

Optimization: Workflow Design

Chien-Ju (CJ) Ho

Logistics - Assignment 3

- Due: Midnight, March 23 (Sat)
- Approaches:
 - EM-Based method
 - Matrix-based method
 - Careful in constructing the matrix (what the **row/column** represents)
 - Others
 - Iterative message passing
 - Be careful about **message normalization** if you want to use this for assignment 3
 - Minimax entropy
- Make sure whether the algorithm you are using requires **+1/-1** or **1/0** labels.

Logistics - Project

- Milestone 2: April 9
 - Try to make some progress before this milestone
 - The goal is to identify whether your approach is feasible or not
 - You can convert the project to literature review if you encounter major difficulty in completing your project
 - Explain what the obstacles are in the milestone report
- Feel free to send me emails to schedule meetings

Where to Look for Papers?

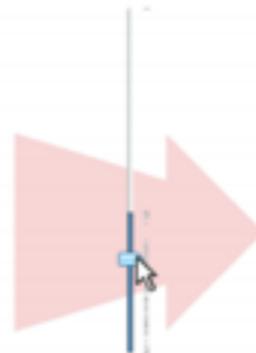
- Human computation research is interdisciplinary
 - General human computation/web conference: [HCOMP](#), [WWW](#)
 - Machine learning: [ICML](#), [NeurIPS \(formally NIPS\)](#)
 - Economics: [EC](#)
 - General Artificial Intelligence: [AAAI](#), [IJCAI](#)
 - Human-computer interaction: [UIST](#), [CHI](#), [CSCW](#),

Crowdsourcing

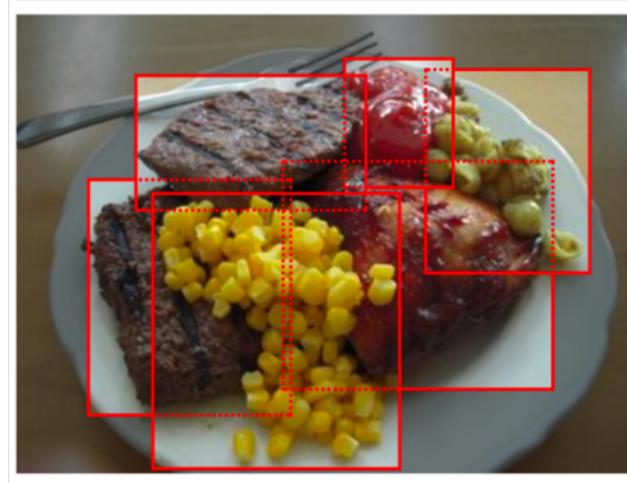
- A lot of focuses are on *microtasks*
 - Labeling images
 - Transcribing a one-minute audio clips
 - Finding the address of a business
 - ...
- A common quality control mechanism
 - Duplicate tasks
 - Majority voting (or fancier label aggregation methods)

What if the target task is complex?

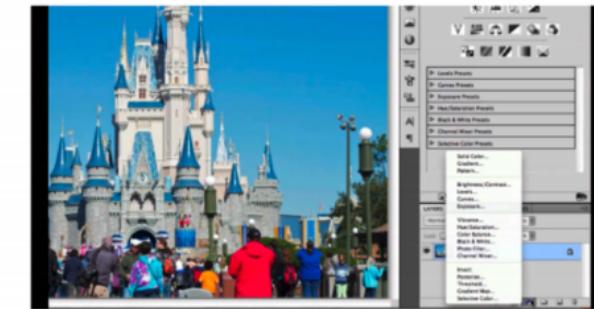
Automatic clustering generally helps separate different kinds of records that need to be edited differently, but it isn't perfect. Sometimes it creates more clusters than needed, because the differences in structure aren't important to the user's particular editing task. For example, if the user only 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.



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 relevant to a specific task. | 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 using drag-and-drop edits. Clustering and selection generalization would also be improved by recognizing common text structure like URLs, filenames, email addresses, dates, times, etc.

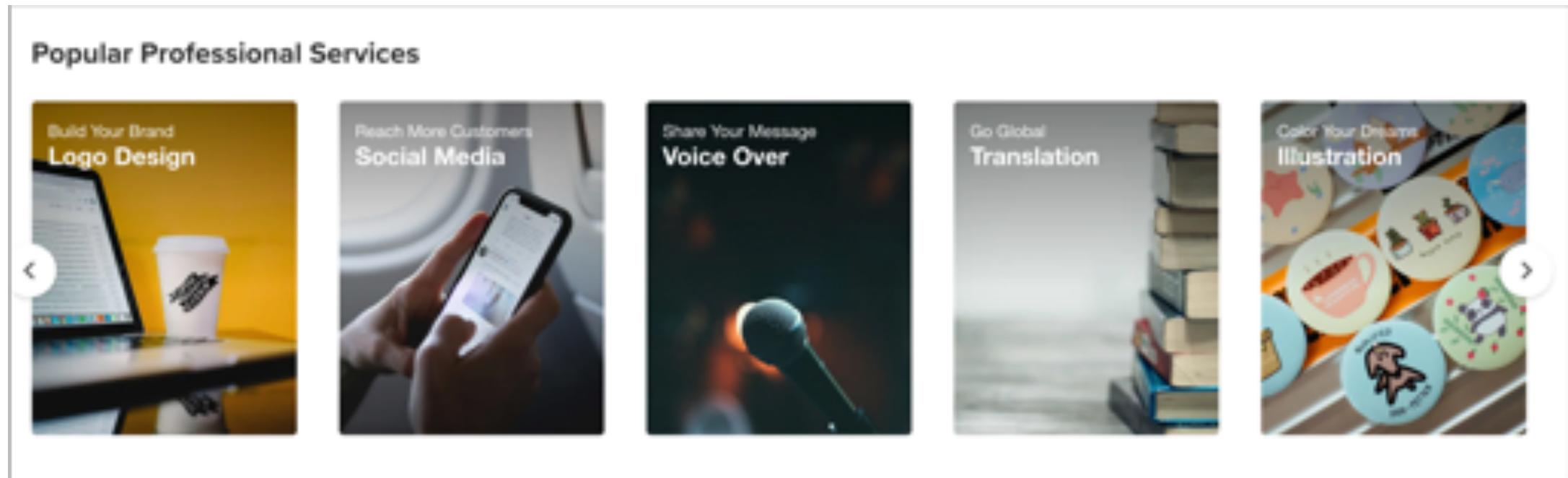


Photoshop: Vintage Effect



What if the target task is complex?

- We can recruit an *expert* in doing the work
 - Traditional workplace approach
 - There exist such crowdsourcing marketplaces as well (e.g., Upwork or Fiverr)



What if the target task is complex?

- We can recruit an *expert* in doing the work
 - Traditional workplace approach
 - There exist such crowdsourcing marketplaces as well (e.g., Upwork or Fiverr)
- More logistics are involved (as in traditional workplaces)
 - Finding suitable workers
 - Training
 - Effort monitoring
 - Evaluating work
 - ...

What if the target task is complex?

