# 米国におけるクラウドソーシング研究の動向

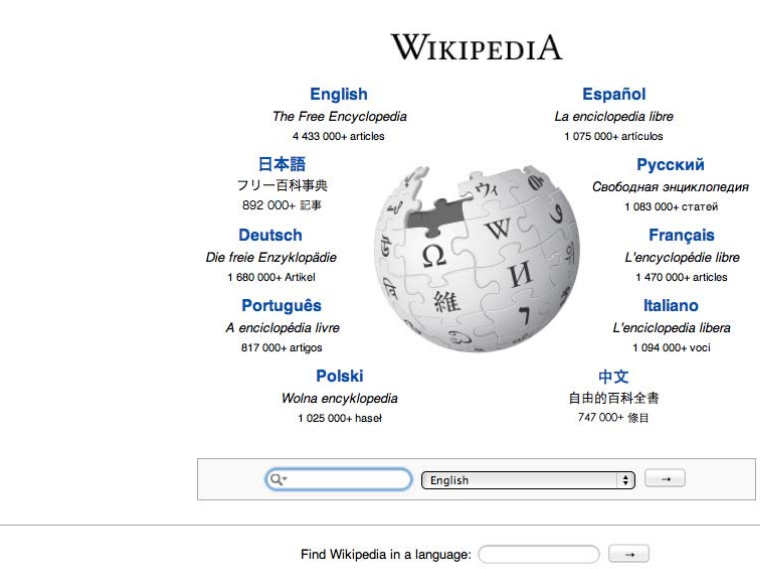
**Trends in Crowdsourcing Research in the United States**

坂本康昭
スティーブンス工科大学

## Overview

| | |
|---|---|
| What is crowdsourcing? | - Definition<br>- Related terms<br>- Dimensions<br>- Goal |
| How does crowdsourcing work? | - Breaking down tasks<br>- Motivating participation<br>- Balancing quality and speed<br>- Amazon Mechanical Turk |
| What are best practices? | - Games with a purpose<br>- Challenge<br>- Crowdsourced science<br>- Combination and refinement |
| What is next? | - Improving the quality of output<br>- Improving the speed<br>- Research Directions<br>- References |

## What is crowdsourcing?



reCAPTCHA

- WHAT IS reCAPTCHA
- GET reCAPTCHA
- PROTECT YOUR EMAIL
- MY ACCOUNT
- RESOURCES: DOCS & PLUGINS

**reCAPTCHA IS A FREE ANTI-BOT SERVICE THAT HELPS DIGITIZE BOOKS.**

steamboat train, from New
this morning ran off the tra
New-London. Four cars plunge


- LEARN HOW reCAPTCHA WORKS

USE reCAPTCHA ON YOUR SITE

- STRONG SECURITY
- ACCESSIBLE TO BLIND USERS
- 30+ MILLION SERVED DAILY

NEW See how accurate reCAPTCHA is at digitizing content!

Blog | About Us | Contact | FAQs | Terms



# Soylent

## A Word Processor with a Crowd Inside

Soylent is a crowd-powered interface: one that embeds workers from Mechanical Turk into Microsoft Word.


Join the Beta

Today's user interfaces are limited: they only support tasks when we know how to write matching algorithms or interface designs. Microsoft Word is good at laying out your document, but poor at understanding writing and suggesting edits to it. But, it is now feasible to embed on-demand human computation within interactive systems. Crowd workers on services like Amazon Mechanical Turk will do tasks for very small amounts of money. **Soylent** is a word processor with a crowd inside: an add-in to Microsoft Word that uses crowd contributions to perform interactive document shortening, proofreading, and human-language macros. Underlying Soylent is a new programming design pattern called **Find-Fix-Verify** that splits tasks into a series of generation and review stages to control costs and increase quality.

Bernstein, M., Little, G., Miller, R.C., Hartmann, B., Ackerman, M., Karger, D.R., Crowell, D., and Panovich, K. **Soylent: A Word Processor with a Crowd Inside.** In Proc. UIST 2010. ACM Press. **Best Student Paper award.**

Soylent is available open-source under the MIT license, and is hosted on Google Code. Contact us at soylent@csail.mit.edu.

# Crowd Research

http://crowdresearch.org

Welcome to CrowdResearch.org, a place for researchers studying crowdsourcing, human computation, and collective intelligence. The goal of this site is to bring together people from different disciplines and perspectives, sharing ideas, techniques, and results.

### Blog

Follow the Crowd tracks active research in the area: recently-published work, soon-to-be-published work, and experiments and ideas that are still work in progress. Follow it today!

### Conferences and Workshops

CrowdCamp: a CSCW 2013 Workshop (February 23 & 24, 2013)

CrowdCamp: a CHI 2012 Workshop (May 5 & 6, 2012)

CHI 2011 Workshop on Crowdsourcing and Human Computation (May 8, 2011)

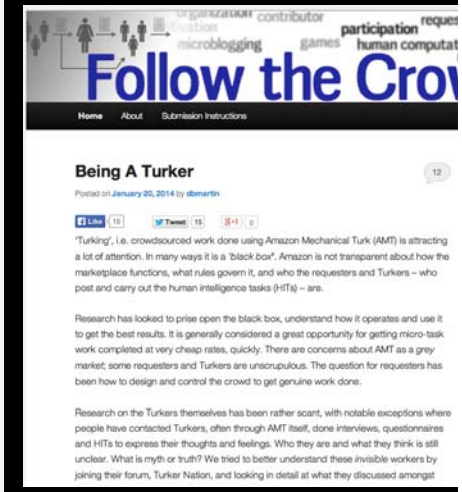
HCOMP 2011 (August 8, 2011)

