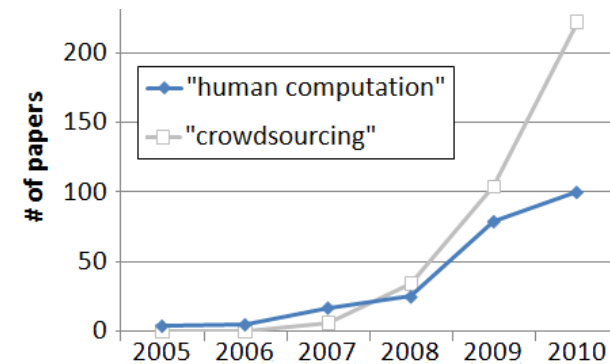


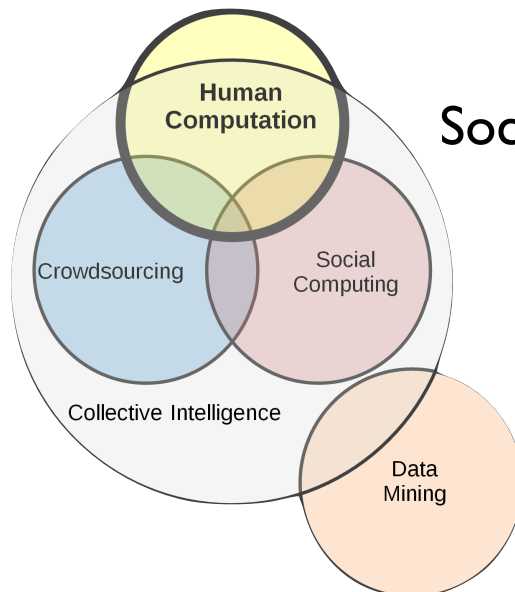
# Crowdsourcing & Human Computation



Today



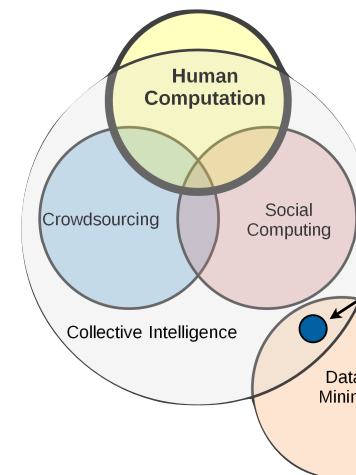
- mainly driven by [Mechanical Turk](#) and [Social Networks](#)



## Taxonomy of Social Computing

[Quinn and Bederson, CHI 2011]

What are the differences?



## Data Mining

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



Greg Smith  
Stanford Alumnus/Alumna  
Microsoft



Choose someone else:

Start typing a friend's name

People who know Greg best:



Amy Karlson 96 points You 85 points Raman Sarin 83 points  
Ed Cutrell 81 points Patrick Baudisch 81 points Desney Tan 78 points

Tag Greg to reveal each hidden item. One point for each tag, another point for each other friend who used the same tag to describe Greg!

Greg's friends have tagged him with:

..... ajax ..... band ... be .....  
..... C# .....  
cruise ..... dev ..... dogs .....  
..... hacker .....  
..... lsjumb .....  
microsoft ..... mscs msr .....  
..... poker .....  
..... smoky ..... stanford .....  
..... vibe .....  
..... Will .....  
.....

My Score: 85 points

microsoft	12 points	×
poker	11 points	×
stanford	11 points	×
vibe	9 points	×
msr	8 points	×

## Collabio

[Bernstein et al., UIST 2009]

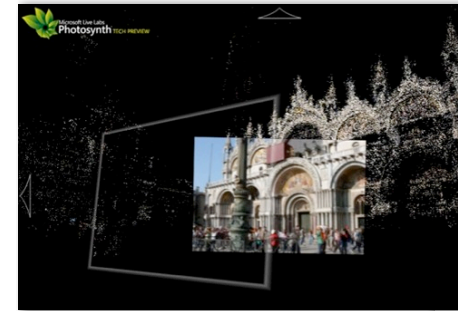
- Guess the tags that describe your friend best
- Points for common tags



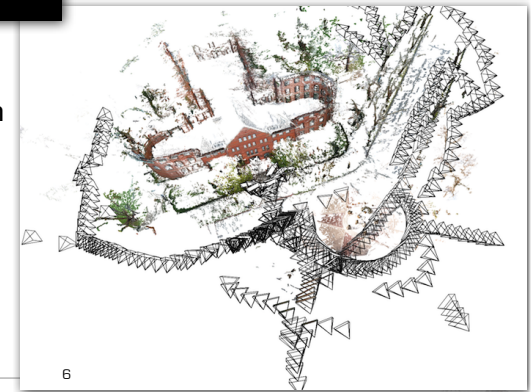
## PhotoCity

[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”

