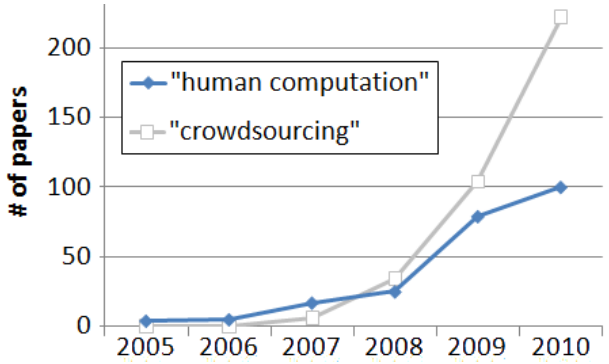
# Crowdsourcing & Human Computation



## Today

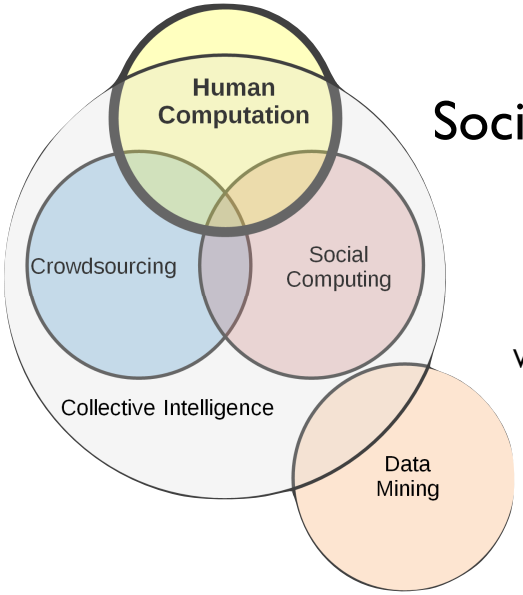



- mainly driven by Mechanical Turk and Social Networks



## Taxonomy of Social Computing

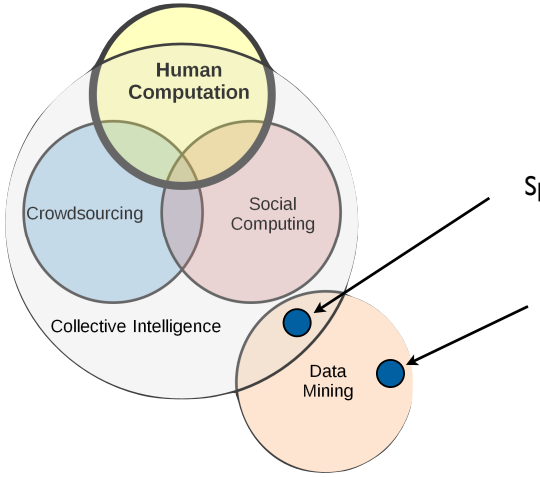
[Quinn and Bederson, CHI 2011]




What are the differences?



## Data Mining




Spam detection

PageRank algorithm

- Users are not aware of DM, happens in the background
- "Uncreative" interactions

# Collabio

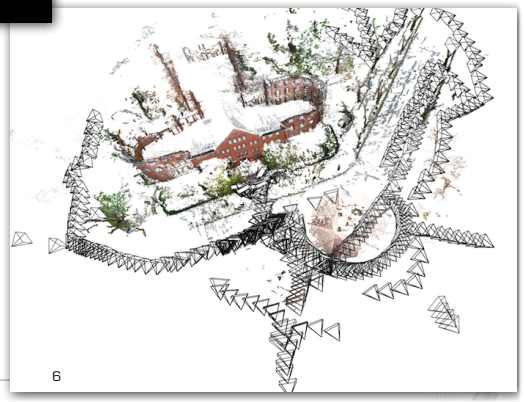
[Bernstein et al., UIST 2009]

- Guess the tags that describe your friend best
- Points for common tags

# PhotoCity

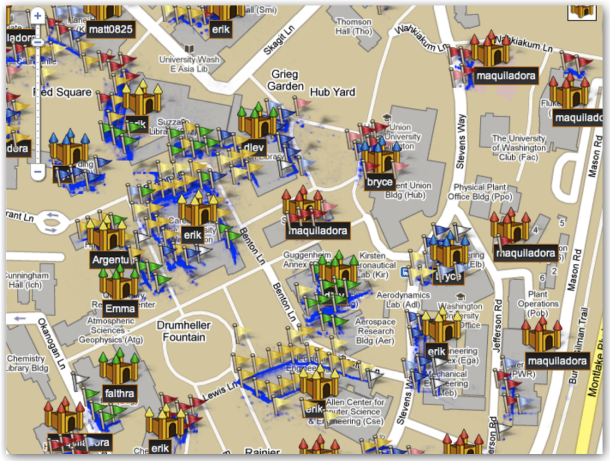
[Tuite et al., CHI 2011]

