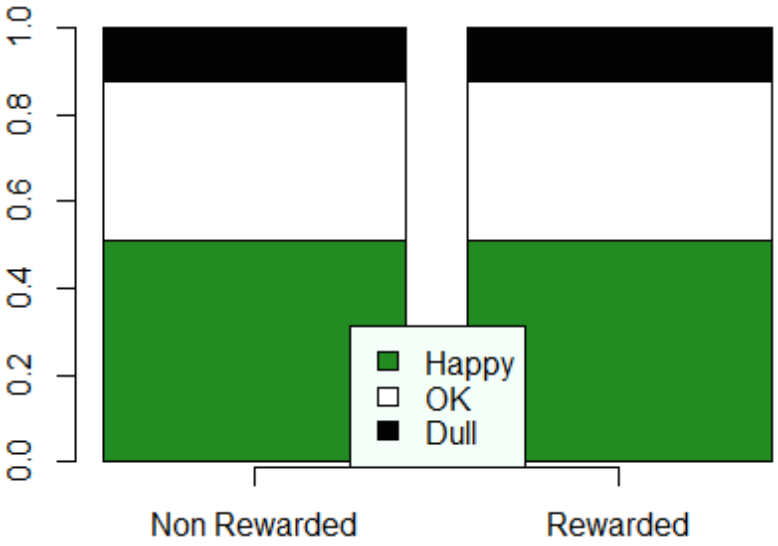
Impact of Rewards on Task Completion

- Completed the 10 rewarded reports
  - 17% of users in IR
  - 11.3% of users in FR

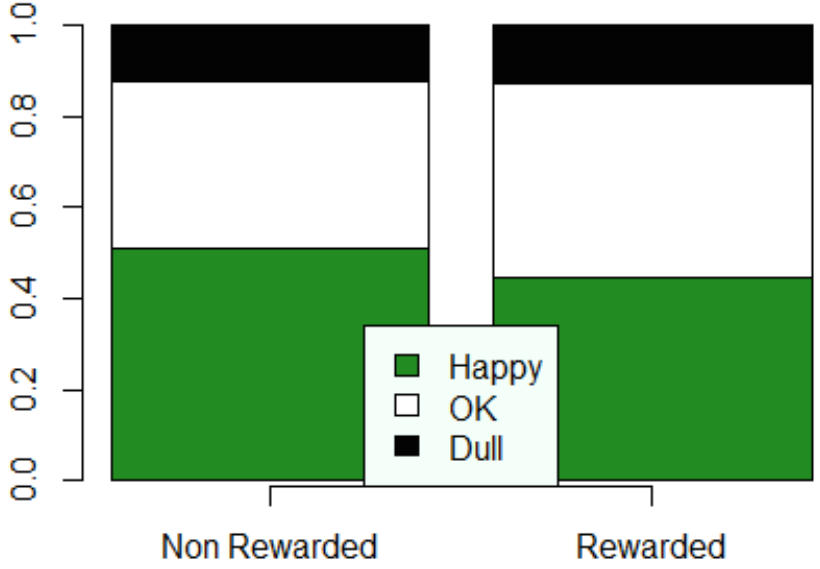


Impact of Rewards on Reported Moods

- Rewards have a negligible impact on the proportion of emotions reported



Fixed Reward (FR)



