# Making Better Use of the Crowd

Jenn Wortman Vaughan

Microsoft Research

Are there better ways to make use of the crowd?

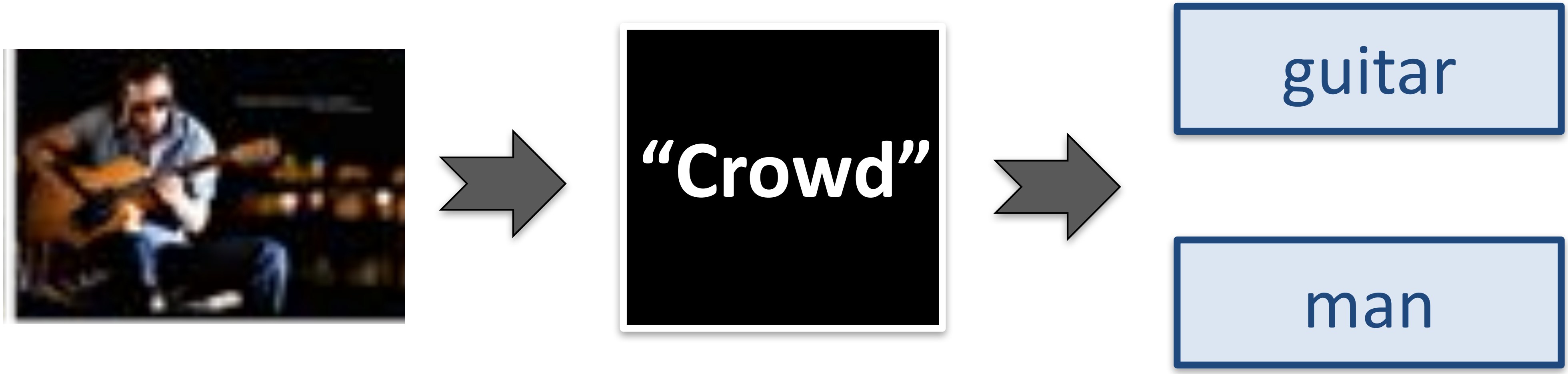
What other problems can the crowd solve?

# Part 1: The Potential of Crowdsourcing

1. Direct Applications to Machine Learning

2. Hybrid Intelligence Systems

3. Large Scale Studies of Human Behavior



“Crowd”

guitar

man

# Part 2: The Crowd is Made of People

- What motivates workers?
- Are workers independent?
- Are workers honest?

What does this teach us about how to effectively interact with crowd?

*Hint: Be respectful. Be responsive. Be clear.*

Extensive notes, slides, and eventually video at

http://www.jennwv.com/projects/crowdtutorial.html

# Part 1:
The Potential of Crowdsourcing

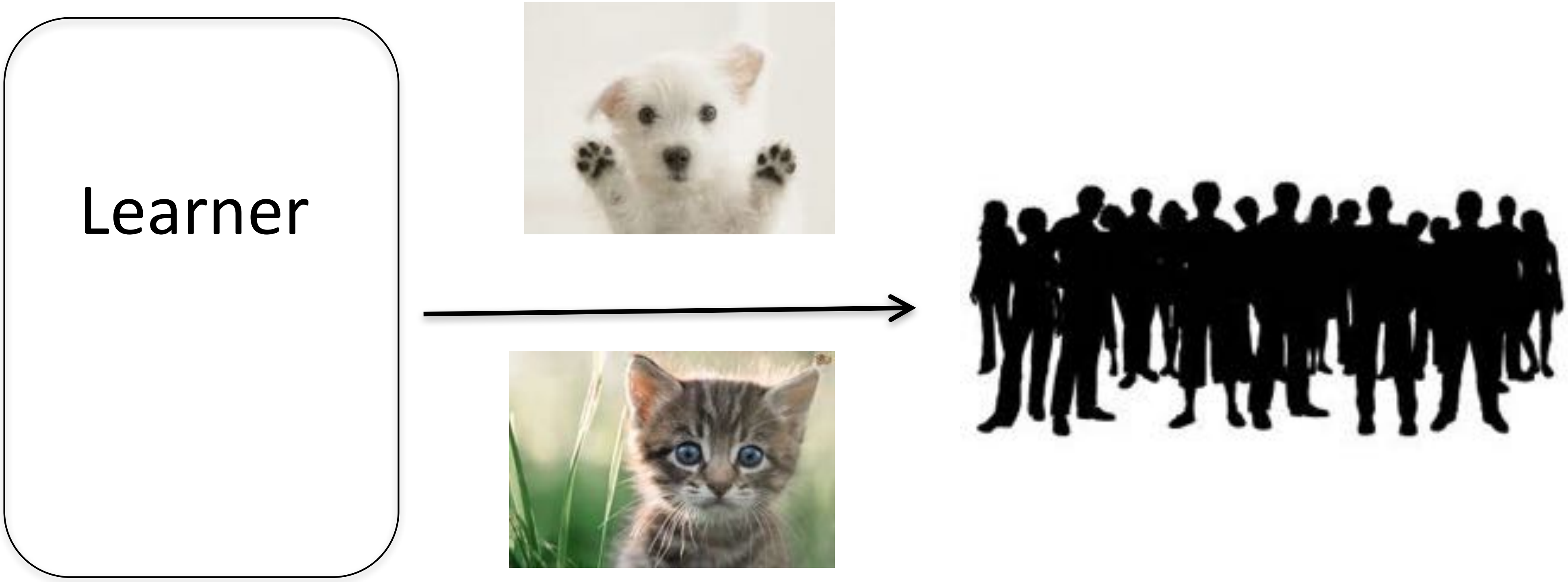
# The Potential of Crowdsourcing

1. Direct Applications to Machine Learning

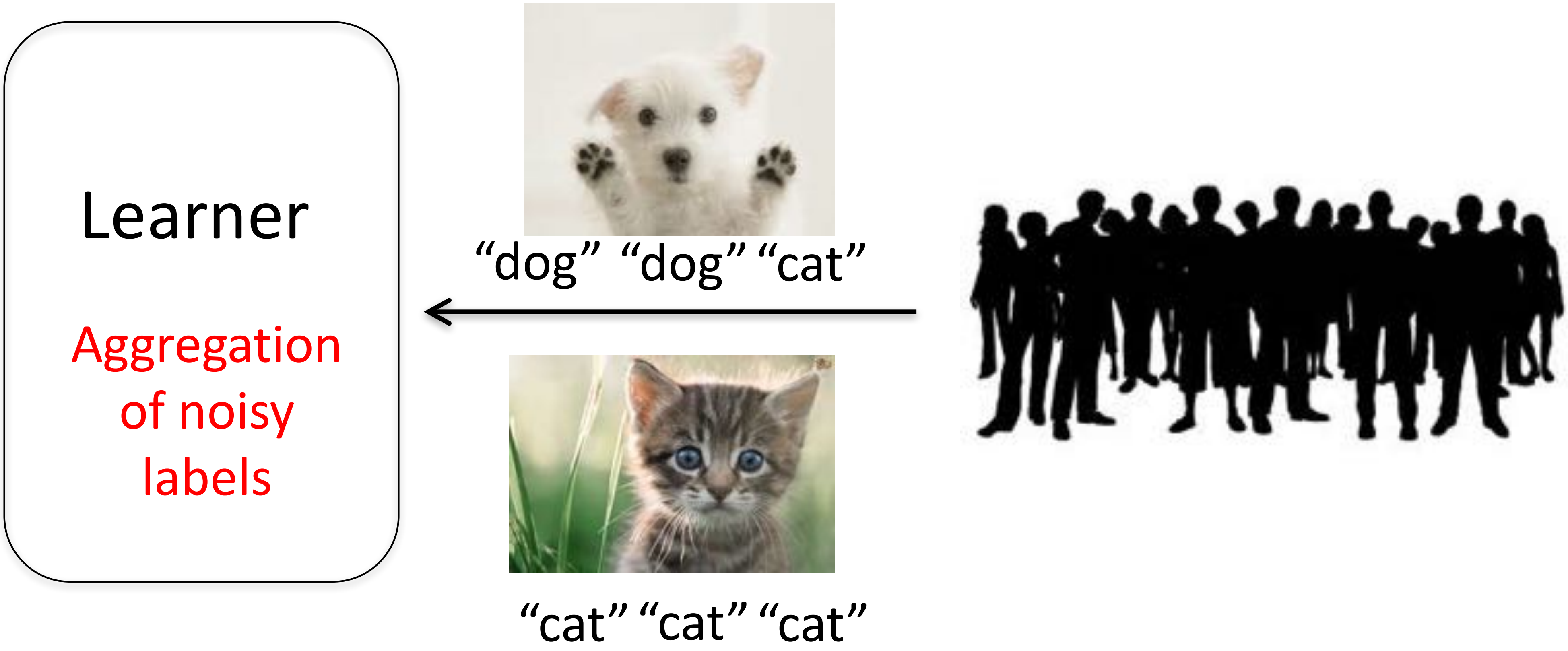
2. Hybrid Intelligence Systems

3. Large Scale Studies of Human Behavior

# Generating Labeled Data



Learner

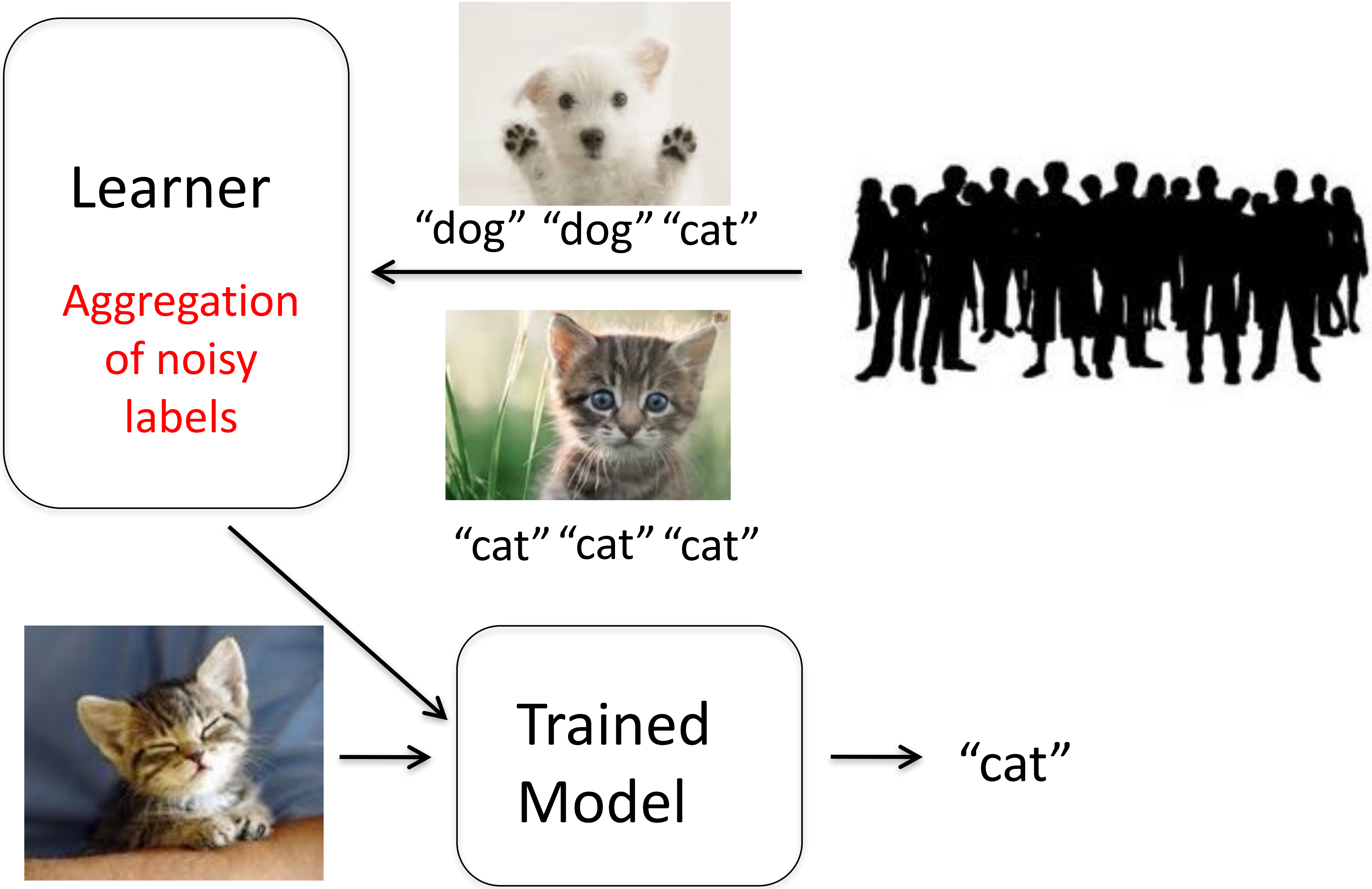


Learner

Aggregation of noisy labels

“dog” “dog” “cat”

“cat” “cat” “cat”



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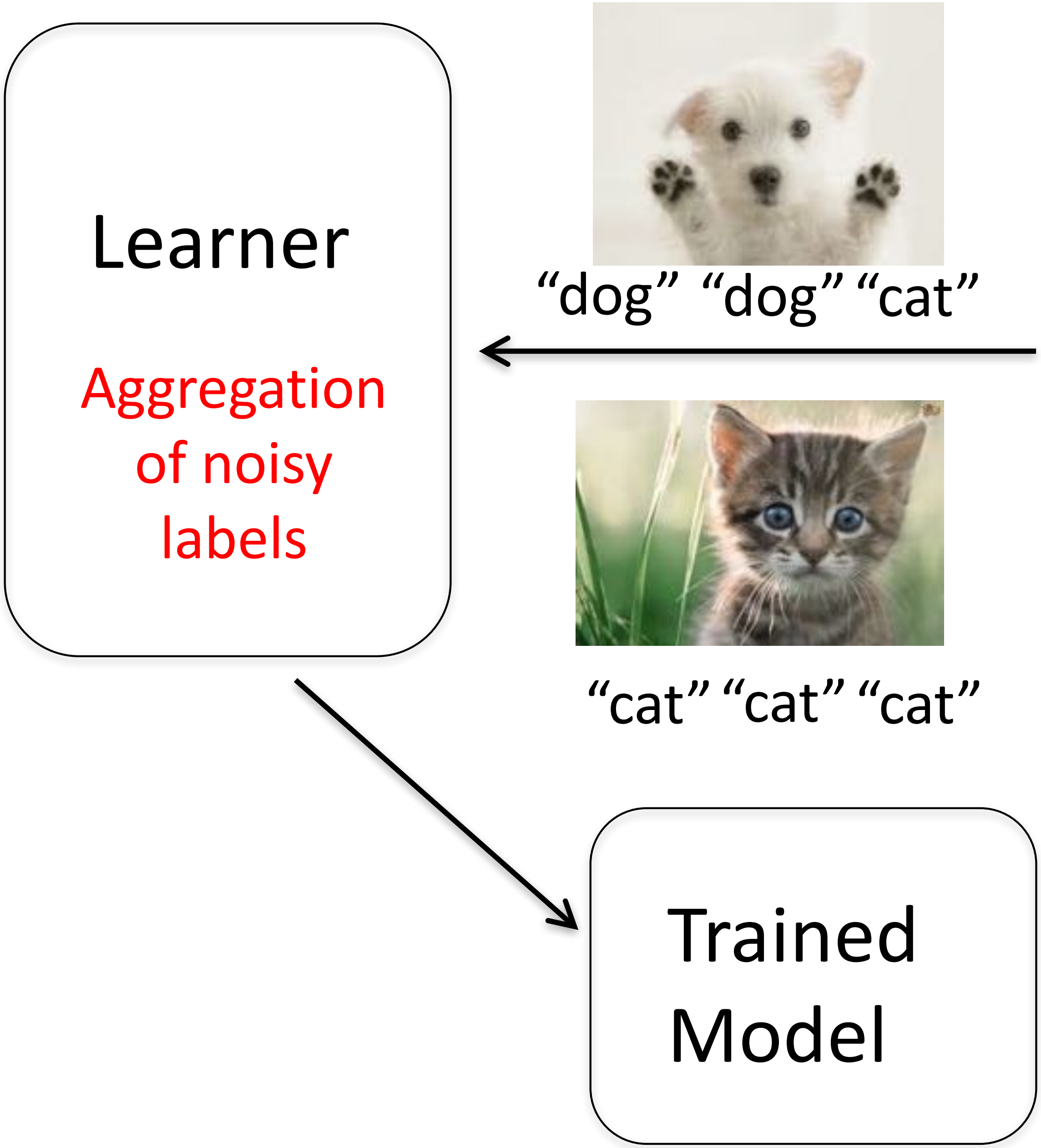
Trained Model

“cat”



Learner

Aggregation of noisy labels

"dog" "dog" "cat"

"cat" "cat" "cat"

Trained Model

Used to annotate medical images, label text, extract and label features of scenes.

Inspired huge amounts of algorithmic work on aggregation.

# Aggregating Labels with EM

- **Input:** Worker-generated labels for each instance
- Calculate an initial estimate of each instance's label based on a simple majority vote
- Repeat until convergence:
  - Treating the current label estimates as truth, estimate each worker's quality
  - Treating the quality estimates as truth, calculate the most likely label for each instance
- **Output:** One aggregated label for each instance

[Dawid and Skene, 1979]

# Aggregating Labels with EM

- No guarantees on optimality, but tends to work pretty well in practice

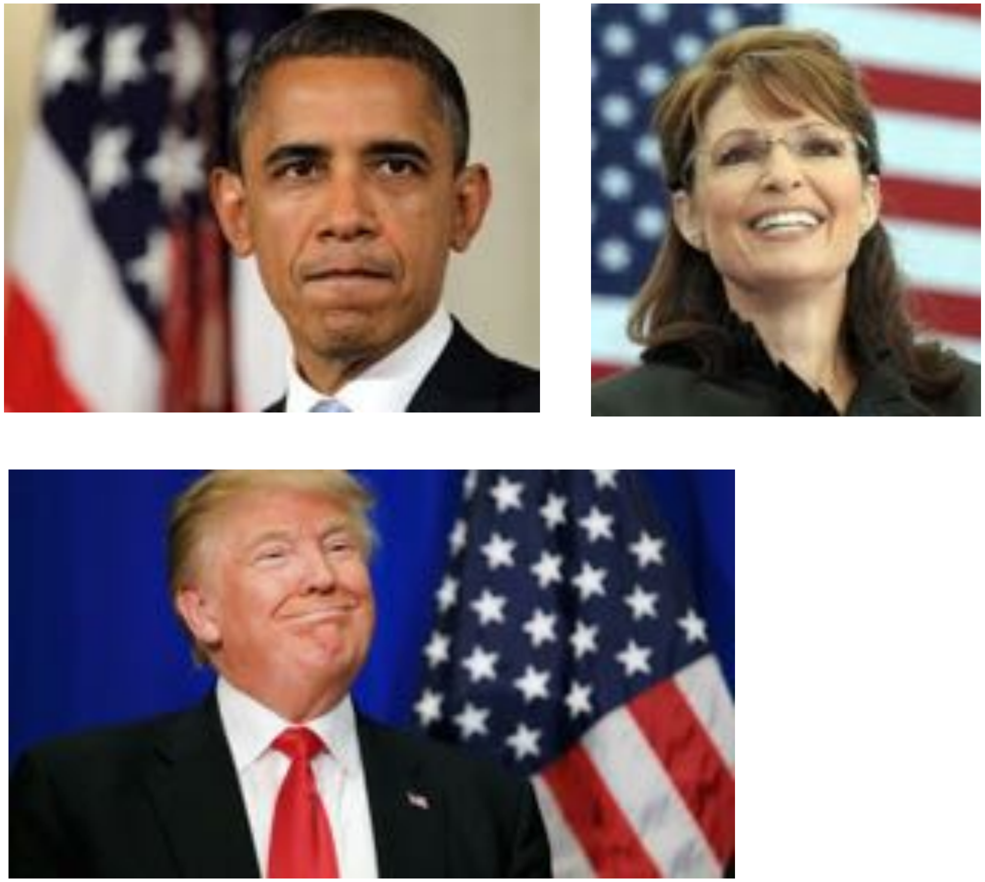
- Many recent variants have been proposed to incorporate the varying difficulty levels of instances, worker expertise, the existence of “gold” tasks, etc.

[Dawid and Skene, 1979]

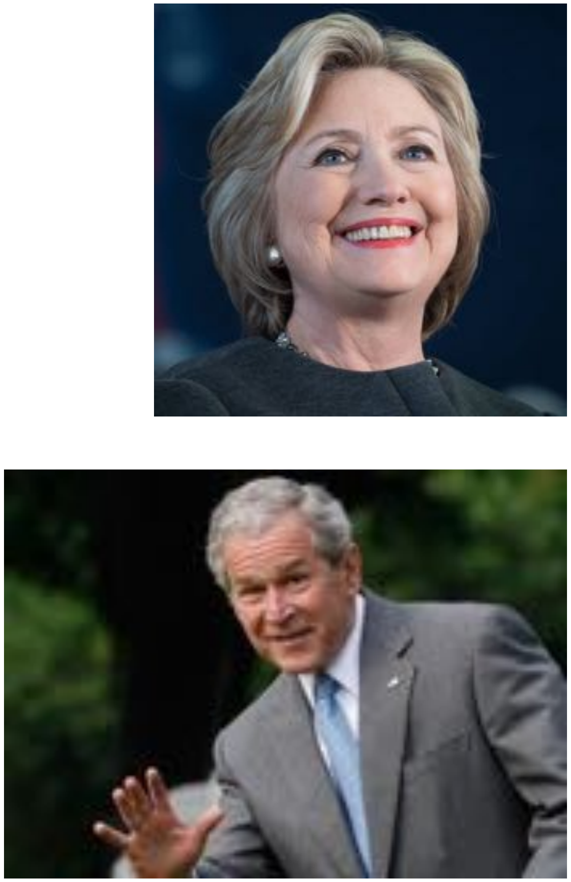
# Generating Similarity Measures

[Gomes et al., 2011]

# Generating Similarity Measures



flags



no flags

[Gomes et al., 2011]

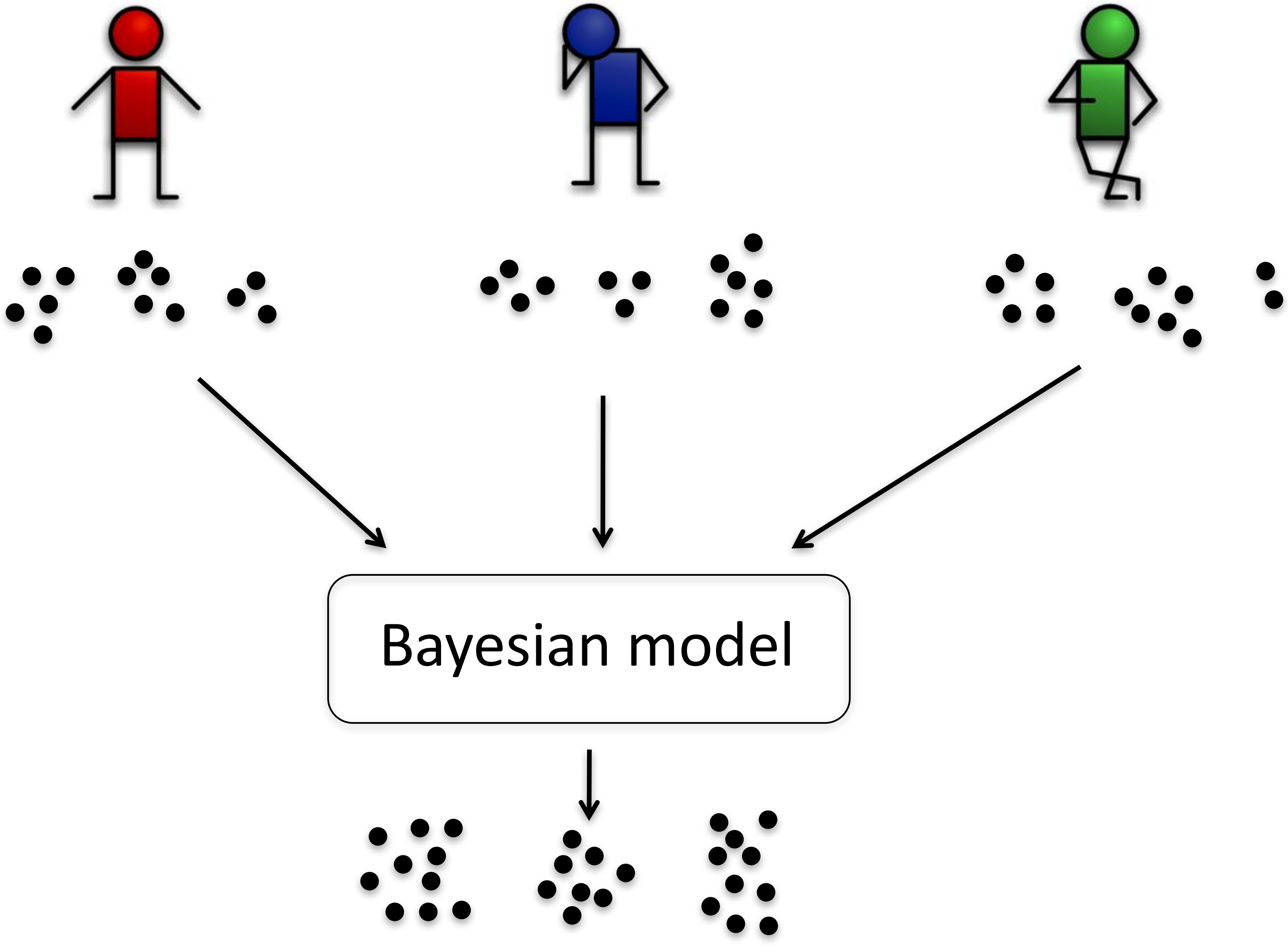
# Generating Similarity Measures

Democrats

Republicans

[Gomes et al., 2011]

# Crowd Clustering



Bayesian model

[Gomes et al., 2011]

# Crowdsourcing for Evaluation

# Evaluating Topic Models

*cheese*
*kale*
*bread*
*steak*
*mushroom*
*pizza*
…

*election*
*senate*
*bill*
*delegate*
*president*
*proposal*
…

To be useful for data exploration or summarization, topics must be human-interpretable!