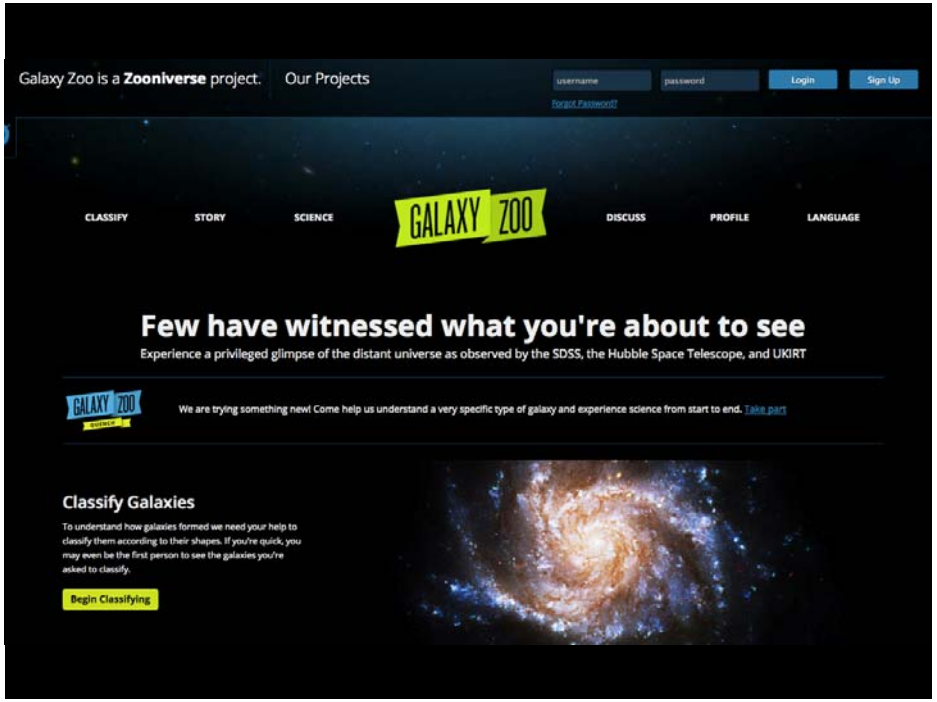
ACIS 2011 Crowdsourcing, Value Co-Creation, and Innovation in the Digital Economy Track (November 30-December 2, 2011)

### Editorial Committee

This site is brought to you by:

Michael Bernstein (MIT)
Ed H. Chi (Google)
Lydia Chilton (UW)
Björn Hartmann (UC Berkeley)
Niki Kittur (CMU)
Rob Miller (MIT)



# PhotoCity

*Capture the world, one photo at a time*

Sign In | Register

MAP | FORUM | HOW TO PLAY | CREDITS

PhotoCity is a **game** played **outdoors**, with **any camera**, even a cell-phone camera. By taking photos of buildings around your **city** or **school campus**, you can *earn points*, *capture flags*, and virtually *own your favorite buildings*, all while contributing to a **large-scale 3D reconstruction**!

More officially, PhotoCity is a product of collaboration between the University of Washington Department of Computer Science and Engineering and the Cornell Department of Computer Science. The game uses our state-of-the-art 3D reconstruction algorithms to build 3D models. Our ultimate goal is to reconstruct the entire world, one photo at a time. The project has been made possible by generous grants from Intel Corporation and Google.

## PhotoCity is Offline

**In the mean time, check out what we've accomplished!**

- Kathleen Tuite, Nadine Tabing, Dun-Yu Hsiao, Noah Snavely and Zoran Popović. *PhotoCity: training experts at large-scale image acquisition through a competitive game.* (CHI 2011)
- Kathleen Tuite, Noah Snavely, Dun-Yu Hsiao, Adam Smith and Zoran Popovic. *Reconstructing the World in 3D: Bringing Games with a Purpose Outdoors.* (Foundations of Digital Games 2010)
- **New York Times:** Computers Turn Flat Photos Into 3-D Buildings
- **UW Daily:** The world at your fingertips
- **UW University Week:** PhotoCity, virtual capture-the-flag, starting this week on UW campus
- **PhotoCity maps during height of empire** (UW, Cornell)

## New Game: PointCraft!!

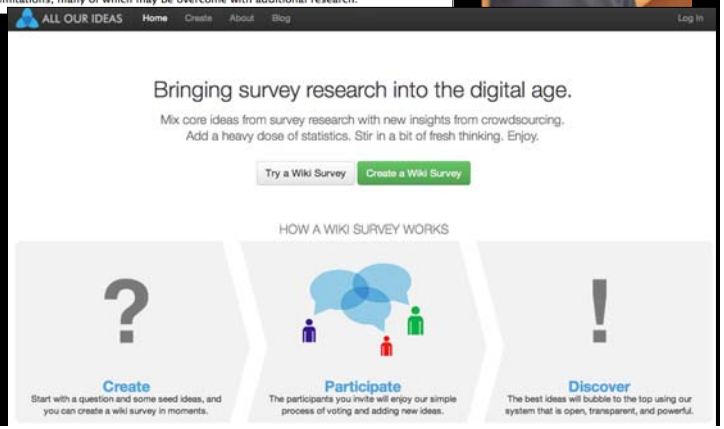
**Try it out now!**


## Wiki surveys: Open and quantifiable social data collection

Matthew J. Salganik, Karen E. C. Levy

*(Submitted on 2 Feb 2012)*

Research about attitudes and opinions is central to social science and relies on two common methodological approaches: surveys and interviews. While surveys enable the quantification of large amounts of information quickly and at a reasonable cost, they are routinely criticized for being "top-down" and rigid. In contrast, interviews allow unanticipated information to "bubble up" directly from respondents, but are slow, expensive, and difficult to quantify. Advances in computing technology now enable a hybrid approach that combines the quantifiability of a survey and the openness of an interview; we call this new class of data collection tools wiki surveys. Drawing on principles underlying successful information aggregation projects, such as Wikipedia, we propose three general criteria that wiki surveys should satisfy: they should be greedy, collaborative, and adaptive. We then present results from www.allourideas.org, a free and open-source website we created that enables groups all over the world to deploy wiki surveys. To date, about 1,500 wiki surveys have been created, and they have collected over 60,000 ideas and 2.5 million votes. We describe the methodological challenges involved in collecting and analyzing this type of data and present case studies of wiki surveys created by the New York City Mayor's Office and the Organisation for Economic Co-operation and Development (OECD). We conclude with a discussion of limitations, many of which may be overcome with additional research.




## Step 1: Create your website

Text of question for your visitors:

For example, "Which do you want more from the student government?"

## Step 2: Choose your URL

http://www.allourideas.org/ studentgovernment

## Step 3: Upload lots of ideas to seed the site

Upload lots of ideas here. You should put one per line. You can copy and paste from a list that you've already created. The maximum length of an idea is 140 characters.

Add your own ideas here...

For example:
More hammocks on campus
Improve student advising
More outdoor tables and benches
Video game tournaments
Start late dinner at 8PM
Lower textbook prices
Bring back parking for sophomores

planYC

Cast Votes | View Results | About this page

Users can view results here

This is a copy of a wiki survey that was used by New York City Mayor's Office. You can read more about the project here: http://bit.ly/planyc

**Which do you think is better for creating a greener, greater New York City?**

Develop plans to increase the number of school children who walk or bike to school.

Require restaurants to only fill water glasses when requested by customers.

Users can vote by clicking one of these options

Add your own idea here...