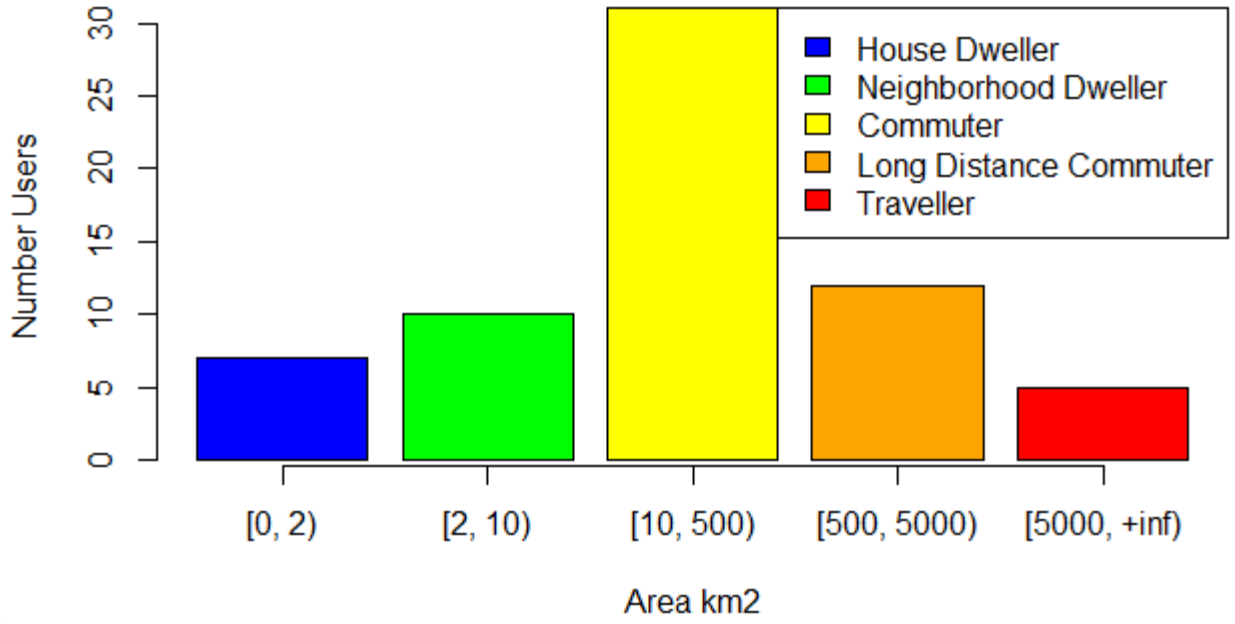
Increasing reward (IR)

Outline

- Introduction
- Campaigns
- **Results**
  - Worker Performance
  - Impacts of Rewards
  - **Worker Mobility**
- Conclusion