Task: reconstruct the geometry of buildings from photos



- PhotoCity is a competition between two universities to get the better model
- "Game with a purpose"



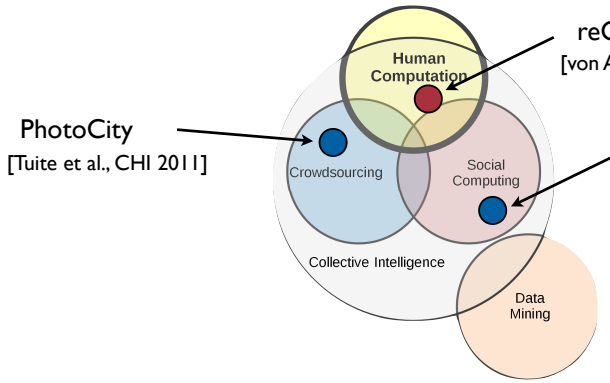



# PhotoCity

[Tuite et al., CHI 2011]

- Players get points for photos with new feature vectors
- Better photos have more new features
- Website guides the players with flags placed at problematic areas



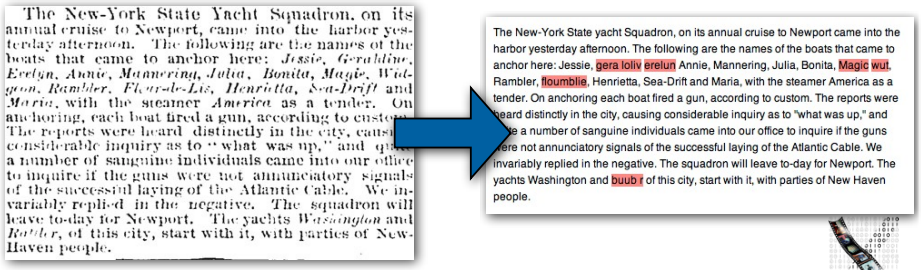



- Social computing facilitates relatively natural human behavior mediated by technology
- Crowdsourcing replaces experts with undefined, usually large groups of people
- Collective intelligence: groups of individuals that are doing things that seem intelligent

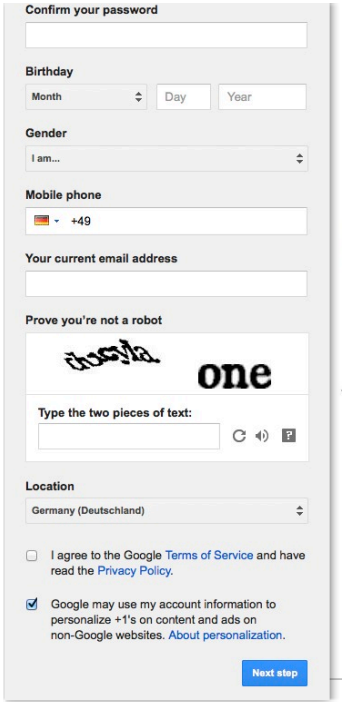
# reCaptcha

[von Ahn et al., Science 2008]

- Prove to be human by deciphering text that OCR cannot
- 200 million CAPTCHAs are solved by humans around the world every day
- Leverage this “processing power”!






# reCaptcha

[von Ahn et al., Science 2008]

# Human Computation

- Von Ahn, 2005

  “... a paradigm for utilizing human processing power to solve problems that computers cannot yet solve”

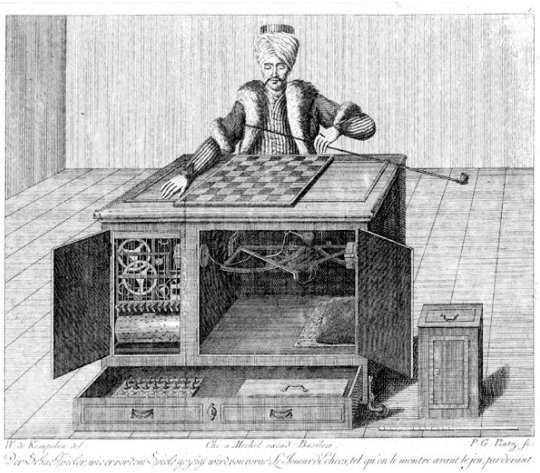
- Human as a processor for a larger (computer directed) algorithm



# In-class Exercise: Mechanical Turk

- Visit http://www.mturk.com/ click “find hits now”
- What kind of jobs are posted there?
- In what manner are they posted?
- How much are they paid?
- How much time do they take?
- What kind of jobs are missing?