Users can add their own ideas here

planYC

Cast Votes | View Results | About this page

**Which do you think is better for creating a greener, greater New York City?**

| Ideas | Score (0 - 100) |
|---|---|
| Promote cycling by installing safe bike lanes | 69 |
| Invest in multiple modes of transportation and provide both improved infrastructure and improved safety | 68 |
| Promote the use of solar energy using the latest technology on all high-rise buildings. | 67 |
| Create a network of protected bike paths throughout the entire city | 66 |
| Continue enhancing bike lane network, to finally connect separated bike lane systems to each other across all five boroughs. | 66 |
| Create a database of all vacant land and make it available to the public | 65 |
| Implement a citywide bicycle-sharing system like the Velib in Paris or Capital Bikeshare in DC | 65 |
| Preserve natural areas and woodlands as natural parks | 64 |
| Introduce "Octopus" style Metrocards that work on MTA bus and subway, LIRR, MTA-North, bike share. | 63 |
| Add improvements to the bike lanes in the inner city. This will encourage exercise and reduce city's carbon footprint. | 63 |

« 1 2 3 4 5 6 7 8 9 ... 26 27 » View All

# Definition

Crowdsourcing is an…

Howe, 2006

…outsourcing of a function
to an undefined network of people
in the form of open call

Brabham, 2008

…online
distributed
problem-solving and production model

**Social-Computational Systems (SoCS)**

**PROGRAM SOLICITATION**
**NSF 09-559**

**National Science Foundation**

Directorate for Computer & Information Science & Engineering
Division of Information & Intelligent Systems
Division of Computer and Network Systems
Division of Computing and Communication Foundations

Directorate for Social, Behavioral & Economic Sciences
Division of Behavioral and Cognitive Sciences
Division of Social and Economic Sciences

**Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):

September 21, 2009

August 31, 2010

The Social-Computational Systems (SoCS) program seeks to reveal new understanding about the properties that systems of people and computers together possess, and to develop a practical understanding of the purposeful design of systems to facilitate *socially intelligent computing*. By better characterizing, understanding, and eventually designing for desired behaviors arising from computationally mediated groups of people at all scales, new forms of knowledge creation, new models of computation, new forms of culture, and new types of interaction will result. Further, the investigation of such systems and their emergent behaviors and desired properties will inform the design of future systems.

# Related Terms

**Crowdsourcing**
**Niche-sourcing**
**Open outsourcing**
**Electronic brainstorming**
**Open innovation**
**Human computation**
**Social computing**

## Dimensions

| Who | What | How | Why |
|---|---|---|---|
| Demographics<br><br>- age<br>- country | Nature of the task<br><br>- recognition<br>- generation | Workflow<br><br>- single step<br>- multiple steps | Motivation of requesters<br><br>- profit<br>- charity |
| Expertise<br><br>- novice<br>- expert | Output of the task<br><br>- label<br>- idea | Incentives<br><br>- prize<br>- payment | Motivation of workers<br><br>- money<br>- fun |

## Task

| Output | Routine (recognition) | Non-routine (generation) |
|---|---|---|
| Emergent (new) | Galaxy Zoo<br>Photocity | All Our Ideas |
| Aggregate (collection) | reCaptcha<br>Soylent | Wikipedia |

## Goal

**Collective intelligence by encouraging collective activity (making it easy and fun)**

| Human | Machine |
|---|---|
| Social | Computational |
| Social | Technological |

## How does crowdsourcing work?

# Breaking Down Tasks

| To determine how to break down and distribute the task, think about… | |
|---|---|
| …who | English speakers |
| …what | Creative ideas for cleaning oil spill |
| …how | Collect, evaluate, combine, evaluate |
| …why | Open innovation, reward |

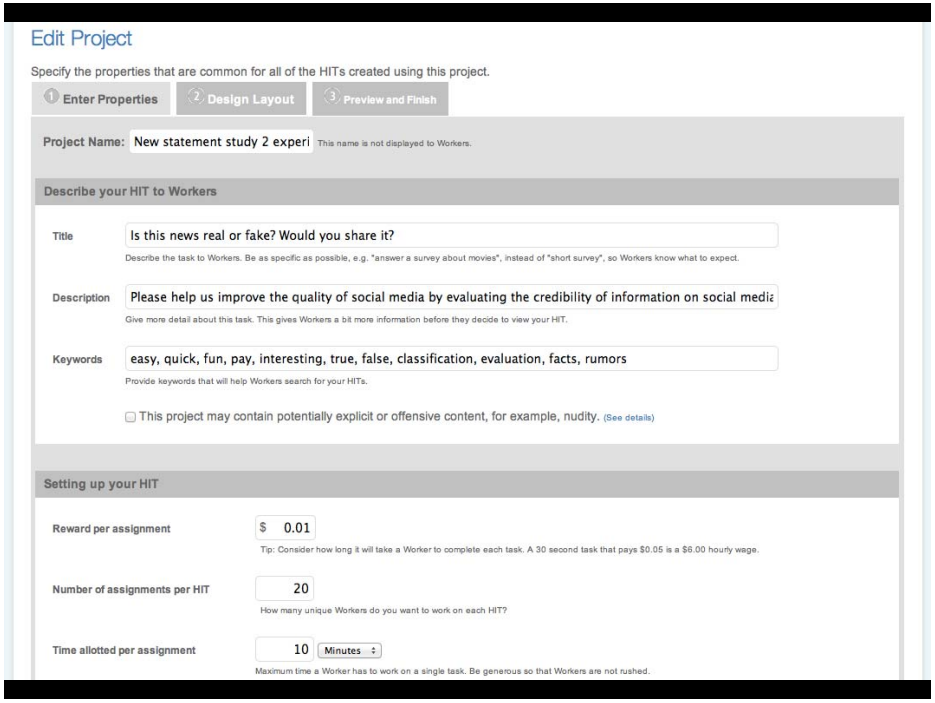
# Motivating Participation

| | |
|---|---|
| Easy | Create sub-tasks that are simple and clear |
| Fun | Convert the task into a game or a challenge |
| Rewarding | Give cash award and/or recognition to the winners |

# Balancing Quality and Speed

| | Routine | Non-routine |
|---|---|---|
| Quality | Insert questions to catch cheaters | Include training and test |
| Speed | Higher payment improves speed but not quality | High payment improves quality |

# Amazon Mechanical Turk



Edit Project

Specify the properties that are common for all of the HITs created using this project.

Project Name: New statement study 2 experi This name is not displayed to Workers.

Describe your HIT to Workers

Title: Is this news real or fake? Would you share it?

Describe the task to Workers. Be as specific as possible, e.g. "answer a survey about movies", instead of "short survey", so Workers know what to expect.

Description: Please help us improve the quality of social media by evaluating the credibility of information on social media

Give more detail about this task. This gives Workers a bit more information before they decide to view your HIT.

Keywords: easy, quick, fun, pay, interesting, true, false, classification, evaluation, facts, rumors

Provide keywords that will help Workers search for your HITs.

