A classic example of the wisdom of crowds is the “Ask the Audience” lifeline on the show Who Wants to Be a Millionaire. According to Regis Philbin, who hosted the show, the crowd was correct about 95% of the time.
Announcements

Busy times!

Assignment 3 questions are due Friday night; remixes due next Tuesday night; votes due next Friday night

Project milestone due a week from Tuesday

No reading response due next week — present your milestones in section
Last time

Crowdsourcing: an open call to a large group of people who self-select to participate

Crowds can be surprisingly intelligent, if opinions are levied with some expertise and without communication, then aggregated intelligently.

Design differently for intrinsically and extrinsically motivated crowds

Vandalism—much like other anti-social behavior—is rare, but can happen
Last time

Parallel, independent contributions

But, this only works if the goal can be subdivided into modular components with few or no interdependencies.

Think filling out rows of a spreadsheet or taking argmax
Today

Interdependent, integrated contributions

Think invention, engineering, or game design.
How?

There are fundamental differences between parallel and interdependent contribution structures.

We can't just make a movie or build Linux with parallel contributions.
Johnny Cash Project: crowdsourced music video
One frame per participant — beautiful, slightly anarchic
Star Wars Uncut: crowdsourced movie remake, 2hr long
One scene per participant — style whiplash
How?

If we can’t do it with parallel contributions, how do we create complex outcomes with distributed online collaborations?

Topics:

- Peer production
- Workflows
- Convergence and coordinated adaptation
Peer production
Get the browser that protects what’s important

No shady privacy policies or back doors for advertisers. Just a lightning fast browser that doesn't sell you out.

Download Firefox
What is peer production?

Crowdsourcing: making an open call to a large set of individuals who self-select into tasks

Peer production includes additional requirements… [Benkler 2002]

- Decentralized conception: many control the direction and outcome, not a traditional bureaucracy
- Diverse motivations: especially non-monetary incentives
- Results treated as a commons: the output is publicly available and generally non-rival (def: when I use it, it doesn’t reduce your ability to use it)
- No contracts: governance and work allocation isn’t handled through signed contracts
When does peer production work?

Benkler’s argument [2002] is that peer production outperforms traditional firms when there exists strong intrinsic motivation and work can be broken down into granular and easy-to-integrate tasks.
From before

Imagine a 10x dropoff between levels

- Lurkers
- Likers
- Commenters
- Contributors
- Mods
Peer production: wiki

Contribution opportunities must be available at every level

- Admins
- Editors
- Writers
- Error Fixers
- Readers
Peer production: OSS

Contribution opportunities must be available at every level.
Why do people do this?

The usefulness of the outcome to the contributor; hedonic pleasure of contributing (e.g., writing software); increased social capital, reputation, and status [von Hippel and von Krogh 2003, von Krogh et al. 2003, Benkler; Shaw and Hill 2015]

People self-select into communities that match their motivations [Glott et al. 2010, Ghosh and Prakash 2000; Belenzon and Schankerman 2008, Benkler; Shaw and Hill 2015]

Those extrinsically motivated by reputation and employment will contribute more to industry-sponsored projects

Those more intrinsically motivated contributed to free culture communities.
But does it really work?

**Pros**

Linus’s Law: “With enough eyes, all bugs are shallow” [Raymond 1999]

Wikipedia used to be disallowed as a citable source because it could not be trusted. But then:

**Cons**

Many efforts do not achieve critical mass needed for quality [Ghost Town lecture]

Peer production appears better at creating functional artifacts (e.g., code) than creative artifacts (e.g., movies) [Benkler 2006]

1.5B monthly Wikipedia views go to articles that would be higher quality if editors optimally distributed their work to meet reader demand. [Warncke-Wang et al. 2015]
And errors do occur...

node.js leftpad module incident

So given these tradeoffs, when would you opt for peer production over firm-based production, assuming you had moderate but not infinite funds? [2min]
Workflows
Iterative crowd algorithm

[Little et al. 2009]
Iterative crowd algorithm

[Little et al. 2009]

You (misspelled) (several) (words). Please spellcheck your work next time. I also notice a few grammatical mistakes. Overall your writing style is a bit too phoney. You do make some good (points), but they got lost amidst the (writing). (signature)
Automatic clustering generally helps separate different kinds of records that need to be edited differently, but it isn't perfect. Sometimes it creates more clusters than needed, because the differences in structure aren't important to the user's particular editing task. For example, if the user only needs to edit near the end of each line, then differences at the start of the line are largely irrelevant, and it isn't necessary to split based on those differences. Conversely, sometimes the clustering isn't fine enough, leaving heterogeneous clusters that must be edited one line at a time. One solution to this problem would be to let the user rearrange the clustering manually, perhaps using drag-and-drop to merge and split clusters. Clustering and selection generalization would also be improved by recognizing common text structure like URLs, filenames, email addresses, dates, times, etc.
Find-Fix-Verify

[Bernstein et al. 2010]

Find-Fix-Verify is a design pattern for open-ended tasks.

