



# Sensing Human Interactions

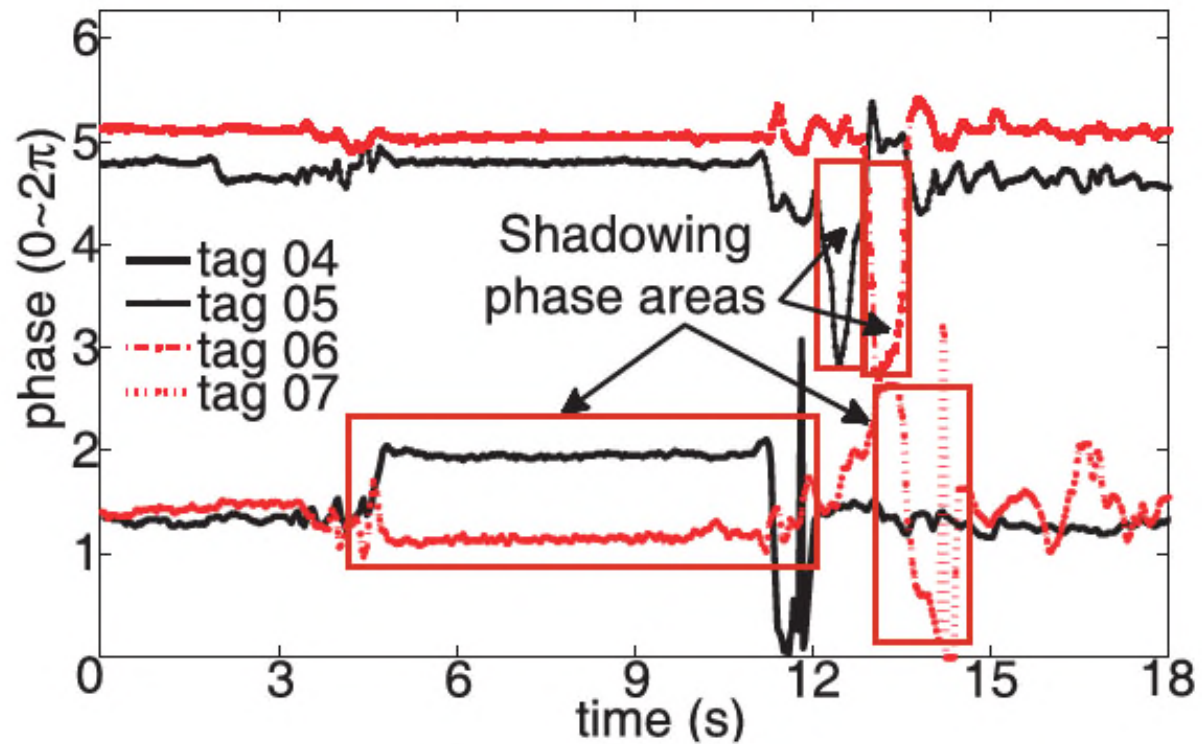


# ShopMiner

- ▶ Which items are popular? (Customers stop to look at them)
- ▶ Which items are hot? (Customers pick them up)
- ▶ Which items are correlated? (Customers showing interest in one also like the other)