☐ This project may contain potentially explicit or offensive content, for example, nudity. (See details)

Setting up your HIT

Reward per assignment: $ 0.01

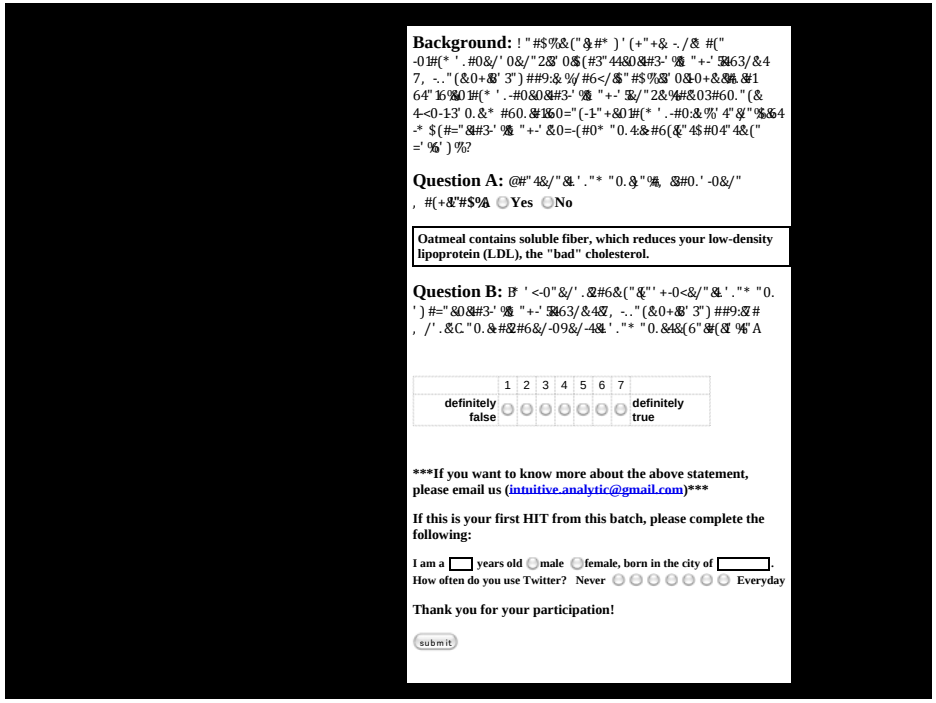
Tip: Consider how long it will take a Worker to complete each task. A 30 second task that pays $0.05 is a $6.00 hourly wage.

Number of assignments per HIT: 20

How many unique Workers do you want to work on each HIT?

Time allotted per assignment: 10 Minutes

Maximum time a Worker has to work on a single task. Be generous so that Workers are not rushed.



**Background:** ! "#$%&("&#* )' (+"+& -./& #("
-01#(* '.#0&/' 0&/"2&3' 0&$(#3"44&0&4#3-' %& "+-' 5&463/&4
7, -.."(&0+&8' 3") ##9:& %/#6</&$"#$%&3' 0&1-0+&&%.&#1
64"16%&01#(* '.-#0&0&4#3-' %& "+-' 5&/"2&%#&03#60."(&
4-<0-1-3' 0.&* #60.&#1&0="(-1-"+&01#(* '.-#0:&%' 4"&"%$&64
-* $(#="&4#3-' %& "+-' &0=-(#0* "0.4:&#6(&"4$#04"4&("
=' %6' ) %?

**Question A:** @#"4&/"&4.'."* "0.&"%, &3#0.' -0&/"
, #(+&"#$%A ○ **Yes** ○ **No**

**Oatmeal contains soluble fiber, which reduces your low-density lipoprotein (LDL), the "bad" cholesterol.**

**Question B:** B* ' <-0"&/'.&2#6&("&"' +-0<&/"&4.'."* "0.
') #="&0&4#3-' %& "+-' 5&463/&4&7, -.."(&0+&8' 3") ##9:&7#
, /'.&C."0.&#&2#6&/-09&/-4&4.'."* "0.&4&(6"&#(&' %"A

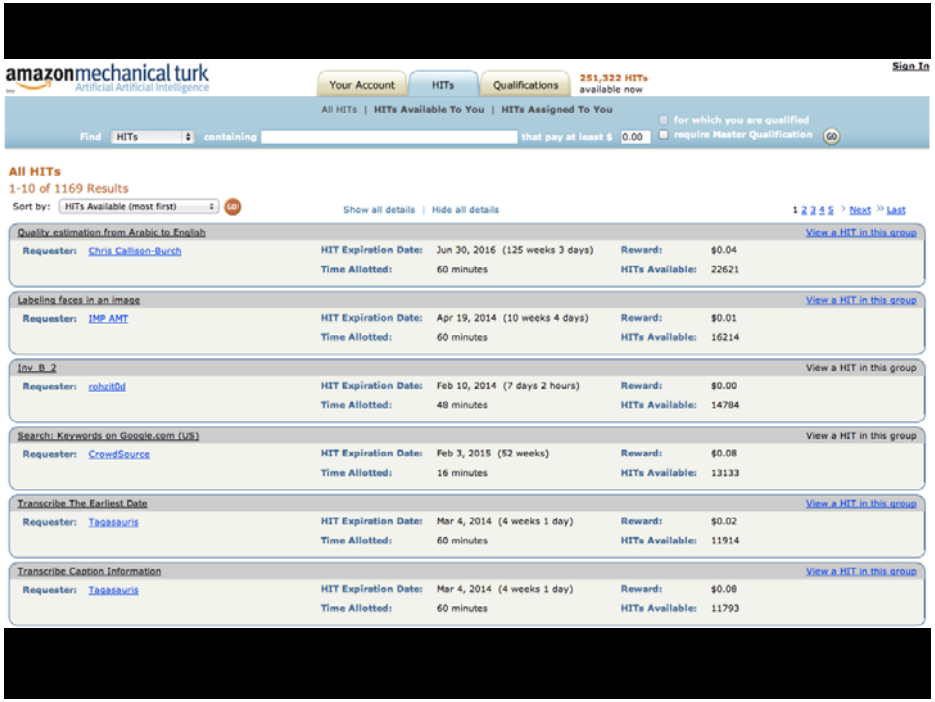
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| definitely false | ○ | ○ | ○ | ○ | ○ | ○ | ○ | definitely true |

*****If you want to know more about the above statement, please email us (intuitive.analytic@gmail.com)*****

**If this is your first HIT from this batch, please complete the following:**

**I am a ☐ years old ○male ○female, born in the city of ☐.**
**How often do you use Twitter? Never ○ ○ ○ ○ ○ ○ ○ Everyday**

**Thank you for your participation!**



251,322 HITs available now

All HITs | HITs Available To You | HITs Assigned To You

Find HITs containing that pay at least $ 0.00 ☐ for which you are qualified ☐ require Master Qualification GO