Find a problem

Fix the problem

Verify each fix

- Soylent is a prototype...
- Soylent is a prototypes...
- Soylent is a prototype test...
Find

“Identify at least one area that can be shortened without changing the meaning of the paragraph.”

Fix

“Edit the highlighted section to shorten its length without changing the meaning of the paragraph.”

Verify

“Choose at least one rewrite that has style errors, and at least one rewrite that changes the meaning of the sentence.”
“Choose at least one rewrite that has style errors, and at least one rewrite that changes the meaning of the sentence.”

Keep suggestions that do not get voted out
How might we enable crowds to achieve complex work such as writing short stories?

Unlike most crowdsourcing workflows, creative work requires tight interconnections between different parts of a story, and between the high-level goal and low-level text.

Reflect
choose a high-level goal

Revise
break into tasks and edit
The Hot Air Balloon

A young boy named Malcolm finds himself alone in a runaway hot air balloon and accidentally travels to a city in the sky.

Malcolm found himself fascinated by the balloon. He imagined what it would be like to fly to some exotic location, soaring above the clouds. He closed his eyes and saw himself flying through the clouds. "Hey you!" he heard a voice shout. "What are you doing in my balloon!" The operator yelled as he dropped his snack and ran toward the balloon. Malcolm, startled by the man stumbled. Trying not to fall he reached out and grabbed a rope hanging next to him. As he pulled it, it released the ballast and the balloon leapt into the air. Before he knew it he was rising up two feet in just a moment. Horrified, he looked down...
relief as he felt the balloon descend a bit. Then suddenly a great gust of wind took the balloon and sent it higher and higher. Fell to the floor, grabbing a lever on the way down that made the balloon rise even faster.

Answer the following questions about the story:

What did you like about the story above?
I like...

What do you wish you could change about the story above?
I wish...

Is the wish you wrote above mostly about the plot, the characters, or the writing? (select one)
Choose...

In one sentence, suggest something for the next revision of the story that could change to address your comments above.
Start your sentence with the words "What if...". Try to write something specific that fits the story.
What if...
The story above! Which change should be the main change for the next revision?

<table>
<thead>
<tr>
<th>Thought about what you wish you could change about the story. Which statement below do you agree with most?</th>
<th>Which new idea below do you think should be the main change for a revision of the story above?</th>
</tr>
</thead>
<tbody>
<tr>
<td>I wish there would be a bit more exposition at the beginning of the story. The events all start very quickly and it's easy to not understand what's going on.</td>
<td>What if instead of beginning so abruptly, we learned a little more about Malcolm first?</td>
</tr>
<tr>
<td>The order of the paragraphs. It jumped all over the place.</td>
<td>What if... We wrote a new story about hot air balloons and a mistaken escape?</td>
</tr>
<tr>
<td>I want to see more exciting things happen to Malcom in Cloud City, and I want to know about his return to the ground.</td>
<td>What if Malcom investigates the Cloud City and then tries to get home, maybe bringing along a friend from Cloud City.</td>
</tr>
</tbody>
</table>
When he woke up, he found himself staring at the glow of big, beautiful crystal-like glass buildings, shimmering in the brilliant sunshine. One was emerald green, another ruby red, still another sparkling like diamonds, others radiating spectacular colors he had never seen. He was a little scared, to be in an unfamiliar place, but he was mostly curious. He could sense that something interesting was going on in this city, and it could be something wonderful. Maybe there were helpful people down below? Perhaps he should take a little gander and see if he can get some help with the balloon.

He suddenly found himself staring at gargantuan glass buildings, their exteriors shimmering under the sun's rays. These buildings were like no others he'd seen before - one was emerald colored, another ruby red, and a third sparkling like a multifaceted diamond. This scenery was frightening, yet, he was curious. Something was going on in this city, and it could be something wonderful. Maybe there were helpful people down below? Perhaps he should take a little gander and see if he can get some help with the balloon.
Flash Teams

[Retelny et al., UIST ’14]

Computationally-guided teams of crowd experts supported by lightweight team structures.
Input: high-level script outline
Output: ~15 second animated movie
Our example:
44.40 hours
$2381.32
Of course, workflows cause issues… [Retelny et al. 2017]

Workflows are inflexible and can become games of telephone, where intent gets lost and errors can propagate over time.
Convergence and coordinated adaptation
Limits of algorithmic coordination

So far, goals such as invention, production, and engineering have remained largely out of reach [Kittur et al. 2013]

Why? [1 min]
Dominant architecture: algorithms

Modularize and pre-define all possible behaviors into workflows.