- Decompose a complex task into microtasks
- Designing workflows

Find-Fix-Verify

Tag-Identify-Measure

Find-Verify-Expand

Assess-Justify-Reconsider

Vote-Explain-Categorize

Designing Workflows

- Treating humans as computation units
- Question:
 - Can we incorporate humans in the computational framework?
 - Can we implement human computation as function calls?

```
ideas = []
for (var i = 0; i < 5; i++) {
    idea = mturk.prompt(
        "What's fun to see in New York City?
        Ideas so far: " + ideas.join(", "))
    ideas.push(idea)
}

ideas.sort(function (a, b) {
    v = mturk.vote("Which is better?", [a, b])
    return v == a ? -1 : 1
})
```

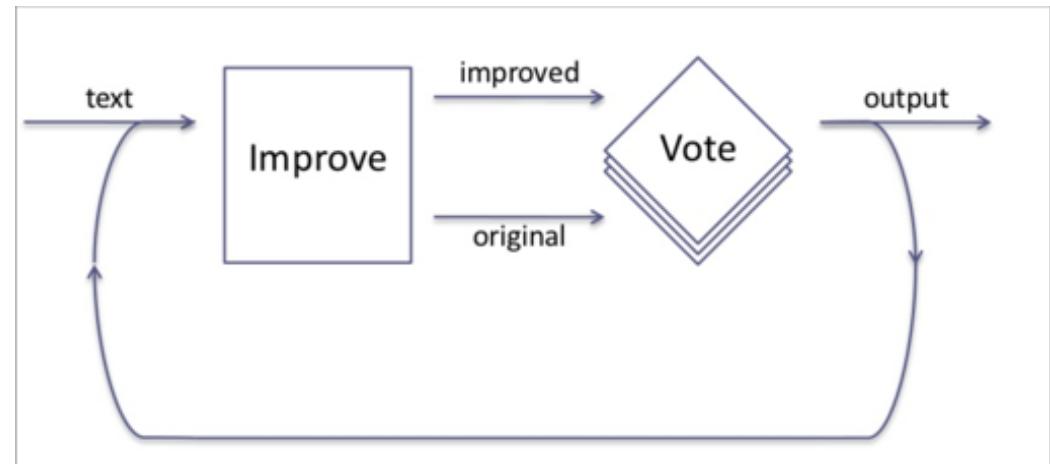
- We are simultaneously collecting data from humans to train AI/ML.
- May gradually replace human computation function calls with automatic process when AI/ML catches up.

TurKit: Human Computation Algorithms

Little et al. UIST 2010.

Example: Iterative Writing

- Task: Have workers iteratively refine the description for the image.



```
// generate a description of X
// and iterate it N times
var text = ""
for (var i = 0; i < N; i++) {
    // generate new text
    var newText = mturk.prompt(
        "Please write/improve this paragraph
        describing " + X + ": " + text)

    // decide whether to keep it
    if (vote("Which describes " + X + " better?",
        [text, newText]) == newText) {
        text = newText
    }
}
```

Example: Iterative Writing

- Task: Have workers iteratively refine the description for the image.



Iteration 1: Lightening strike in a blue sky near a tree and a building.

Iteration 2: The image depicts a strike of fork lightening, striking a blue sky over a silhouetted building and trees. [\(4/5 votes\)](#)

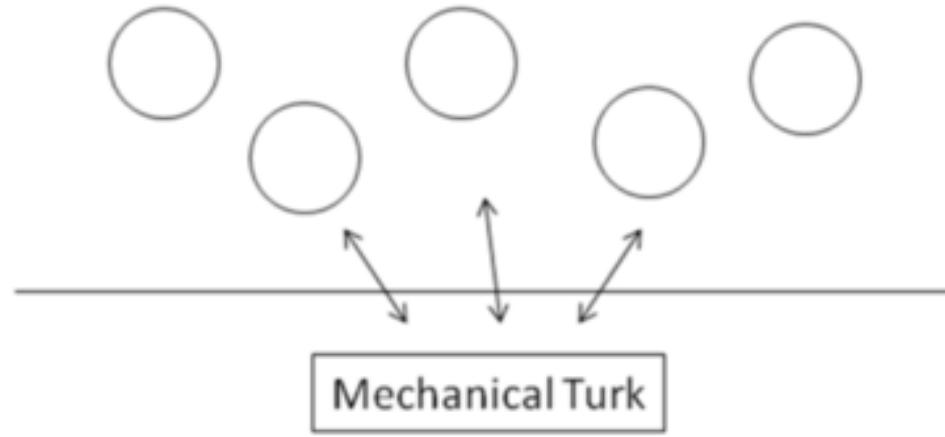
Iteration 3: The image depicts a strike of fork lightning, against a blue sky with a few white clouds over a silhouetted building and trees. [\(5/5 votes\)](#)

Iteration 4: ~~The image depicts a strike of fork lightning, against a blue sky wonderful capture of the nature.~~ [\(1/5 votes\)](#)

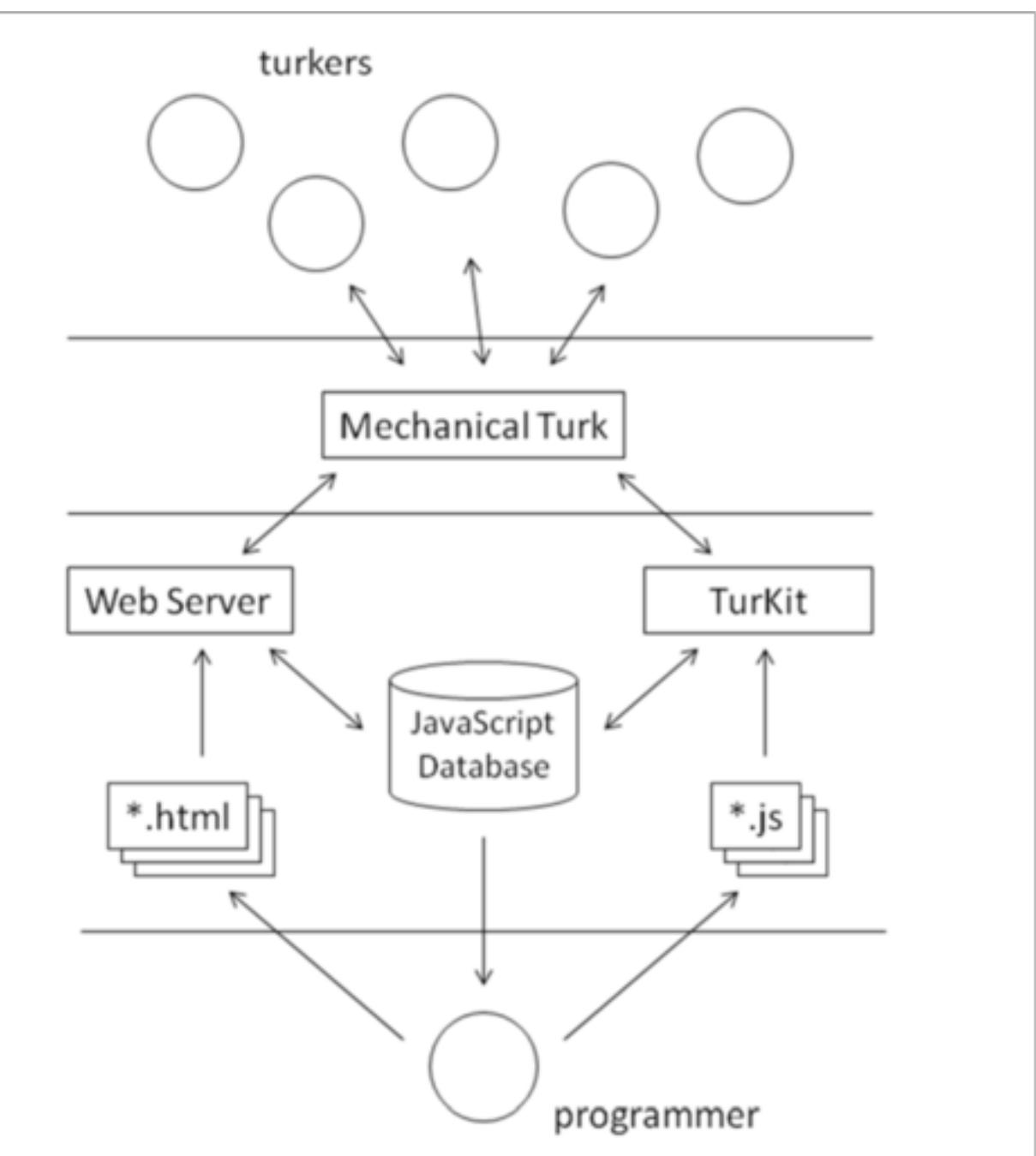
Iteration 5: This image shows a large white strike of lightning coming down from a blue sky with the tops of the trees and rooftop peeking from the bottom. [\(3/5 votes\)](#)