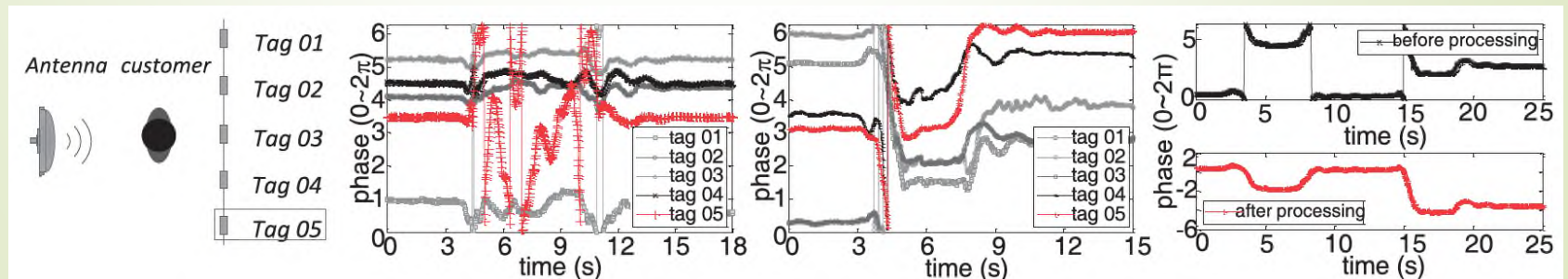
# Identifying Popular Items

- Body line-of-sight blocking (between tag and reader)



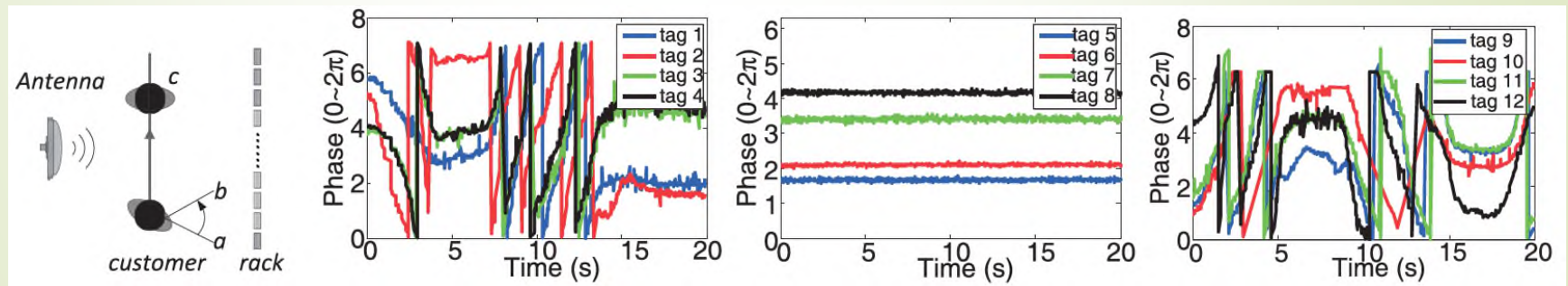
# Identifying Hot Items

- Looks for large changes in phase between tag and reader
  - Phase changes with distance
  - Distance changes when items are moved
- KL-divergence is used to detect differences in phase distribution over successive time windows
- Highest variance tag is considered the target
- Correlation between target and nearby tag differentiates turn-around from pick-out