Computation decides which behaviors are taken, when, and by whom; optimizes, error-checks, and combines submissions.

[Kittur 2011]
[Little 2009; Little 2010]
[Dai and Weld 2010]
Limits of algorithmic coordination

Returning to the question: why have complex goals remained largely out of reach?

Open-ended, complex goals are fundamentally incompatible with a requirement to modularize and pre-define every behavior [Van de Ven, Delbecq, and Koenig 1976; Rittel and Webber 1973; Schön 1984]
With the Linux kernel […] we want to have a system which is as modular as possible. The open-source development model really requires this, because otherwise you can’t easily have people working in parallel.” [Torvalds 1999]

“Peer production is limited not by the total cost or complexity of a project, but by its modularity.” [Benkler 2002]

“With the Linux kernel […] we want to have a system which is as modular as possible. The open-source development model really requires this, because otherwise you can’t easily have people working in parallel.” [Torvalds 1999]
Interdependence and collective action remain challenging

The result: algorithmic, workflow-based architecture confines collaborations to goals so predictable that they can be entirely modularized and pre-defined.

But many valuable collective activities do not fit this criteria.
Why are these challenging?

**Convergence:** crowds are excellent at generating ideas and at spreading awareness, but it's much more challenging for them to build consensus toward a single action.
Convergence

The New York Times
Twitter Users Split on Boycott Over Platform’s Move Against Rose McGowan

VOGUE
CULTURE > OPINION
Why I’m Not Joining the Women Boycotting Twitter Today

The Washington Post
#WomenBoycottTwitter revives post-election conversations about the lack of solidarity among women

MADAMENOIRE
Black Women Commandeer #WomenBoycottTwitter And Turn It Into A Celebration Of Ourselves With #WOCAffirmation
Convergence

Lauren@AnimeBoston
@laureinispace

So let me get this straight: we're fed up with men silencing us, so we're going to just silence ourselves? #WomenBoycottTwitter

Danielle Henderson
@knottyarn

Big ups to those participating in #WomenBoycottTwitter but the foundation of my feminism is about NOT being silenced.

Elizabeth Minkel
@elizabethminkel

I think as a tool of economic activism, this thing was too slipshod to be effective—and that women of color are spot-on in their critiques.
Why are these challenging?

**Coordinated adaptation**: changing direction in sync with each other.

Crowds are excellent at executing pre-defined tasks, but it’s much more challenging for them to continually re-evaluate goals and adapt in sync.
Hybrid peer production

Why is it that many successful peer production projects form traditional organizations to support their efforts?

MongoDB: MongoDB, Inc.

Ubuntu: Canonical

In reality, peer production struggles with tasks that traditional contract-based firms achieve (e.g., marketing, keeping release schedules, integrated contributions). So, hybridized models often support the community.

Example: plugging a USB drive into a Ubuntu machine
Ratatouille TikTok musical

Seed idea

Structure

Divergence

Convergence

Required a focused team
Has your opinion changed?

When would you opt for peer production over firm-based production, assuming you had moderate but not infinite funds?

Which would you use if the goal were to:

- Write a lecture for CS 278?
- Redesign the requirements for your major?
- Decide on the future of Stanford neighborhoods?

[2min]
Exam

80 minute closed-book exam on paper on the Tuesday of Week 8

Questions sampled from the question bank of top ~10% questions from voting. Question bank posted in advance.

Roughly 1/4 Easy questions, 1/4 Medium questions, 1/4 Hard questions…

And 1/4 staff-written questions

Study groups OK, but no collaboration on or sharing notes or answers

Details on the website
Summary

Shifting from simple wisdom-of-the-crowd tasks requires much more than just a scaling up of ambition: it requires designing for interdependence.

Peer production — the term encompassing shared open work (e.g., Wikipedia, open source) is one powerful method for volunteer coordination. Workflows and algorithms offer another approach. Both have their issues.

Aiming higher means we will need to solve issues of convergence and coordinated adaptation.
References


References


References


Social Computing

CS 278 | Stanford University | Michael Bernstein

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