Iteration 6: This image shows a large white strike of lightning coming down from a blue sky with the silhouettes of tops of the trees and rooftop peeking from the bottom. The sky is a dark blue and the lightening is a contrasting bright white. The lightening has many arms of electricity coming off of it. [\(4/5 votes\)](#)

turkers



programmer



Human Computation Algorithms

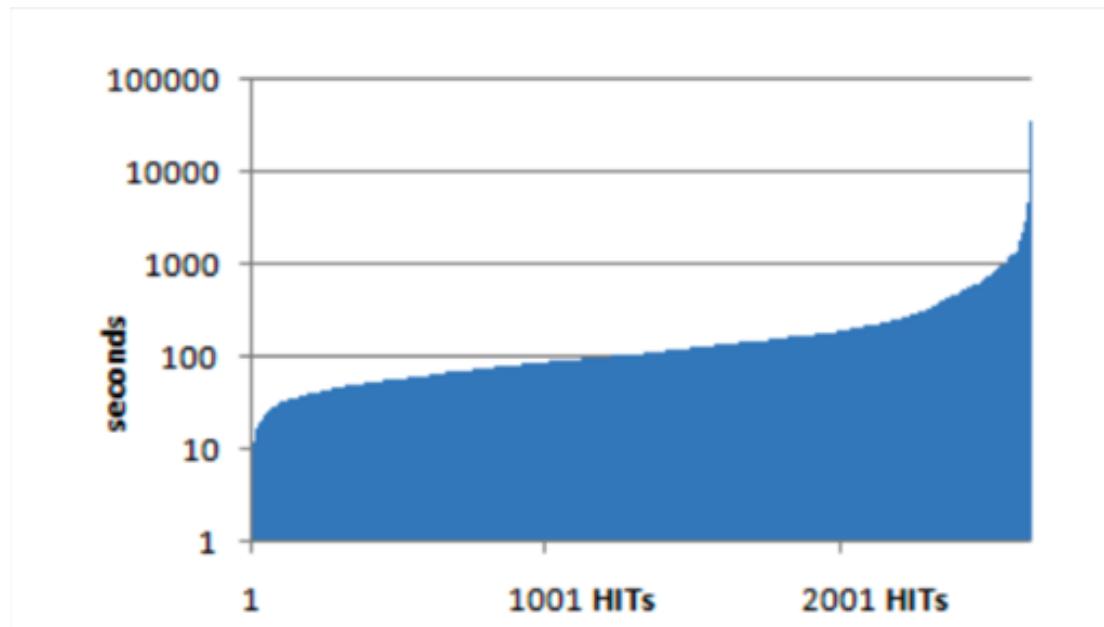
- Key Properties:
 - Human computation **costs more** (in terms of **time** and **money**) than machine computation.
 - Web applications are generally prone to errors.
- Goal: Design a robust algorithmic framework for human computation algorithms

Crash-and-Rerun Programming

- Intuitions:
 - Store the results of human computation function calls to database (DB).
 - If error happens, **crash** the program and **rerun** from the start
 - For costly operations, obtain results from the DB instead of running it
- Implementation: introduce keyword *once*
 - Remove non-determinism
 - Store costly operations
- Provide functionalities
 - prompt, vote, sort
 - fork, join
 - work with MTurk APIs

Performance Evaluation

- The paper demonstrates the results for a couple of applications.
- They also measure the time for completion for 1-cent HITs.



Can we reduce the latency?
Apr 9: Real-time crowdsourcing

Other Frameworks

- AutoMan
 - <https://emeryberger.com/research/automan/>
 - Developed by the team at UMass Amherst
 - Provide support for quality and budget control
- TurkServer
 - <https://github.com/TurkServer>
 - Support multi-worker collaborations

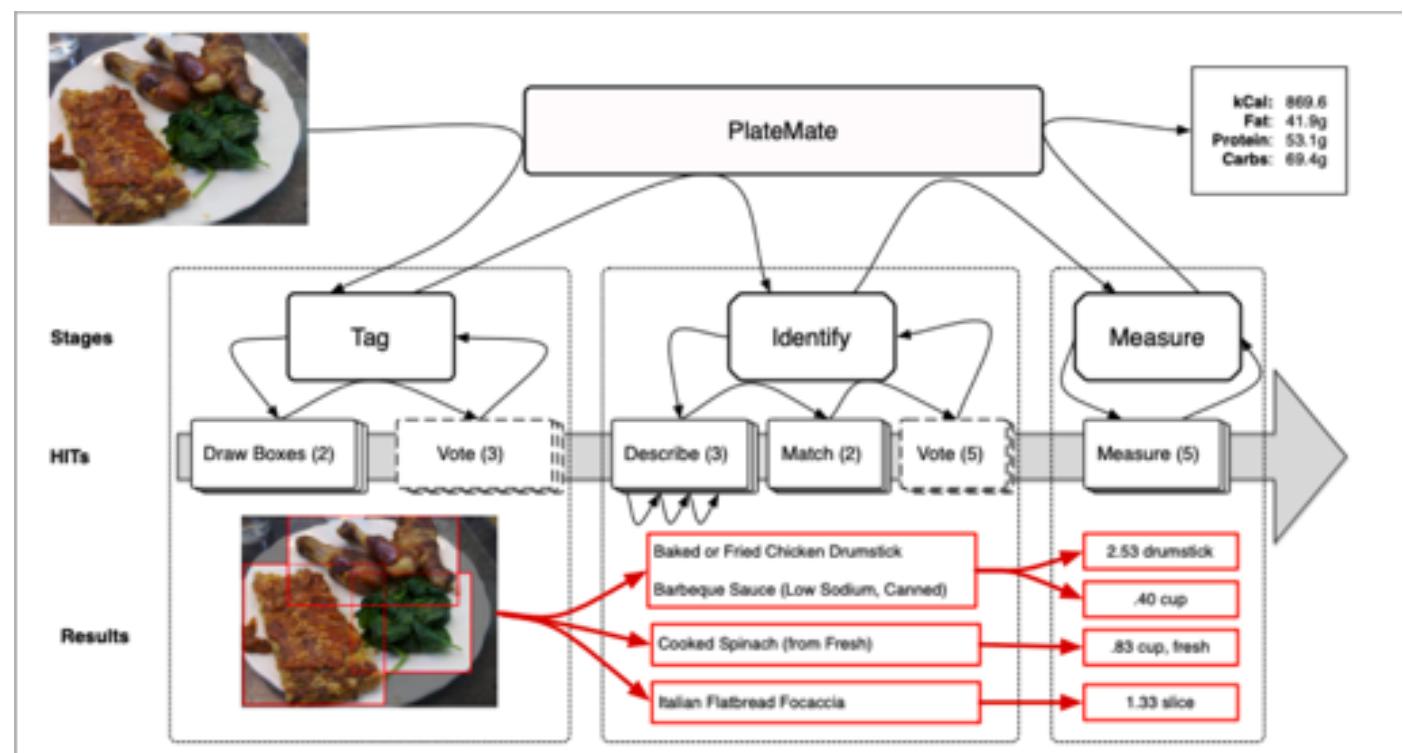
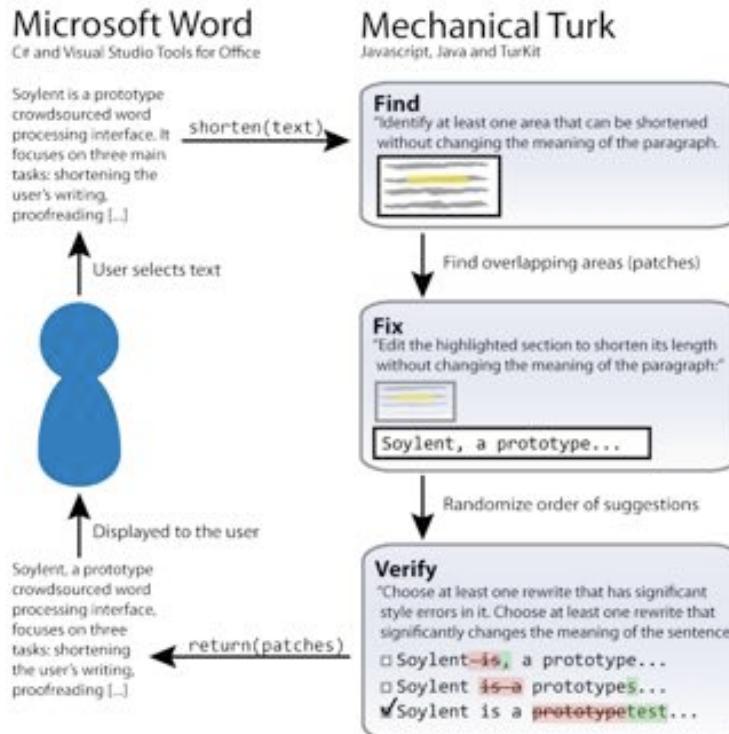
Discussion