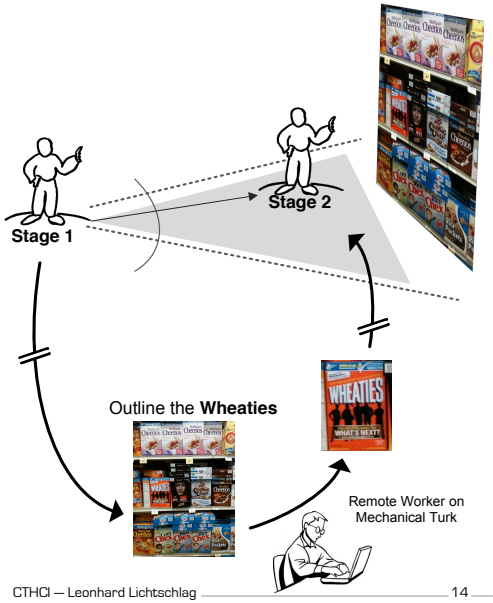
# The original Mechanical Turk





# VizWiz: Nearly Real-time Answers to Visual Questions

[Bigham et al., 2010]

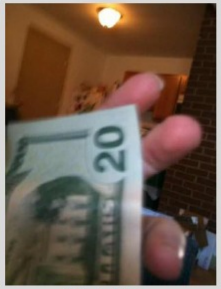



1. Blind user takes a photo with his smartphone and formulates a question
2. Turker has a look at the photo and listens to question
3. Answer is transmitted back to the phone and blind user

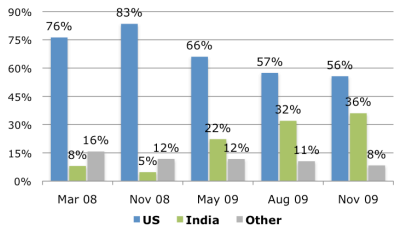


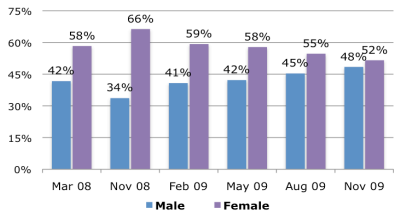
# VizWiz: Nearly Real-time Answers to Visual Questions

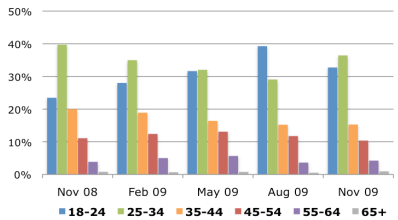
[Bigham et al., 2010]

| What denomination is this bill? | Do you see picnic tables across the parking lot? | What temperature is my oven set to? | Can you please tell me what this can is? |
|---|---|---|---|
|  | | | |
| **(24s)** 20<br>**(29s)** 20 | **(13s)** no<br>**(46s)** no | **(69s)** it looks like 425 degrees but the image is difficult to see.<br>**(84s)** 400<br>**(122s)** 450 | **(183s)** chickpeas.<br>**(514s)** beans<br>**(552s)** Goya Beans |






# Who are the Crowdworkers?

[Ross et al., CHI 2011]

- Mechanical Turk was launched in 2005
- 400k registered workers in 2010
- 66k Hits this morning
- Average pay per hour: 2$
- Typical worker is well-educated, Indian or American, and young

# TurKit

[Little et al., UIST 2010]

```
// generate a description of X
// and iterate it N times
var text = ""
for (var i = 0; i < N; i++) {
    // generate new text
    var newText = mturk.prompt(
        "Please write/improve this paragraph
         describing " + X + ": " + text)

    // decide whether to keep it
    if (vote("Which describes " + X + " better?",
        [text, newText]) == newText) {
        text = newText
    }
}
```