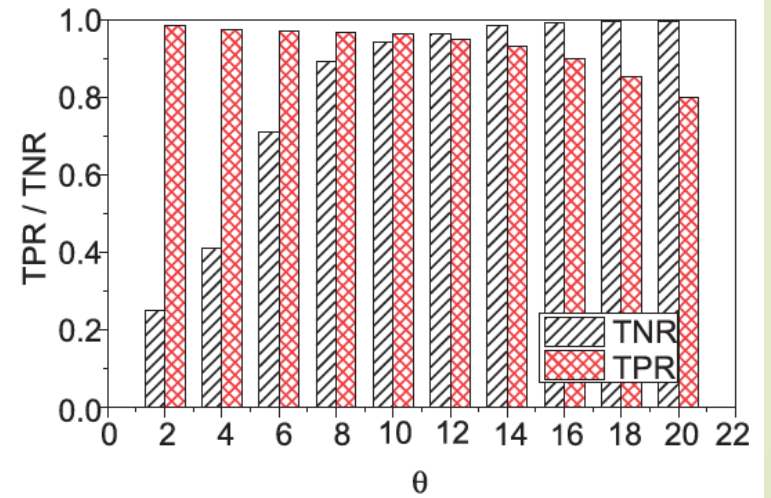
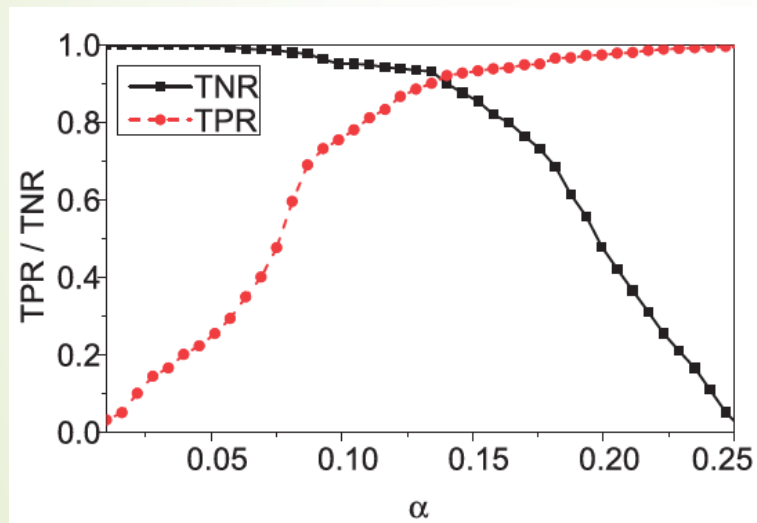
# Identifying Correlated (i.e., Jointly Picked-out) Items

- Use correlations in phase trends to determine groups of simultaneously picked out items