**All HITs**
1-10 of 1169 Results
Sort by: HITs Available (most first) GO!

Show all details | Hide all details

1 2 3 4 5 › Next » Last

Quality estimation from Arabic to English — View a HIT in this group
Requester: Chris Callison-Burch | HIT Expiration Date: Jun 30, 2016 (125 weeks 3 days) | Reward: $0.04
Time Allotted: 60 minutes | HITs Available: 22621

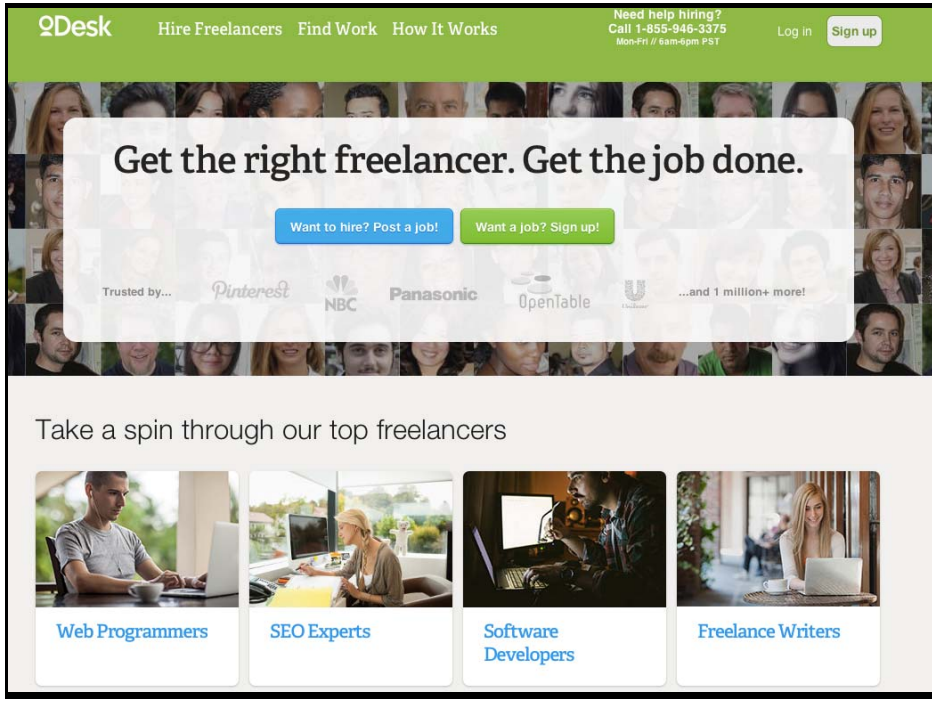
Labeling faces in an image — View a HIT in this group
Requester: IMP AMT | HIT Expiration Date: Apr 19, 2014 (10 weeks 4 days) | Reward: $0.01
Time Allotted: 60 minutes | HITs Available: 16214

Inv_B_2 — View a HIT in this group
Requester: rohzit0d | HIT Expiration Date: Feb 10, 2014 (7 days 2 hours) | Reward: $0.00
Time Allotted: 48 minutes | HITs Available: 14784

Search: Keywords on Google.com (US) — View a HIT in this group
Requester: CrowdSource | HIT Expiration Date: Feb 3, 2015 (52 weeks) | Reward: $0.08
Time Allotted: 16 minutes | HITs Available: 13133

Transcribe The Earliest Date — View a HIT in this group
Requester: Tagasauris | HIT Expiration Date: Mar 4, 2014 (4 weeks 1 day) | Reward: $0.02
Time Allotted: 60 minutes | HITs Available: 11914

Transcribe Caption Information — View a HIT in this group
Requester: Tagasauris | HIT Expiration Date: Mar 4, 2014 (4 weeks 1 day) | Reward: $0.08
Time Allotted: 60 minutes | HITs Available: 11793



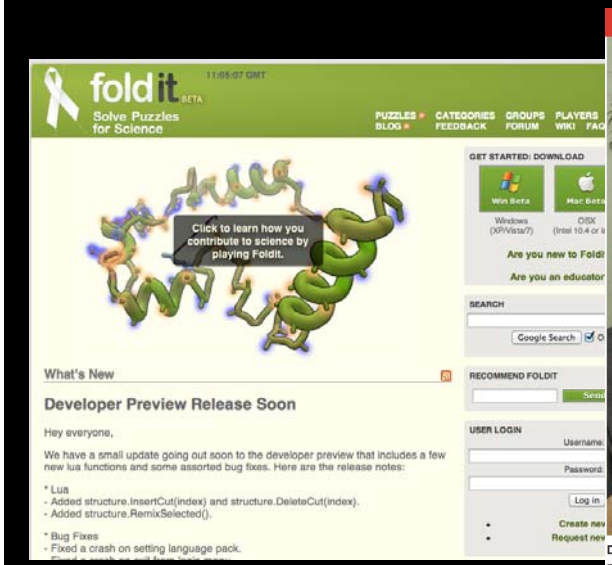
**What are best practices?**

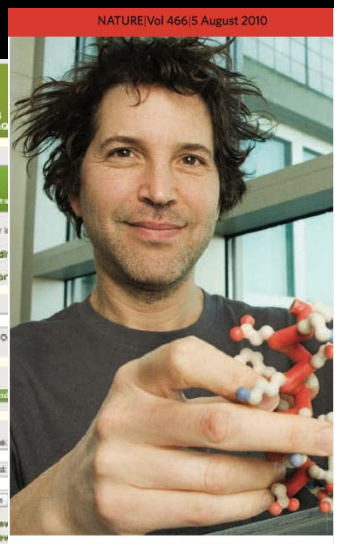
## Games with a Purpose


## Games with a Purpose


*Figure 1. Partners agreeing on an image in the* ESP Game. *Neither player can see the other's guesses.*

