Ubiquitous and Mobile Computing
CS 403x: Sleep Monitoring

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Introduction

- Current sleep monitoring apps are:
  - Intrusive (headbands, wristbands)
  - Requires user input
  - Change behavior
  - Consistent user action
  - Need to be on bed (some)
Vision

- No touching your phone
- No sensors
- Just go to bed
Best Effort Sleep (BeWell)

- Automatically detects sleep duration
- Does not provide detailed analysis of sleep quality
- Uses following sensors/states:
  - Light
  - Silence
  - Phone on/off
  - Phone charging
  - Phone lock
  - Stationary
Best Effort Sleep (BeWell)
Similar Apps

- Fitbit / Jawbone (Wristband)
- Zeo (Headband)
- Sleepcycle (Sleep with phone)

Other Concepts:
- Meditation
- Yoga
- Ambient / White noise
- Nature sounds
Methodology

- 8 users:
  - All male
  - 23-31 years old
  - Computer Science, Material Engineering of Dartmouth College
  - Visiting Scholars and Graduate Students
Methodology

- One week
- Each carried 3 phones
- Used all 4 methods
  - Zeo headband (LG Nexus 4)
  - Jawbone wristband (iPhone 4S)
  - Sleep With Phone (Google Nexus One)
  - BeWell (LG Nexus 4)
- Users wrote down sleep times
Results

- **BeWell**
  - ~45 mins accuracy
  - High user satisfaction
  - Most flexible

- **Other methods**
  - Between 20-40 mins accurate
  - Low user satisfaction
  - Users forgot steps
  - Inflexible to interruptions
Their Conclusion

- Our app is “good enough”
  - Sleep is usually measured by hour anyway
- Promising technology
  - Free
  - No extra hardware
  - Easiest to use
  - Most flexible
Critique

- Small study
- One demographic
- Used different phones
- Didn’t factor in:
  - Daily activities
  - Eating habits
  - Health
  - Sleeping conditions
Potential Improvements

- Better study
  - Larger user group
  - Longer timeframe
  - More demographics
  - Consistent hardware
  - Factor sleep influences

- Apply machine learning individually
  - Properly weight the six sleep factors