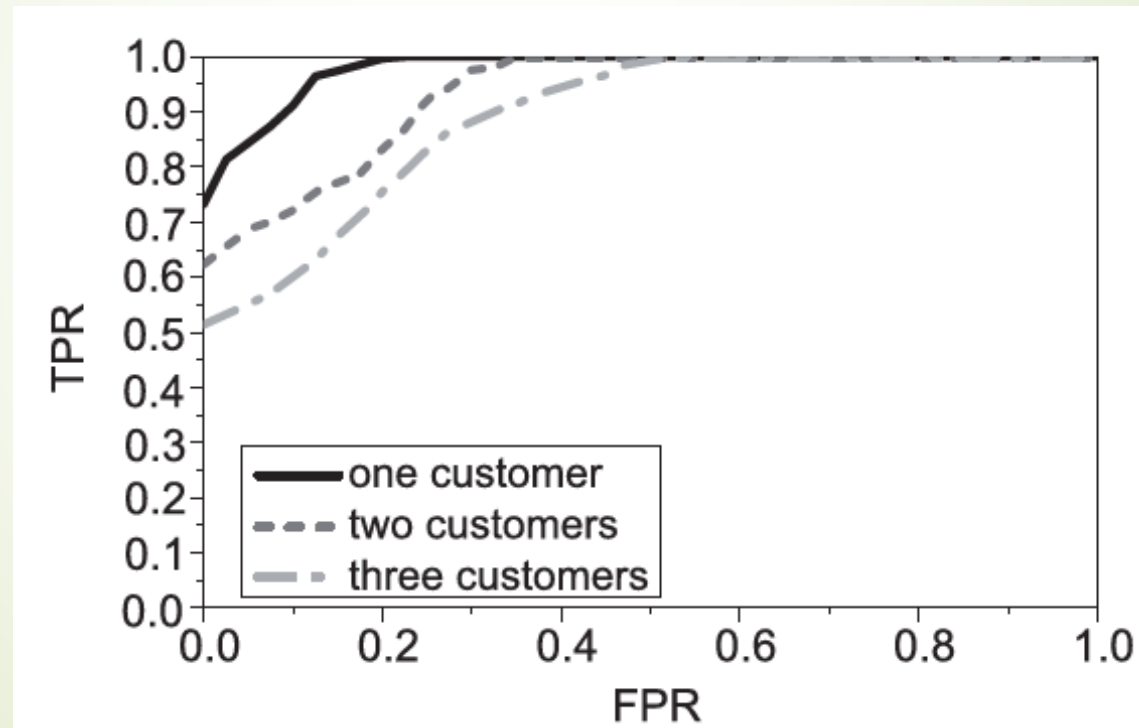
# Evaluation

## Identifying Popular Items



# Evaluation

- Identifying Hot Items





# Evaluation

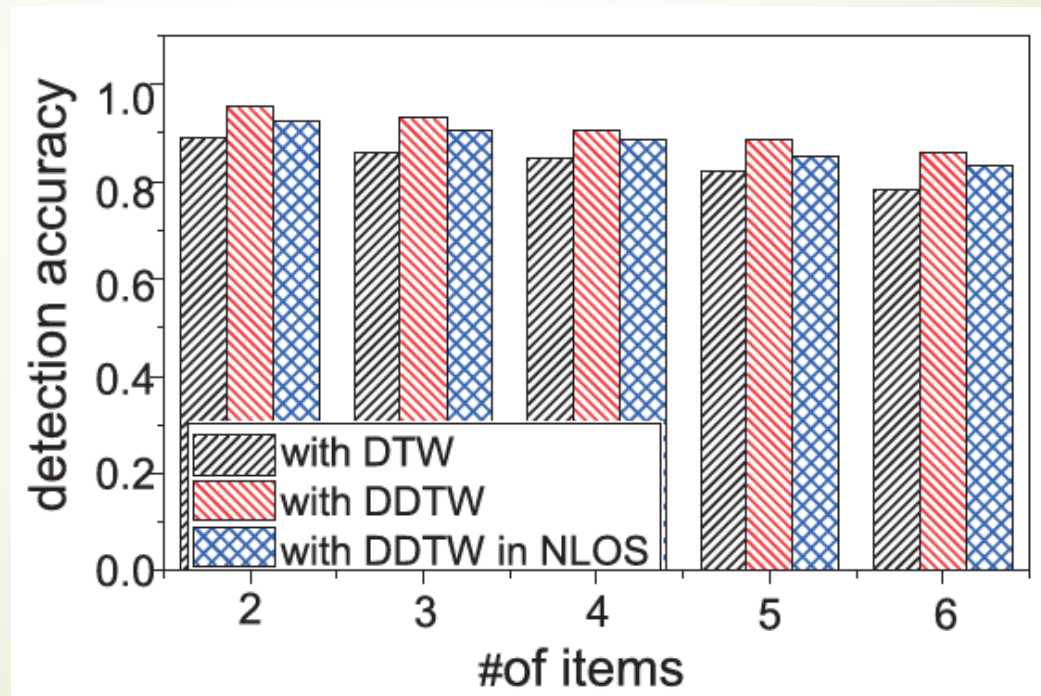
- Confusion matrix (pick out versus turn around)

<b>Ground-truth</b>	<b>Predicted</b>					
	Turn around			Pick out		
	1	2	3	1	2	3
Turn around	187	184	178	13	16	22
Pick out	9	10	13	191	190	187