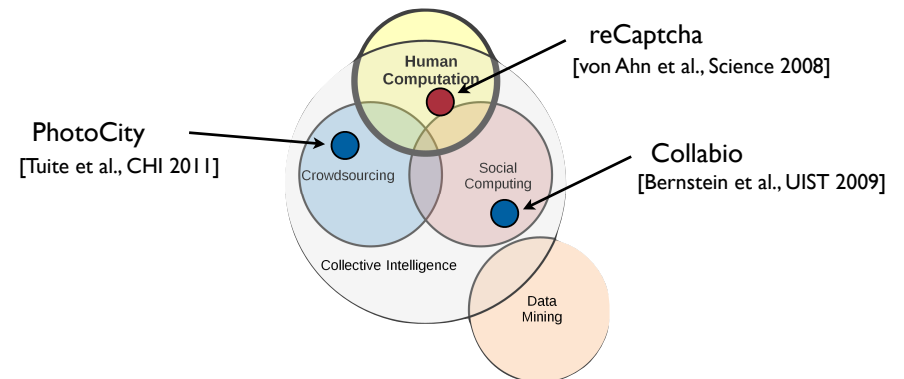


- Players get points for photos with new feature vectors
- Better photos have more new features
- Website guides the players with flags placed at problematic areas



## PhotoCity

[Tuite et al., CHI 2011]



- 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”!

The New-York State Yacht Squadron, on its annual cruise to Newport, came into the harbor yesterday afternoon. The following are the names of the boats that came to anchor here: *Jessie*, *Geraldine*, *Evelyn*, *Annie*, *Mannerling*, *Julia*, *Bonita*, *Magie*, *Wagon*, *Rambler*, *Fleur-de-Lis*, *Henrietta*, *Sea-Drift* and *Maria*, with the steamer *America* as a tender. On anchoring, each boat fired a gun, according to custom. The reports were heard distinctly in the city, causing considerable inquiry as to “what was up,” and a number of sanguine individuals came into our office to inquire if the guns were not annunciations of the successful laying of the Atlantic Cable. We invariably replied in the negative. The squadron will leave to-day for Newport. The yachts *Washington* and *Bobber*, of this city, start with it, with parties of New Haven people.

The New-York State yacht Squadron, on its annual cruise to Newport came into the harbor yesterday afternoon. The following are the names of the boats that came to anchor here: Jessie, **gera loliv ereluj** Annie, Mannering, Julia, Bonita, **Magic wut**. Rambler, **foumbile**, Henrietta, Sea-Drift and Maria, with the steamer America as a tender. On anchoring each boat fired a gun, according to custom. The reports were heard distinctly in the city, causing considerable inquiry as to “what was up,” and a number of sanguine individuals came into our office to inquire if the guns were not annunciations of the successful laying of the Atlantic Cable. We invariably replied in the negative. The squadron will leave to-day for Newport. The yachts Washington and **buub** of this city, start with it, with parties of New Haven people.



## 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



Confirm your password

Birthday  
Month: Day: Year:

Gender  
I am...

Mobile phone  
+49

Your current email address

Prove you're not a robot

Type the two pieces of text:

Location  
Germany (Deutschland)

☐ I agree to the Google [Terms of Service](#) and have read the [Privacy Policy](#).

☒ Google may use my account information to personalize +1's on content and ads on non-Google websites. [About personalization](#).

Next step

# reCaptcha

[von Ahn et al., Science 2008]

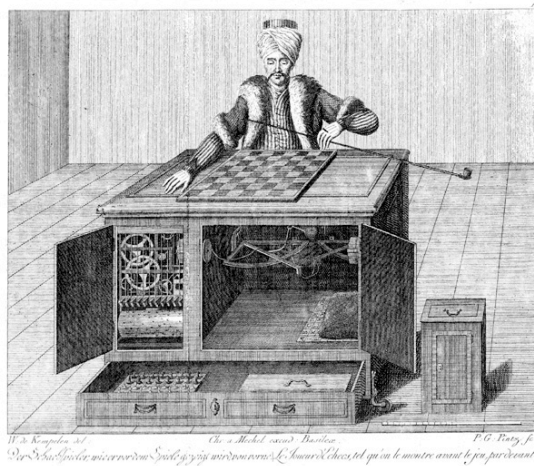


## In-class Exercise: Mechanical Turk

- 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?