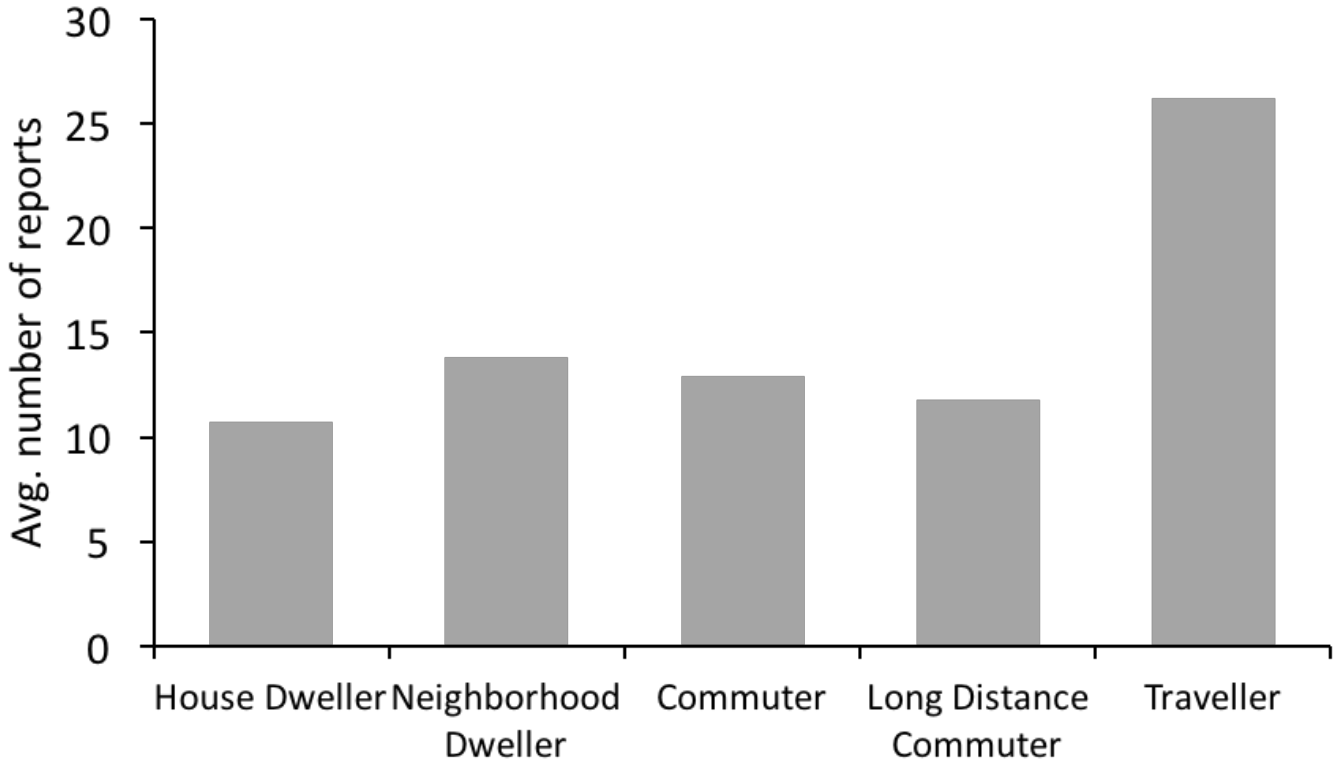
Worker Mobility

- Categorize users with at least six reports based on their mobility
  - *Genkii Territory* is the area of the MBR that encloses the locations of all the reports by a user



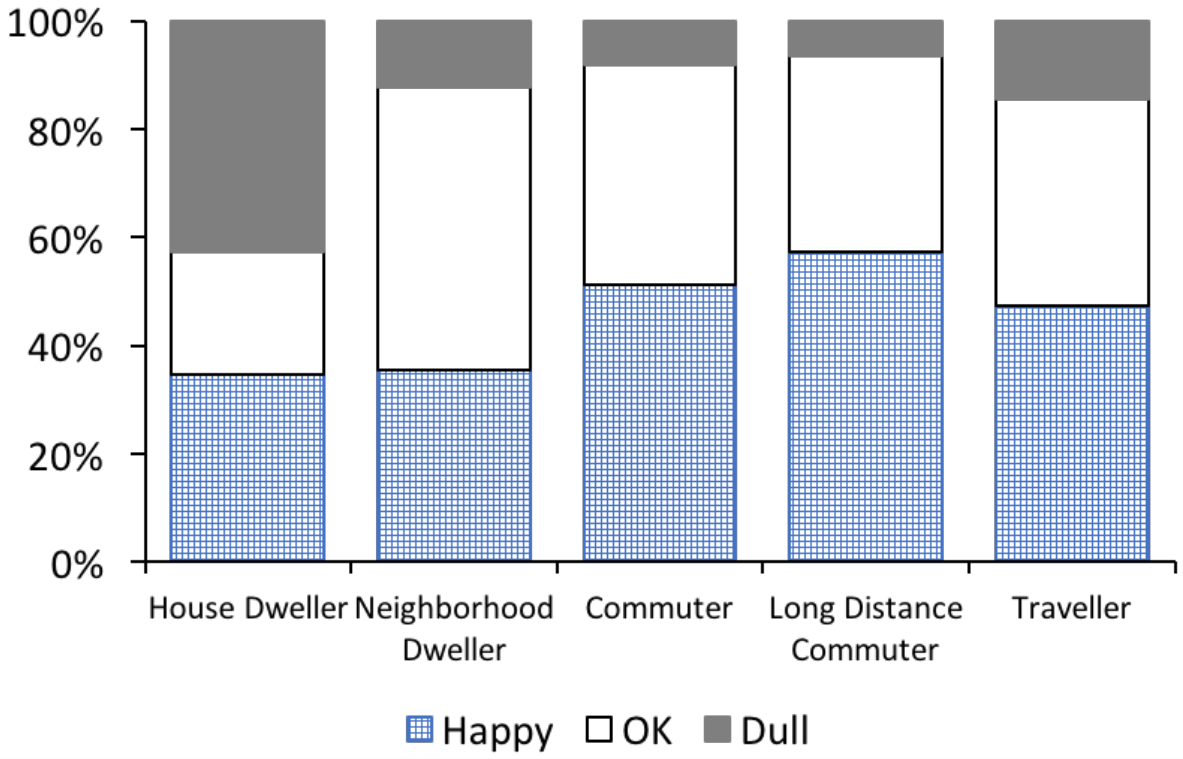
Effects of Genkii Territory on Worker Performance

- *Travellers* report as twice as the other groups while *House Dwellers* are less willing to report



Mood Distribution per Degree of Mobility

- *Dwellers* shows largest fraction of Dull reports (i.e., 43%) and smallest percentage of Happy reports (i.e., 34%)
- *Commuters* and *Travellers* show higher fraction of Happy reports (i.e., 57%).



Conclusions and Future Work

- Provided an exploration of real SC workers' behavior
- Increasing reward campaign encouraged users to perform more tasks
- Reported data explained trends and cultural aspects

- In the future, how to incentivize people to perform SC tasks
  - E.g., how reward correlates with travel cost

Q/A

Hien To

Email: hto@usc.edu