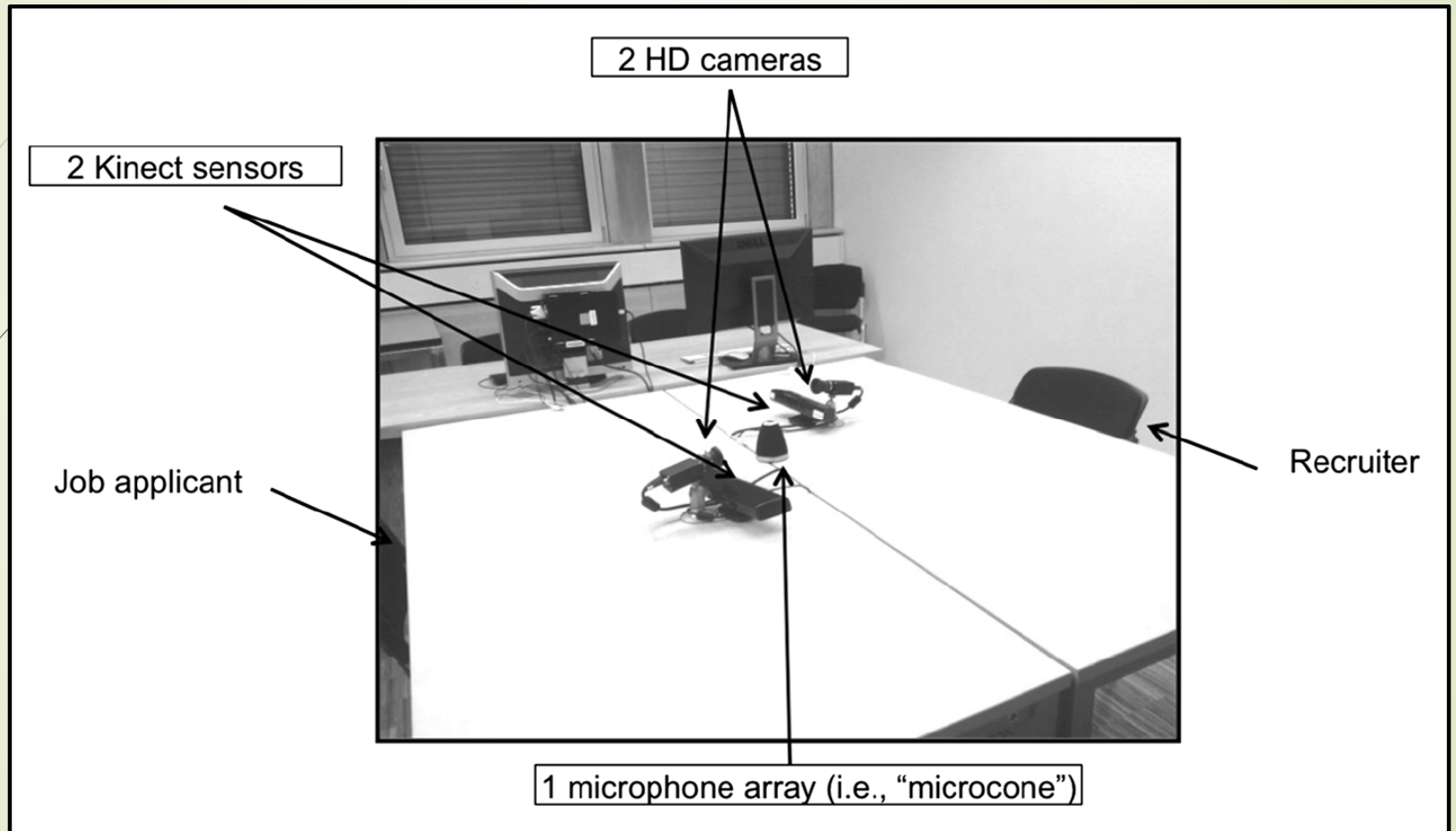


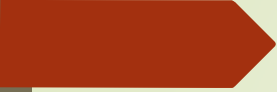
# Evaluation

- Detection of correlated items




# Monitoring Nonverbal Cues





# Cues Recorded in an Applicant/Interviewer Scenario

- ▶ Smiling at Interviewer
  - ▶ Looking at Interviewer
  - ▶ Nodding at Interviewer
  - ▶ Audio back-channeling
  - ▶ Turn-taking
  - ▶ Tempo variation
- 



# Process

- ▶ 62 applicants applying to sale job (average age: 24)
- ▶ Interview conducted by RAs based on a set of standard questions
- ▶ Professional recruiters evaluated hireability based on answers
- ▶ Audio and video cues extracted automatically from recording
- ▶ Audio and video cues also manually labeled
- ▶ Questions answered:
  - ▶ Is automatic extraction of cues accurate?
  - ▶ How well do they predict hireability?