- What's your general thoughts on TurKit? What other functionalities do you hope they also provide?
- Do you think AI/ML will eventually be able to do everything humans can do? Why?
- What are the implications of your answers above?

We can write workflows with TurkIt

However...

- Workflow design is domain specific and requires a great amount of effort



Can we utilize AI to help design workflows...

Will discuss this next Tuesday:
how to utilize AI to help tune the parameters of workflow

Can we utilize the crowd to design workflows...

Turkomatic: A workflow for designing workflows

Kulkarni, Can, and Hartmann. CSCW 2012.

Example Task

Create a new blog about Mechanical Turk with two posts.

CROWDSOURCE IT!

mtworker

Just another WordPress.com site

Home About

How much should I pay for my HIT?

Posted on April 30, 2011

You may be inclined to price your HIT's at the lowest possible rate, but this isn't always the best choice. Instead, you should base your pricing on:

- How long will the HIT take?
- Is the HIT similar to other HITs? If so, price it slightly less than theirs.
- If the HIT involves a lot of qualifications, you may want to price it higher, to attract more qualified workers.

In general, higher priced HITs are great for attracting more skilled workers! You can use this in conjunction with worker qualifications, which I'll talk about next.

(hosted by [LocateLocal](#) | [Leave a comment](#))

Search

Recent Posts

- How much should I pay for my HIT?
- Hello
- Hello world!

Archives

- April 2011

Categories

- Uncategorized

Meta

- Register
- Log in

Follow

Price-Divide-Solve

- A divide-and-conquer workflow
- Price: Can this task be solved for 20 cents
- If yes: Solve the task and return the answer
- If no: Divide the task into multiple steps
 - For each step, start from the price step
 - Merge steps into solutions

Price-Divide-Solve

- A divide-and-conquer workflow
- **Price**: Can this task be solved for 20 cents
- If yes: **Solve** the task and return the answer
- If no: **Divide** the task into multiple steps
 - For each step, start from the price step
 - Merge steps into solutions

Create a new blog about Mechanical Turk with two posts.

CROWDSOURCE IT!

Price

Can we solve it for
20 cents?

No.

Can this task be solved for 20 cents?

Write a blog about Mechanical Turk

- Yes
- No

Submit

Timer: 00:00:00 of 30 minutes Want to work on this HIT?

Total Earned: \$79.60
Total HITs Submitted: 707

Estimate a fair price for this HIT! Fast and easy!
Requester: Berkeley Turks Reward: \$0.10 per HIT HITs Available: 1 Duration: 30 minutes
Qualifications Required: HIT approval rate (%) is not less than 90, Location is US

Can the task below be solved for under twenty cents?

Instructions: We are dividing a large task among several workers on Mechanical Turk. This is an experiment to see how complicated tasks can be shared between multiple workers on Mechanical Turk.

Your question: Is twenty cents a fair price to pay on Mechanical Turk for someone to do the following task?

Create a new blog about Mechanical Turk, with at least two posts.

- Yes
- No

Answer carefully! You will be paid only if your answer matches the answers given by other Turkers.

Optional: click [here](#) to email us feedback about this HIT.

Want to work on this HIT?

Create a new blog about Mechanical Turk with two posts.

CROWDSOURCE IT!

Divide

Divide it into two
or more steps.

Break down the following task.

Write a blog about Mechanical Turk

Step 1:

Step 2:

Add Step

Submit

Create a new blog about Mechanical Turk with two posts.

CROWDSOURCE IT!

Divide

Divide it into two
or more steps.

Create a new blog on
Wordpress.com.

Write one entry for
a blog.

Write a second entry
for a blog.

Create a new blog about Mechanical Turk with two posts.

CROWDSOURCE IT!

Price

Create a new blog on
Wordpress.com.

Write one entry for
a blog.

Write a second entry
for a blog.

Can we solve it for
20 cents?

Can we solve it for
20 cents?

Can we solve it for
20 cents?

Yes.

Yes.

Yes.

Create a new blog about Mechanical Turk with two posts.

CROWDSOURCE IT!

Price

Create a new blog on
Wordpress.com.

Write one entry for
a blog.

Write a second entry
for a blog.

Can we solve it for
20 cents?

Yes.

Can we solve it for
20 cents?

Yes.

Can we solve it for
20 cents?

Yes.

Create a new blog about Mechanical Turk with two posts.

CROWDSOURCE IT!

Solve

Create a new
Wordpress.co

Can we solve
20 cent

Yes

Solve the following task.

Create a new blank blog on Wordpress

Submit

and entry

ive it for
ts?

Create a new blog about Mechanical Turk with two posts.

CROWDSOURCE IT!

Solve

Create a new blog on Wordpress.com.

Write one entry for a blog.

Write a second entry for a blog.



"Welcome to my blog about Mechanical Turk! Here, I'll be posting some of my favorite recipes for Mechanical Turk. You'll be able to follow along at home and create delicious HITs. From the comfort of your own home! Stay tuned and i'll show you some of the best strategies for keeping your Turk workers engaged."

"You may be inclined to price your HITs at the lowest possible rate, but this isn't always the best choice. Instead, you should base your pricing on:

- How long will the HIT take?
- Is the HIT similar to other HITs? If so, price it slightly less than theirs.
- If the HIT involves a lot of qualifications, you may want to price it higher, to attract more qualified workers."

Create a new blog about Mechanical Turk with two posts.

CROWDSOURCE IT!

Merge

Combine the results of solved steps.

Create a new blog on

Merge the following subtasks.

