

Wisdom of Crowds examples

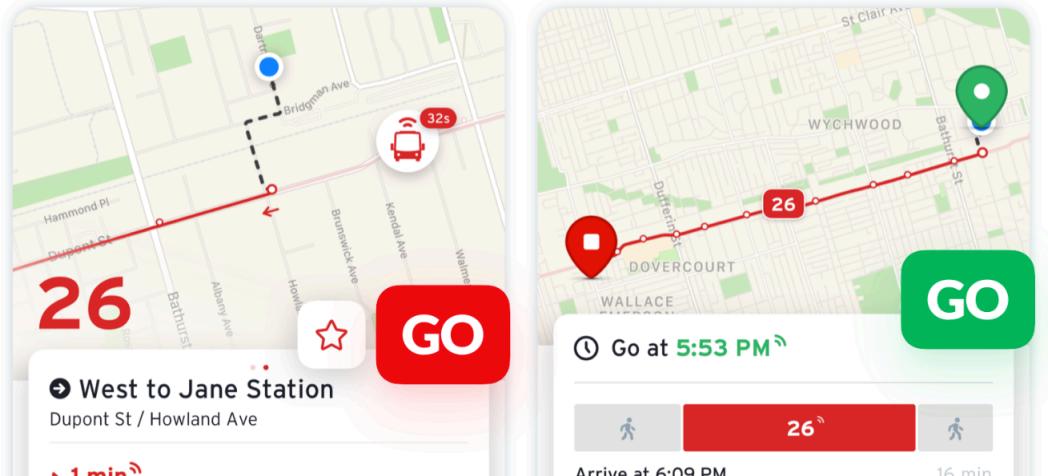
Attendance:



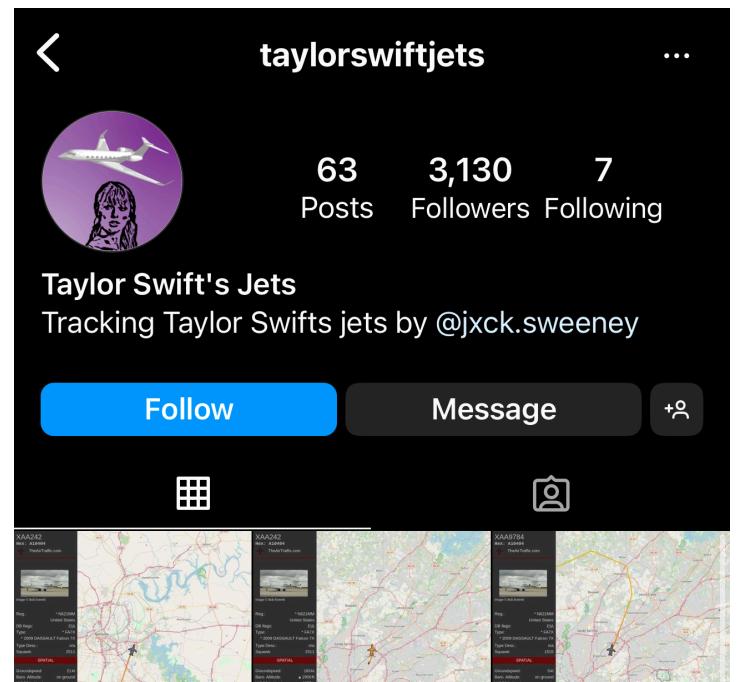
Mhar T: Crowdsourced bus timing report

What is Crowdsourcing?

When you use GO to guide you along your transit trip, you're also sharing the location of your bus with other Transit users to provide them with super-accurate vehicle tracking information.



Kyla G: crowdsourced airplane flight path tracking





Crowdsourcing and Peer Production

CS 278 | Stanford University | Michael Bernstein





Announcements

Busy times!

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

Project milestone due next Wednesday night

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

The screenshot shows the NASA Solve homepage. At the top, there's a navigation bar with the NASA logo, "NASA TV", a search bar, and a menu icon. Below the header, the text "NASA Solve" is displayed. The main content area features a large, bold heading "Welcome to NASA Solve!". Below it, a paragraph of text reads: "Interested in helping NASA solve tough problems? You are in the right place! This one-stop-shop website is where you'll find opportunities to participate in challenges, prize competitions, and citizen science activities that develop solutions for problems related to NASA's mission. So, jump in and become a NASA SOLVE-r!" On the left side of the main content area, there's a blue button labeled "TAP". To the right, there are icons for "Watch later" and "Share". The bottom half of the page features a large, stylized graphic of the word "SOLVE" in white. The letter "O" is replaced by a magnifying glass icon with a play button in the center, symbolizing problem-solving or searching.