# Process

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  - ▶ How well do they predict hireability?
- ▶ Accuracy of automatic cue extraction:
  - ▶  $r = 0.88$  for visual cues
  - ▶  $r = 0.78$  for audio cues



# Predictors of Hire-ability

- ▶ Model:  
$$\text{Hireability} = a (\text{factor1}) + b (\text{factor2}) + c (\text{factor3}) + \dots$$
- ▶ Coefficients a, b, c, determined by regression analysis
- ▶ Statistically significant predictors
  - ▶ Longer turn taking
  - ▶ Looking at interviewer
  - ▶ Tempo variation

# Study of Activity-based Working

- ▶ **Activity-based working:** Some companies are replacing dedicated desk with shared spaces designed to support specific activities. The idea being that individuals will use the space that best matches the activity they need to perform at the time.
- ▶ The paper presents a study of workplace interaction patterns in the above model.
- ▶ Instrument: Proximity-based sensors, trained to detect proximity from Bluetooth measurements

	<b>TP Rate</b>	<b>FP Rate</b>	<b>F-Measure</b>
Non-proximity	0.981	0.014	0.984
Proximity	0.986	0.019	0.984
<b>Average</b>	<b>0.984</b>	<b>0.016</b>	<b>0.984</b>

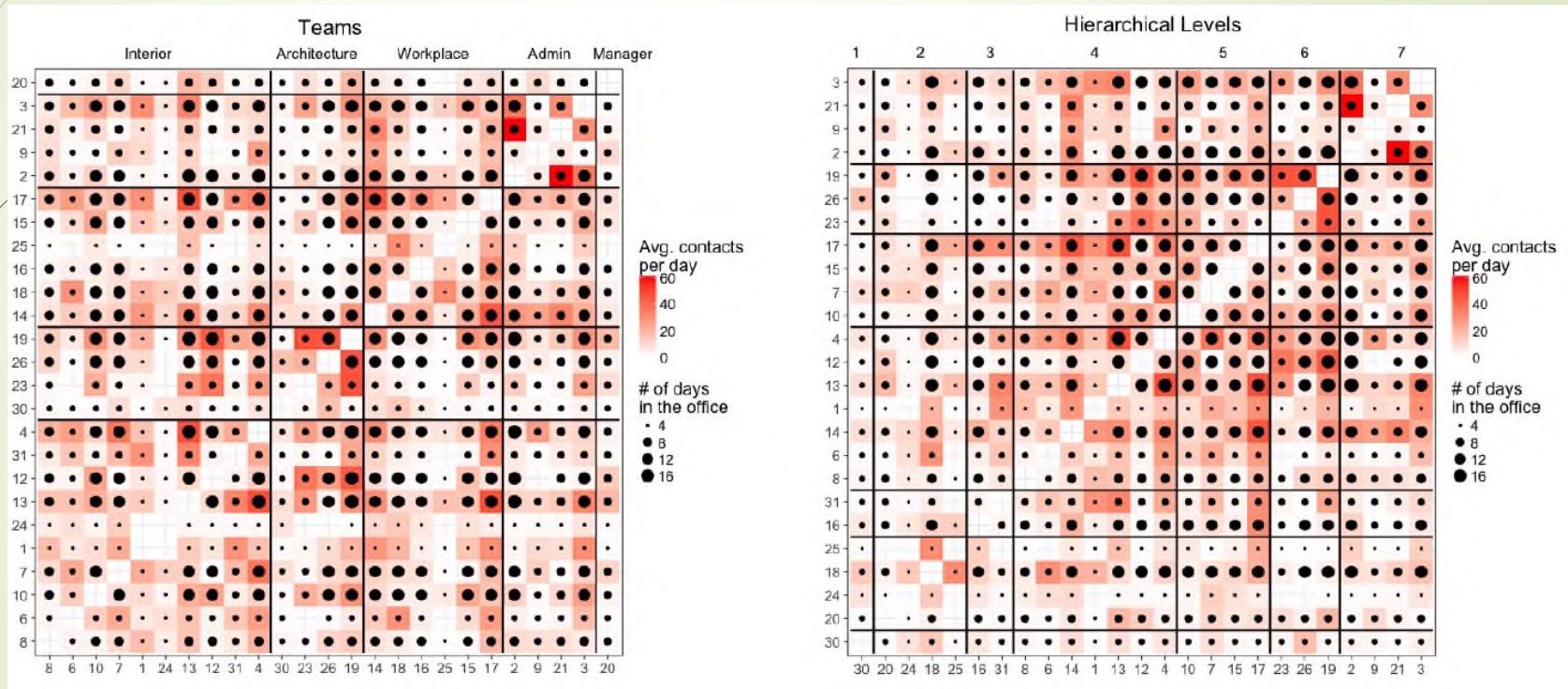


# Location Sensing

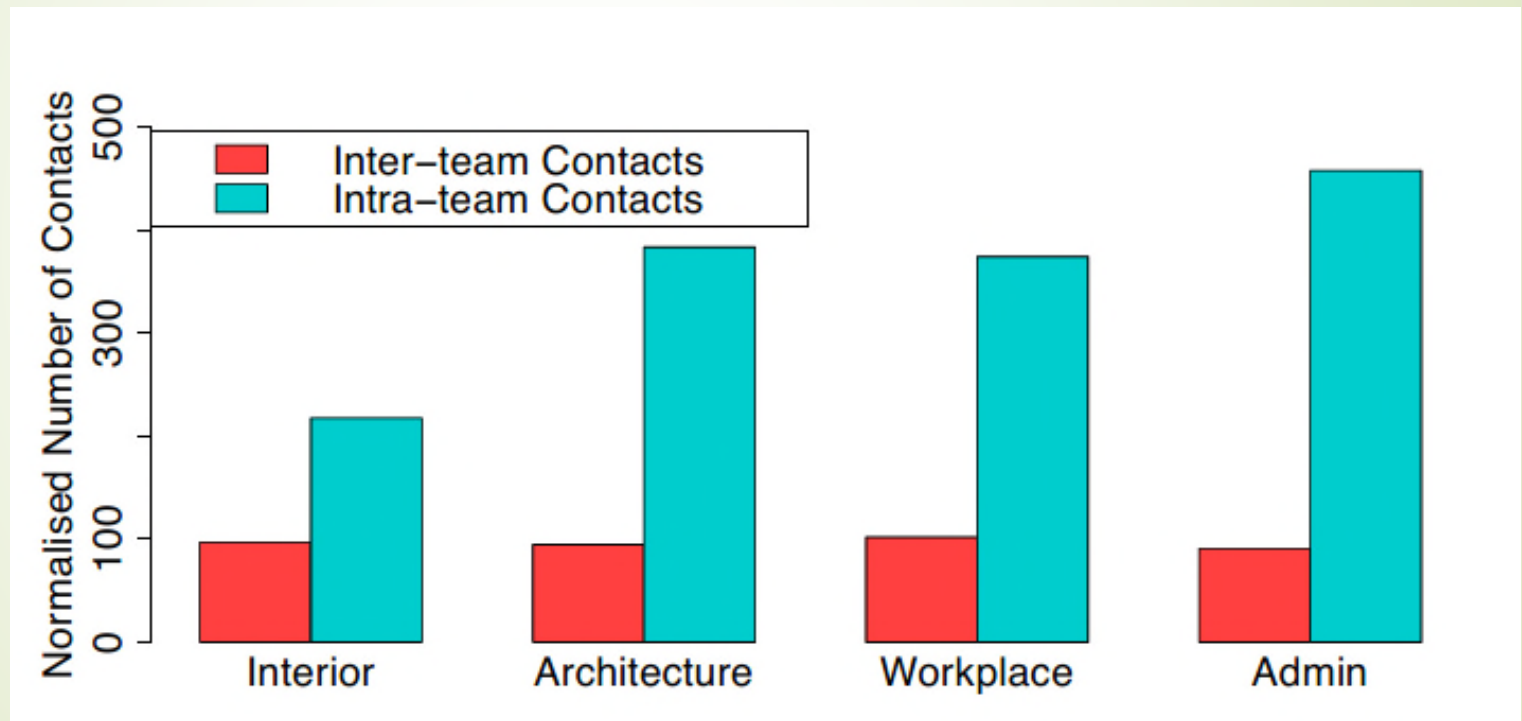
- 17 static BLE beacons were deployed to help identify locations
- Location of participant is dictated by the strongest received beacon
- Accelerometer detects walking. No location change is recorded unless walking is detected first