Write a blog about Mechanical Turk

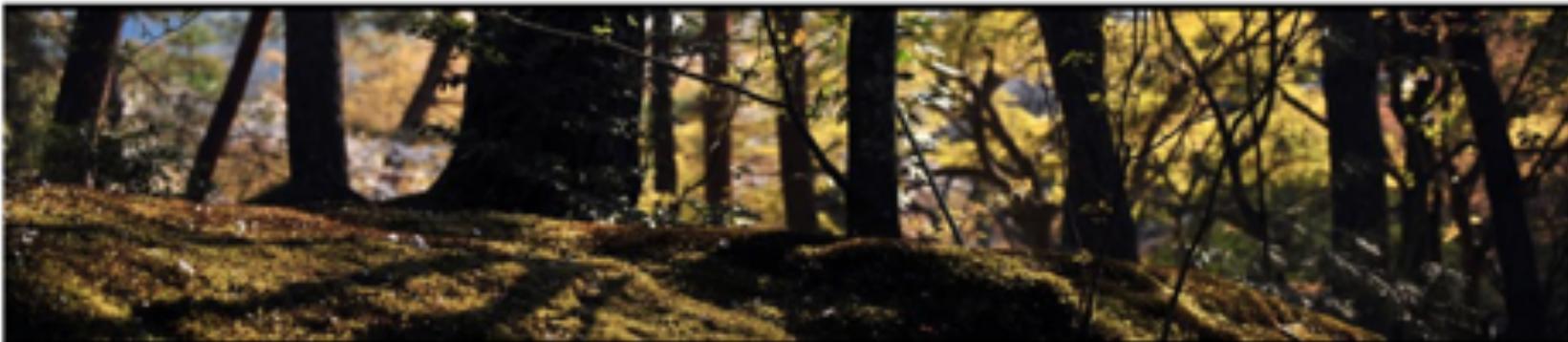
Workers previously divided this task into simpler steps and solved each step. Combine their work into a complete solution.

Step 1: Create a blank blog about Mechanical Turk [answer: www...]

Step 2: Write a blog post about Mechanical Turk. [answer: This post is...]

Submit

mtworker.wordpress.com



[Home](#) [About](#)

How much should I pay for my HIT?

Posted on April 30, 2011

You may be inclined to price your HITs at the lowest possible rate, but this isn't always the best choice. Instead, you should base your pricing on:

- How long will the HIT take?
- Is the HIT similar to other HITs? If so, price it slightly less than theirs.
- If the HIT involves a lot of qualifications, you may want to price it higher, to attract more qualified workers.

In general, higher priced HITs are great for attracting more skilled workers! You can use this in conjunction with worker qualifications, which I'll talk about next.

0 comments | trackback | 11 views | 0 comments

Recent Posts

- [How much should I pay for my HIT?](#)
- [Hello](#)
- [Hello world!](#)

Archives

- [April 2011](#)

Categories

- [Uncategorized](#)

Meta

- [Register](#)
- [Log in](#)

[Follow](#)

Create a new blog about Mechanical Turk with at least two posts.

CROWDSOURCE IT!

Requester Interface



Algorithm

mtworker

Just another WordPress.com site



Home About

How much should I pay for my HIT?

Posted on April 30, 2011

You may be inclined to price your HIT's at the lowest possible rate, but this isn't always the best choice. Instead, you should base your pricing on:

- How long will the HIT take?
- Is the HIT similar to other HITs? If so, price it slightly less than theirs.
- If the HIT involves a lot of qualifications, you may want to price it higher, to attract more qualified workers.

In general, higher priced HITs are great for attracting more skilled workers! You can use this in conjunction with worker qualifications, which I'll talk about next.

Want to work on this HIT?

Recent Posts

- How much should I pay for my HIT?
- Hello
- Hello world!

Archives

- April 2011

Categories

- Uncategorized

Meta

- Register
- Log in

System Output

Timer: 00:00:00 of 30 minutes **Want to work on this HIT?** **Total Earned: \$79.60** **Total HITs Submitted: 707**

Estimate a fair price for this HIT! Fast and easy!

Requester: Berkeley Turks Reward: \$0.10 per HIT HITs Available: 1 Duration: 30 minutes

Qualifications Required: HIT approval rate (%) is not less than 90, Location is US

Can the task below be solved for under twenty cents?

Instructions: We are dividing a large task among several workers on Mechanical Turk. This is an experiment to see how complicated tasks can be shared between multiple workers on Mechanical Turk.

Your question: Is twenty cents a fair price to pay on Mechanical Turk for someone to do the following task?

Create a new blog about Mechanical Turk, with at least two posts.

Yes
 No

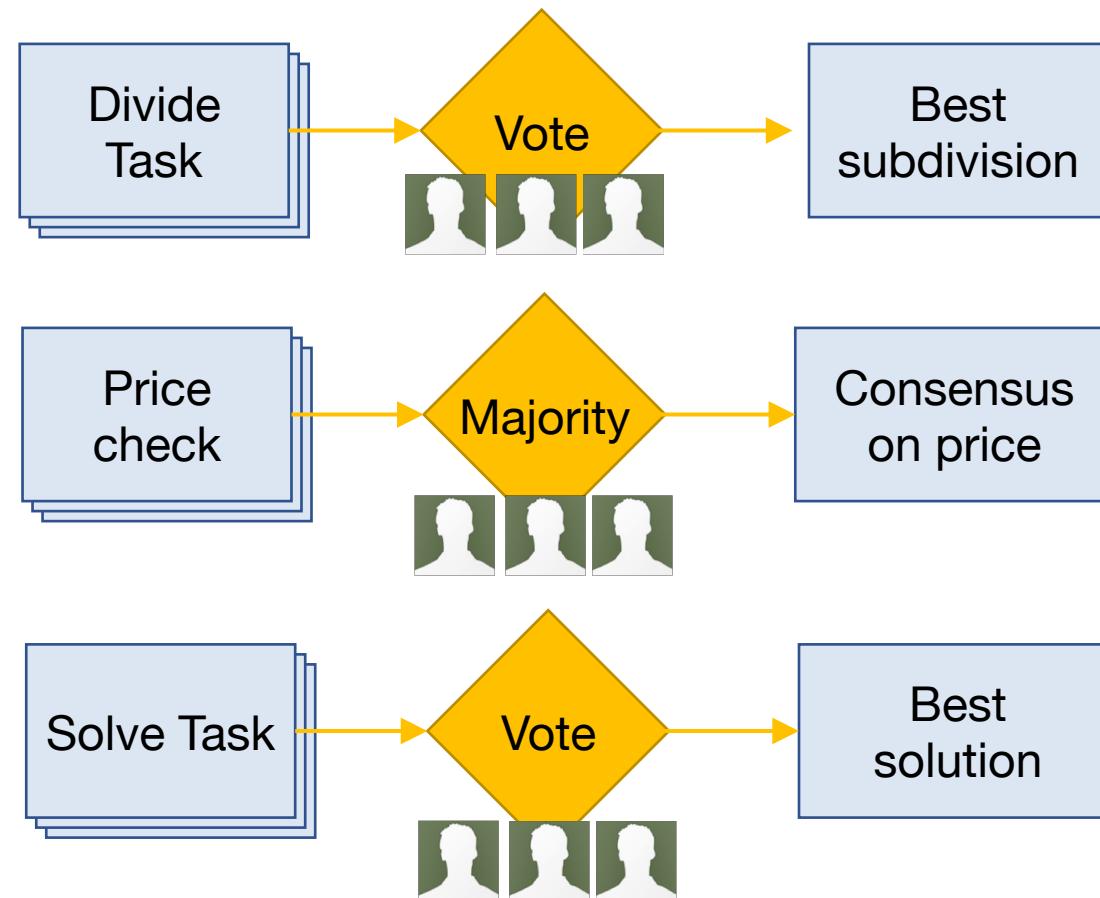
Answer carefully! You will be paid only if your answer matches the answers given by other Turkers.

Optional: click [here](#) to email us feedback about this HIT.

Want to work on this HIT?

Worker Interface

Using Majority Vote to Ensure Quality



Discussion

- What's your opinion on this approach?
- Do you think whether this approach will work?
- Can you come up with scenarios/situations that this approach might fail? What are the potential fixes?