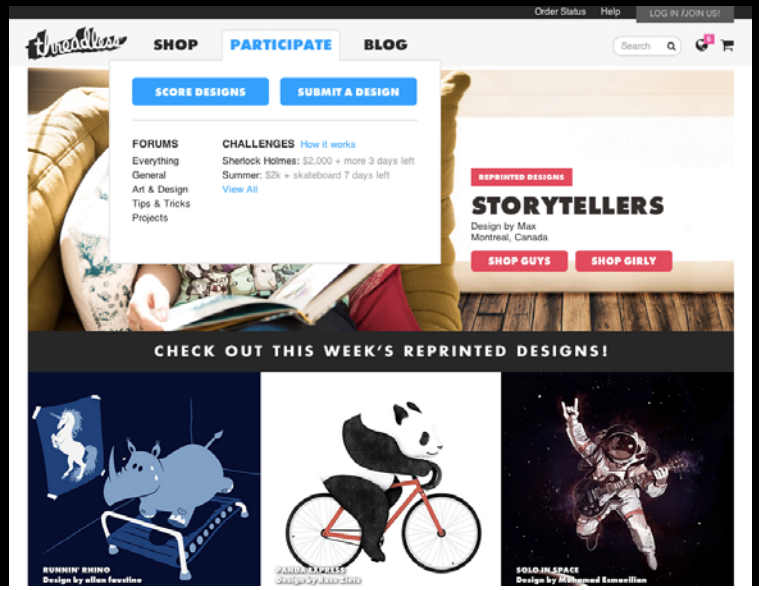
## Games with a Purpose



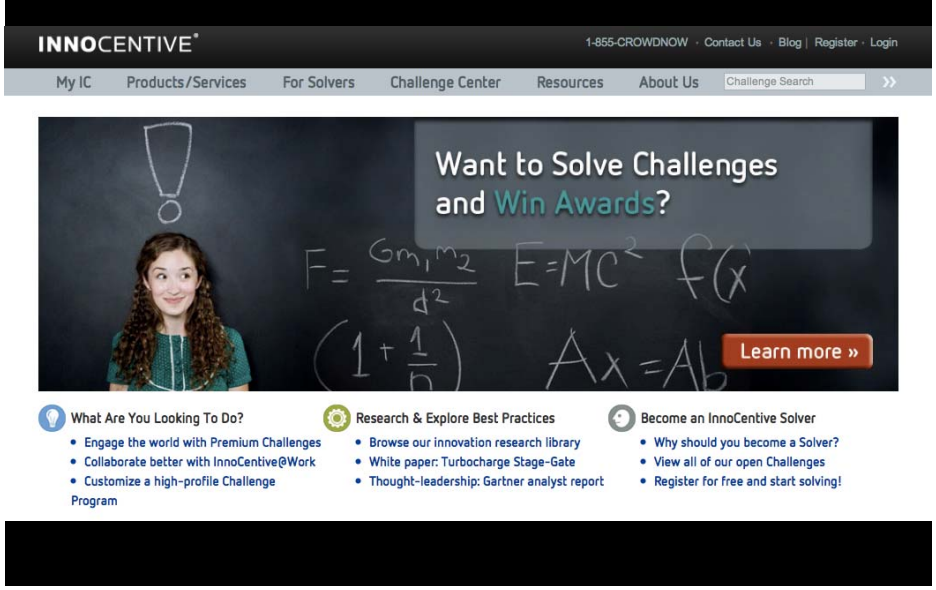




David Baker's online game Foldit uses the basic problem-solving skills of volunteers to help solve three-dimensional protein structures.

# Challenge

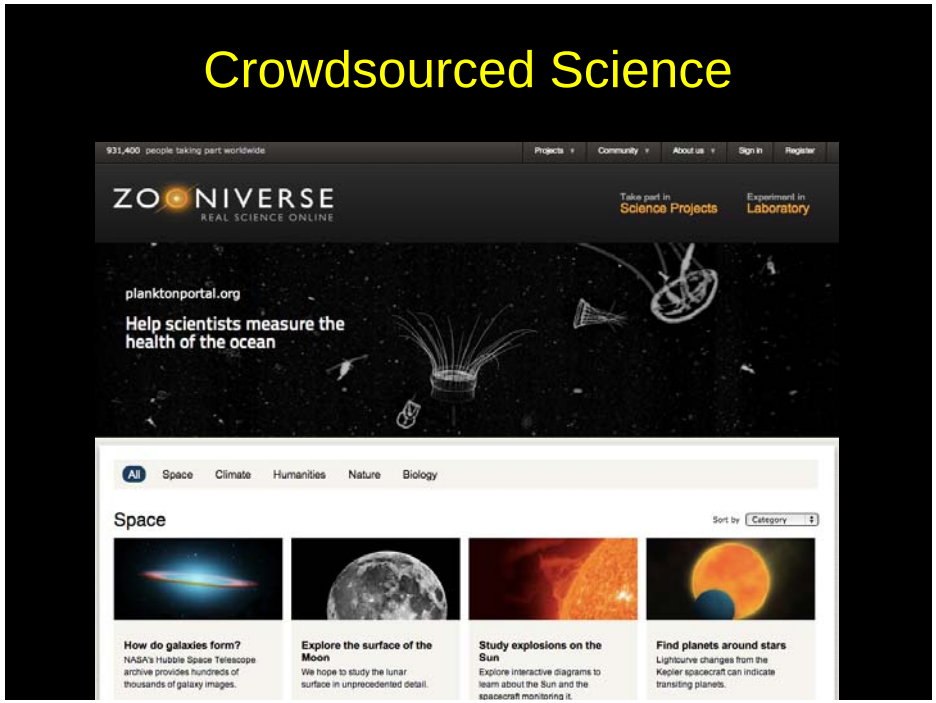



# Challenge



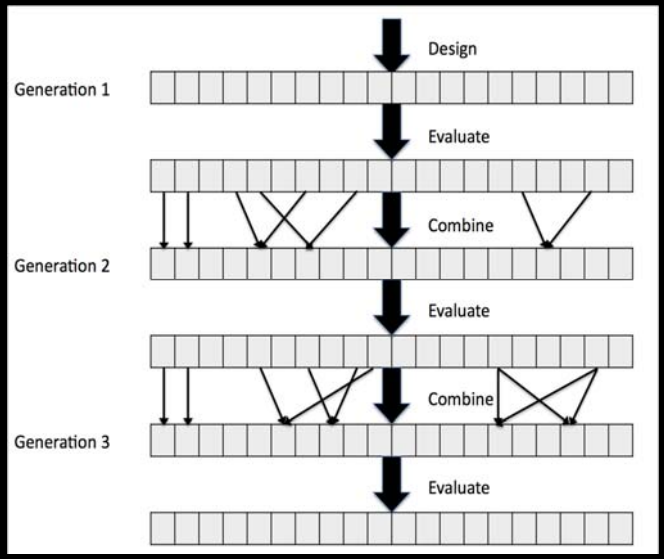

# Challenge


# Crowdsourced Science



| Output | Task: Routine (recognition) | Task: Non-routine (generation) |
|---|---|---|
| Emergent (new) | Galaxy Zoo<br>Photocity | Foldit<br>InnoCentive<br>Climate Colab<br>All Our Ideas<br>Threadless |
| Aggregate (collection) | reCaptcha<br>Soylent<br>ESP | Wikipedia |

# Combination and Refinement




# Combination and Refinement

*Please use the space below to share your creative and novel idea for stopping or cleaning an oil spill like the one in the Gulf of Mexico. Other workers on Mturk will vote for all ideas. We will pay a $2 bonus to players whose idea ranks in top three!*

Idea 1: Spilled oil should be skimmed as fast as possible. It's hard to do this using large ships as it is done today. One good solution would be to create robotic unmanned floating (or underwater) drones equipped with sensors that detect oil presence that could collect it and deposit in other, larger, floating autonomous storages. Such robot swarms that work in large teams could be deployed to skim the spilled oil as fast as possible.