Today

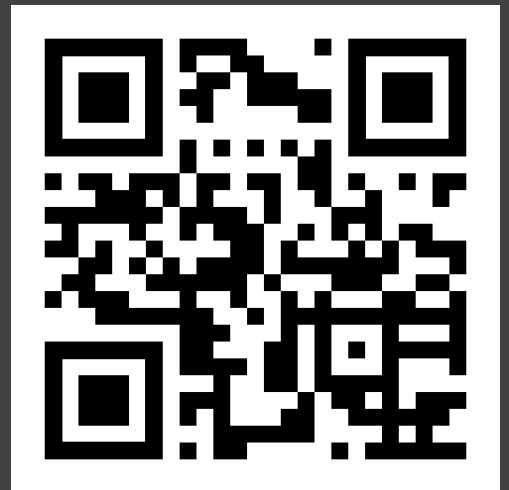
Interdependent, integrated contributions



Think invention, engineering,
or game design.



Let's try it:
collective note
taking at
<http://hci.st/notes>



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?

There are fundamental differences between parallel and interdependent contributions. We can't just make a movie or build Linux with parallel contributions.

So, how do we create complex outcomes with distributed online collaborations?

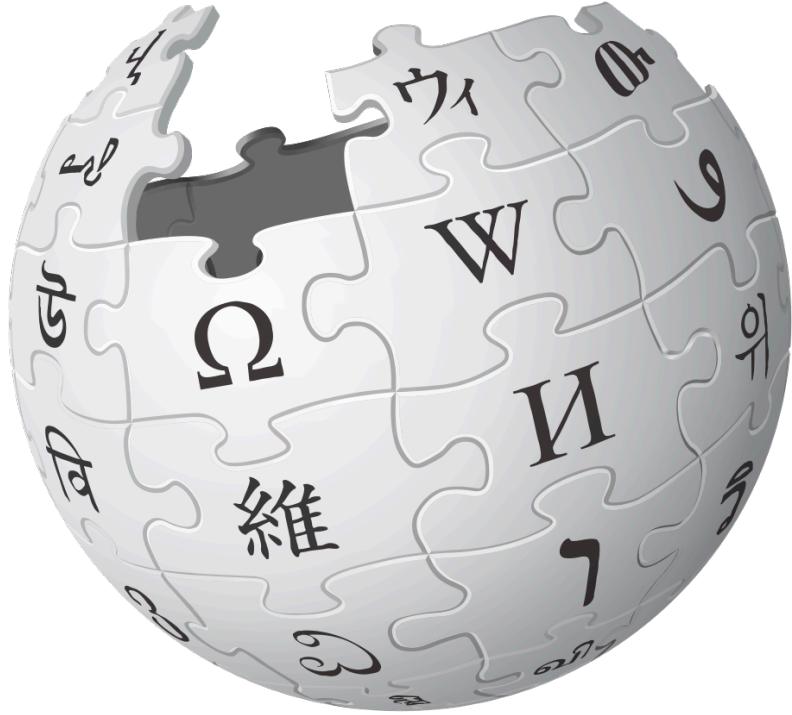
Topics:

Workflows

Peer production

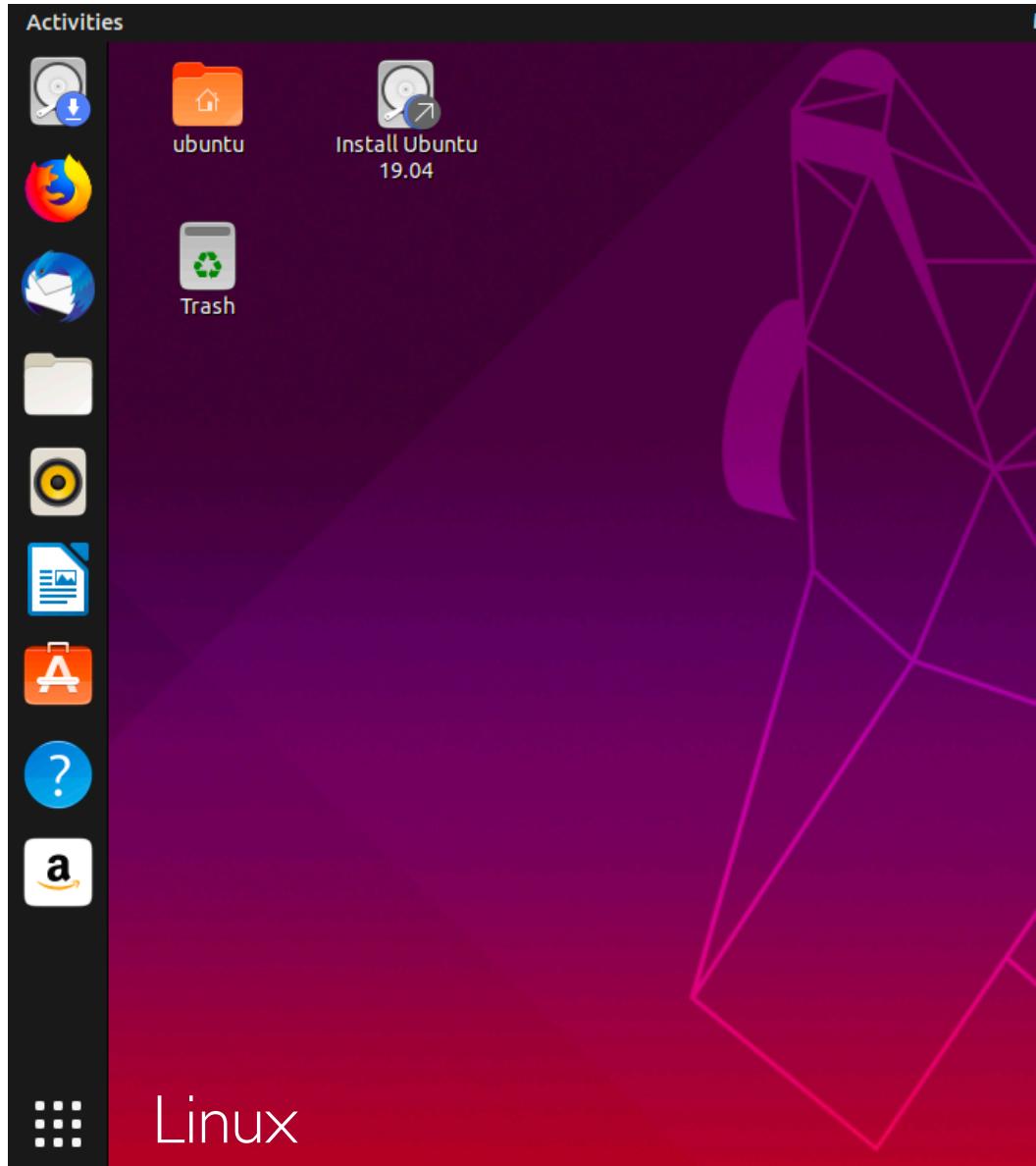
Convergence and coordinated adaptation

Peer production



WIKIPEDIA

The Free Encyclopedia



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 2009]

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)

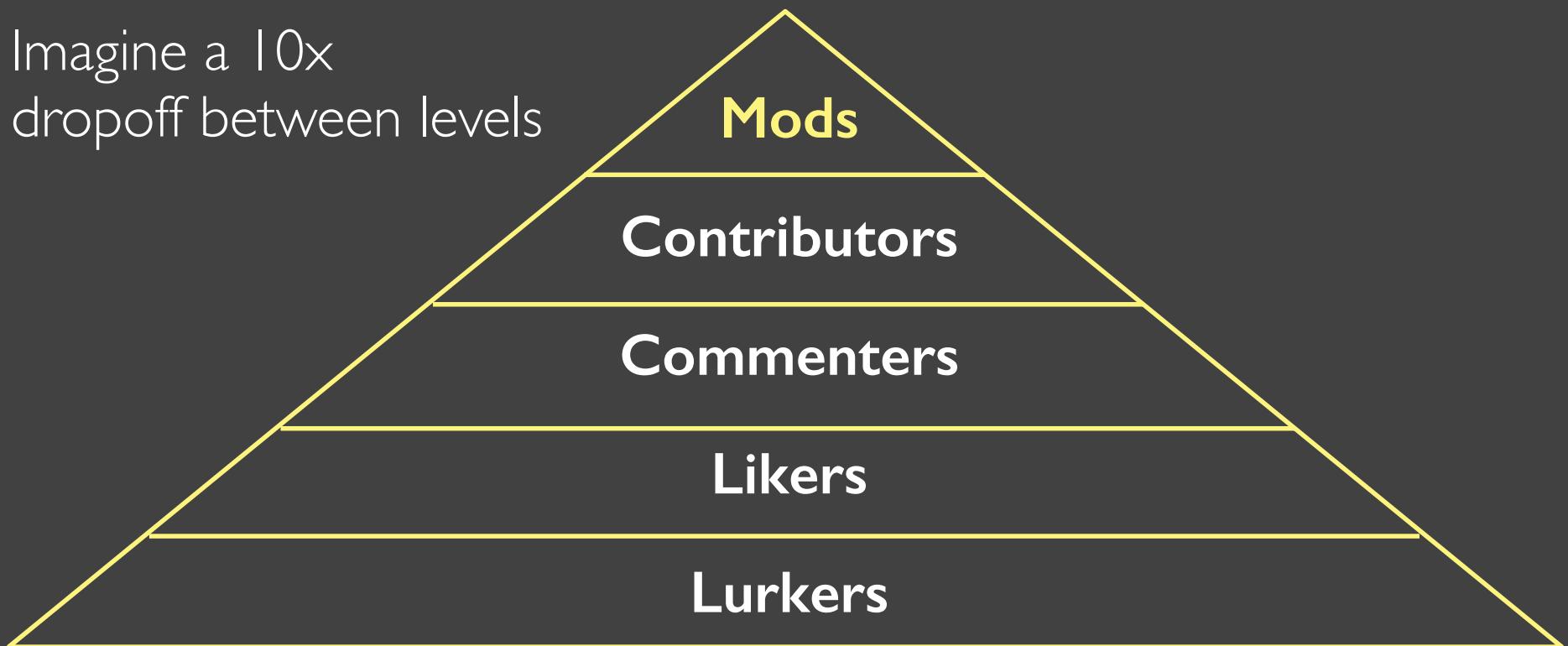
No contracts: governance and work allocation isn't handled through signed contracts