Success Experiment

Write a 3-paragraph essay about whether it's ever OK to lie.

CROWDSOURCE IT!

Write one paragraph arguing it's OK to lie sometimes.

Write one paragraph suggesting it's never OK to lie.

Write a conclusion reconciling the two.

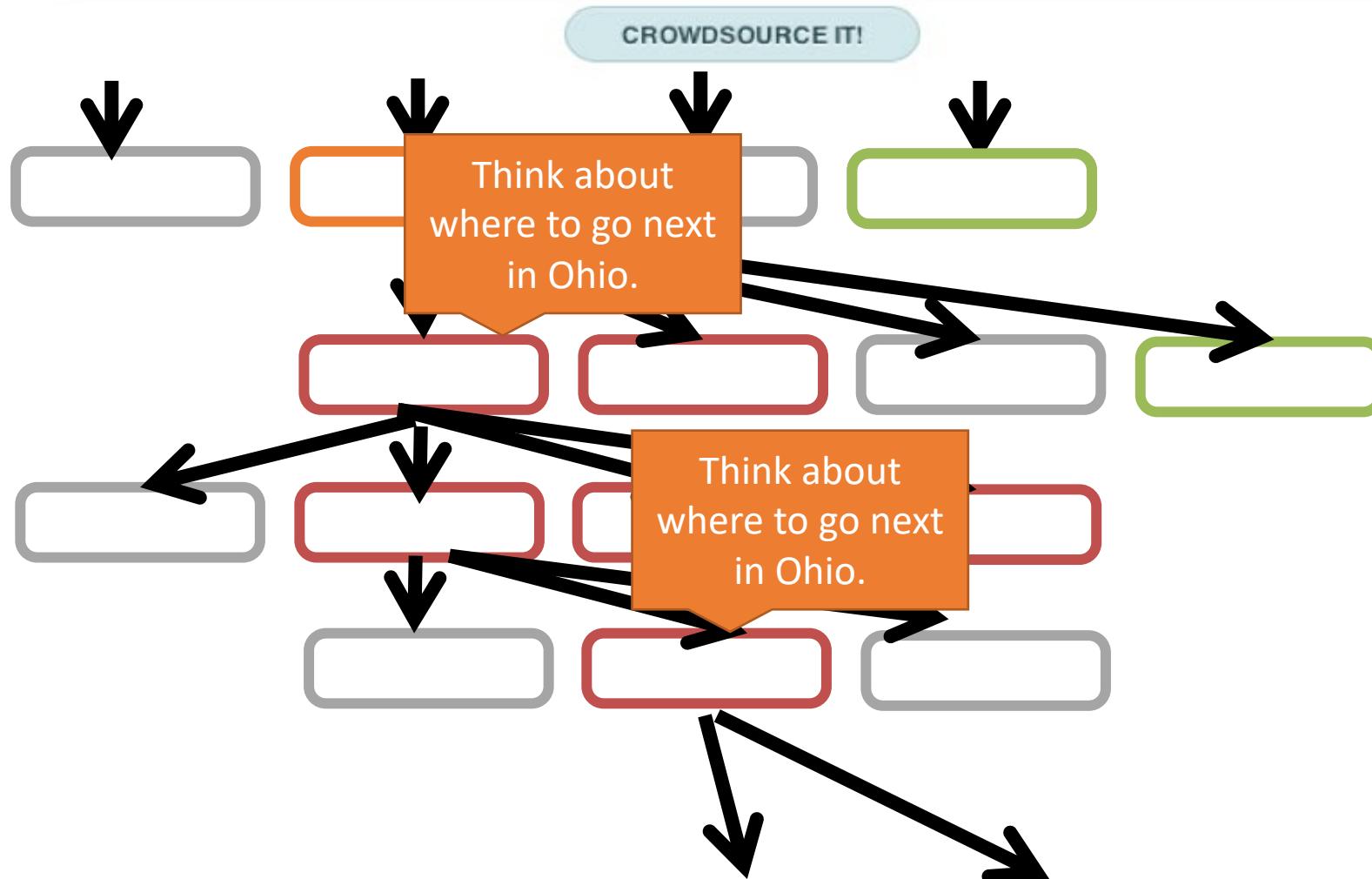
Write one sentence to open the conclusion.

Write 2-3 sentences in the middle of the conclusion.

Write a concluding sentence.

Failed Experiment 1

Plan a trip from New York to S.F. that visits 5 interesting places.



Failed Experiment 2

List the department chairs of the top 20 US programs in CS.

CROWDSOURCE IT!

aalto armchair
poang lounge chair
adirondack chair
aeron chair
balans chair
ball chair
....

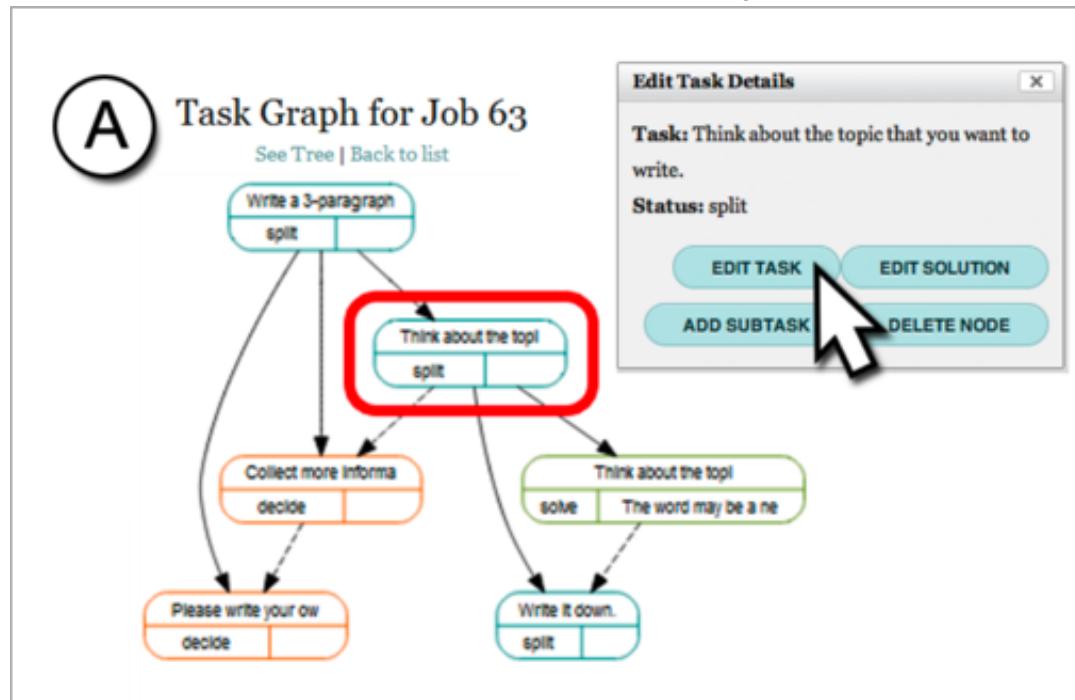
Turkomatic worker:

“...I’ve taken a look at your instructions, and I understand them perfectly. However, this task seems to have been inadvertently sabotaged by other turkers who do not understand what you are asking them to do...”