Idea 2: I think that using a kind of absorbant fibers will help to stop an oils spill.

# Combination and Refinement

*Select one out of seven points representing how good each idea is:*

Spilled oil should be skimmed as fast as possible. It's hard to do this using large ships as it is done today. One good solution would be to create robotic unmanned floating (or underwater) drones equipped with sensors that detect oil presence that could collect it and deposit in other, larger, floating autonomous storages. Such robot swarms that work in large teams could be deployed to skim the spilled oil as fast as possible.

Very poor – 1 – 2 – 3 – 4 – 5 – 6 – 7 – Very good

# Combination and Refinement

*Please use the space below to combine two ideas for stopping or cleaning an oil spill like the one in the Gulf of Mexico. Other workers on Mturk will vote on all combined ideas. We will pay a $2 bonus to players whose combined idea ranks in top three!*

Idea 1: Spilled oil should be skimmed as fast as possible. It's hard to do this using large ships as it is done today. One good solution would be to create robotic unmanned floating (or underwater) drones equipped with sensors that detect oil presence that could collect it and deposit in other, larger, floating autonomous storages. Such robot swarms that work in large teams could be deployed to skim the spilled oil as fast as possible.

Idea 2: I think that using a kind of absorbant fibers will help to stop an oils spill.

Combined idea: Using absorbent fibers wrap around the robotic unmanned floating (or underwater) drones equipped with sensors that detect oil presence that could collect it and deposit in other, larger, floating autonomous storage.

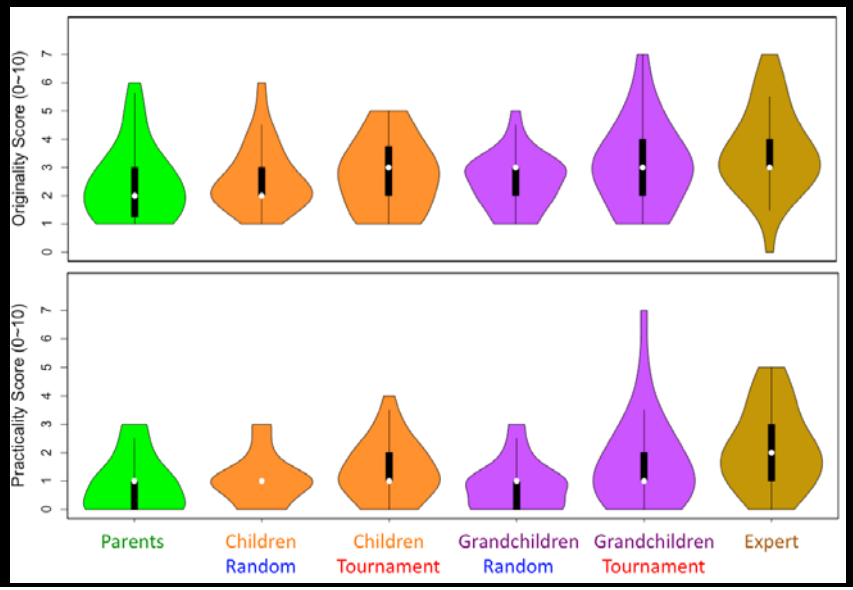
# Combination and Refinement

*Recently we collected 180 ideas for solving oil spill problems. One idea that was most novel and surprising received an originality award.*

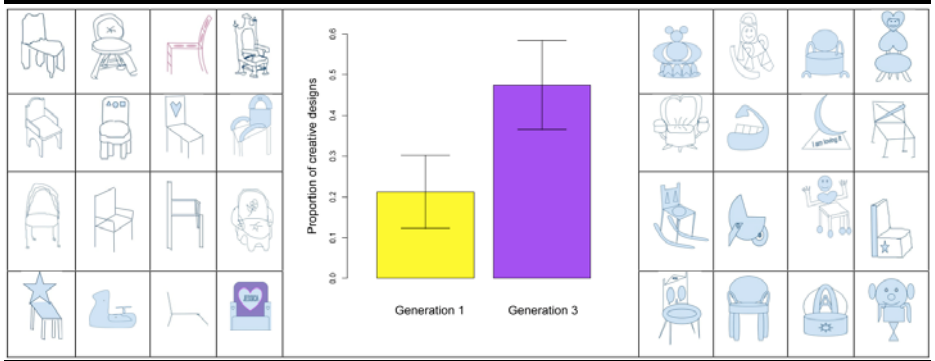
Using absorbent fibers wrap around the robotic unmanned floating (or underwater) drones equipped with sensors that detect oil presence that could collect it and deposit in other, larger, floating autonomous storage.

This idea is [ the winner = 1, not the winner = 0 ]