[Chang et al., 2009]

# Evaluating Topic Models

Word intrusion task:

*mushroom, kale, cheese, bread, [✓ election], steak*

worker accuracy ⟷ human-interpretability

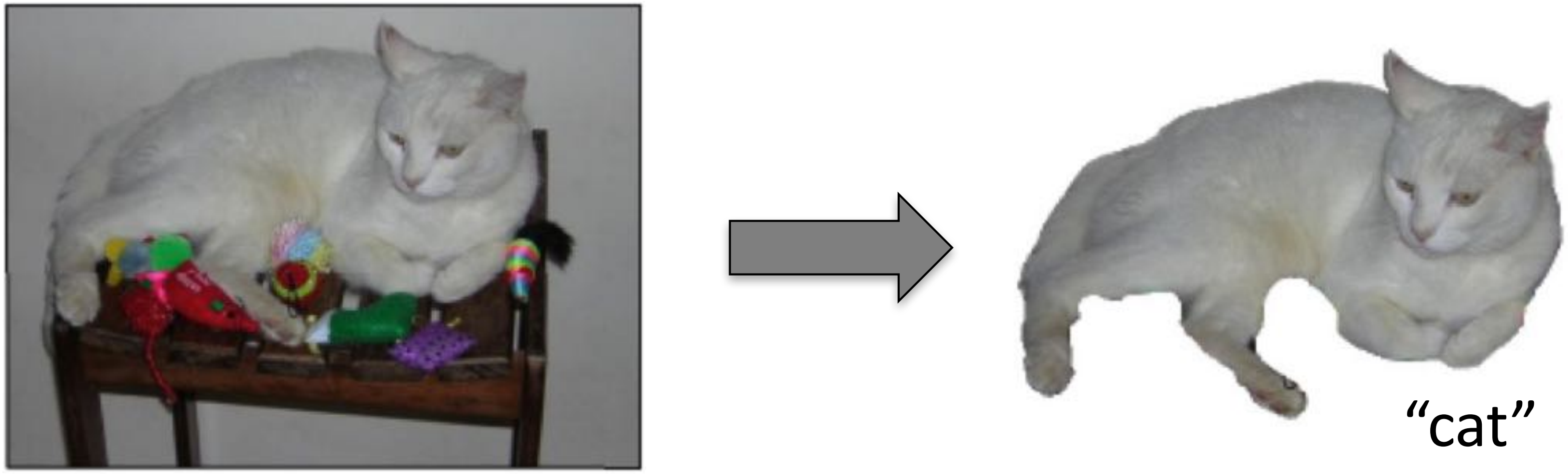
Previous measures of success (e.g., log likelihood of held-out data) do not imply interpretability!

[Chang et al., 2009]

# Human Debugging

# Human Debugging

- Semantic segmentation: partition an image into semantically meaningful parts, label each part



[Parikh & Zitnick, 2011; Mottaghi et al., 2013]

# Human Debugging

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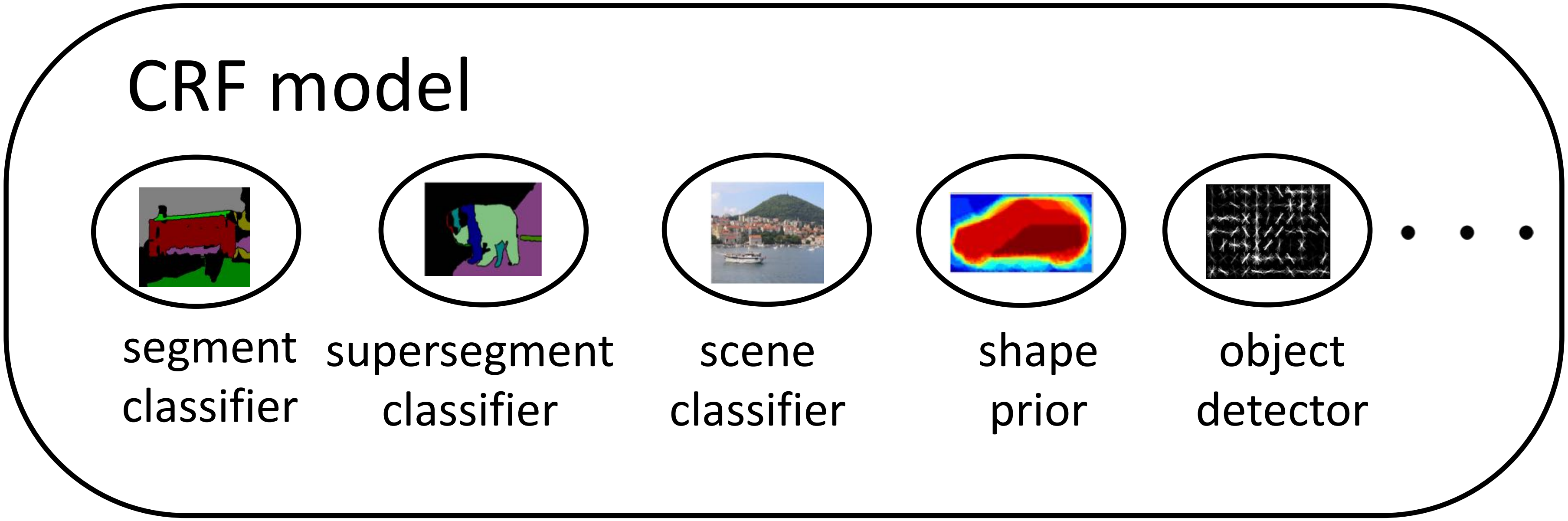


CRF model

segment classifier

supersegment classifier

scene classifier

shape prior

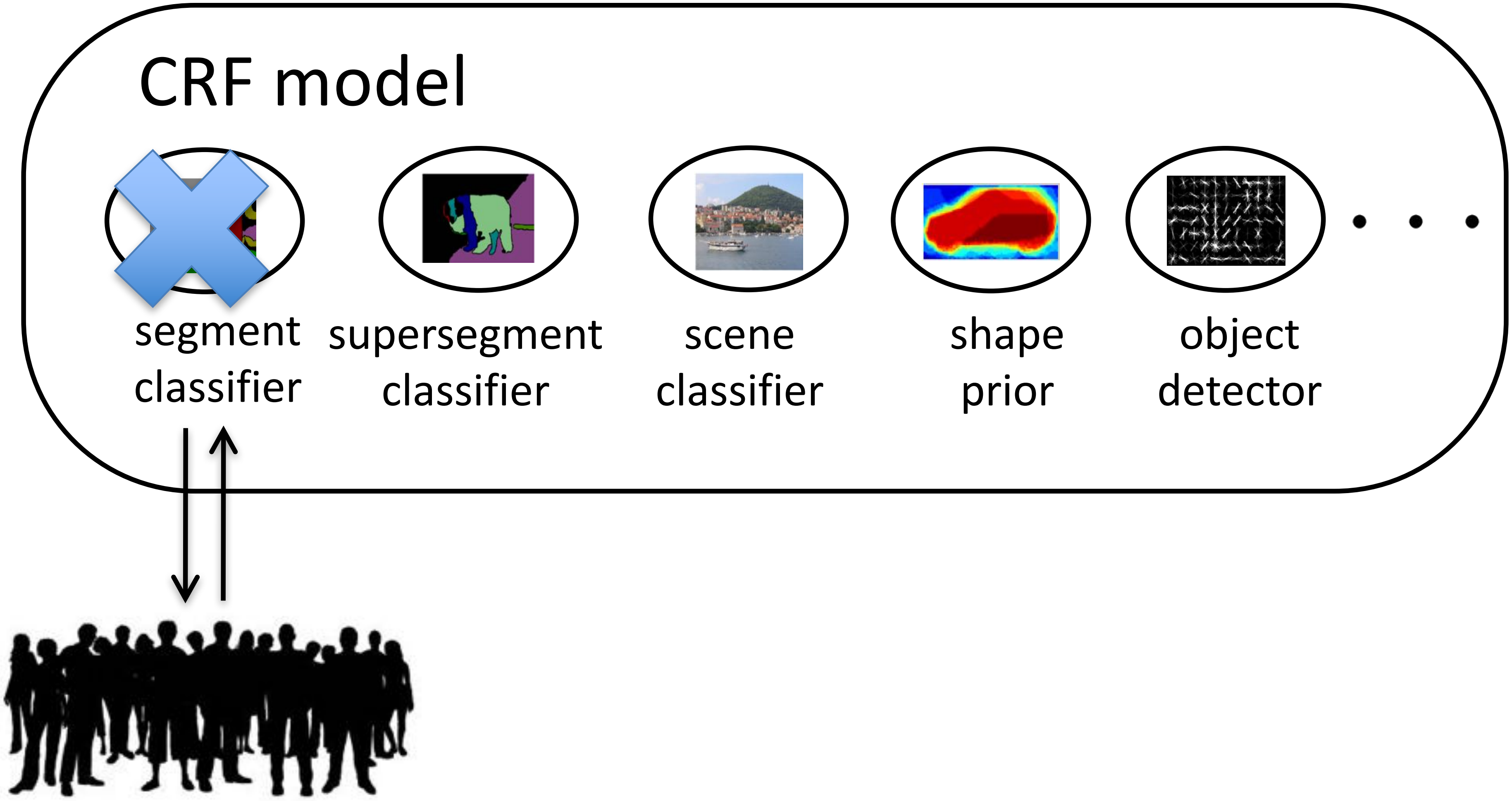
object detector

. . .

Which component is the weakest link?

[Parikh & Zitnick, 2011; Mottaghi et al., 2013]

# Human Debugging



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[Parikh & Zitnick, 2011; Mottaghi et al., 2013]

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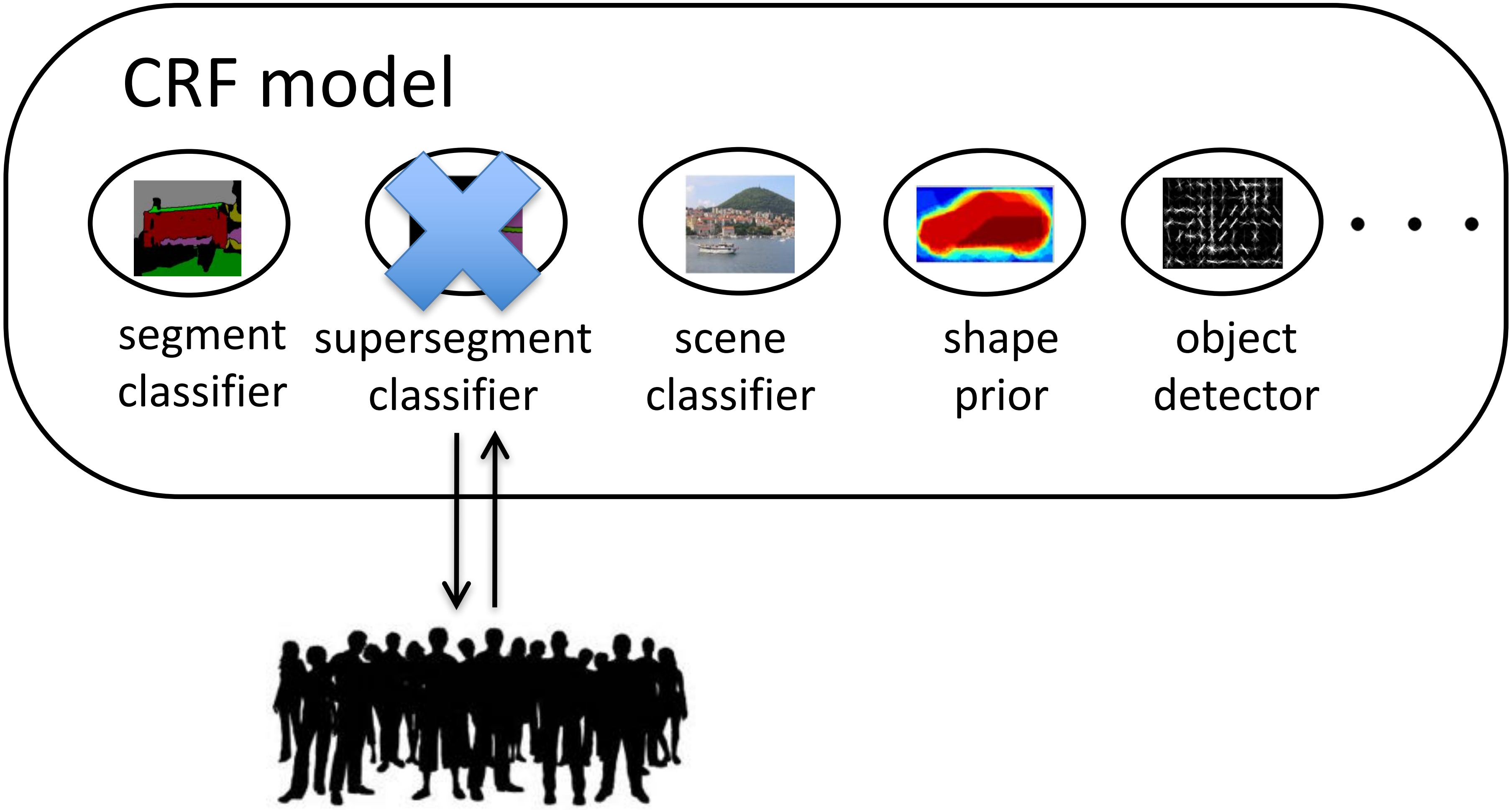

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[Parikh & Zitnick, 2011; Mottaghi et al., 2013]

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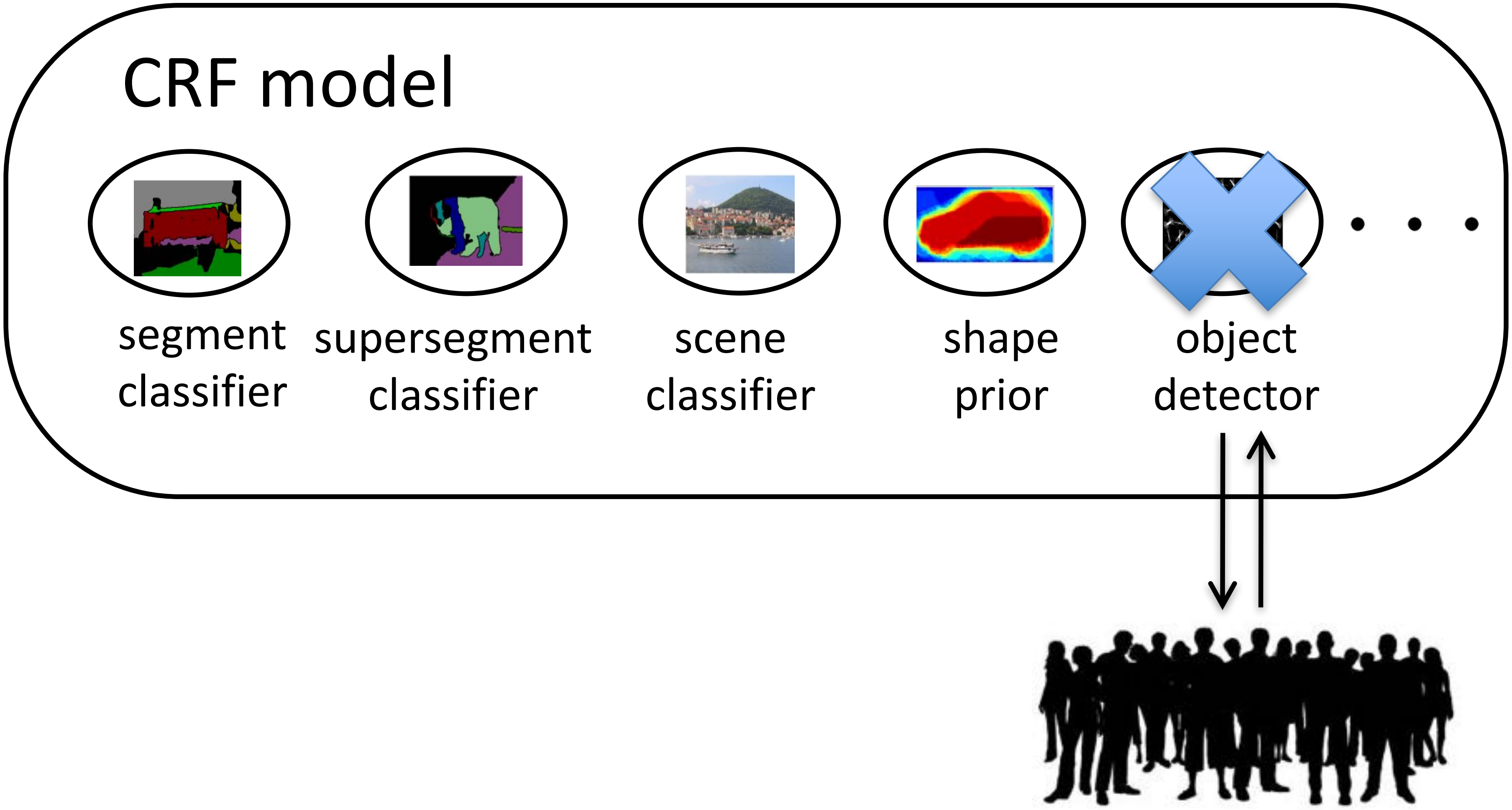

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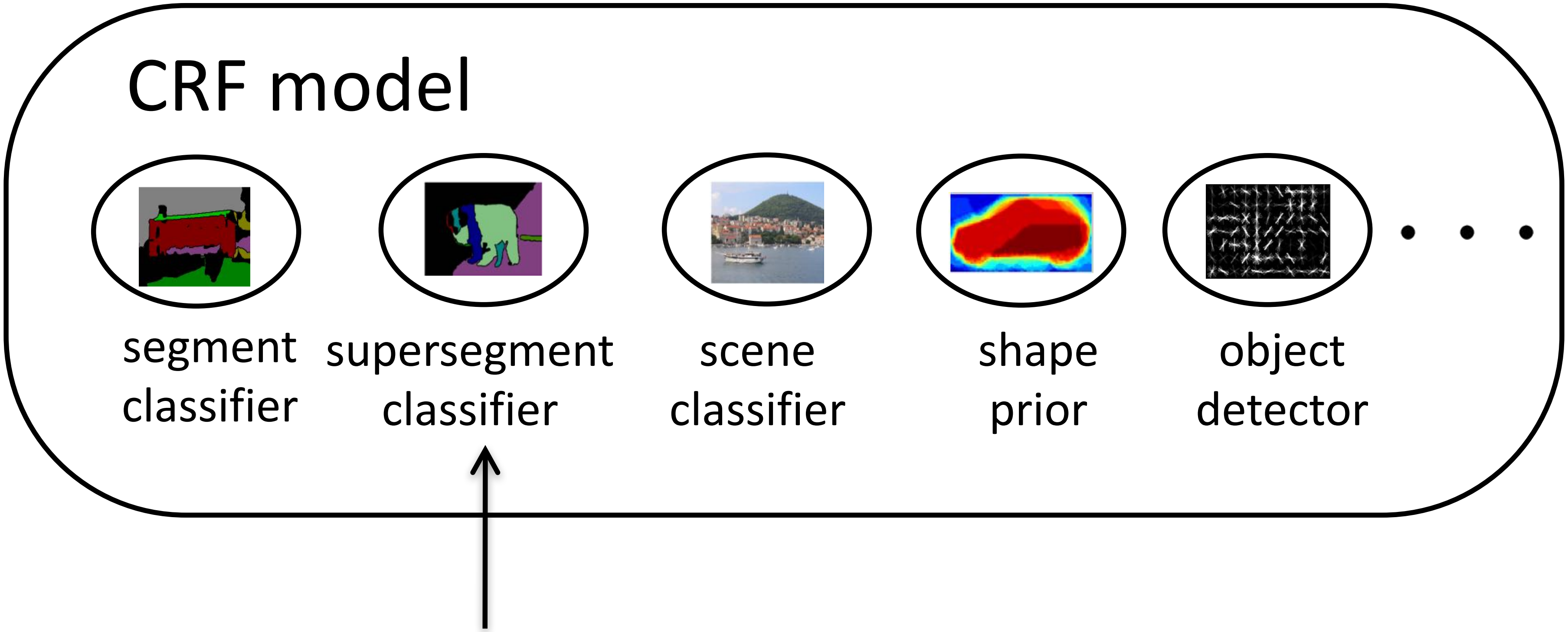

CRF model

segment classifier

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. . .

Humans less accurate at task, but system performance still improved

[Parikh & Zitnick, 2011; Mottaghi et al., 2013]

# The Potential of Crowdsourcing

1. Direct Applications to Machine Learning

2. Hybrid Intelligence Systems

3. Large Scale Studies of Human Behavior

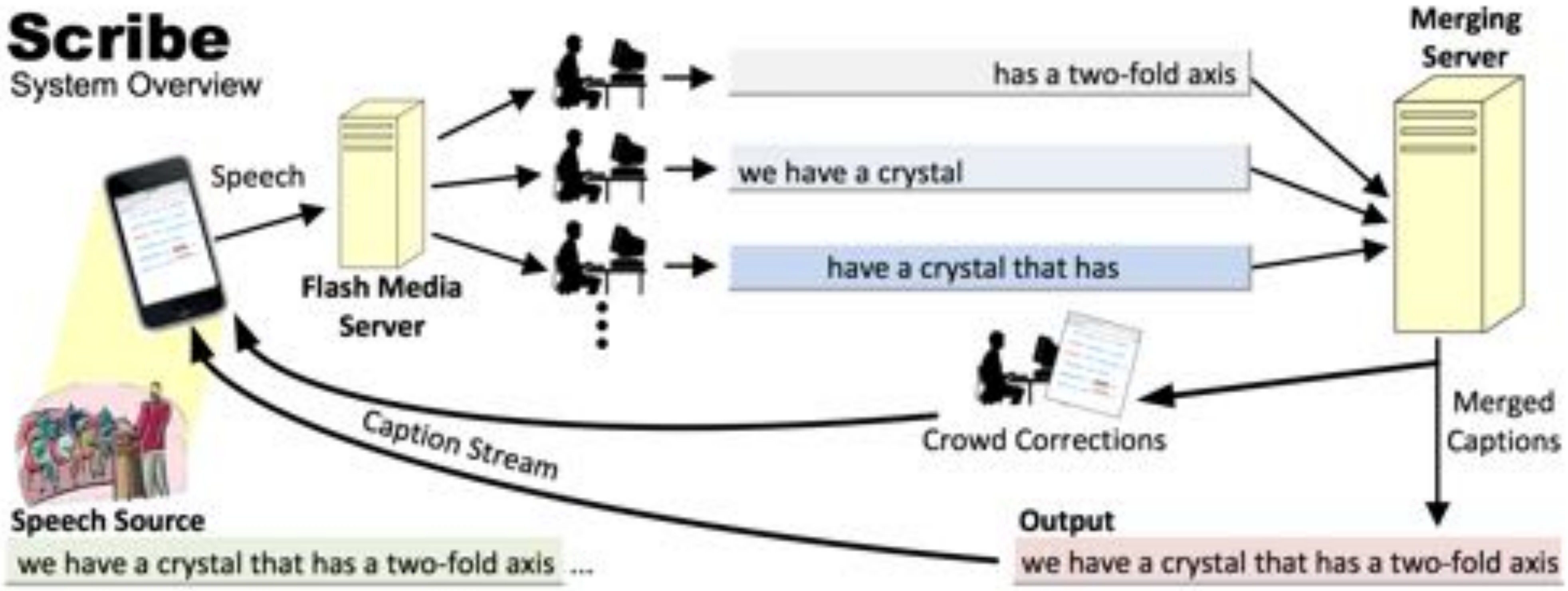
# Hybrid Intelligence for Speech Recognition

# Crowd-Based Closed Captioning

Is it possible to provide real-time closed captioning of lectures, meetings, or other day-to-day conversations?