Early mistakes propagate

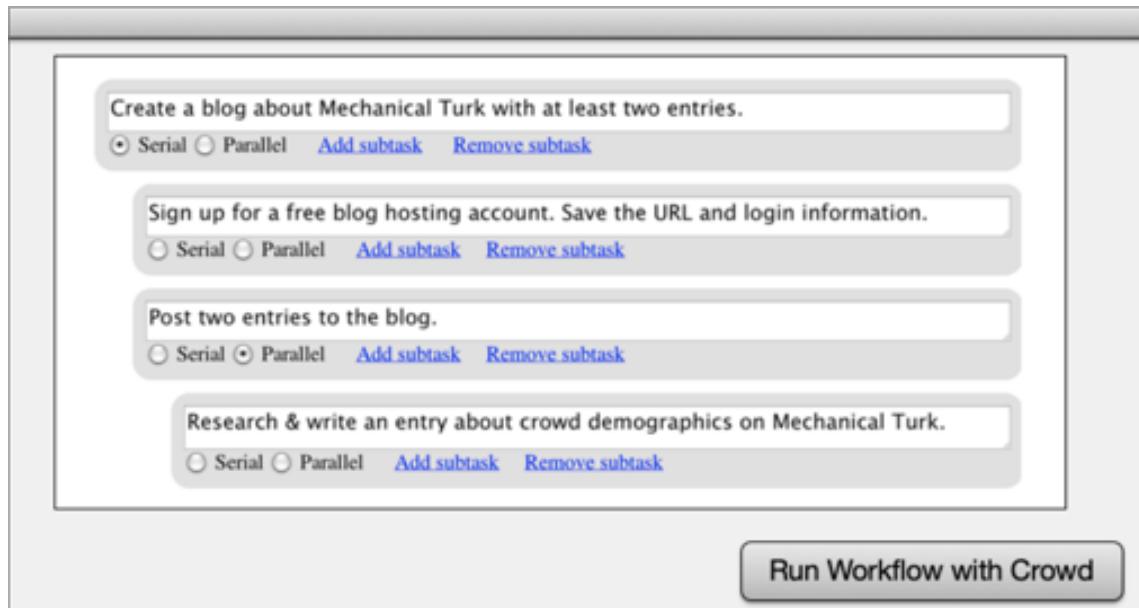
Proposed Fixes

- Utilizing more skilled workers
 - The experiments using graduate students as workers are all successful
- Including requester interventions
 - Designing visualizations, and enable requesters to modify the workflow on the fly



Proposed Fixes

- Utilizing more skilled workers
 - The experiments using graduate students as workers are all successful
- Including requester interventions
 - Designing visualizations, and enable requesters to modify the workflow on the fly
 - Allow requesters to provide seed workflows



Can we use the idea of workflows
in our daily tasks?

Selfsourcing Personal Tasks

Teevan, Liebling, and Lasecki. CHI WiP 2014.

How long can you continuously focus on work?

before being interrupted by

- checking emails
- checking Facebook/Instagram/Twitter
- ...

Microproductivity: Designing Workflows for Yourself

Task Structure – Break tasks into microtasks

- What we know: Examples of many complex tasks can be broken down
- Still needed: What tasks can be broken down? How to capture context?

Task Completion – Make it easy to do microtasks

- What we know: Microtasking is easier, especially when mobile
- Still needed: When to break tasks down? How to prioritize microtasks?

Task Sharing – Get microtasks to the right person

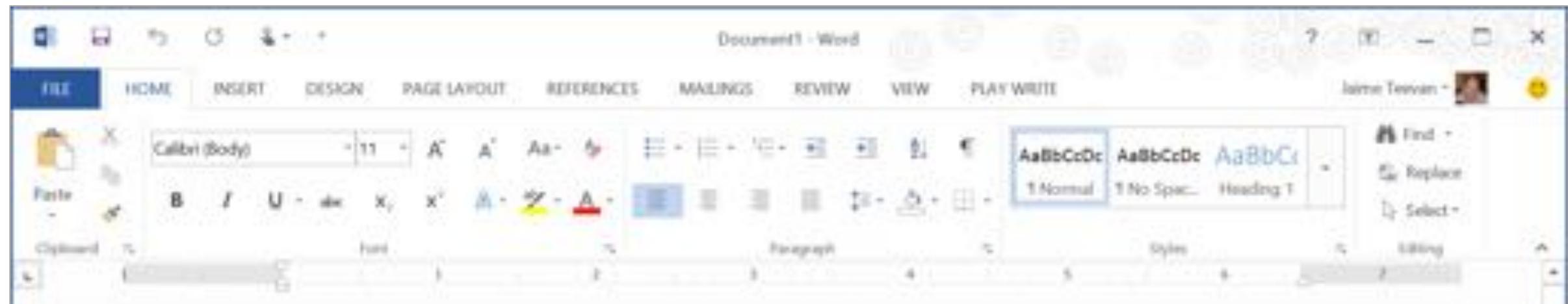
- What we know: Reduce collaboration overhead with colleagues, crowd
- Still needed: Who is the best person to do a microtask?

Task Automation – Learn microtasks via hybrid intelligence

- What we know: Possible to incorporate automation into workflows
- Still needed: When can AI systems benefit from human input?

Example: Article Writing

Slides from Jaime Teevan



Microsoft Word

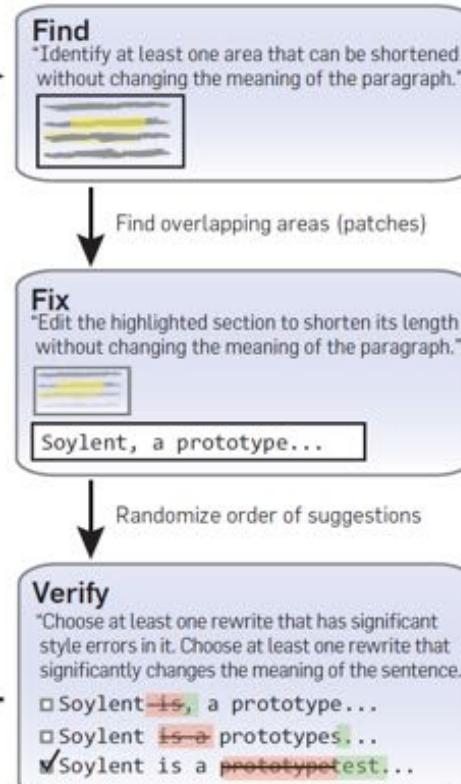
C# and Visual Studio Tools for Office

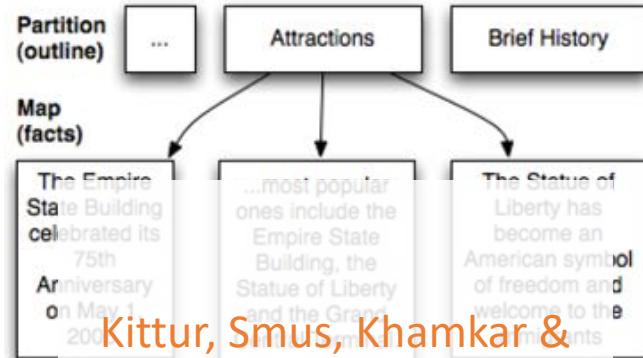
Soylent is a prototype crowdsourced word processing interface. It focuses on three main tasks: shortening the user's writing, proofreading [...]

shorten(text)

Mechanical Turk

Javascript, Java and TurKit





Reduce (paragraph)

Kittur, Smus, Khamkar & Kraut. CrowdForge: Crowdsourcing complex work. UIST 2011.

Ask most people who plan to travel to New York City what they want to see and you will probably you will hear about the top tourist attractions: the Empire State Building, the Statue of Liberty, and the Grand Central Terminal, with the Empire State Building probably coming in as number one on the list of "must see" for visitors to the city. No wonder: the Empire State Building has a long history, having celebrated its **seventy-fifth anniversary on May 1, 2006**. Yet the Statue of Liberty is also a popular tourist destination.

Agapie, Teevan & Monroy-Hernández. Crowdsourcing in the field: A case study using local crowds for event reporting. HCOMP 2015.