**Iteration 1:** Lightening strike in a blue sky near a tree and a building.
**Iteration 2:** The image depicts a strike of fork lightening, striking a blue sky over a silhoutted building and trees. (4/5 votes)
**Iteration 3:** The image depicts a strike of fork lightning, against a blue sky with a few white clouds over a silhouetted building and trees. (5/5 votes)
**Iteration 4:** ~~The image depicts a strike of fork lightning, against a blue sky. wonderful capture of the nature.~~ (1/5 votes)
**Iteration 5:** This image shows a large white strike of lightning coming down from a blue sky with the tops of the trees and rooftop peaking from the bottom. (3/5 votes)
**Iteration 6:** This image shows a large white strike of lightning coming down from a blue sky with the silhouettes of tops of the trees and rooftop peeking from the bottom. The sky is a dark blue and the lightening is a contrasting bright white. The lightening has many arms of electricity coming off of it. (4/5 votes)

http://turkit-online.appspot.com/

# In-class Exercise: Quality Control

- 30% of open ended tasks tend to yield unusable results
- Lazy Workers do only the minimum amount required
- Eager Beavers might try to do more than your algorithm can handle
- Exercise: In groups, come up with strategies how one can ensure quality of the delivered work

# Quality Control Mechanisms

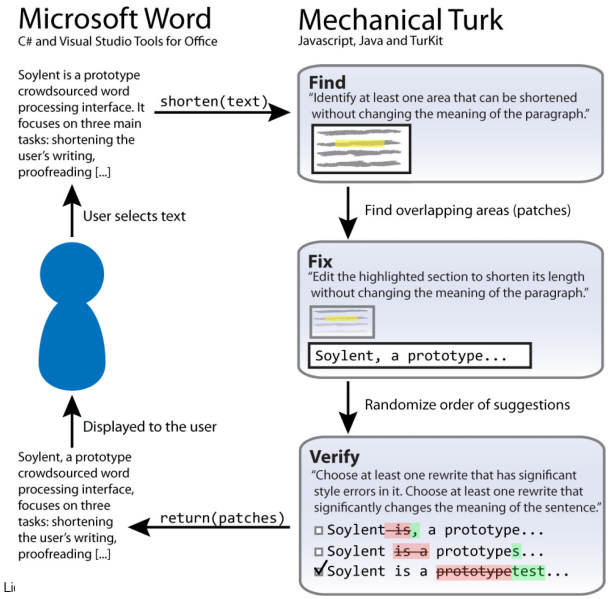
- Verify the work: Verification is often easier than the task
- Output agreement: Have multiple workers agree on answer
- Reputation: Mechanical Turk records approval rate
- Economic models: Pay more for honest workers
- Defensive task design: Is it easier to cheat than to be honest?
- Statistical filtering: Discard outliers from an expected distribution
- Multilevel review: One worker reviews the previous stage of work

# Soylent

[Bernstein et al., UIST 2010]

- Word processor with cloud inside
- Plug-in to MS Word with different modules
  - Crowdproof: spelling and grammar checking by asking Mechnical Turk workers
  - Shortn: asks workers to suggests ways to shorten a given text
  - The Human Macro: any word processing task
- Embed human computation in an everyday application
  - Wizard-of-Oz prototyping as part of running system
- Achieves complex tasks that would require expert users otherwise
- Multilevel review: Find-fix-verify pattern
  - Splits task into a series of generation and review stages

# Shortn via Find-Fix-Verify






# Problems and Open Questions:

- Latency, real-time answers?
- Sustainability and reliability?
- Ethical questions
- Privacy
- Ownership
- Personalization
- Impact on the worker

  poor compensation

  no team interaction, no learning from peers

  •no perception of context, pride in work

[O'Neill et al., CHI 2013]



# Using Mechanical Turk for HCI Studies

- E.g. Harrison et al., 2011, Kineticons

  asked users to rate meaning of the moving icon

- Mechanical Turk offers the researcher a large user pool
- Quick and relatively inexpensive results

Wave

- But workers will try to game the system
- Insert verifiable questions before subjective questions to judge the worker's honesty (E.g., describe the animation of the icon)

[Kittur et al., 2008; Komarov et al. CHI 2013]

- Make an dishonest answer as hard as an honest one
- Used in design classes for user evaluations

[Dow et al., CHI 2013]



# Summary

- Humans can act as processor in Human Computation schemes to solve algorithms that CPUs will not solve
- Human Computation can solve simple and complex tasks
- Many options for quality control and incentives
- HCI researchers can use Mechanical Turk for their user studies or teaching