[Lasecki et al., 2012]

# Crowd-Based Closed Captioning

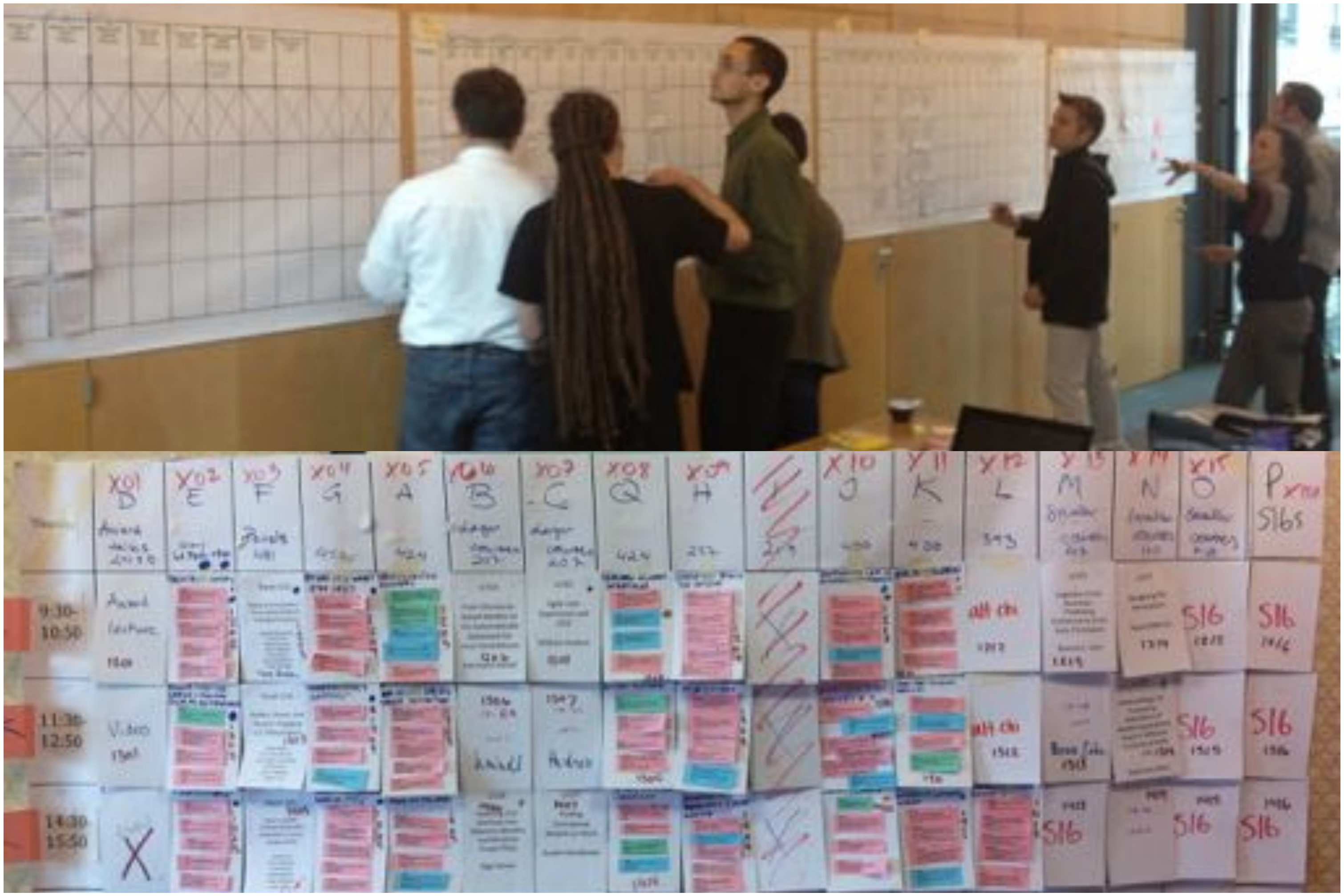


The system merges real-time partial inputs from dynamic, untrained crowds to outperform individuals

[Lasecki et al., 2012]

# Hybrid Intelligence for Scheduling

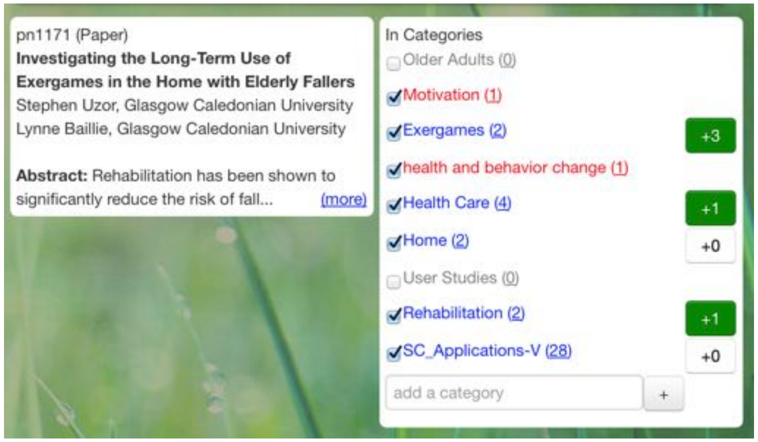
# Cobi: Communitysourced Scheduling



A big constrained optimization problem with no access to the constraints!

[projectcobi.com]

## 1. Committeesourcing



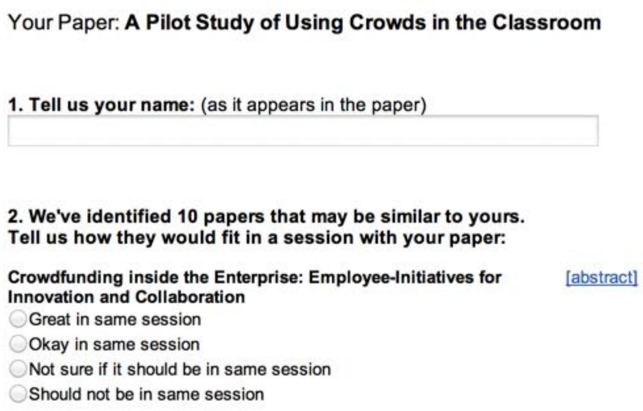
pn1171 (Paper)
**Investigating the Long-Term Use of Exergames in the Home with Elderly Fallers**
Stephen Uzor, Glasgow Caledonian University
Lynne Baillie, Glasgow Caledonian University

**Abstract:** Rehabilitation has been shown to significantly reduce the risk of fall... (more)

In Categories
- □ Older Adults (0)
- ☑ Motivation (1)
- ☑ Exergames (2) +3
- ☑ health and behavior change (1)
- ☑ Health Care (4) +1
- ☑ Home (2) +0
- □ User Studies (0)
- ☑ Rehabilitation (2) +1
- ☑ SC_Applications-V (28) +0

add a category +

## 2. Authorsourcing



Your Paper: **A Pilot Study of Using Crowds in the Classroom**

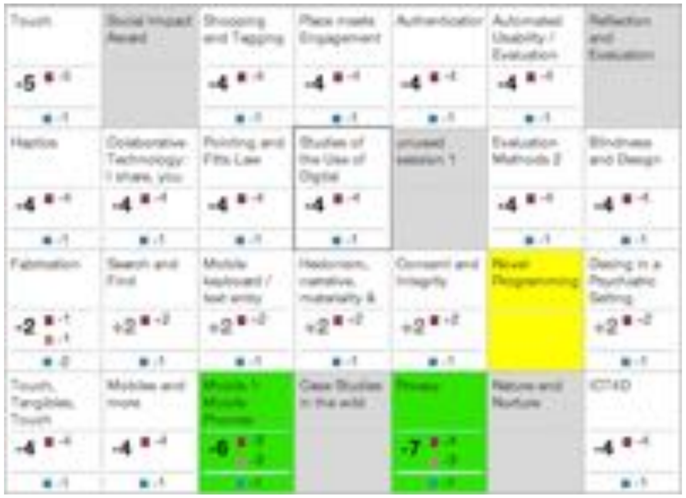
**1. Tell us your name:** (as it appears in the paper)

**2. We've identified 10 papers that may be similar to yours. Tell us how they would fit in a session with your paper:**

**Crowdfunding inside the Enterprise: Employee-Initiatives for Innovation and Collaboration** [abstract]

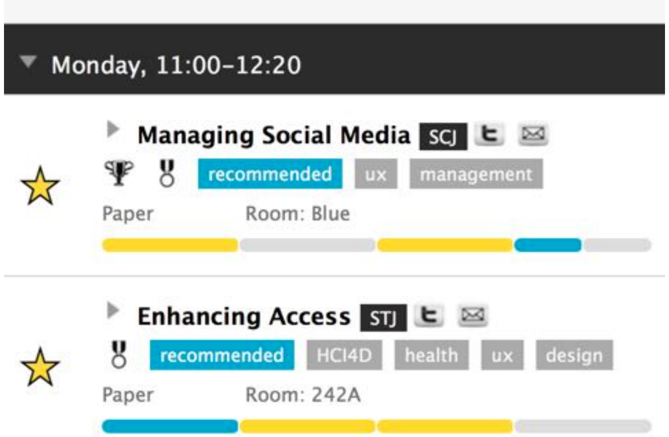
○ Great in same session
○ Okay in same session
○ Not sure if it should be in same session
○ Should not be in same session

## 3. Scheduling



| | | | | | | |
|---|---|---|---|---|---|---|
| Touch<br>-5 | Social Impact Award | Shopping and Tapping<br>-4 | Place meets Engagement<br>-4 | Authentication<br>-4 | Automated Usability / Evaluation<br>-4 | Reflection and Evaluation |
| Haptics<br>-4 | Collaborative Technology: I share, you<br>-4 | Pointing and Fitts Law<br>-4 | Studies of the Use of Digital<br>-4 | unused session 1 | Evaluation Methods 2<br>-4 | Blindness and Design<br>-4 |
| Fabrication<br>-2 | Search and Find<br>+2 | Mobile keyboard / text entry<br>+2 | Hedonism, narrative, materiality &<br>+2 | Consent and Integrity<br>+2 | Novel Programming | Dating in a Psychiatric Setting<br>+2 |
| Touch, Tangibles, Touch<br>-4 | Mobiles and more<br>-4 | Mobile 1: Mobile Phones<br>-6 | Case Studies in the wild | Privacy<br>-7 | Nature and Nurture | ICT4D<br>-4 |

## 4. Attendeesourcing



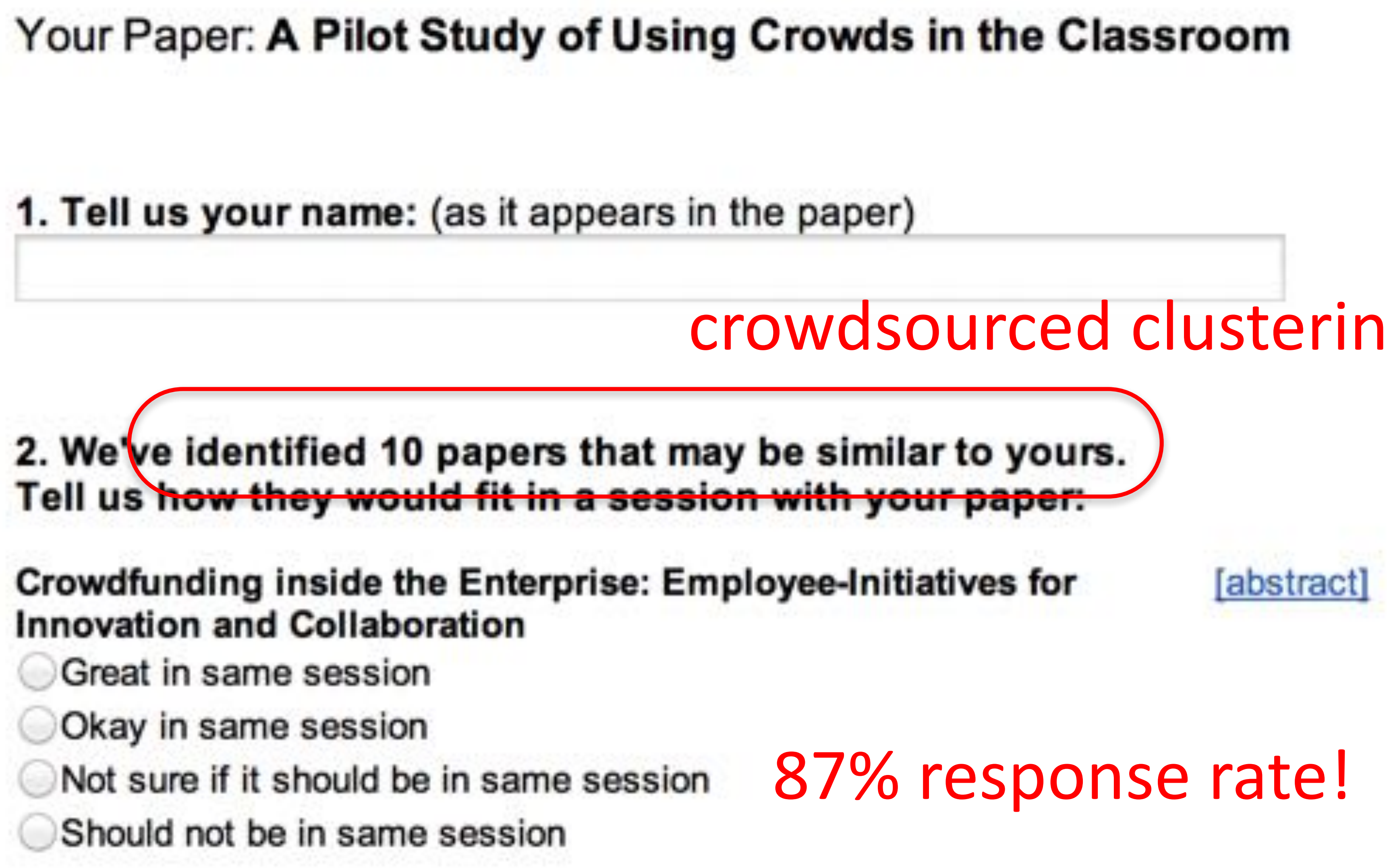
▼ Monday, 11:00–12:20

☆ ▶ **Managing Social Media** SCJ
recommended · ux · management
Paper  Room: Blue

☆ ▶ **Enhancing Access** STJ
recommended · HCI4D · health · ux · design
Paper  Room: 242A

[projectcobi.com]

# Authorsourcing



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crowdsourced clustering!

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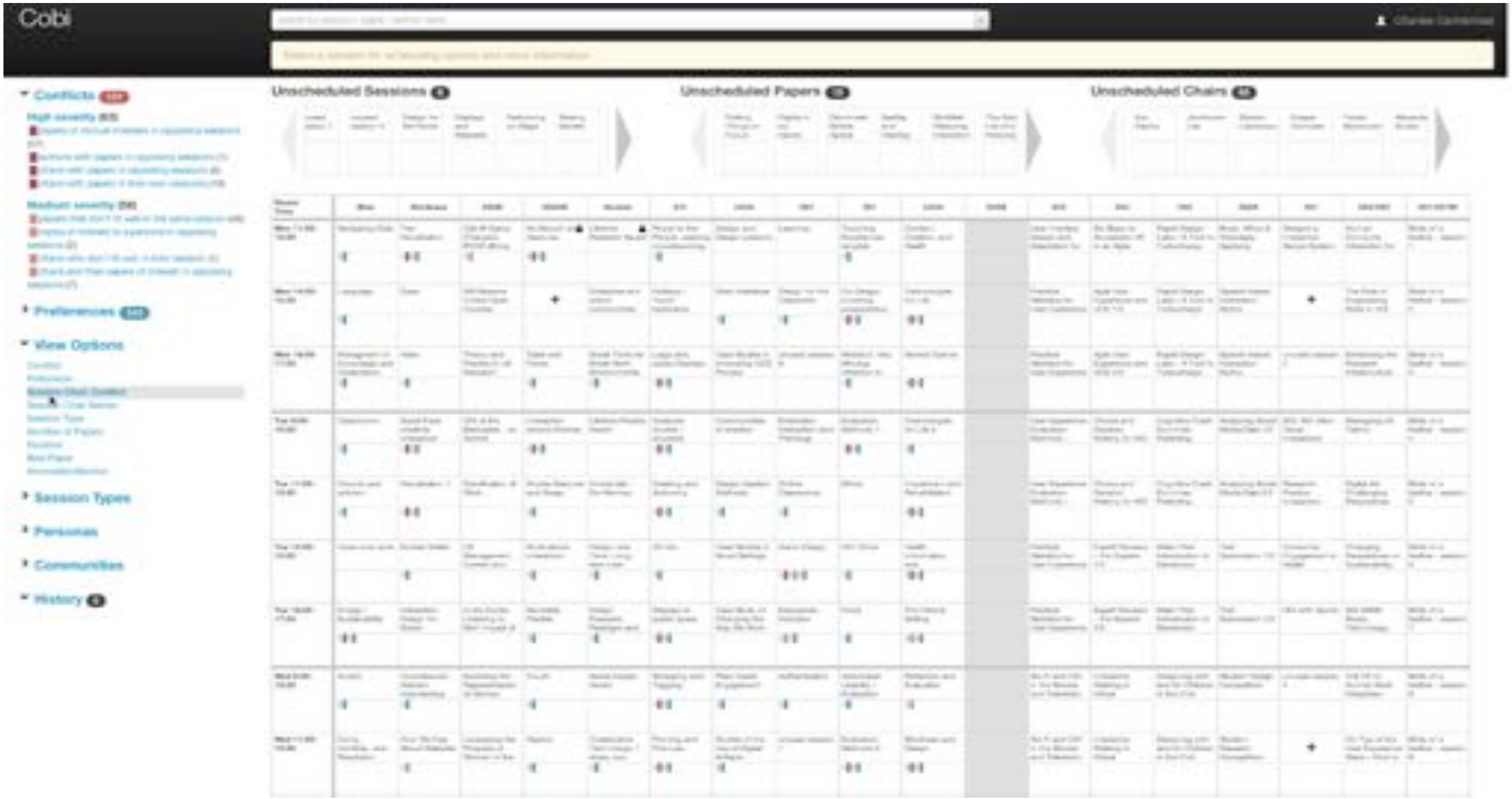
87% response rate!

[projectcobi.com]

# Scheduling



The system solves an optimization problem to propose a schedule, but chairs retain control.

[projectcobi.com]

# Hybrid Intelligence for Writing

# The Selfsourcing Process

1. Collect content
2. Organize content
3. Turn content into writing

[Teevan et al., 2016]

# Collect Content

The MicroWriter breaks writing into microtasks.

Microtasks can be shared with collaborators.

Microtasks can be done while mobile.

Collaborative writing typically requires coordination.

Collaborators can be known or crowd workers.

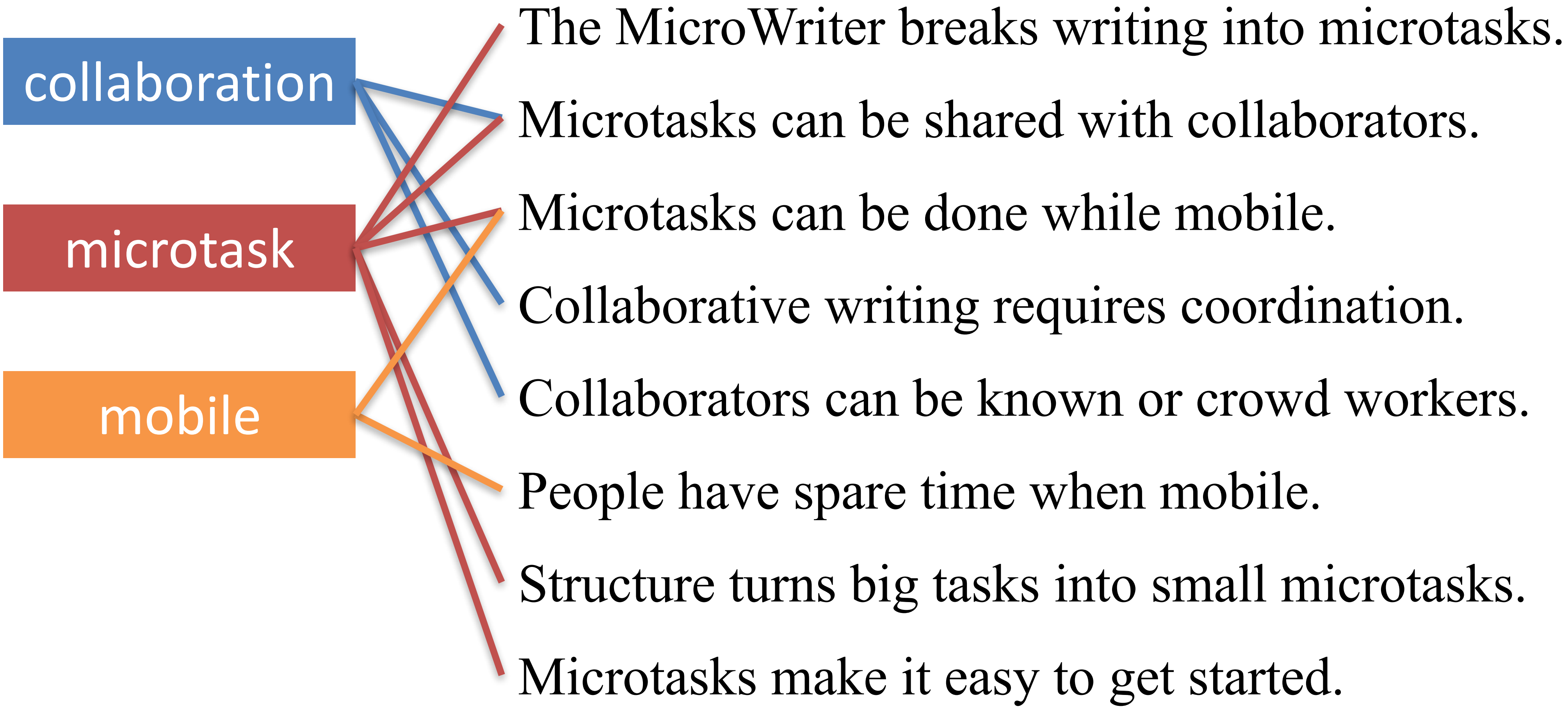
People have spare time when mobile.

Structure turns big tasks into small microtasks.

Microtasks make it easy to get started.