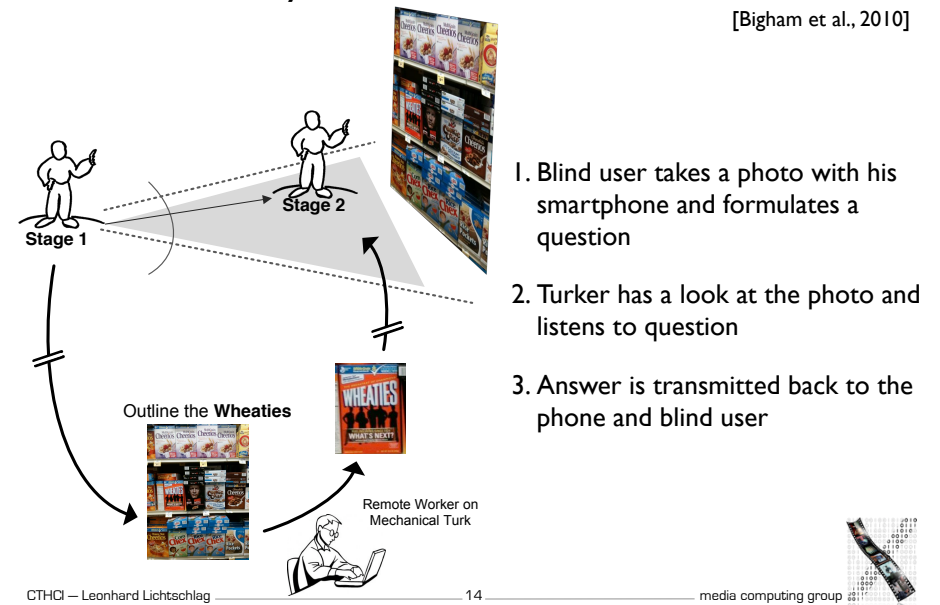


# The original Mechanical Turk



## VizWiz: Nearly Real-time Answers to Visual Questions

[Bigham et al., 2010]



## VizWiz: Nearly Real-time Answers to Visual Questions

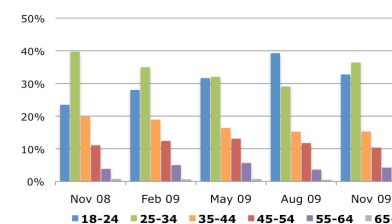
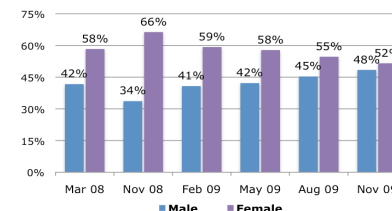
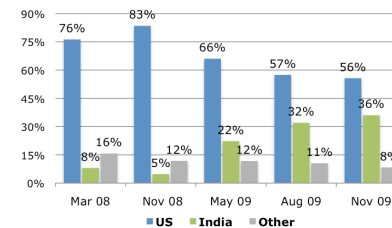
[Bigham et al., 2010]

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





```
// 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 silhouetted 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 peeking 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

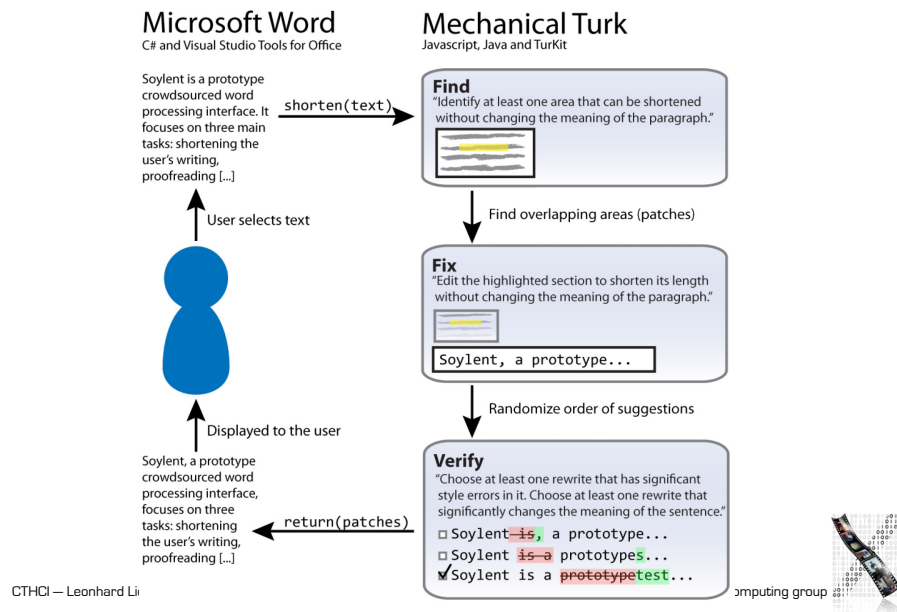
- **Verify the work:** Verification is often easier than the task
- **Output agreement:** Have multiple workers agree on answer
- **Reputation:** Mechanical Turk records approval rate
- **Economic models:** Pay more for honest workers
- **Defensive task design:** Is it easier to cheat than to be honest?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



- Word processor with cloud inside
- Plug-in to MS Word with different modules
  - **Crowdproof:** spelling and grammar checking by asking Mechanical 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



# Shorten 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
- 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]



Wave

## 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