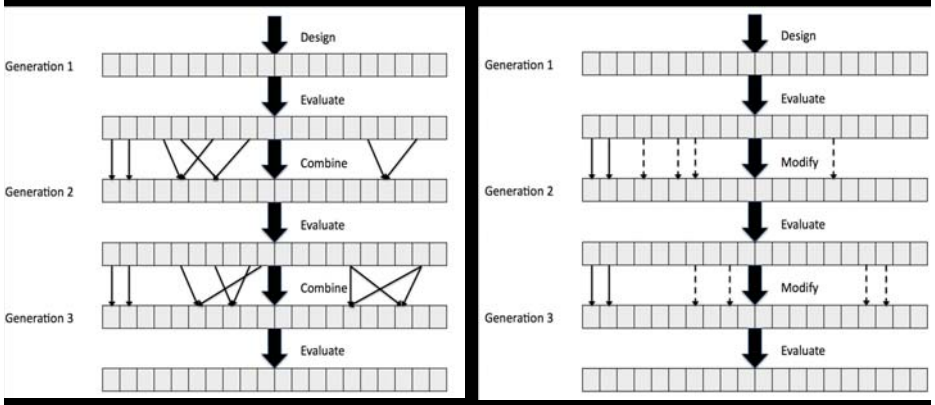
# Combination and Refinement



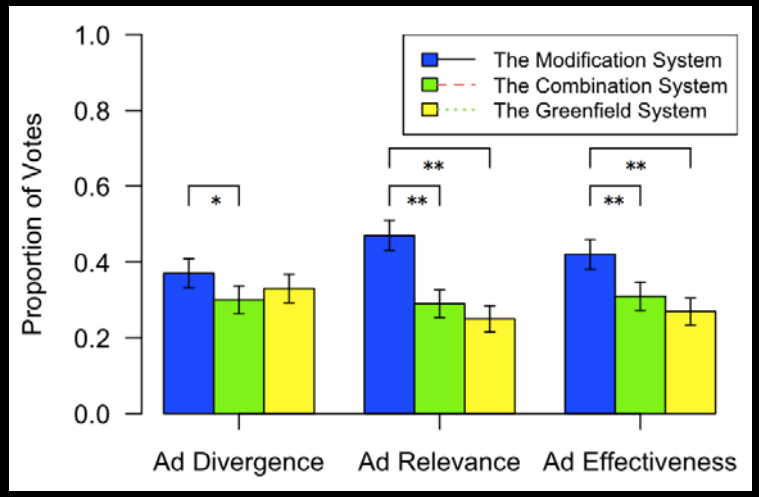

# Combination and Refinement



## Combination and Refinement




## Combination and Refinement




**What is next?**

## Improving the Quality of Output

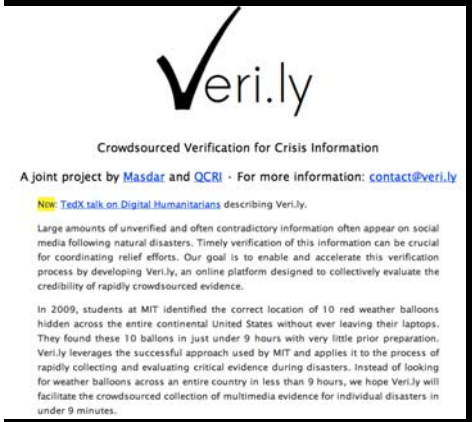
| | |
|---|---|
| Match task and crowd | Niche sourcing |
| Match task and goal | Predict winner to identify the best idea |
| Match process and output | Combine ideas for emergent output |
| Match incentive and motivation | Study the crowd |

# Improving the Quality of Output

| Connection through: | Example action |
|---|---|
| virtual proximity | Approach someone in a virtual world |
| an overall task | Guess the weight of an animal |
| seeing two examples | Combine |
| modifying another's work | Remix a computer program |
| being a member of a team | Collaborate with team members |
| focus on one example | Critique |
| playing a two-person game | Guess image labels |
| playing a many-person game | Solve NP-Complete problems |
| dyadic conversation | Recognize threats |
| discussion boards | Code software |

# Improving the Speed


# Improving the Speed





# Research Directions

| Non-routine task (creative problem solving) | |
|---|---|
| Niche | Study crowds, build community |
| Evaluation | Think about how to evaluate output |

| Routine task (also in general) | |
|---|---|
| Simple | Easy task and clean interface |
| Fast | Quick response and calculation |
| Available | App on a device carried everywhere |
| Habit | A required or an addictive task |
| Fun | Prize, game, and challenge |

# References


Adar, E. (2011). Why I hate Mechanical Turk research (and Workshops). CHI 2011 Workshop on Crowdsourcing and Human Computation: Systems, Studies, and Platforms.

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? Perspectives on Psychological Science, 6, 3-5.

Crump M. J. C., McDonnell J. V., and Gureckis T. M. (2013). Evaluating Amazon's Mechanical Turk as a tool for experimental behavioral research. PLoS ONE; 8: e57410.

Mason W and Suri S. (2011). A Guide to Behavioral Experiments on Mechanical Turk. Behavior Research Methods 2011; 44: 1-23.

Mason W. and Watts DJ. (2009). Financial incentives and the 'performance of crowds.' In: Proceedings of *HCOMP*, pp. 77-85.

Paolacci, G., Chandler, J., & Ipeirotis, P. G. (2010). Running experiments on Amazon Mechanical Turk. Judgment and Decision Making, 5, 411-419.

Sun, Y., Wang, N., & Peng, Z. (2011). Working for one penny: Understanding why people would like to participate in online tasks with low payment. Computers in Human Behavior, 27, 1033-1041.

Ross, J., Zaldivar, A., Irani, L., Tomlinson, B., Silberman, M. S. (2010). Who are the crowdworkers? Shifting demographics in Mechanical Turk. In Proceedings of CHI.



Galton, F. (1907). Vox Populi. Nature. pp. 450-451.

Surowiecki, J. (2004). The wisdom of crowds: Why the many are smarter and how collective wisdom shapes business, economies, societies, and nations. New York: Random House.

Howe, J. (2006). The rise of crowdsourcing. Wired magazine, 14(6), 1-4.

Von Ahn, L. and Dabbish, L. (2008). Designing games with a purpose. Communications of the ACM. 51, 8, pp. 58-67. ACM.

Howe, J. (2009). Crowdsourcing: Why the power of the crowd is driving the future of business. Three Rivers Pr.

Malone, T. W., Laubacher, R., and Dellarocas, C. (2010). Harnessing crowds: Mapping the genome of collective intelligence. MIT Sloan School Working Paper 4732-09.

Kittur, A. (2010). Crowdsourcing, collaboration and creativity. XRDS: Crossroads.

Quinn, A. J. and Bederson, B. B. (2011). Human Computation: A Survey and Taxonomy of a Growing Field. CHI. ACM Press.

Sakamoto, Y., & Bao, J. (2011). Testing tournament selection in creative problem solving using crowds. ICIS 2011.

Sakamoto, Y., Tanaka, Y., Yu, L., & Nickerson, J. V. (2011). The crowdsourcing design space. Human Computer Interaction International, Lecture Notes in Computer Science. Springer.

Nickerson, J. V., Sakamoto, Y., & Yu, L. (2011). Structures for creativity: The crowdsourcing of design. CHI 2011 Workshop on Crowdsourcing and Human Computation.

Yu, L., Nickerson, J. V., & Sakamoto, Y. (2012). Collective creativity: Where we are and where we might go. Collective Intelligence conference.

Aniket Kittur, Jeffrey V. Nickerson, Michael S. Bernstein, Elizabeth M. Gerber, Aaron Shaw, John Zimmerman, Matthew Lease, and John J. Horton (2013). The Future of Crowd Work. CSCW: ACM Conference on Computer-Supported Cooperative Work 2013.

Rajan Vaish, Keith Wyngarden, Jingshu Chen, Brandon Cheung, Michael Bernstein (2014). Twitch Crowdsourcing: Crowd Contributions in Short Bursts of Time. CHI: ACM Conference on Human Factors in Computing Systems 2014

Ren, J., Nickerson, J. V., Mason, W., Sakamoto, Y. and Graber, B. (2014). Increasing the Crowd's Capacity to Create: How Alternative Generation Affects the Diversity, Relevance and Effectiveness of Generated Ads. Decision Support Systems, special issue on "Social Decision Making and Crowdsourcing."


# Thank You