[Teevan et al., 2016]

# Organize Content



collaboration

microtask

mobile

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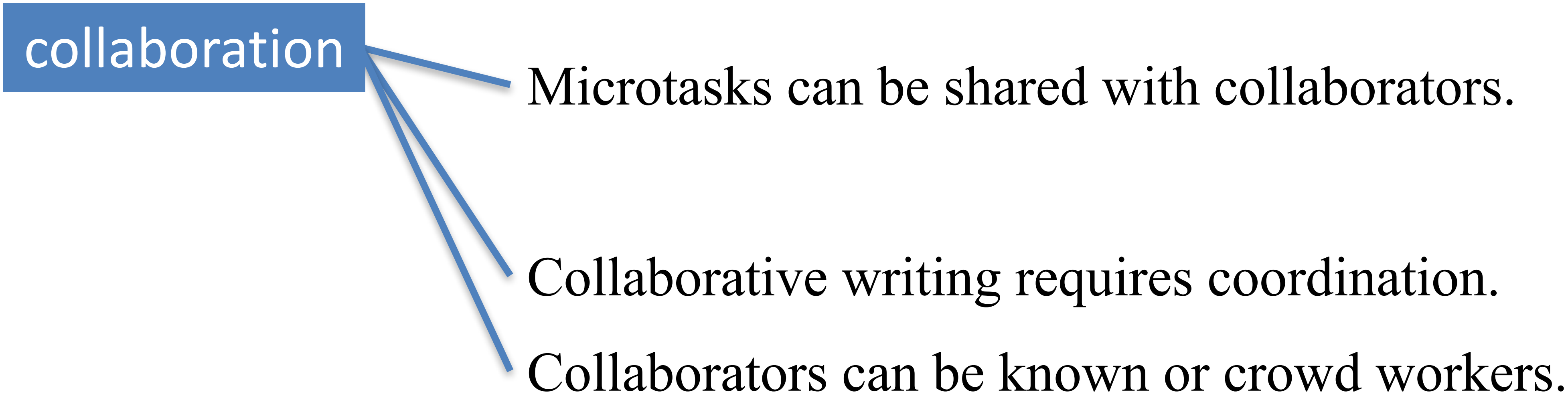
# Turn Content into Writing



collaboration

Microtasks can be shared with collaborators.

Collaborative writing requires coordination.

Collaborators can be known or crowd workers.

*Collaborative writing typically requires coordination, but microtasks are easy to share with collaborators without the need for coordination. The collaborators can be known colleagues or paid crowd workers.*

[Teevan et al., 2016]

# Turn Content into Writing

*Structure makes it possible to turn big tasks into a series of smaller microtasks. For example, the MicroWriter breaks writing into microtasks. These microtasks make the larger task easier to start.*

*Collaborative writing typically requires coordination, but microtasks are easy to share with collaborators without the need for coordination. The collaborators can be known colleagues or paid crowd workers.*

*People have spare time when mobile, and these micromoments are ideal for doing microtasks.*

[Teevan et al., 2016]

# The ~~Selfsourcing~~ Crowdsourcing Process

1. Collect content
2. Organize content
3. Turn content into writing

- Steps 2 & 3 could be down by crowdworkers, traditional ML/AI approaches, or a combination
- Author takes final pass, no need for perfection

[Teevan et al., 2016]

# Hybrid Intelligence in Industry

# The Potential of Crowdsourcing

1. Direct Applications to Machine Learning

2. Hybrid Intelligence Systems

3. Large Scale Studies of Human Behavior

# User Studies for Security Research

# How well do Internet users understand security risks?

p@ssw0rd vs. pAsswOrd

*Who tries to guess passwords?*

Only 14% mentioned both strangers *and* familiar people as threats

[Ur et al., 2016]

# User Studies to Improve the Communication of Numbers

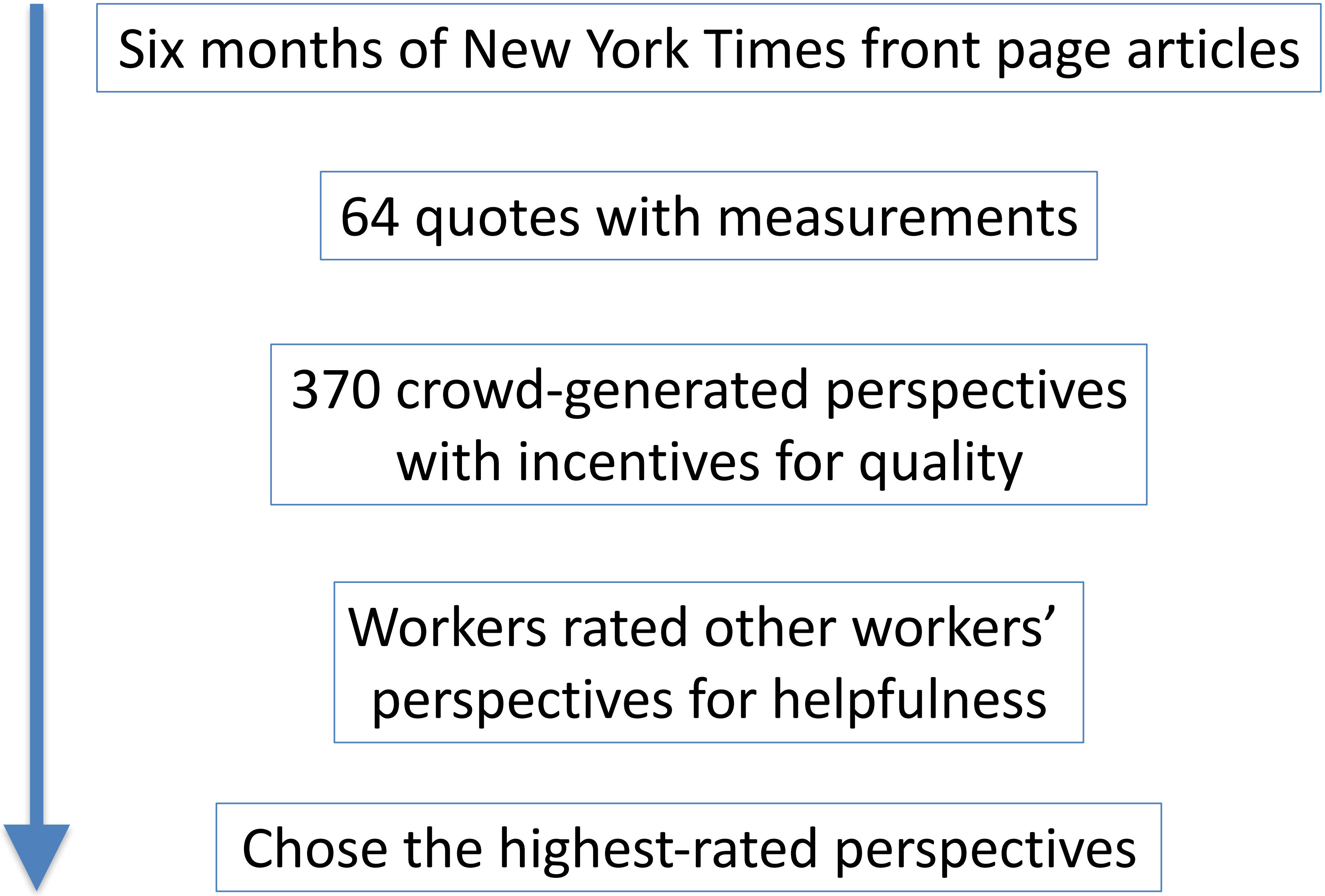
# Perspectives

- Is a one hundred billion dollar cut to the US federal budget big or small?

- One hundred billion dollars is about...
  - 3% of the 2015 US federal budget
  - 1/6 of annual US spending on military
  - 30% of the net worth of Beyoncé
  - $5 for every person in New York state

[Barrio et al., 2016]

# Step 1: Perspective Generation



Six months of New York Times front page articles

64 quotes with measurements

370 crowd-generated perspectives with incentives for quality

Workers rated other workers' perspectives for helpfulness

Chose the highest-rated perspectives

[Barrio et al., 2016]

# Perspective Examples

- The Ohio National Guard brought 33,000 gallons of drinking water to the region.

- To put this into perspective, 33,000 gallons of water is about equal to the amount of water it takes to fill 2 average swimming pools.

[Barrio et al., 2016]

# Perspective Examples

- They also recommended safety programs for the nation’s gun owners; Americans own almost 300 million firearms.

- To put this into perspective, 300 million firearms is about 1 firearm for every person in the United States.

[Barrio et al., 2016]

# Step 2: Perspective Experiments

- Randomized experiments run on 3200+ subjects on AMT to test three proxies of comprehension
  - Recall
  - Estimation
  - Error detection

- Support found for the benefits of perspectives across all experiments
  - Example: 55% remembered number of firearms in US with perspective, only 40% without

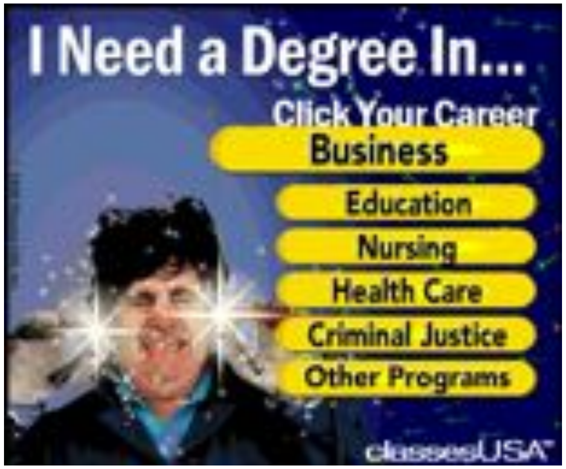
[Barrio et al., 2016]

# User Studies for Online Advertising

# The Cost of Annoying Ads

chrome
The Fast, Simple, Safe Browser

vs.



Advertisers pay publishers to display ads, but annoying ads cost publishers page views.

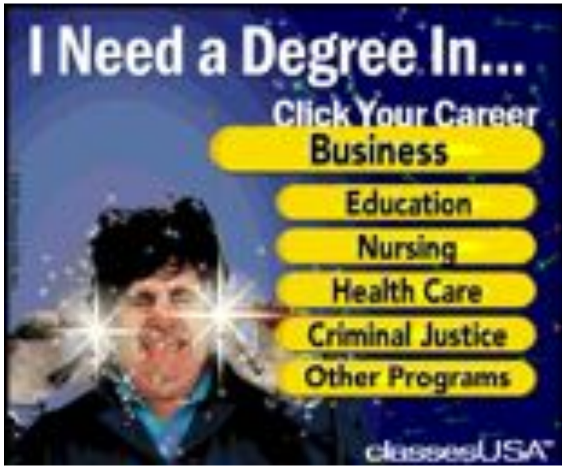
How much do annoying ads cost publishers in dollars?

[Goldstein et al., 2013]

# The Cost of Annoying Ads

chrome
The Fast, Simple, Safe Browser

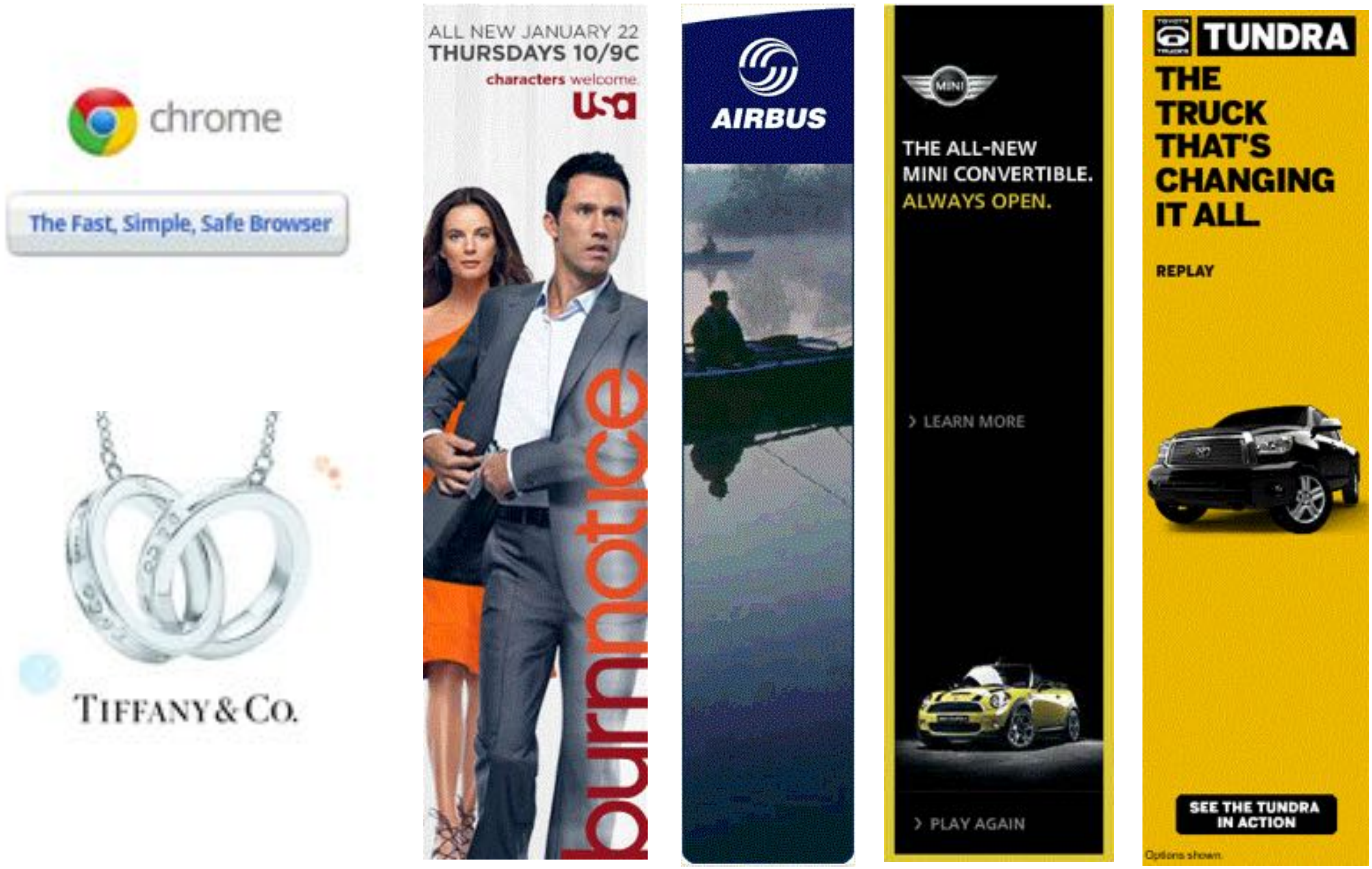
vs.



Step 1: Use the crowd to identify annoying ads.

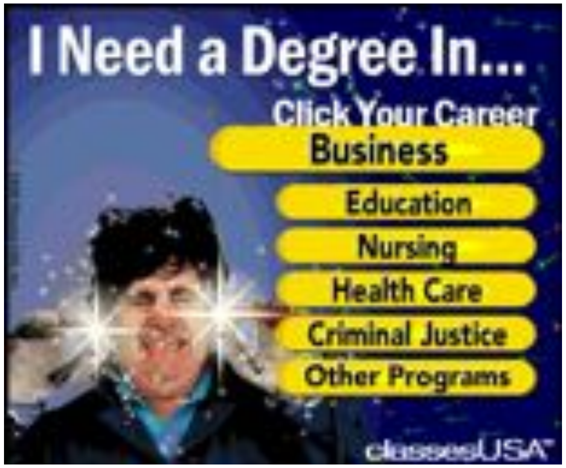
[Goldstein et al., 2013]

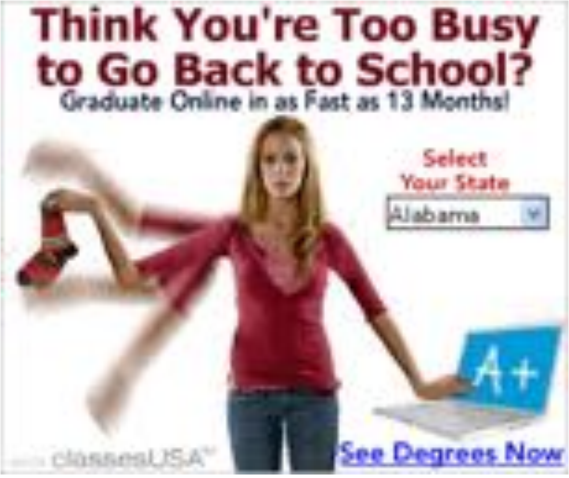
# Good Ads

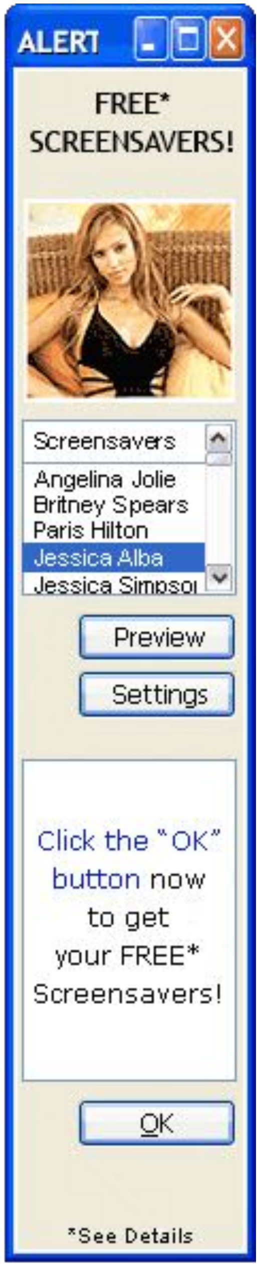


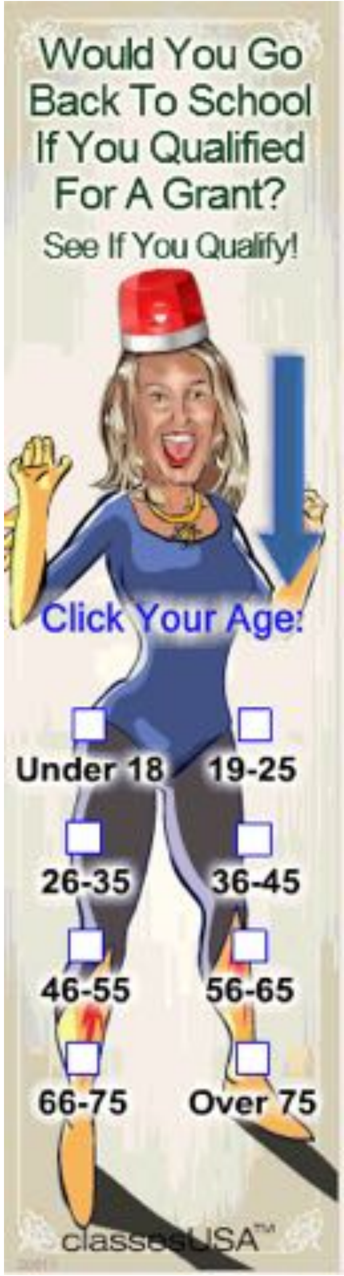
[Goldstein et al., 2013]

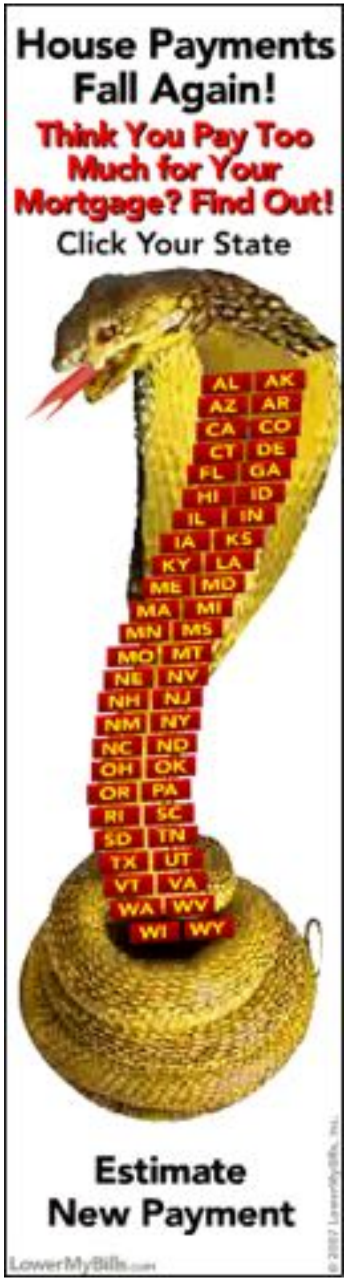
# Bad Ads

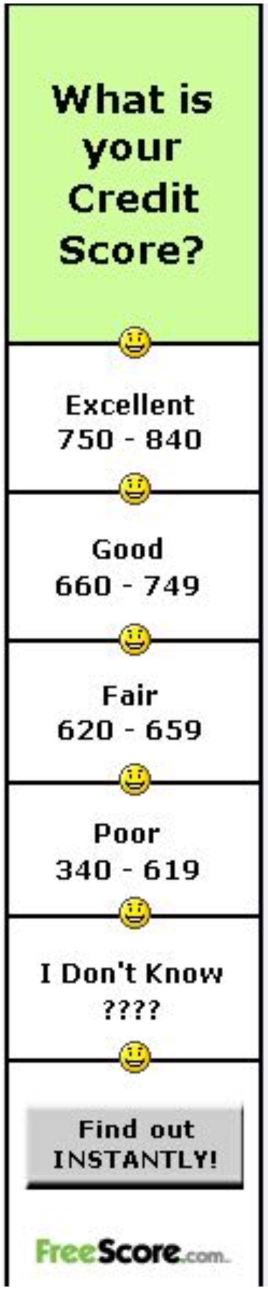



Think You're Too Busy to Go Back to School?
Graduate Online in as Fast as 13 Months!
Select Your State
Alabama
A+
classesUSA
See Degrees Now





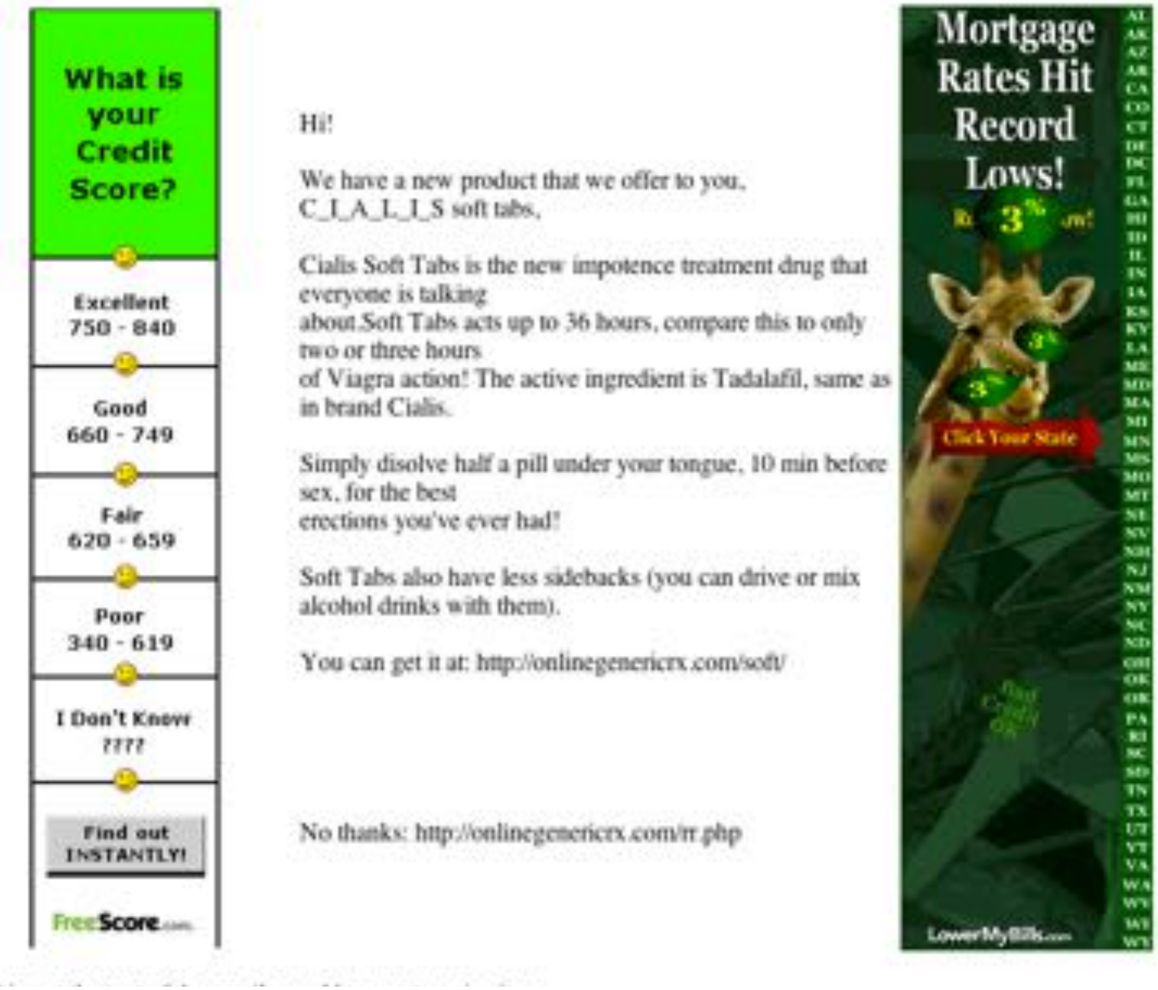

House Payments Fall Again!
Think You Pay Too Much for Your Mortgage? Find Out!
Click Your State
AL AK AZ AR CA CO CT DE FL GA HI ID IL IN IA KS KY LA ME MD MA MI MN MS MO MT NE NV NH NJ NM NY NC ND OH OK OR PA RI SC SD TN TX UT VT VA WA WV WI WY
Estimate New Payment
LowerMyBills.com



[Goldstein et al., 2013]

# Step 2: Estimate the Cost

- Workers asked to label email as spam or not
- Shown good, bad, or no ads; paid varying amounts per email
- *How much more must a worker be paid to do the same tasks when shown bad ads?*



Hi!