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.

Contribution pyramid

Imagine a 10x
dropoff between levels



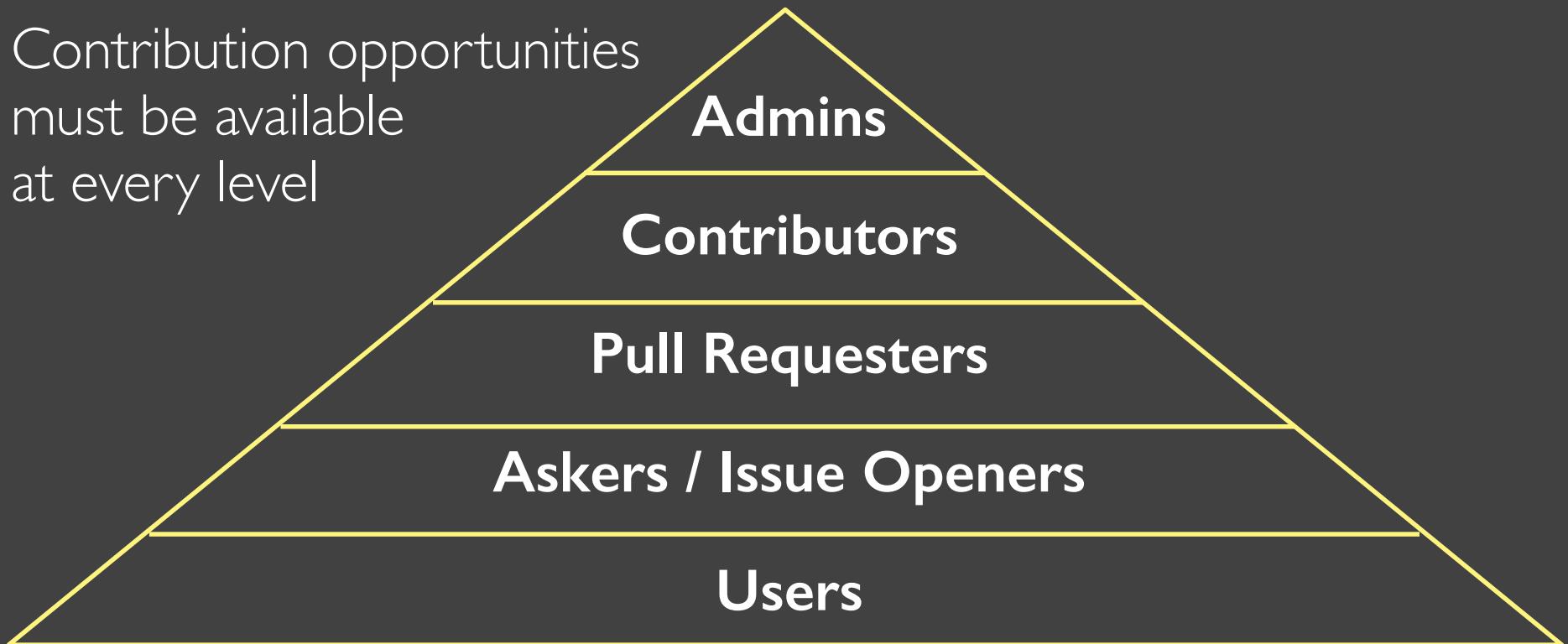
Peer production: wiki

Contribution opportunities
must be available
at every level



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 2003, Benkler, Shaw and Hill 2015]