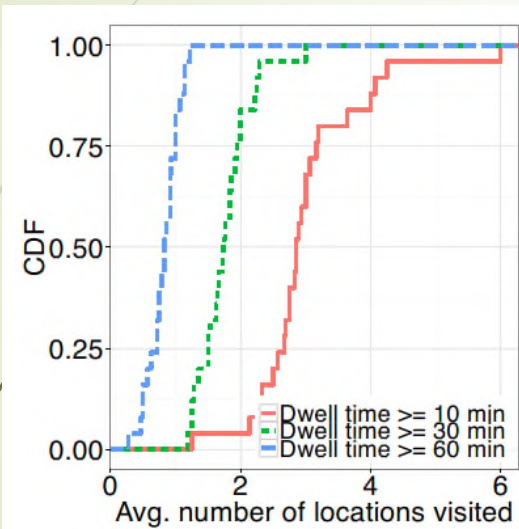
# Interaction Structure



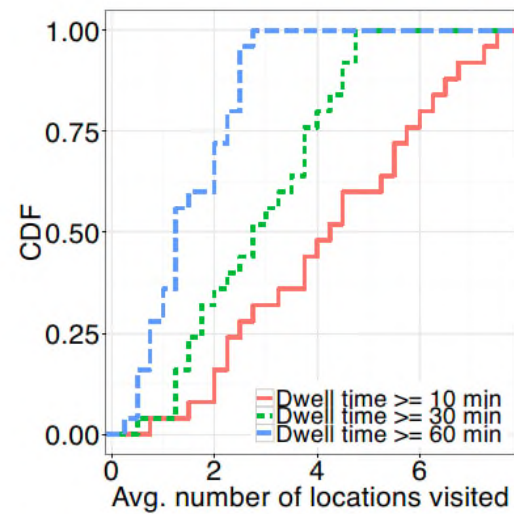
# Interaction Structure



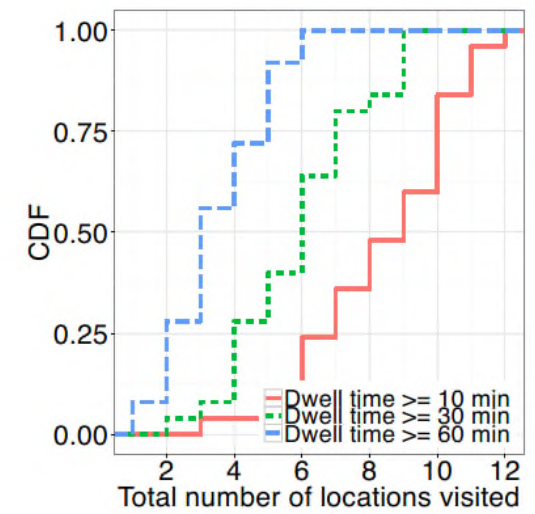
# Distribution of Locations Visited



(a) Average number of locations visited per day.



(b) Average number of locations visited per week.



(c) Total number of locations visited in the entire study.



# Tie Strength and Location Preference

- People with stronger social ties tended to choose to work closer together (as opposed to choosing workstation based on job function)