We have a new product that we offer to you, C_I_A_L_I_S soft tabs,

Cialis Soft Tabs is the new impotence treatment drug that everyone is talking about.Soft Tabs acts up to 36 hours, compare this to only two or three hours of Viagra action! The active ingredient is Tadalafil, same as in brand Cialis.

Simply disolve half a pill under your tongue, 10 min before sex, for the best erections you've ever had!

Soft Tabs also have less sidebacks (you can drive or mix alcohol drinks with them).

You can get it at: http://onlinegenericrx.com/soft/

No thanks: http://onlinegenericrx.com/rr.php

[Goldstein et al., 2013]

# Step 2: Estimate the Cost

- Good ads lead to about the same number of views (emails classified) as no ads

- Costs more than $1 extra to generate 1000 views of bad ads instead of no ads or good ads

- Takeaway: Publishers lose money by showing bad ads unless they are paid significantly more to show them

[Goldstein et al., 2013]

# Summary of Part 1

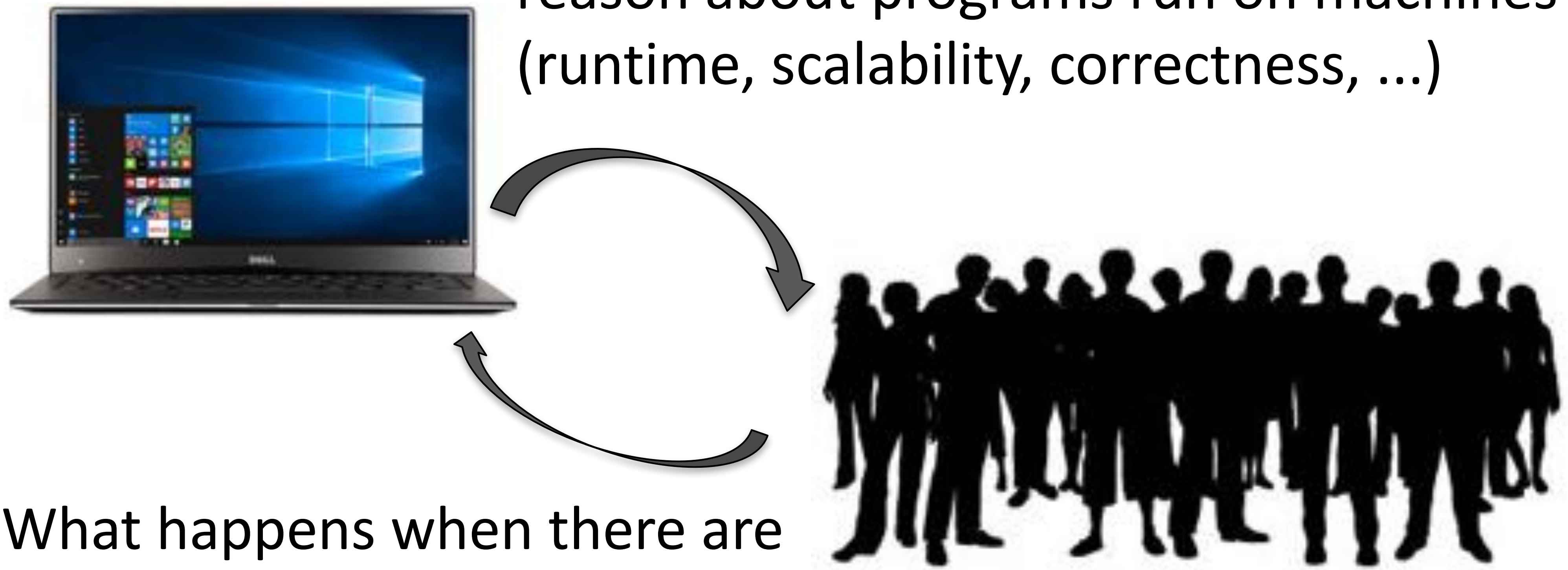
1. Direct Applications to Machine Learning

2. Hybrid Intelligence Systems

3. Large Scale Studies of Human Behavior

# Part 2:
# The Crowd is Made of People

Traditional computer science tools let us reason about programs run on machines (runtime, scalability, correctness, ...)



What happens when there are humans in the loop?

Need a model of human behavior. (Are they accurate? Honest? Do they respond rationally to incentives?)

Wrong assumptions lead to suboptimal systems!

“But I only want to use crowdsourcing to generate training data or evaluate my model.”

Understanding the crowd can teach you

- How much to pay for your tasks and what payment structure to use
- How much you really need to worry about spam
- How and why to communicate with workers
- Whether your labels/evaluations are independent
- How to avoid common pitfalls

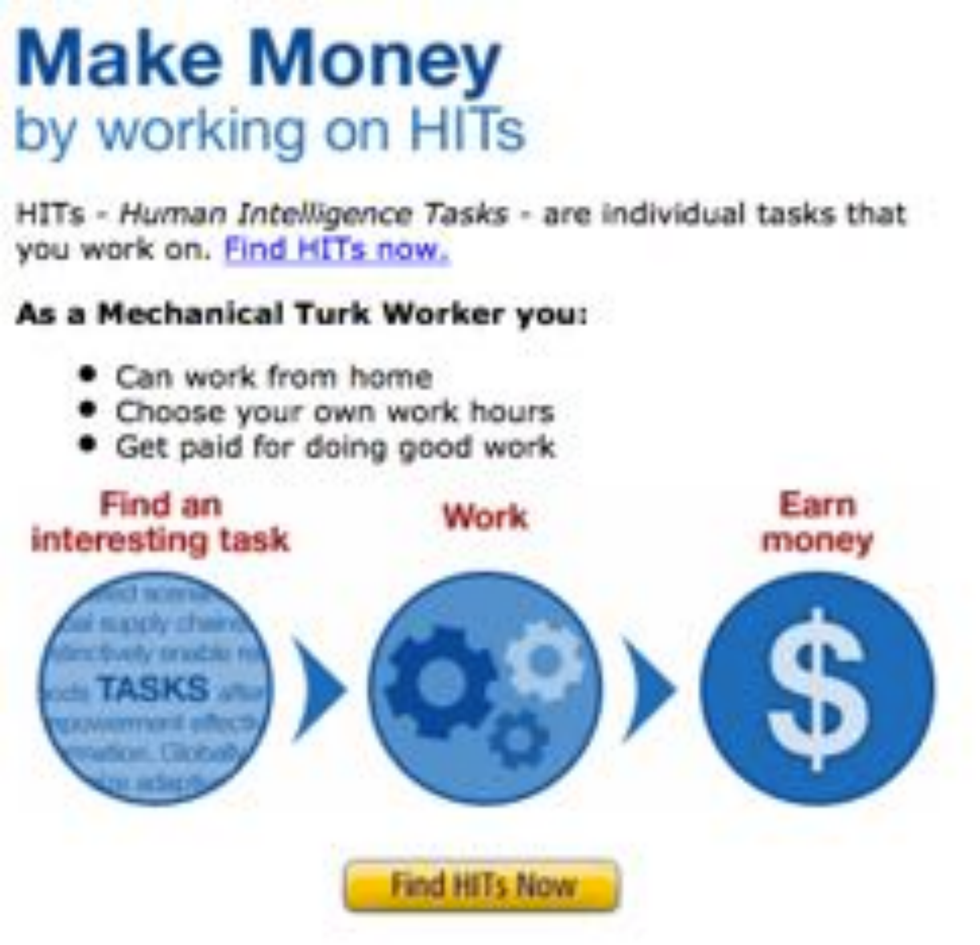
# The Crowd is Made of People

- Crowdworker demographics
- Honesty of crowdworkers
- Monetary incentives
- Intrinsic motivation
- The network within the crowd

Best practices! Tips and tricks!

# Crowdsourcing Platforms

# Amazon Mechanical Turk

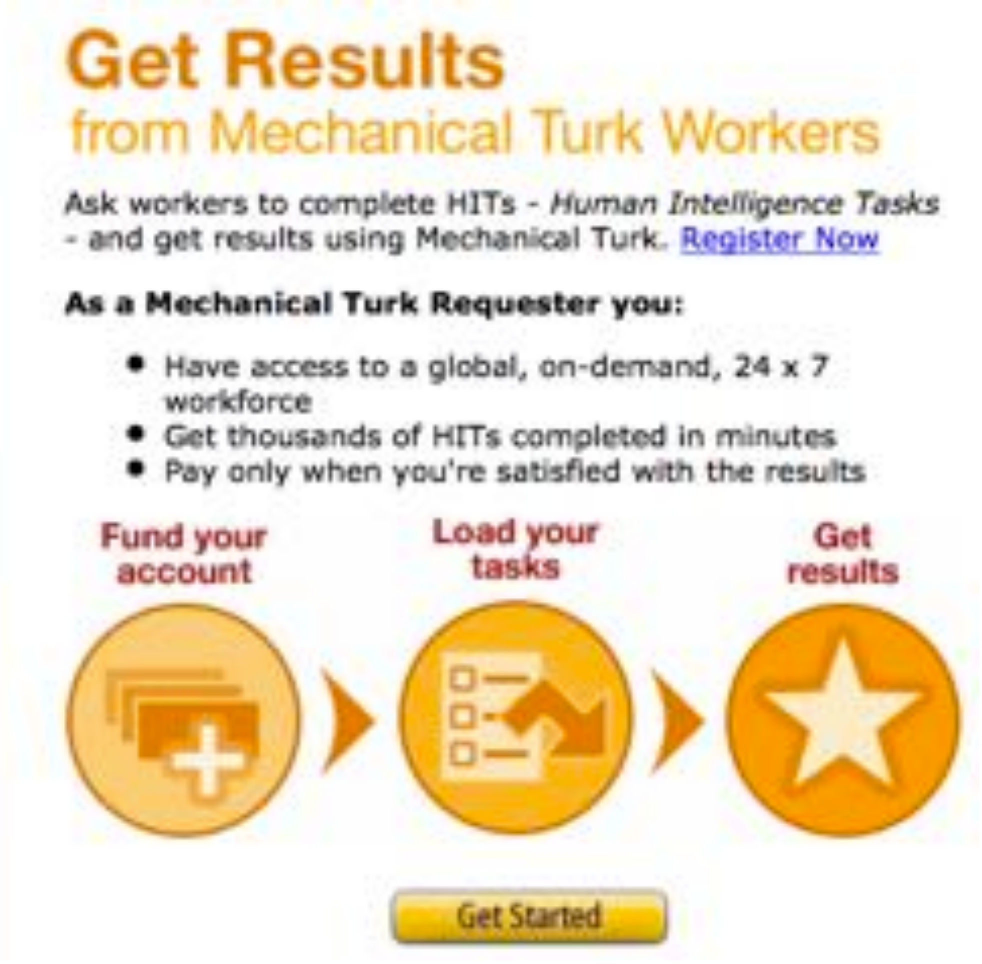


## Make Money
by working on HITs

HITs - *Human Intelligence Tasks* - are individual tasks that you work on. Find HITs now.

**As a Mechanical Turk Worker you:**

- Can work from home
- Choose your own work hours
- Get paid for doing good work



## Get Results
from Mechanical Turk Workers

Ask workers to complete HITs - *Human Intelligence Tasks* - and get results using Mechanical Turk. Register Now

**As a Mechanical Turk Requester you:**

- Have access to a global, on-demand, 24 x 7 workforce
- Get thousands of HITs completed in minutes
- Pay only when you're satisfied with the results

Workers

Requesters

# Alternative Platforms

CrowdFlower

- Offers enterprise solutions for businesses with AI/data needs (search relevance evaluation, sentiment analysis, data classification)

clickworker

- German platform with many European workers offering support for translation and web research plus mobile crowdsourcing

# Alternative Platforms

## Prolific

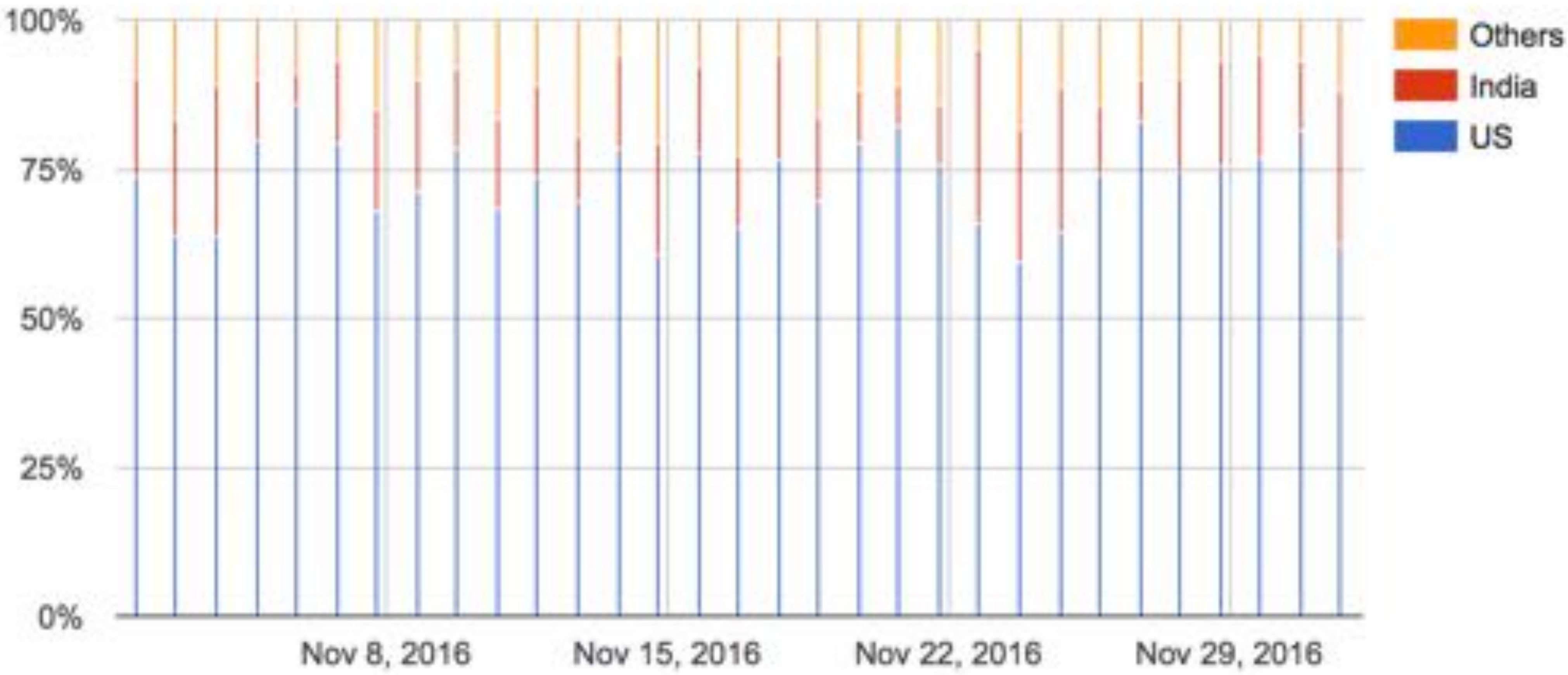
- UK-based platform focused on connecting researchers with subjects for experiments

## upwork

- Marketplace for freelancers with larger jobs like writing articles or designing websites

# Crowdworker Demographics

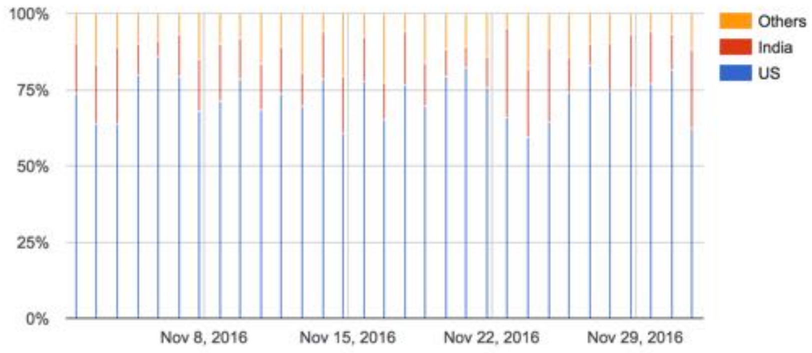
# Demographics of Mechanical Turk



[mturk-tracker.com]

# Demographics of Mechanical Turk

- 70-80% US, 10-20% India



- Roughly equal gender split
- Median (reported) household income:
  - $40K-$60K for US workers
  - Less than $15K for Indian workers
- Can be big changes depending on time of day

[mturk-tracker.com]

# Are workers dishonest?

# Experimental Paradigm

- Ask participants about demographics
  - Sex, Age, Location, Income, Education

- Ask participants to **privately** roll a die (or simulate it on an external website) and report the outcome

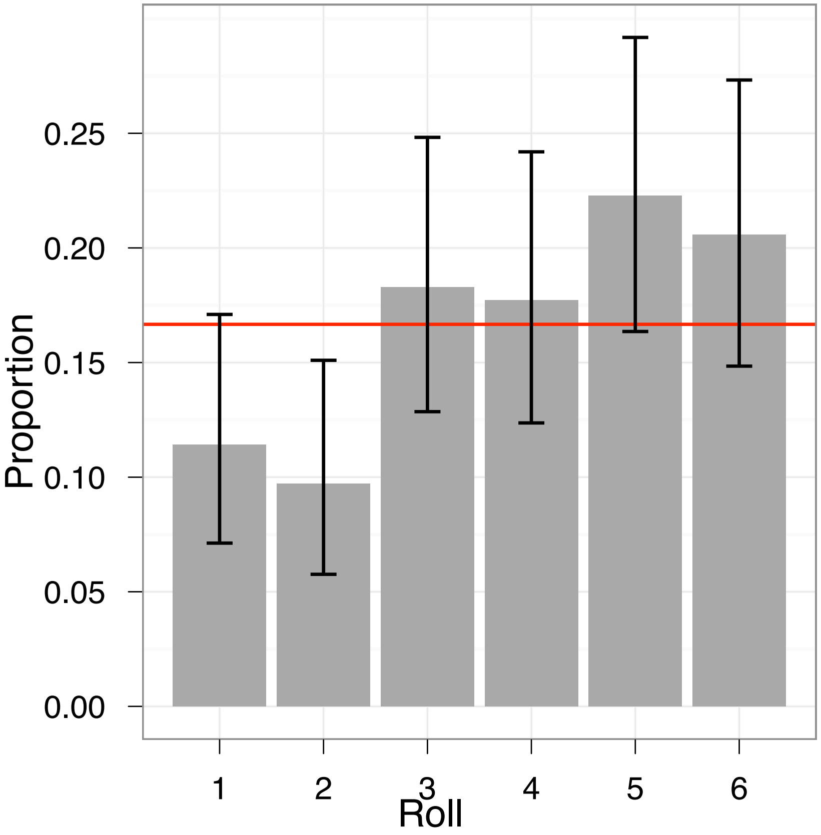
$$\text{payment} = \$0.25 + (\$0.25 * \text{roll})$$

- If workers honest, mean reported roll should be about 3.5... What do you think the mean was?

[Suri et al., 2011]

# Baseline

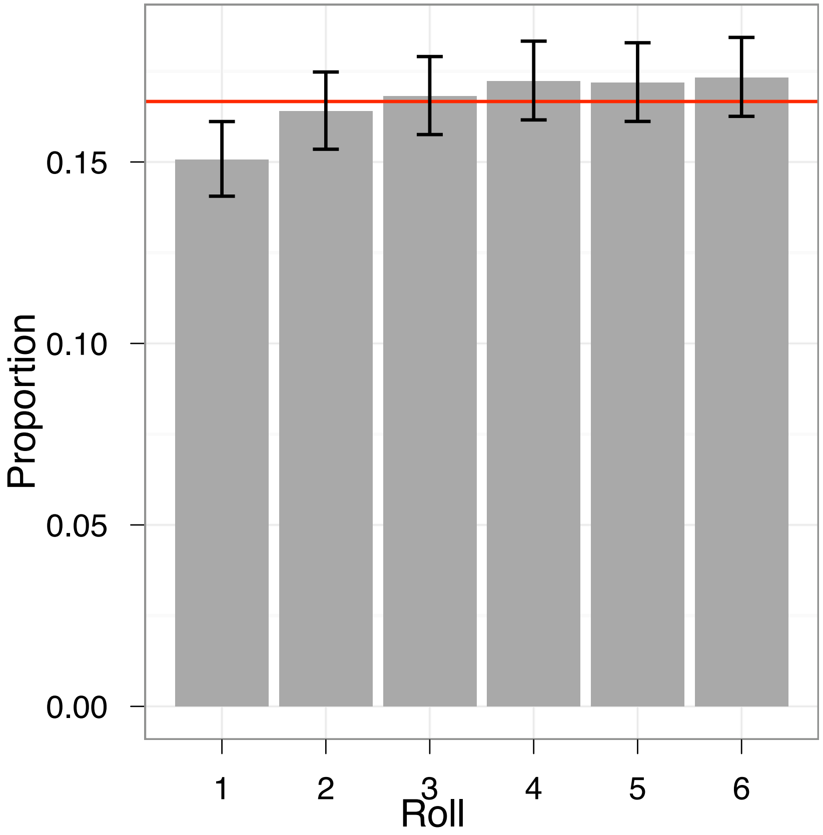
- Average reported roll higher than expectation
  - M = 3.91, $p < 0.0005$
- Players under-reported ones and twos and over-reported fives
- **But many workers were honest!**
- Similar to Fischbacher & Huesi lab study



[Suri et al., 2011]

# Thirty rolls

- Overall, much less dishonesty
- Average reported roll much closer to expectation
  - M = 3.57, $p < 0.0005$
- Only 3 of 232 reported significantly unlikely outcomes
- Only 1 was fully income maximizing (all sixes)
- **Why is this the case?**



[Suri et al., 2011]

# Dishonesty Can Add Up

- "Are you the parent or guardian of a child with autism?"
  - 4.3% of participants said yes in control
  - 7.8% of participants said yes when told that this was a prescreening test for a further study
- Seems like a small difference, but would lead to (at least) 45% imposters in the subsequent study!

[Chandler and Paolacci, 2011]

# Takeaways & Related Best Practices

- Most workers are honest most of the time.
- But some are not. You should still use care to avoid attacks.
- Workers may deceive requesters to gain access to work. Prescreening should be done with care, ideally as part of a separate task.