Many, many surveys have revealed that there exists a diverse tapestry of motivations [Glott et al. 2010, Ghosh and Prakash 2000]

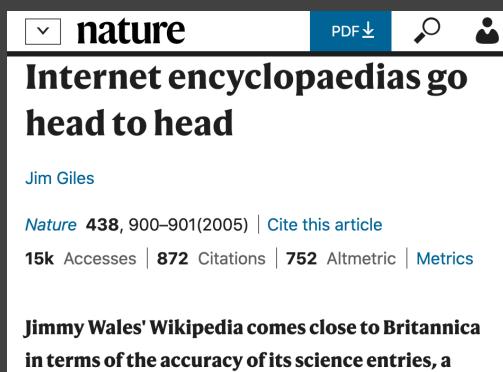
But people self-select into communities that match their motivations: Those extrinsically motivated by reputation and employment will contribute more to industry-sponsored projects. Those more intrinsically motivated contributed to free culture communities. [Belenzon and Schankerman 2008, Benkler, Shaw and Hill 2015]

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...

The screenshot shows a news article from Quartz. At the top, there's a navigation bar with icons for search, refresh, and user profile. Below it, the word "QUARTZ" is prominently displayed. On the right side of the header, there's a small icon of a person with a question mark above their head. The main title of the article is "How one programmer broke the internet by deleting a tiny piece of code". Below the title, the date "March 27, 2016" is shown. To the left of the date is a small circular profile picture of a man. To the right of the date, the author's name "By Keith Collins" and title "Tech Reporter" are listed. The main content of the article is a code listing for a file named "leftpad.js". The code is as follows:

```
1 module.exports = leftpad;
2 function leftpad(str, len, ch) {
3   str = String(str);
4   var i = -1;
5   if (!ch && ch !== 0) ch = ' ';
6   len = len - str.length;
7   while (++i < len) {
8     str = ch + str;
9   }
10  return str;
11}
```

node.js `leftpad` module incident

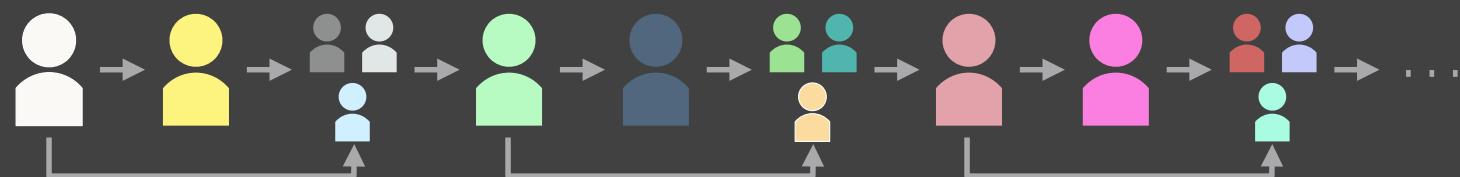
So given these tradeoffs, when would you opt for peer production over firm-based production, assuming you had moderate but not infinite funds?
[2min]

Workflows

Iterative crowd algorithm

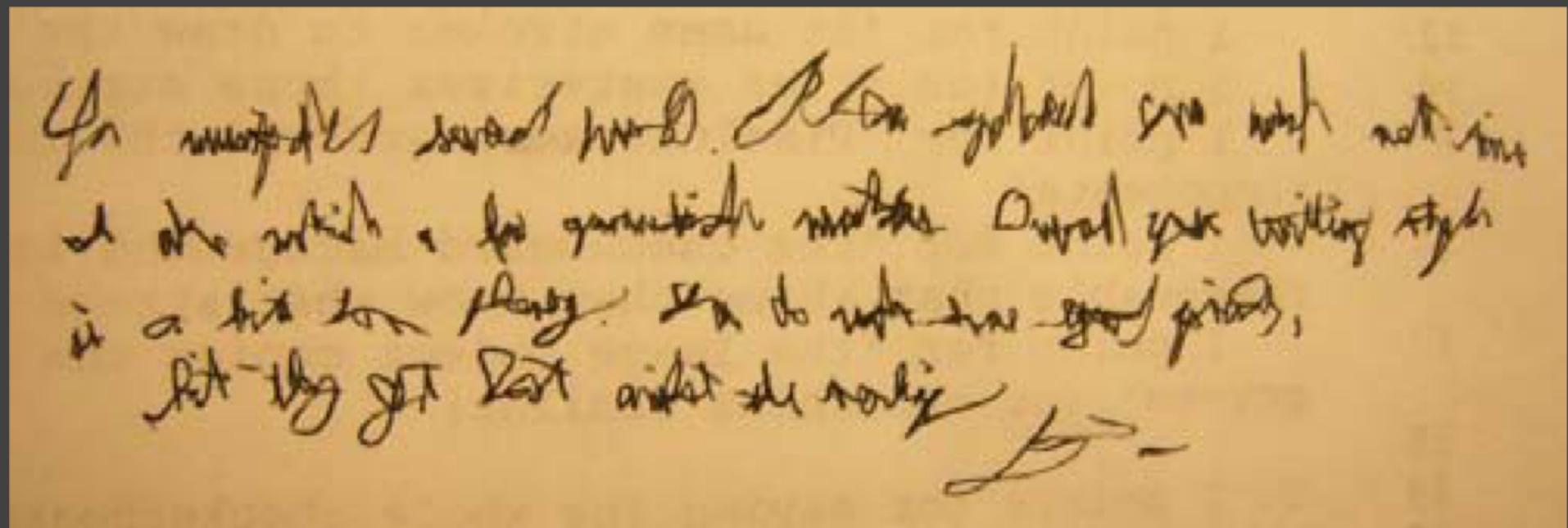
[Little et al. 2009]