# Monetary Incentives

# How much should you pay?

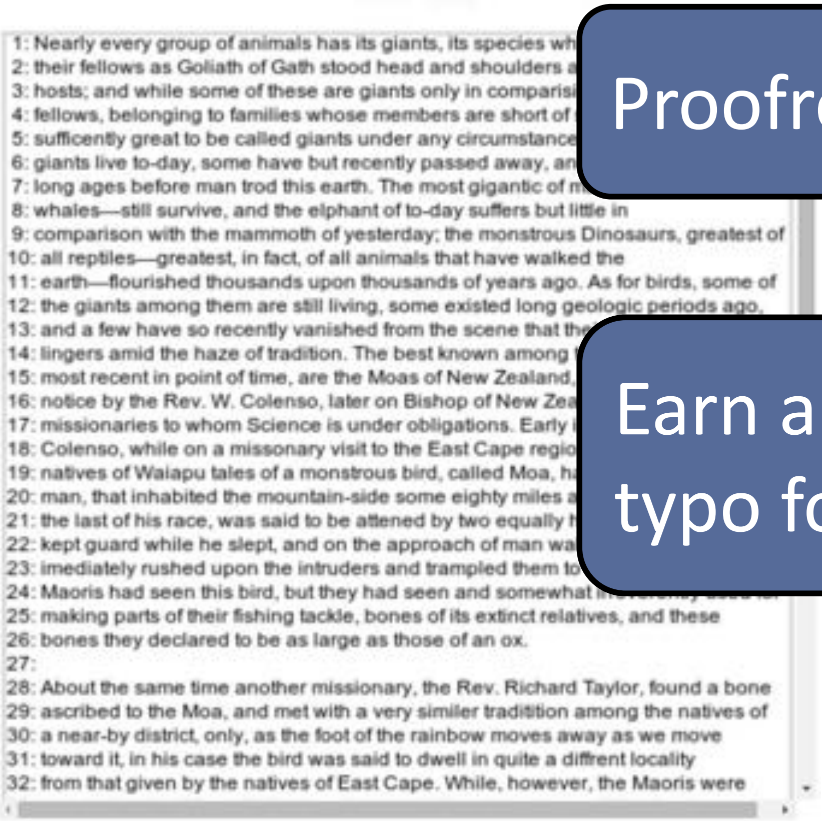
A useful trick:

- Pilot your task on students, colleagues, or a few workers to see how long it generally takes.
- Use that to make sure your payments work out to at least the US minimum wage.

Benefits:

- It’s the decent thing to do!
- It helps maintain good relationships with workers.

# Can performance-based payments improve the quality of crowdwork?



1: Nearly every group of animals has its giants, its species wh
2: their fellows as Goliath of Gath stood head and shoulders a
3: hosts; and while some of these are giants only in comparisi
4: fellows, belonging to families whose members are short of
5: sufficently great to be called giants under any circumstance
6: giants live to-day, some have but recently passed away, an
7: long ages before man trod this earth. The most gigantic of m
8: whales—still survive, and the elphant of to-day suffers but little in
9: comparison with the mammoth of yesterday; the monstrous Dinosaurs, greatest of
10: all reptiles—greatest, in fact, of all animals that have walked the
11: earth—flourished thousands upon thousands of years ago. As for birds, some of
12: the giants among them are still living, some existed long geologic periods ago,
13: and a few have so recently vanished from the scene that the
14: lingers amid the haze of tradition. The best known among
15: most recent in point of time, are the Moas of New Zealand,
16: notice by the Rev. W. Colenso, later on Bishop of New Zea
17: missionaries to whom Science is under obligations. Early i
18: Colenso, while on a missonary visit to the East Cape regio
19: natives of Waiapu tales of a monstrous bird, called Moa, ha
20: man, that inhabited the mountain-side some eighty miles a
21: the last of his race, was said to be attened by two equally h
22: kept guard while he slept, and on the approach of man wa
23: imediately rushed upon the intruders and trampled them to
24: Maoris had seen this bird, but they had seen and somewhat irreverently used for
25: making parts of their fishing tackle, bones of its extinct relatives, and these
26: bones they declared to be as large as those of an ox.
27:
28: About the same time another missionary, the Rev. Richard Taylor, found a bone
29: ascribed to the Moa, and met with a very similer tradititon among the natives of
30: a near-by district, only, as the foot of the rainbow moves away as we move
31: toward it, in his case the bird was said to dwell in quite a diffrent locality
32: from that given by the natives of East Cape. While, however, the Maoris were

Proofread this text, earn $0.50

Earn an extra $0.10 for every typo found

[Ho et al., 2015]

# Prior Work on Crowd Payments

- Paying more increases the quantity of work, but not the quality [MW09, RK+11, BKG11, LRR14]
- PBPs improve quality [H11, YCS14]
- PBPs do not improve quality [SHC11]
- Bonus sizes don't matter [YCS13]

[Ho et al., 2015]

# Performance-Based Payments

We explore **when**, **where**, and **why** performace-based payments improve the quality of crowdwork on Amazon Mechanical Turk.

[Ho et al., 2015]

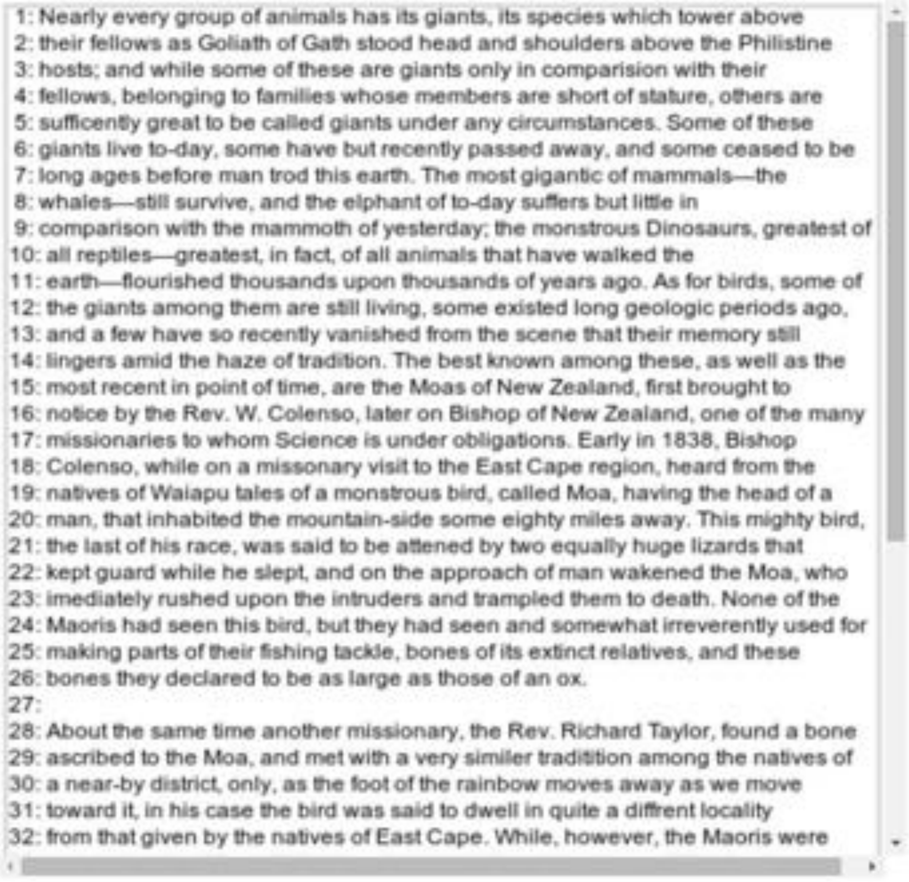
# Can PBPs work?

- Warm-up to verify that PBPs can lead to higher quality crowdwork on some task.
- Test whether there exists an implicit PBP effect: workers have subjective beliefs on the quality of work they must produce to receive the base payment, and so already behave as if payments are (implicitly) performance-based.

[Ho et al., 2015]

# Can PBPs work?

- Task: Proofread an article and find spelling errors.



Nearly every group of animals has its giants, its species which tower above their fellows as Goliath of Gath stood head and shoulders above the Philistine hosts; and while some of these are giants only in comparision with their fellows, belonging to families whose members are short of stature, others are sufficently great to be called giants under any circumstances. Some of these giants live to-day, some have but recently passed away, and some ceased to be long ages before man trod this earth. The most gigantic of mammals—the whales—still survive, and the elphant of to-day suffers but little in comparison with the mammoth of yesterday; the monstrous Dinosaurs, greatest of all reptiles—greatest, in fact, of all animals that have walked the earth—flourished thousands upon thousands of years ago. As for birds, some of the giants among them are still living, some existed long geologic periods ago, and a few have so recently vanished from the scene that their memory still lingers amid the haze of tradition. The best known among these, as well as the most recent in point of time, are the Moas of New Zealand, first brought to notice by the Rev. W. Colenso, later on Bishop of New Zealand, one of the many missionaries to whom Science is under obligations. Early in 1838, Bishop Colenso, while on a missonary visit to the East Cape region, heard from the natives of Waiapu tales of a monstrous bird, called Moa, having the head of a man, that inhabited the mountain-side some eighty miles away. This mighty bird, the last of his race, was said to be attened by two equally huge lizards that kept guard while he slept, and on the approach of man wakened the Moa, who imediately rushed upon the intruders and trampled them to death. None of the Maoris had seen this bird, but they had seen and somewhat irreverently used for making parts of their fishing tackle, bones of its extinct relatives, and these bones they declared to be as large as those of an ox.

About the same time another missionary, the Rev. Richard Taylor, found a bone ascribed to the Moa, and met with a very similer traditition among the natives of a near-by district, only, as the foot of the rainbow moves away as we move toward it, in his case the bird was said to dwell in quite a diffrent locality from that given by the natives of East Cape. While, however, the Maoris were

- We randomly insert 20 typos
  - sufficiently -> sufficently
  - existence -> existance
  - …
- Useful properties:
  - Quality is measurable
  - Exerting more effort -> better results

[Ho et al., 2015]

# Can PBPs work?

Base payment: $0.50; Bonus payment: $1.00

**Three Bonus Treatments:**

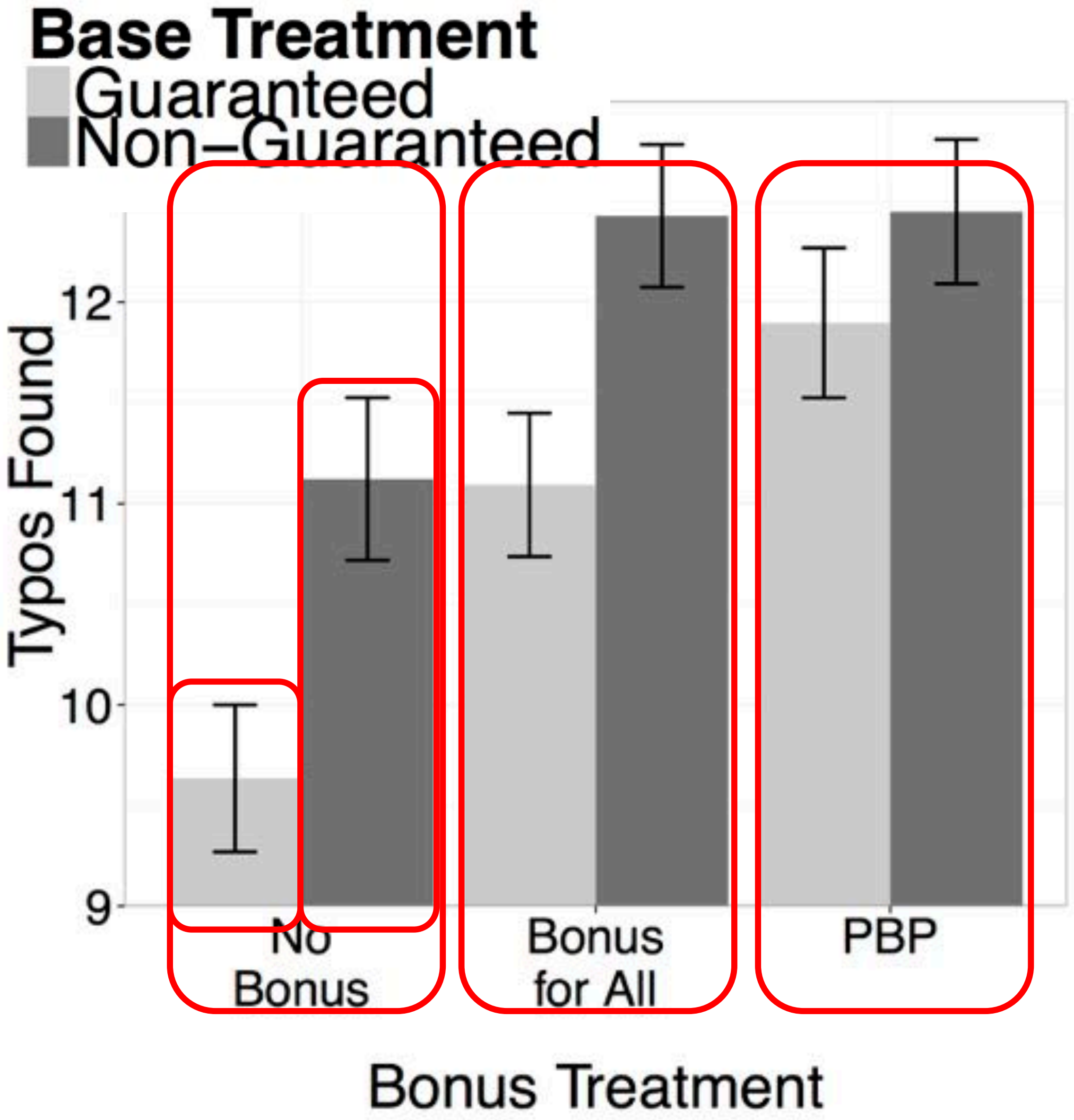
- *No Bonus:* no bonus or mention of a bonus
- *Bonus for All:* get the bonus unconditionally
- *PBP:* get the bonus if you find 75% of the typos found by others

**Two Base Treatments:**

- – *Guaranteed:* guaranteed to get paid
- – *Non-Guaranteed:* no mention of a guarantee

[Ho et al., 2015]

# Can PBPs work?



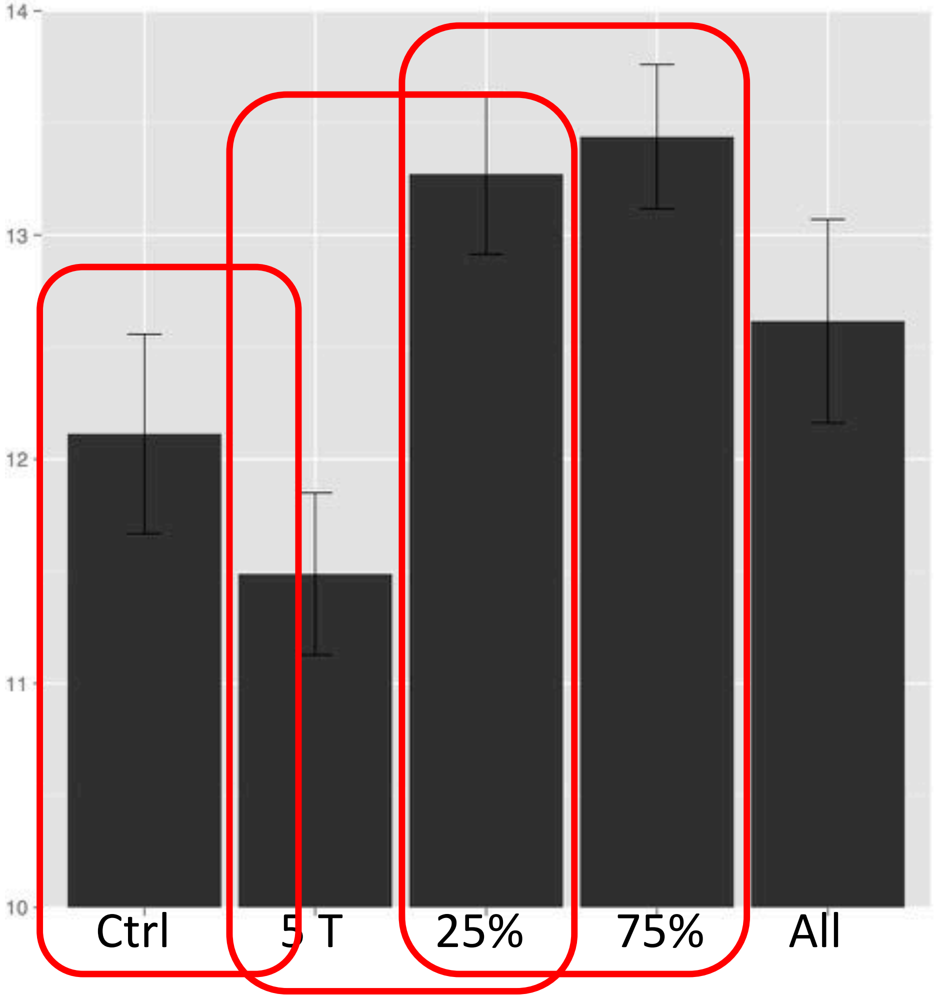
- Results from 1000 unique workers
- Guaranteed payments hurt (implicit PBP)
- PBPs improve quality
- Unlike in prior work, paying more also improves quality

[Ho et al., 2015]

# Under what conditions do PBPs work?

**Bonus threshold** (585 unique workers)

- $0.50 base + $1.00 bonus for finding *X* typos



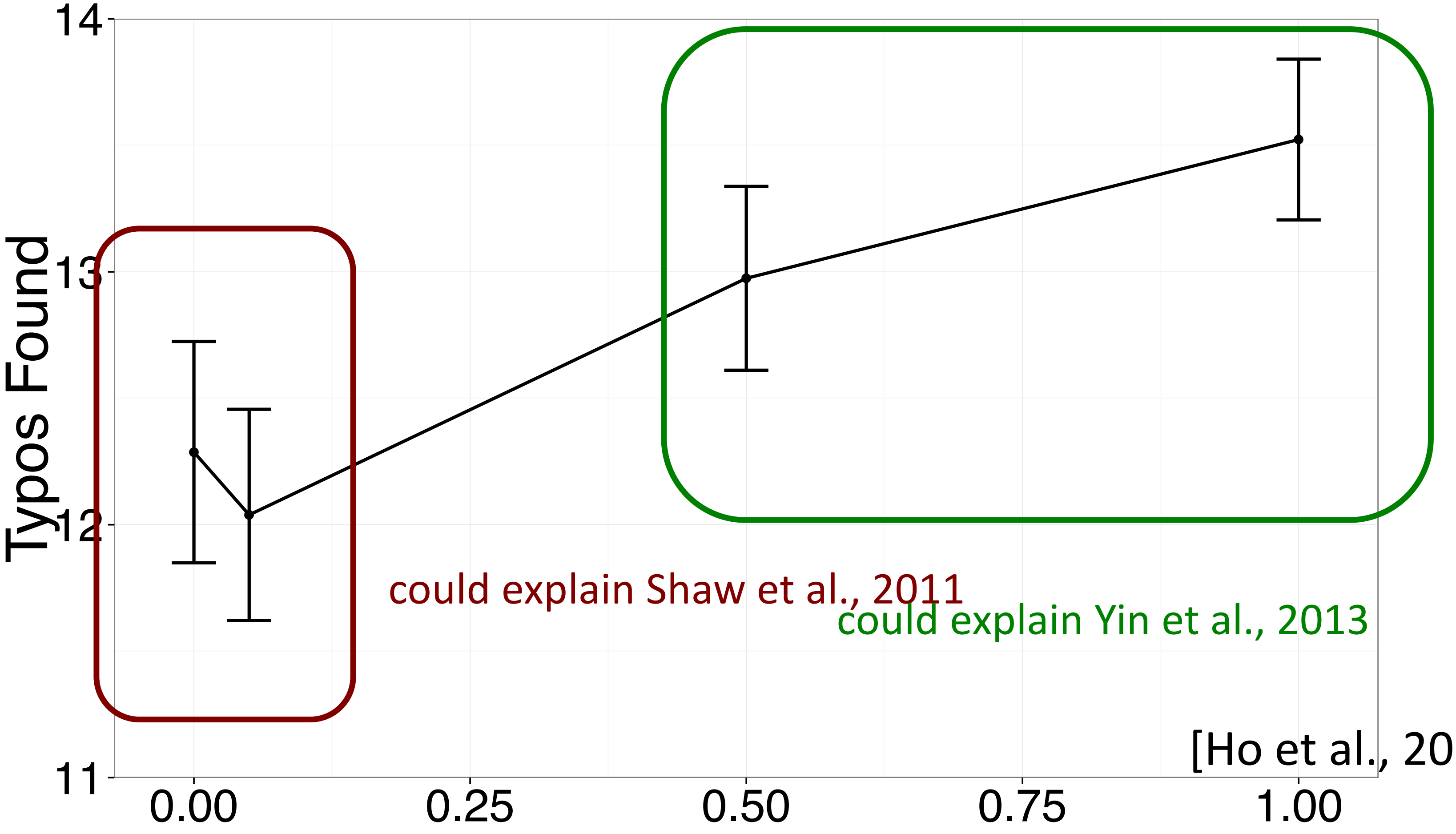
- PBPs work for a wide range of thresholds
- Subjective beliefs (5 typos vs. 25% of typos) can improve quality

[Ho et al., 2015]

# Under what conditions do PBPs work?

**Bonus amounts** (451 unique workers)

- $0.50 base + $*X* bonus for finding 75% of typos
- PBPs work as long as the bonus is large enough



could explain Shaw et al., 2011

could explain Yin et al., 2013

[Ho et al., 2015]

# Which tasks do PBPs work on?

- What properties of a task lead to quality improvements from performance-based pay?

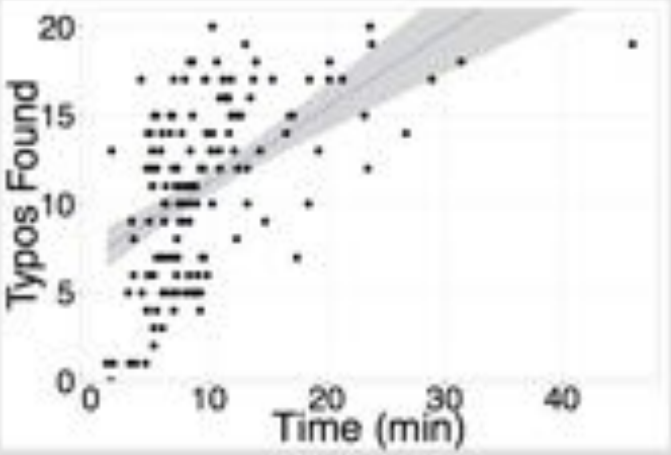
- Some pilot experiments on audio transcription suggested that
  - PBPs improve quality for effort-responsive tasks
  - It is not always straight-forward to guess which tasks are effort-responsive

[Ho et al., 2015]

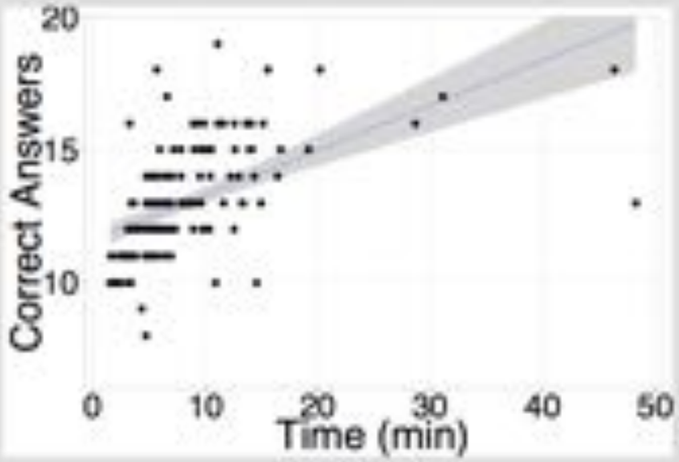
# Which tasks do PBPs work on?