You wouldn't want me. When you look up with nothing
in the which a few questions makes. Overall you writing style
is a bit too flabby. You do make some good points,
but they get lost amidst the noise



Iterative crowd algorithm

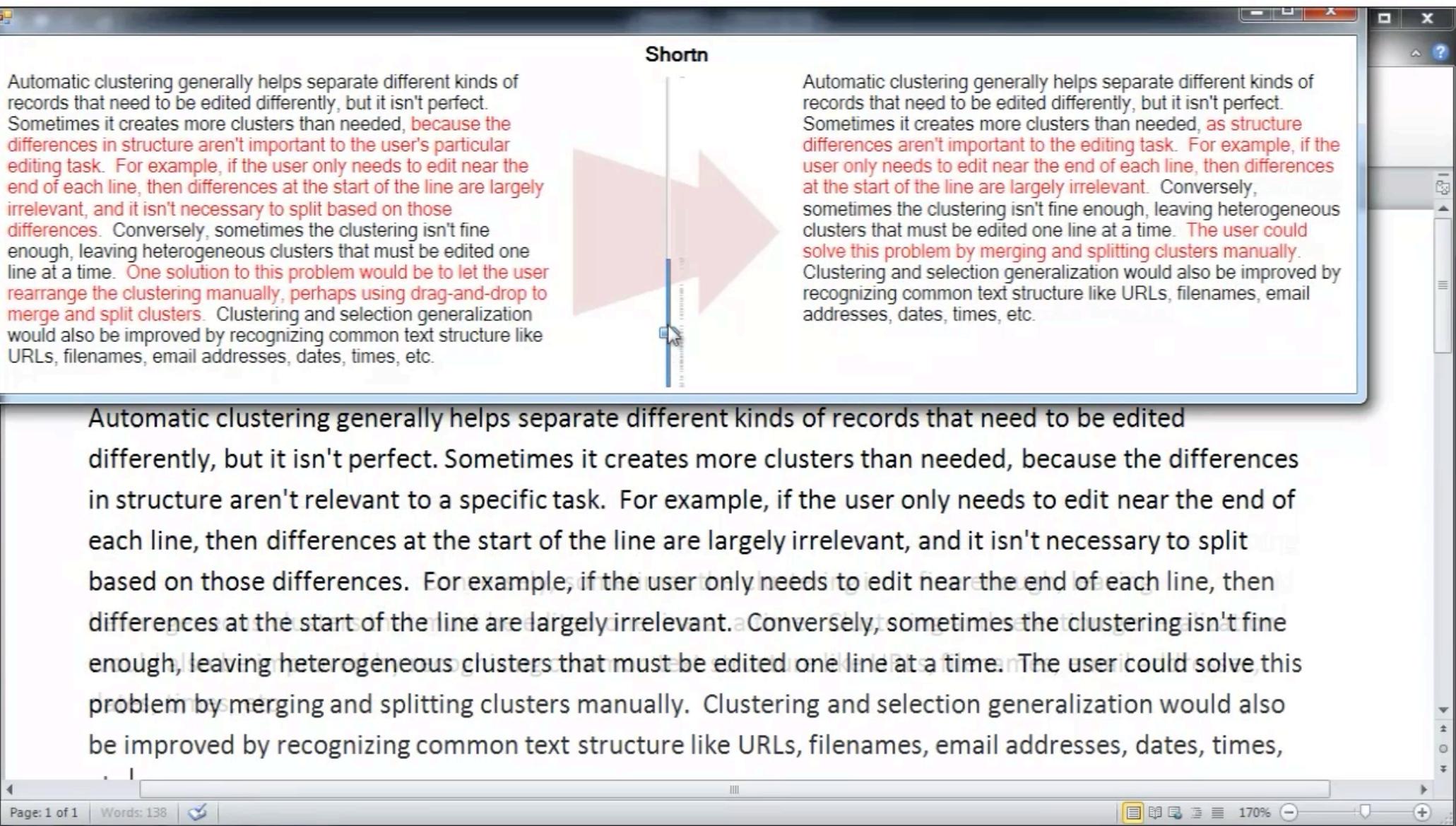
[Little et al. 2009]



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.