✓

PBP works



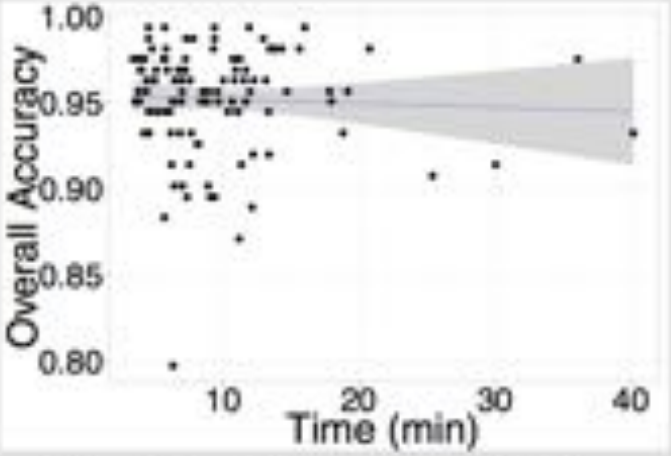
proofreading



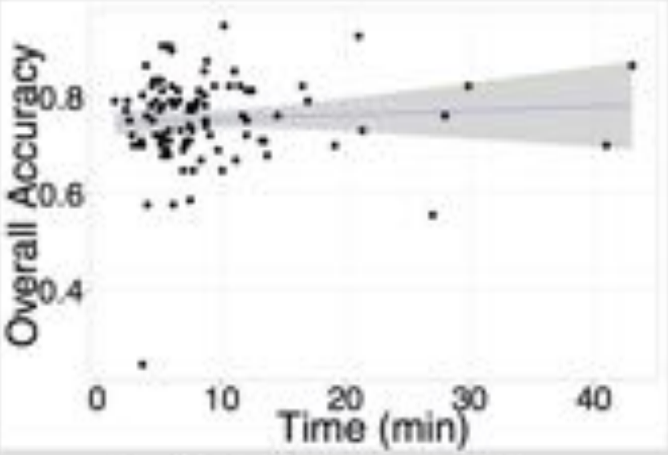
Spotting differences

✗

PBP doesn't work



Handwriting recognition



Audio transcription

# Takeaways & Related Best Practices

- Aim to pay at least US minimum wage. Pilot your task to find out how long it takes.

- Performance-based payments can improve quality for effort-responsive tasks. Pilot to check the relationship between time and quality.

- Bonus payments should be large relative to the base. The precise amount and precise criteria for receiving the bonus don’t matter too much.

# Intrinsic Motivation

# Work That Matters

- Three treatments:
  - **control:** no context given
  - **meaningful:** told they were labeling tumor cells to assist medical researchers
  - **shredded:** no context, told work would be discarded

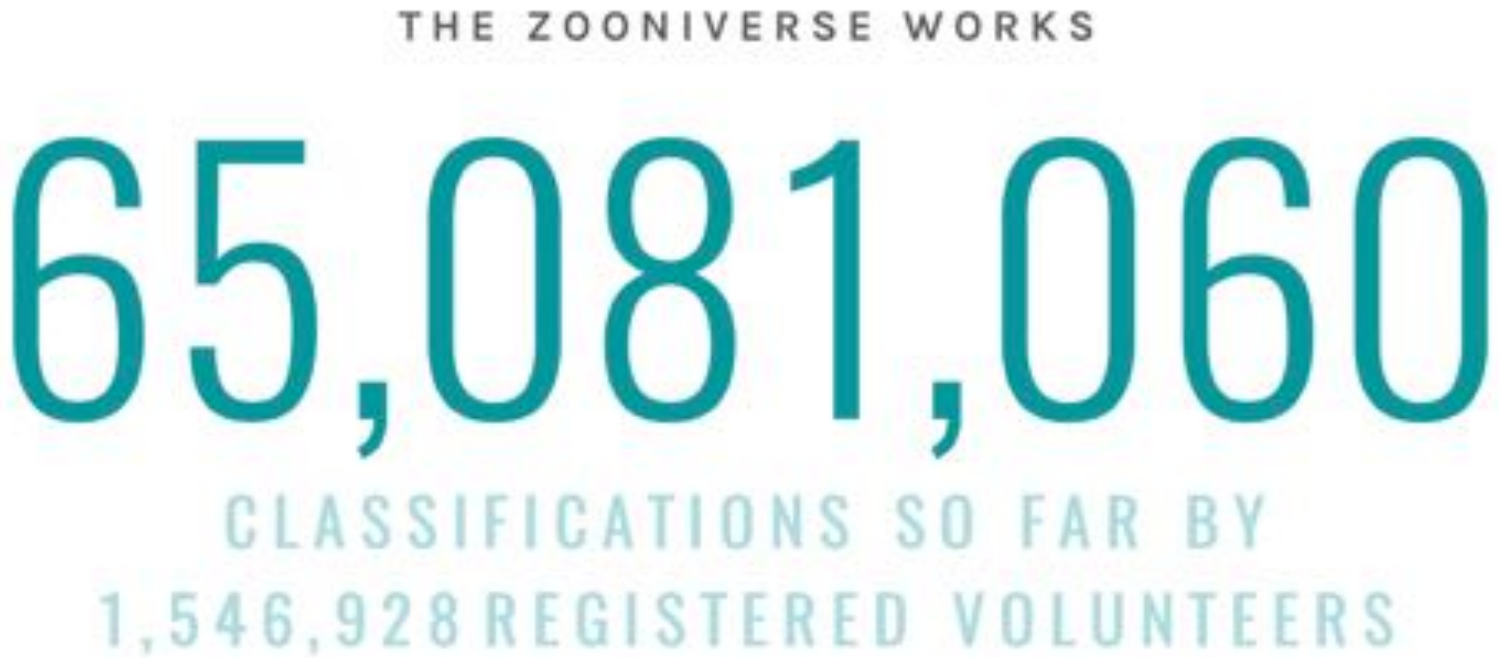
We'll train you to identify tumor cells in images

- Meaningful -> **quantity** up, but **quality** similar
- Shredded -> **quality** down, but **quantity** similar

[Chandler and Kapelner, 2013]

ZOONIVERSE

REAL SCIENCE ONLINE



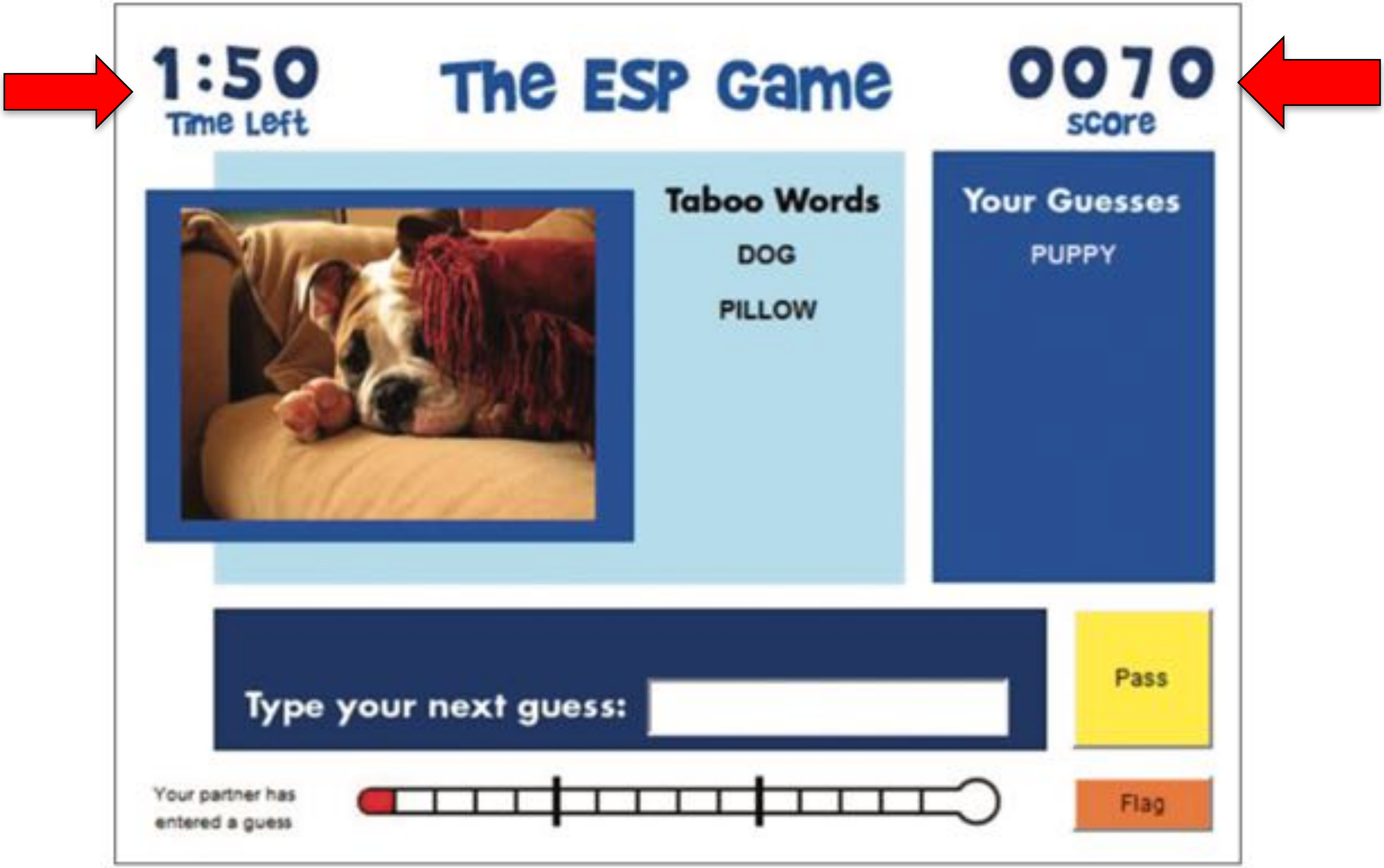
THE ZOONIVERSE WORKS

65,081,060

CLASSIFICATIONS SO FAR BY

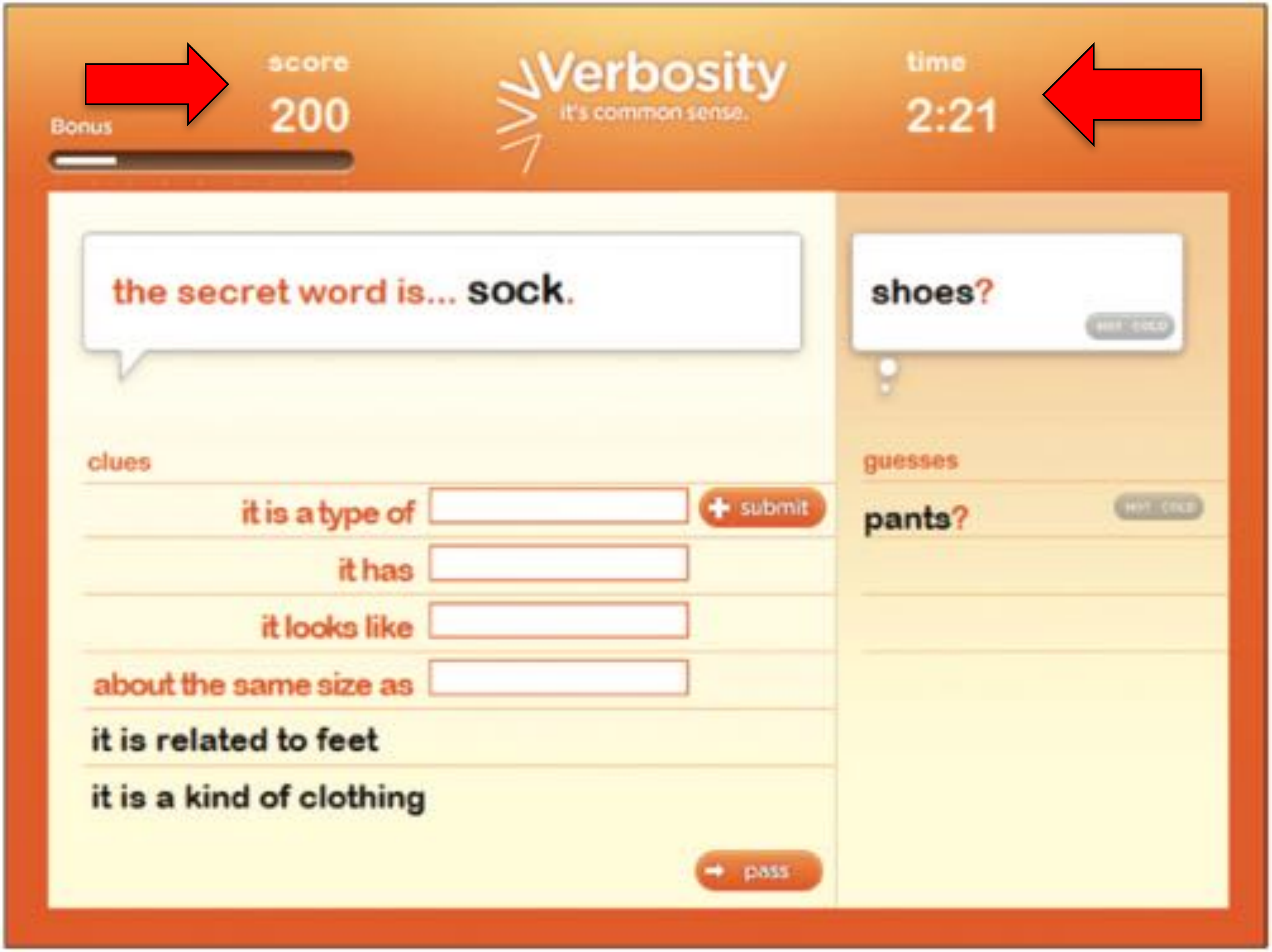
1,546,928 REGISTERED VOLUNTEERS

# Gamification



[von Ahn and Dabbish, 2004]

# Gamification



the secret word is... sock.

shoes?

it is a type of

it has

it looks like

about the same size as

it is related to feet

it is a kind of clothing

pants?

[von Ahn, Kedia, and Blum, 2006]

# Takeaways & Related Best Practices

- Workers produce more work when they know they are performing a meaningful task, but the quality of their work might not improve.

- Gamification can also increase productivity.  Well calibrated timed responses and score keeping (with or without high score lists) can both increase enjoyment.

# The Communication Network Within the Crowd

# Implicit assumption: Crowdworkers are independent

ARCTIC OCEAN
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
NORTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
SOUTH PACIFIC OCEAN
THE WORLD

[Yin et al., 2016]

# In reality workers talk and collaborate

Ethnographic field studies show that crowdworkers...

Help each other with administrative overhead

Share tasks and reputable employers

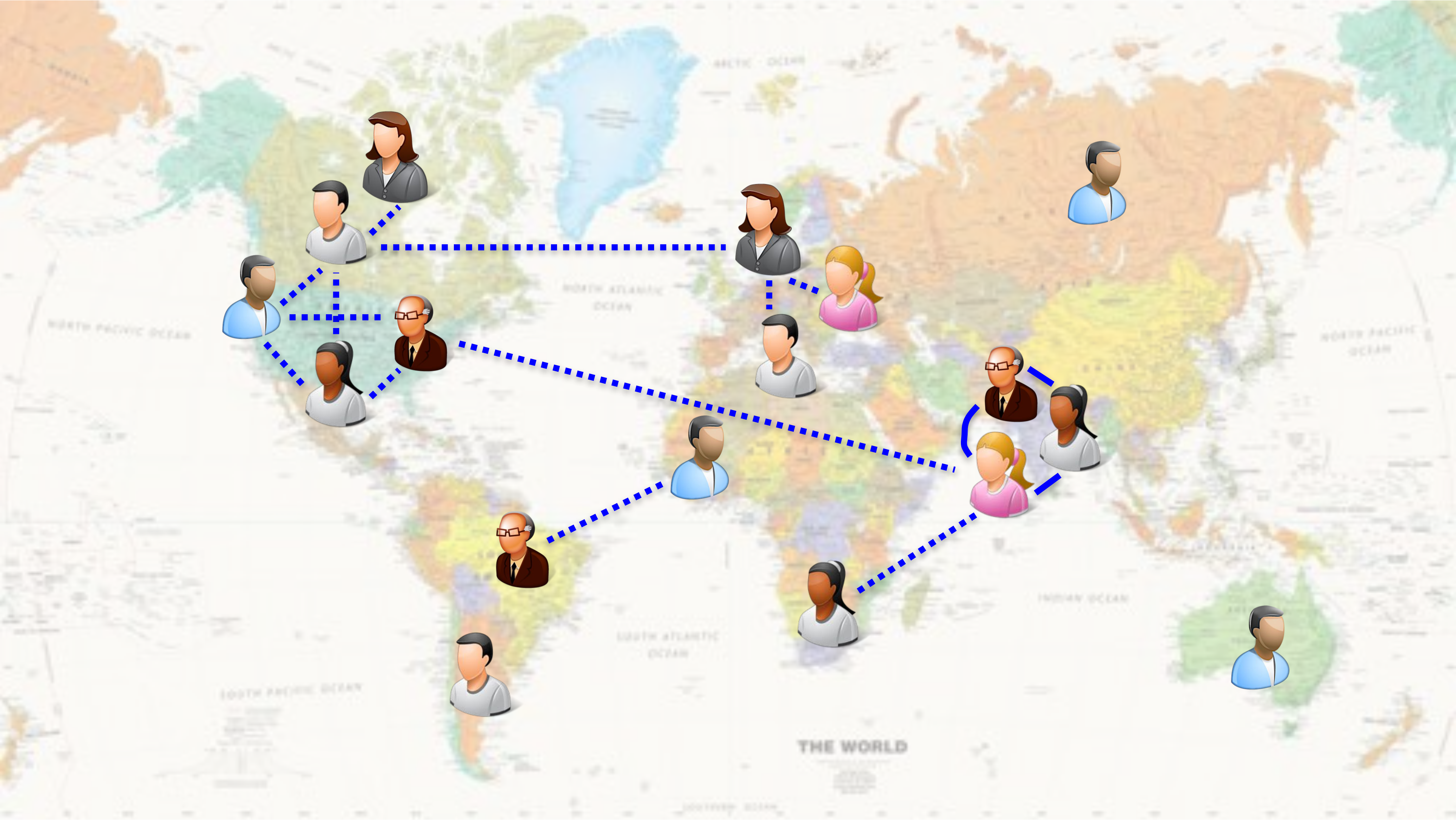
Recreate social connections and support

M.L. Gray, S. Suri, S.S. Ali and D. Kulkarni. The Crowd is a Collaborative Network. *CSCW* 2016

N. Gupta, D. Martin, B.V. Hanrahan and J. O’Neil. Turk-life in India. *Group* 2014

[Yin et al., 2016]

# A Communication Network



What is the scale? What is the structure? How is it used?

[Yin et al., 2016]

# Why is it challenging?

The network is not accessible from the API so we can’t simply download, crawl, or scrape it!

Want to map the network in a way that

**#1** Elicits only “true” edges

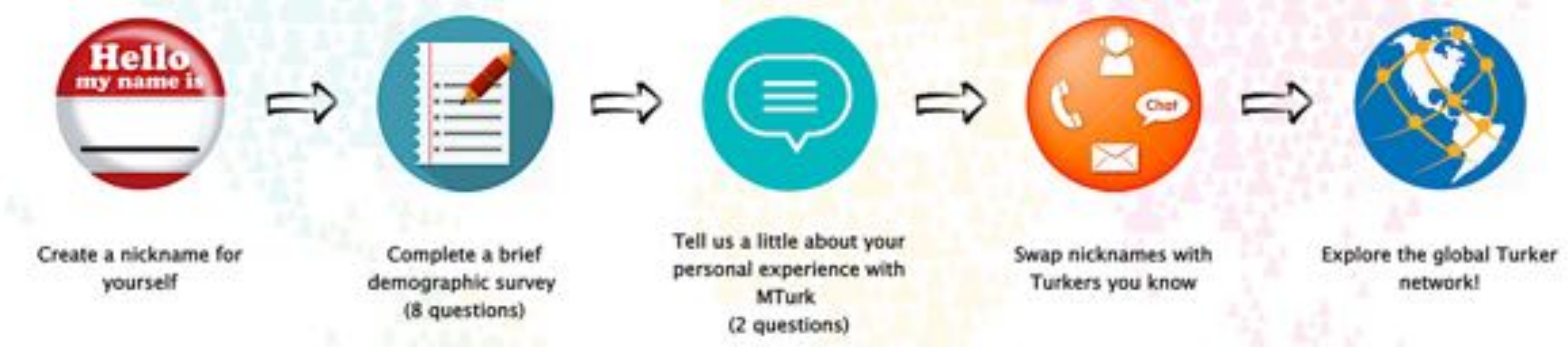
**#2** Elicits as many true edges as possible

**#3** Preserves workers’ privacy

[Yin et al., 2016]

# A Web App

- Workers self-report their connections
- Provides some value back to the workers so that it's in their best interest to report as many true connections as possible



Create a nickname for yourself

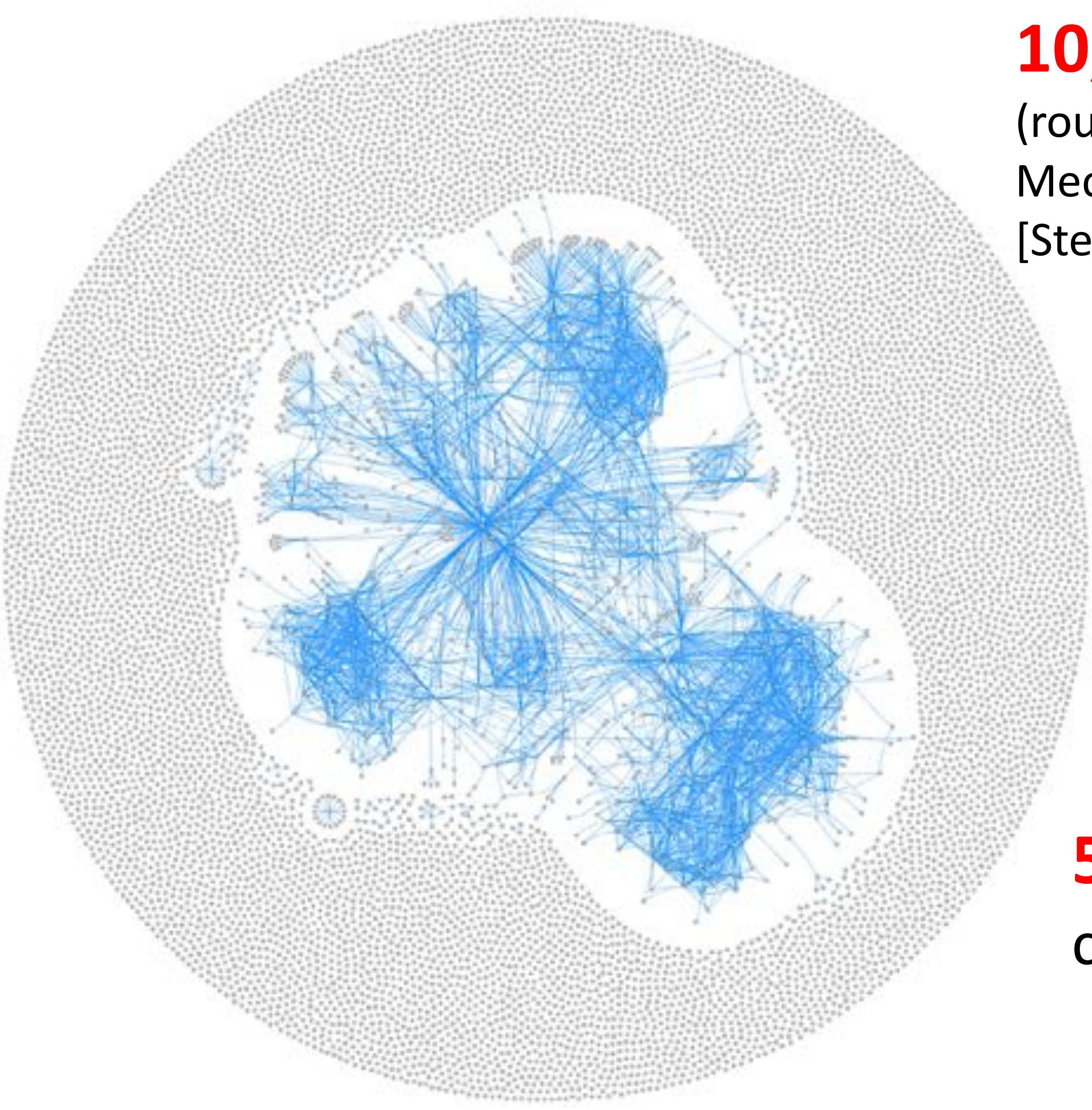
Complete a brief demographic survey (8 questions)

Tell us a little about your personal experience with MTurk (2 questions)

Swap nicknames with Turkers you know

Explore the global Turker network!