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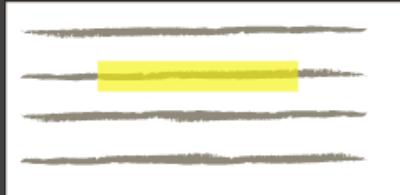
Page: 1 of 1 | Words: 138 |  |      170%  

Find-Fix-Verify

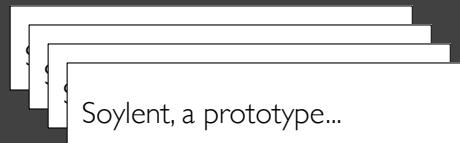
[Bernstein et al. 2010]

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~~s~~...
- Soylent is a ~~prototype~~test~~s~~...

Find

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



Independent agreement
to identify patches

Fix

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



Soylent, a prototype...



Randomize order of
suggestions

Verify

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

✗ Soylent-is, a prototype...
✗ Soylent-is-a prototypes...
✓ Soylent is a prototypetest...

Verify

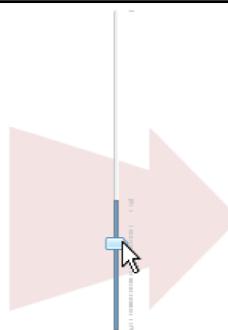
“Choose at least one rewrite that has style errors, and at least one rewrite that changes the meaning of the sentence.”

☐ Soylent ~~is~~, a prototype...
☐ Soylent ~~is-a~~ prototypes...
✓ Soylent is a ~~prototype~~ test...



Keep suggestions that do not get voted out

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Mechanical Novel

[Kim et al., CSCW 2017]

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

#1

+

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...

Submit

the story above! Which change should be the main change for the next revision?

ut the
do you

detail and
imagine
oughout.

ot air balloon

he previous
used and it's
iting than

Think about what you wish you could change about the story. Which statement below do you agree with most?

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.

The order of the paragraphs. It jumped all over the place.

I want to see more exciting things happen to Malcom in Cloud City, and I want to know about his return to the ground.

Which new idea below do you think should be the main change for a revision of the story above?

What if instead of beginning so abruptly, we learned a little more about Malcolm first?

What if... We wrote a new story about hot air balloons and a mistaken escape?

What if Malcom investigates the Cloud City and then tries to get home, maybe bringing along a friend from Cloud City.



When he woke up, he found himself staring at 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

Make the following change to the text on the left:

*First, there is a typo ("she he") should be "should he". Finish paragraph with:
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.

#1

#2

#3

#4

#5

#6

#7

+

**Convergence and
coordinated adaptation**

Limits of algorithmic coordination

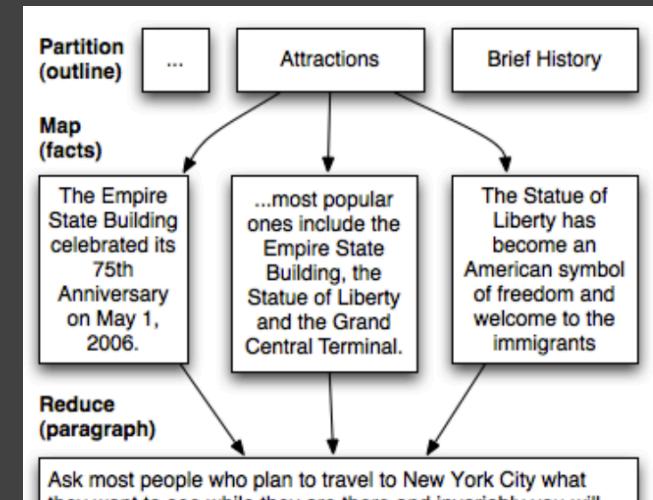
So far, goals such as invention, production, and engineering have remained largely out of reach [Kittur et al. 2013]

Why?

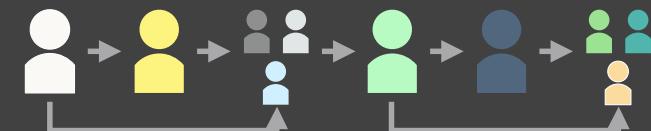
Dominant architecture: algorithms

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 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 Weber 1973; Schön 1984]

Limits of crowdsourcing and peer production

“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]

HOW TOPCODER ATOMIZES PROJECTS INTO THEIR COMPONENTS



[Boudreau, Lacetera, and Lakhani 2011]

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.

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.

colnick101: !!yes after all these years
neikrodent: hard right
creeplosion: 420
richie05d: SPAM 420!
Bunneo: drive
Barn16: LET'S DO THIS
Xcizer7911: reverse
Tommyan6803: 3
jokogaming1: Drive
zepinktacos: MUM IM A PILOT!
panseysandpaws: drive
xxHulkermanxx: drive
Khaely_-: Dawn
richie05d: 420
ajoconnor64: hi YouTube?
Q2Vertigo: drive

0.00



HYPERRAVA FOLLOW
SNIPPYLLAMA 100 BITS
ROLFER FOLLOW

Can Twitch Chat land an Airplane without dying?

Rules: fly for at least 30 seconds, then land the plane without dying. !GtaCommands for controls.



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

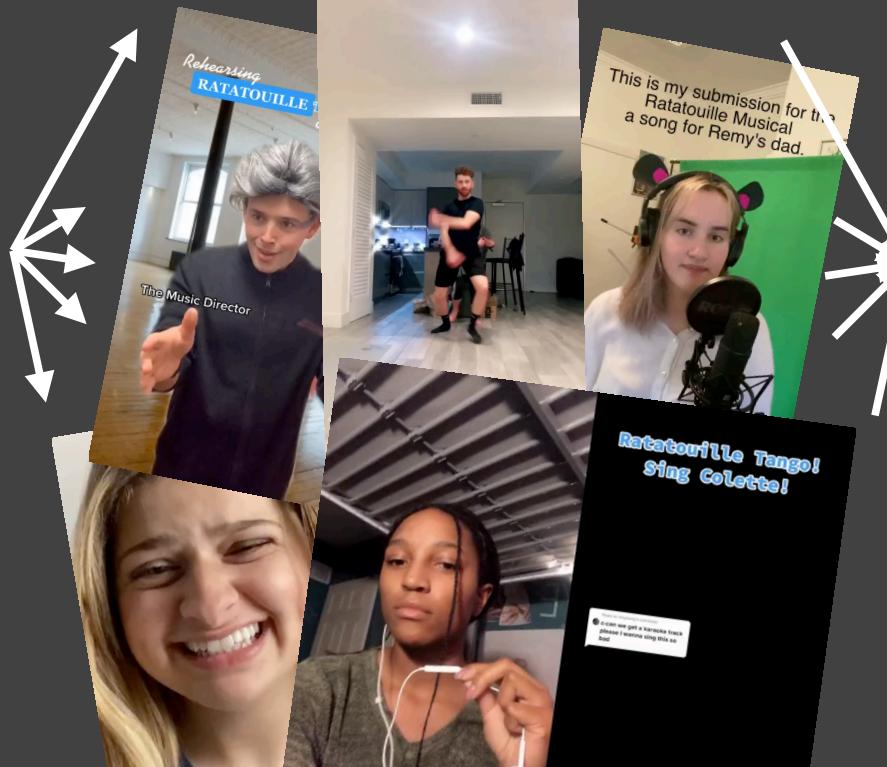
Seed idea



Structure



Divergence



Convergence



Required a focused team

Has your opinion changed?

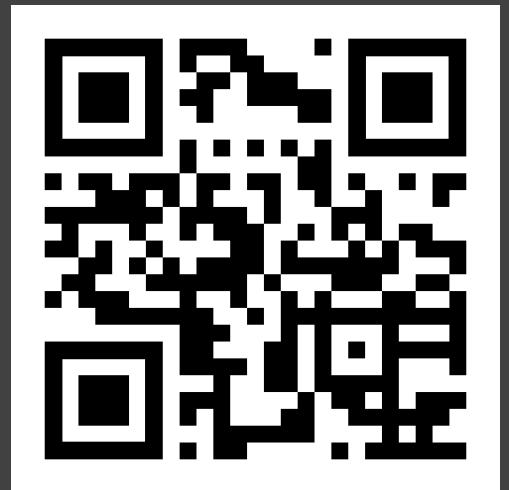
When would you opt for peer production over firm-based production, assuming you had moderate but not infinite funds?

Which would you use if the goal were to:

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

[2min]

How did the
collective
notetaking go?
<http://hci.st/notes>



Exam

50 minute closed-book exam on paper during class 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.

Social Computing

CS 278 | Stanford University | Michael Bernstein

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