[Yin et al., 2016]

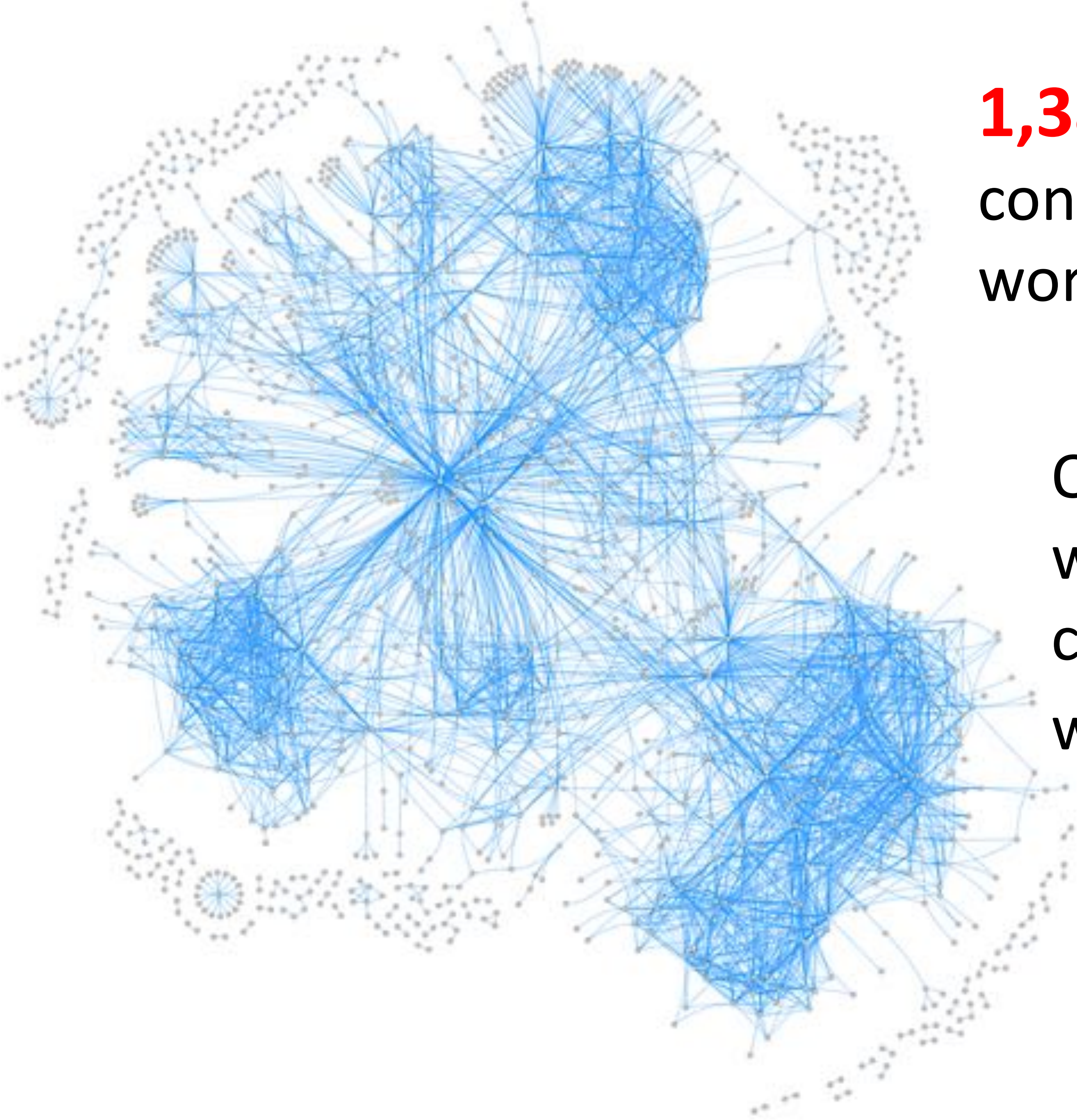


**10,354** workers

(roughly a census of Mechanical Turk [Stewart et al. 2015])

**5268** connections

[Yin et al., 2016]

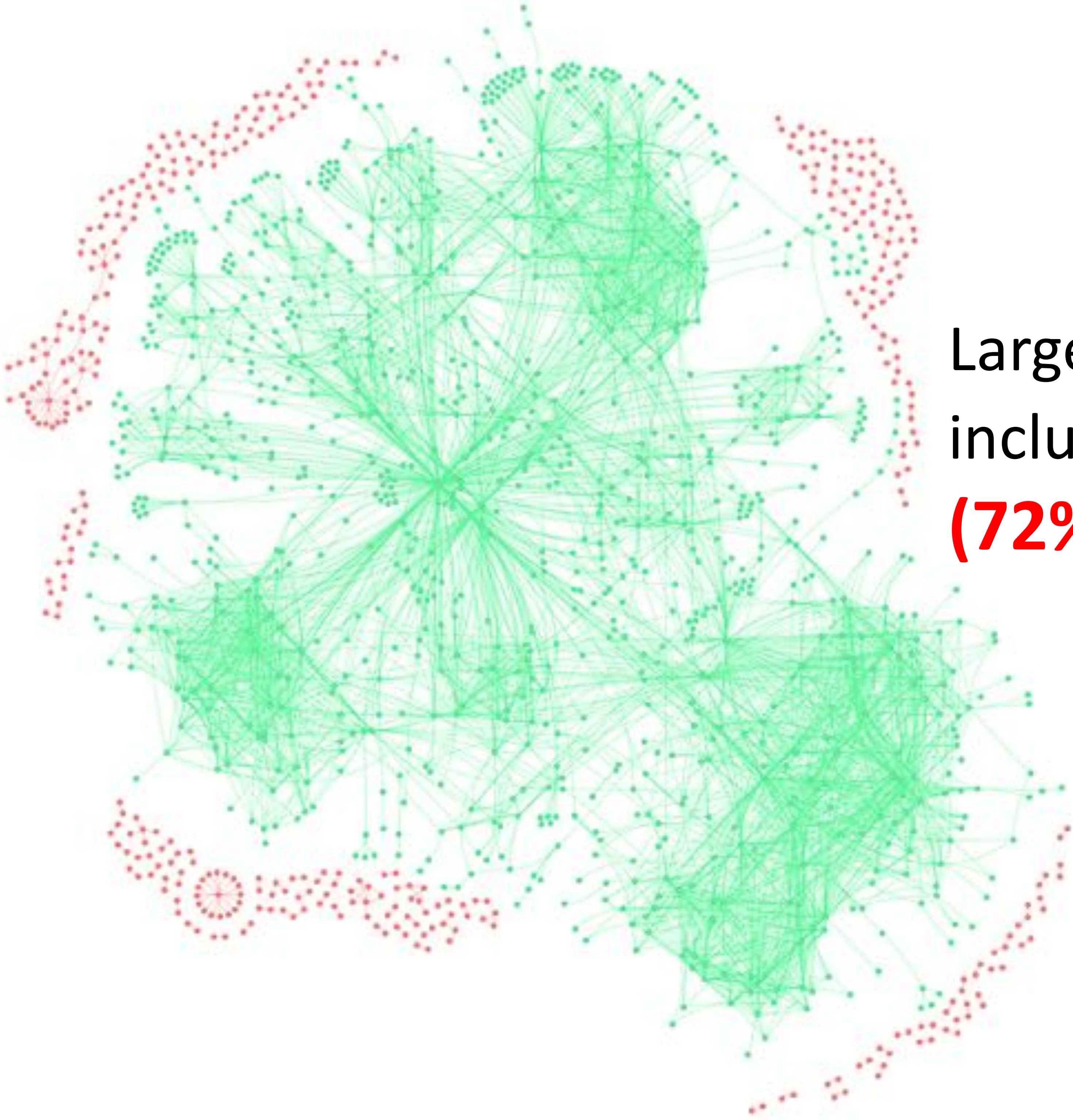


**1,389 (13%)** connected workers

On average, workers communicate with **7.6** others

Max degree is **321**

[Yin et al., 2016]



Largest component includes **994 (72%)** workers

[Yin et al., 2016]

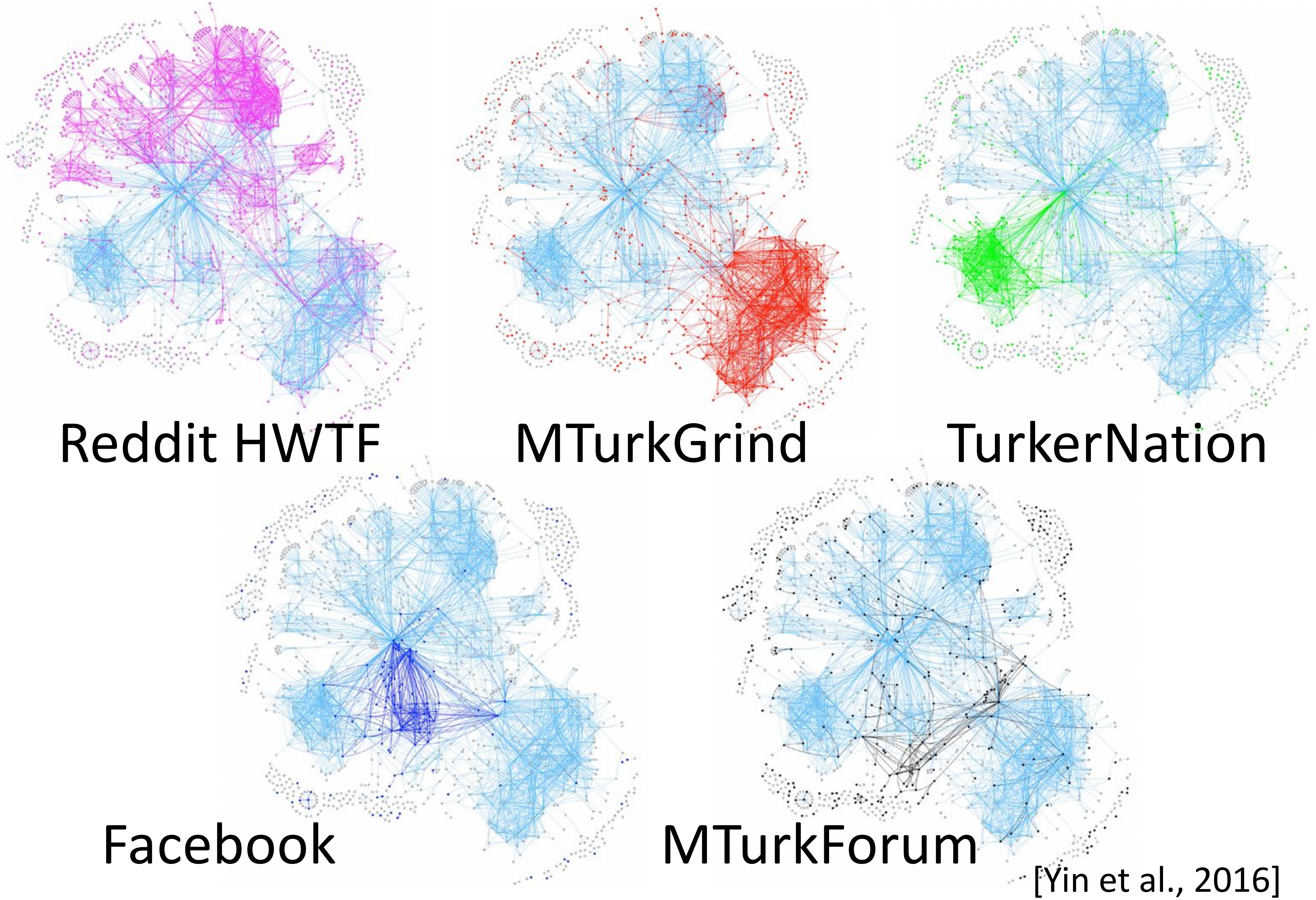
# A Network Enabled By Forums

- **59%** of all workers and **83%** of connected workers reported using at least one forum.

- **90%** of all edges are between pairs of workers who communicate via forums, and **86%** are between pairs who communicate *exclusively* through forums.

[Yin et al., 2016]

# Forums Create Subcommunities



Reddit HWTF

MTurkGrind

TurkerNation

Facebook

MTurkForum

[Yin et al., 2016]

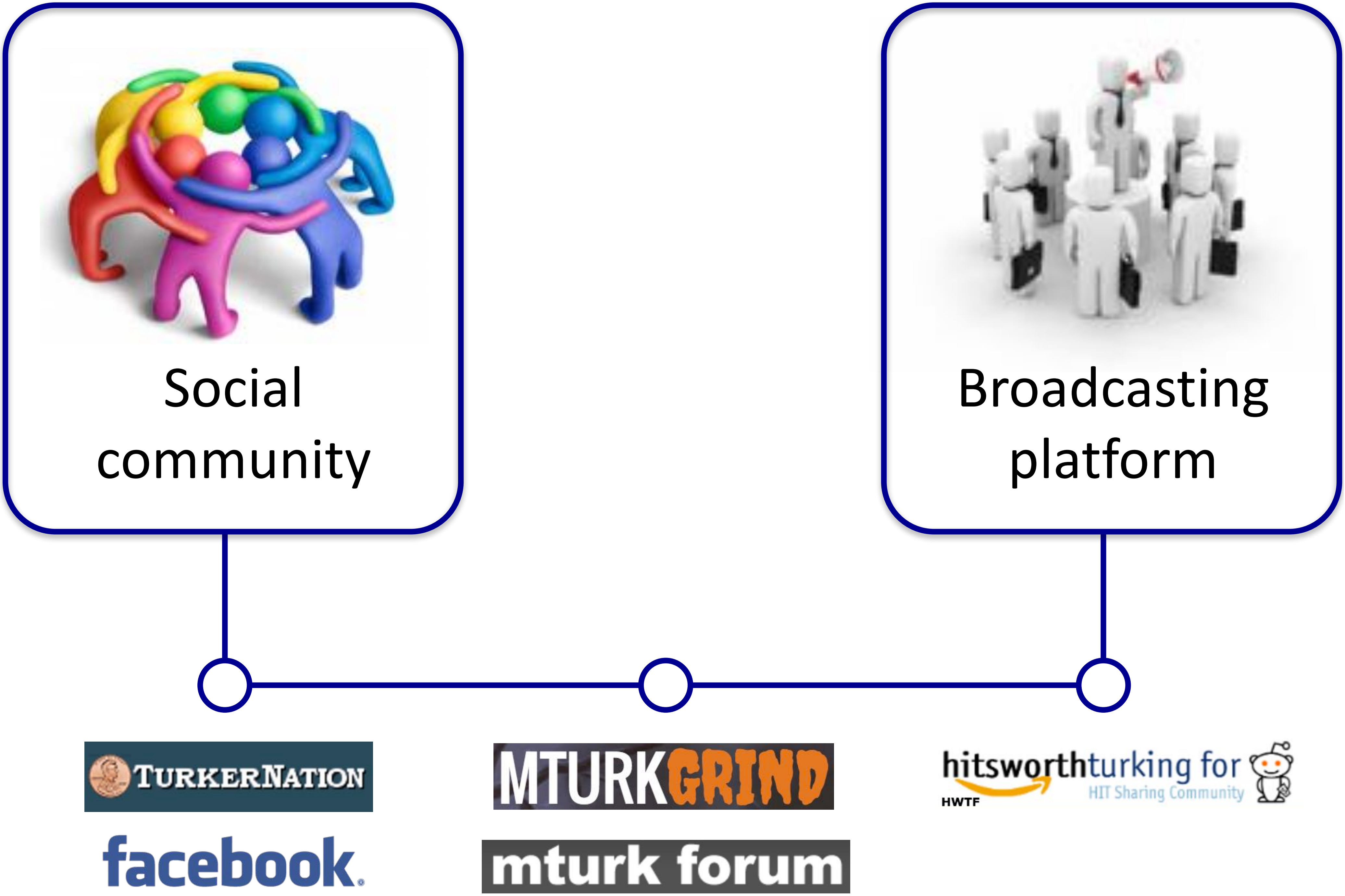
# Subcommunities Are Different

Topological Structure: How tightly connected is each subcommunity?

Temporal Dynamics: Do relationships endure over time?

Communication Content: Is communication social or strictly business?

[Yin et al., 2016]



Social community

Broadcasting platform

# Measures of Success

| Property | Connected | Unconnected |
|---|---|---|
| Be active > 1 year | 55% | 46% |
| Use forums | 83% | 56% |
| Master | 11% | 7% |
| Approval rate | 98.6% | 97.4% |

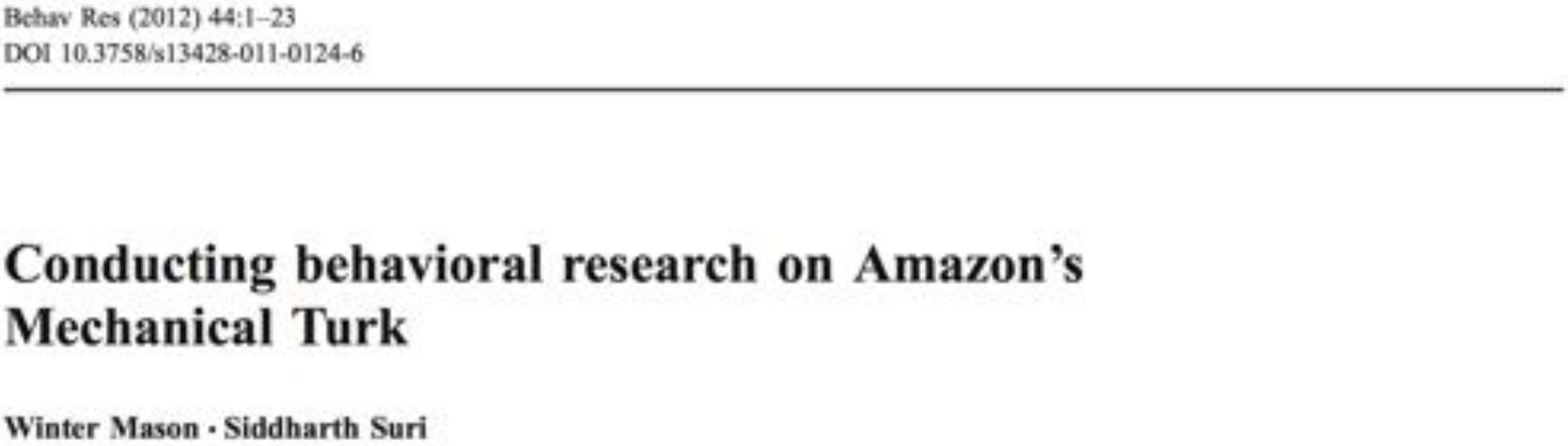
Connected workers were also more likely than unconnected workers to find our task early.

[Yin et al., 2016]

# Takeaways and Related Best Practices

- Forum usage is widespread. Forums are the virtual “water coolers” of crowdworkers.
- Engage with workers on forums. Introduce yourself. Introduce your tasks.
- Actively monitor forum discussion about your task. When appropriate, request that workers do not discuss your task. Monitor anyway.
- Be careful about assuming independence!

# Additional Best Practices



Behav Res (2012) 44:1–23
DOI 10.3758/s13428-011-0124-6

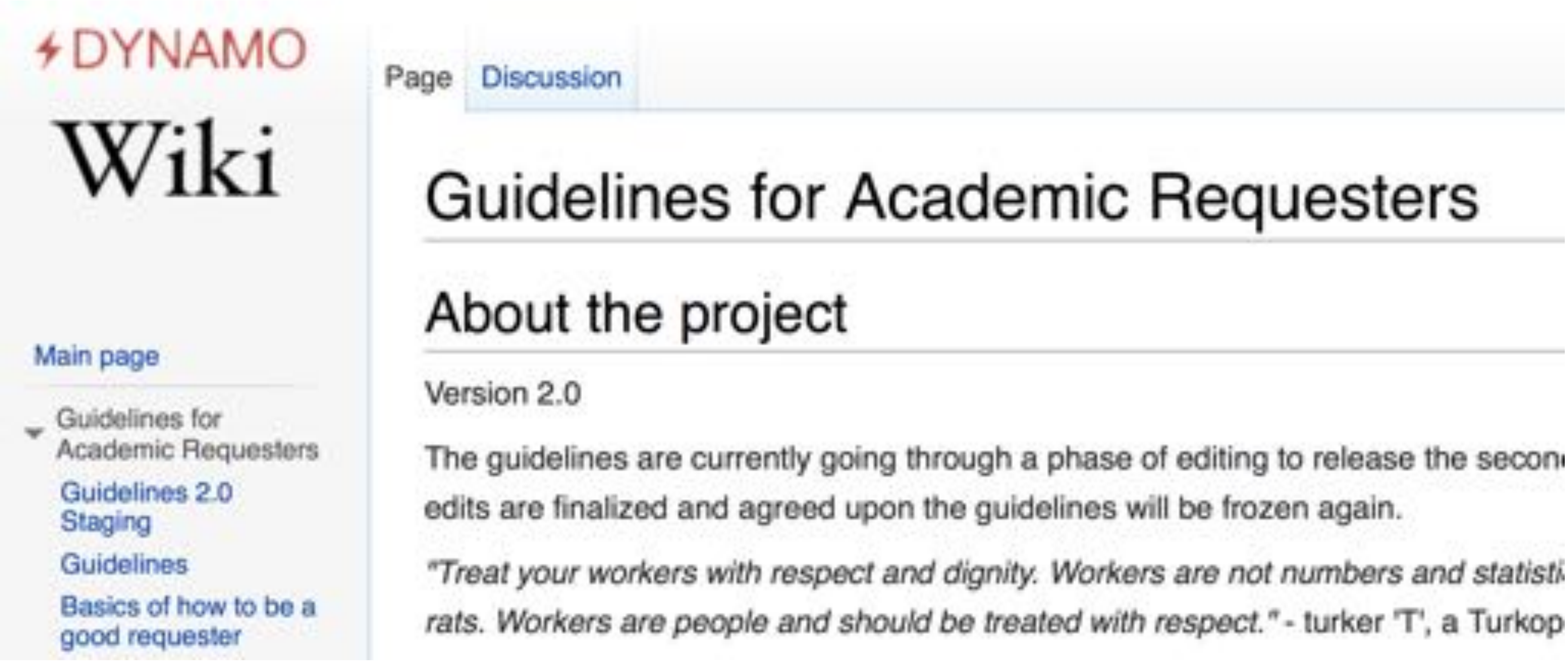
# Conducting behavioral research on Amazon's Mechanical Turk

Winter Mason · Siddharth Suri

# Maintain Good Relationships with Workers

- Set aside time to actively monitor your requester email account and respond to questions.
- Approve work quickly.
- Avoid rejecting work except in the most extreme of circumstances.
- Strive to be an ethical requester.

# http://guidelines.wearedynamo.org



DYNAMO
Wiki
Main page
Guidelines for Academic Requesters
Guidelines 2.0 Staging
Guidelines
Basics of how to be a good requester
Page
Discussion

## Guidelines for Academic Requesters

## About the project

Version 2.0

The guidelines are currently going through a phase of editing to release the secon
edits are finalized and agreed upon the guidelines will be frozen again.

*"Treat your workers with respect and dignity. Workers are not numbers and statisti
rats. Workers are people and should be treated with respect."* - turker 'T', a Turkop

# Tips to Make Your Project Run Smoothly

- Pilot, pilot, pilot! Test your task on your collaborators, other colleagues, and eventually small batches of workers.
- Iterate as many times as needed.

**If you remember one slide from this talk, remember this!**

# Tips to Make Your Project Run Smoothly

- Create clear instructions. Include quiz questions if needed. Pilot them and collect feedback.

- Create an attractive and easy-to-use interface. Pilot this too!

- Ask workers for feedback. Ask them to report bugs. Conduct exit surveys when appropriate. Workers generally want to help!

# Thanks...

To Chien-Ju Ho, Andrew Mao, Joelle Pineau, Sid Suri, Hanna Wallach, and especially Ming Yin for extensive discussions and feedback

To Dan Goldstein, Chien-Ju Ho, Jake Hofman, Roozbeh Mottaghi, Sid Suri, Jaime Teevan, Ming Yin, Haoqi Zhang, and all of their collaborators for the use of material from their slides

And to all the people who sent me pointers to cool research... this tutorial was a crowdsourced effort!

Extensive notes, slides, and eventually video at

http://www.jennwv.com/projects/crowdtutorial.html

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