INTERMEDIATE OUTPUT
(event reports, curated feed)

FINAL OUTPUT
(article)

Nebeling, To, Guo, de Freitas, Teevan, Dow & Bigham.
WearWrite: Crowd-assisted writing from smartwatches. CHI 2016.

complete tasks
ask questions

Crowd Workers

Mechanical Turk
Javascript, Java and TurKit

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

Bernstein, Little, Miller, Hartmann, Ackerman, Karger, Crowell & Panovich. Soylent:
A word processor with a crowd inside. UIST 2010.

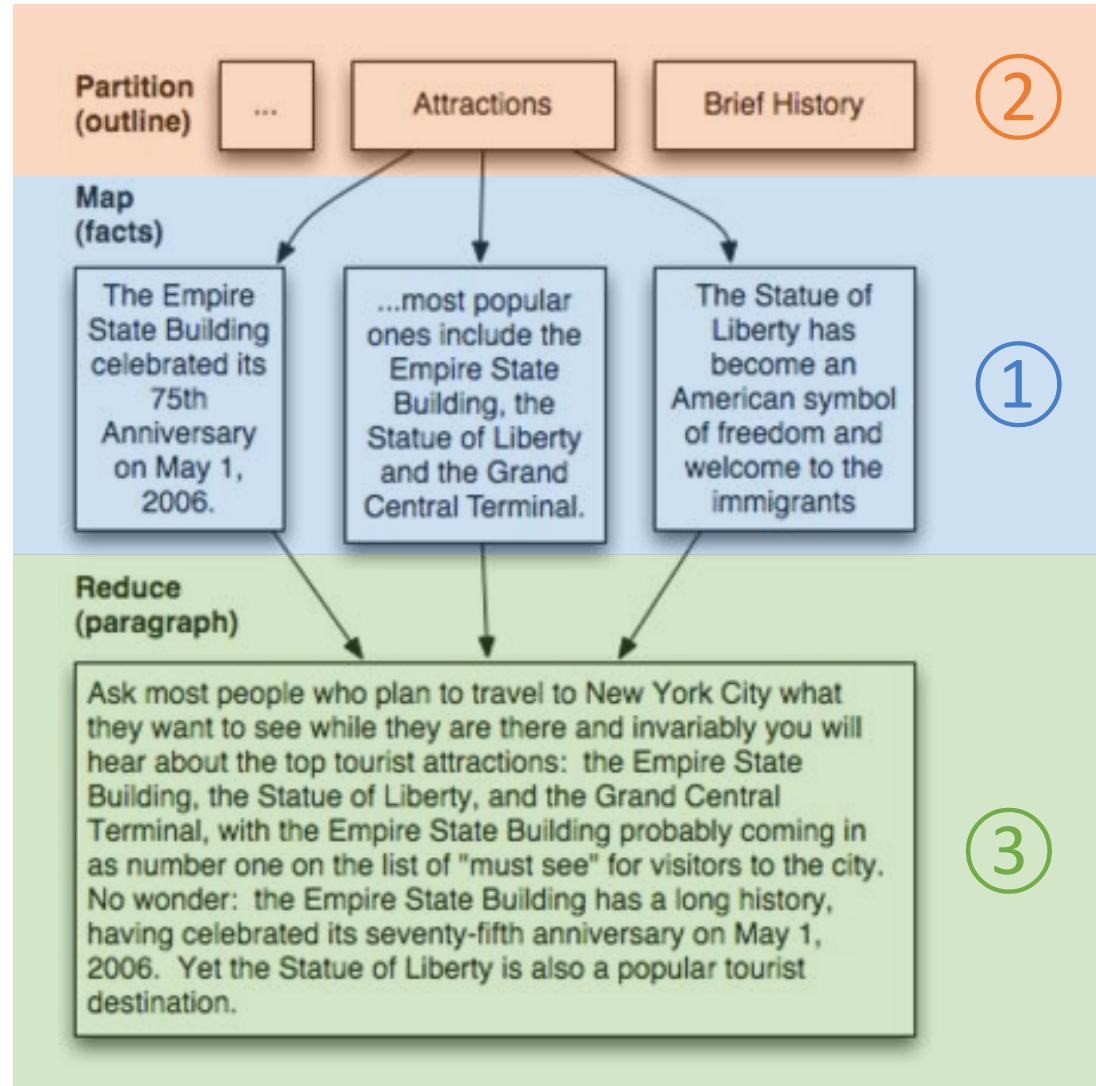
Verify
"Choose at least one rewrite that has significant style errors in it. Choose at least one rewrite that significantly changes the meaning of the sentence."

Soylent is a prototype...
 Soylent is prototypes...
 Soylent is a prototypetest...

Luther, Hahn, Dow & Kittur. Crowdlines: Supporting Synthesis of Diverse Information Sources through Crowdsourced Outlines. HCOMP 2015.

Hahn, Chang, Kim & Kittur. The Knowledge Accelerator: Big picture thinking in small pieces. CHI 2016.

Kim, Cheng & Bernstein. Ensemble: Exploring complementary strengths of leaders and crowds in creative collaboration. CSCW 2014.



- ① **Collect content**
- ② **Organize content**
- ③ **Turn content into writing**

① 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

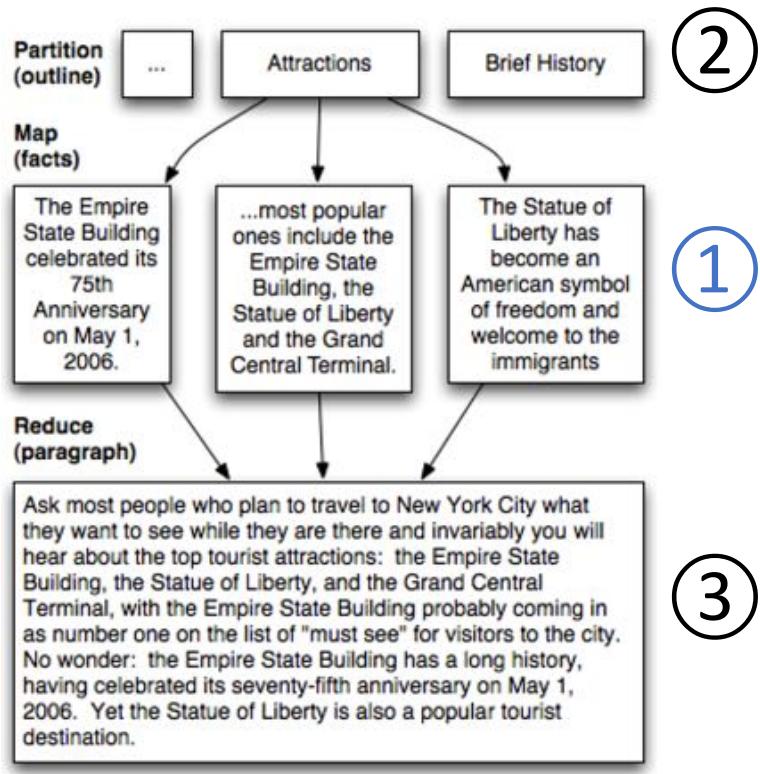
People have spare time when mobile

Structure turns big tasks into series of small microtasks

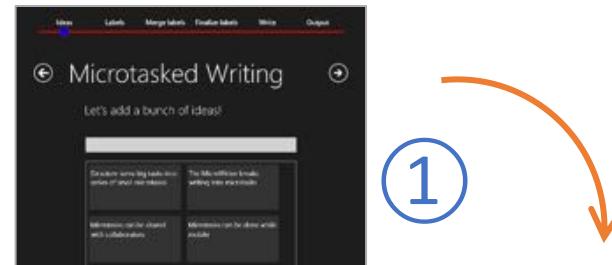
Microtasks make it easy to get started

① Collect Content





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



Suggest Categories for tips about Traveling

Read the tip below, and tell us what category you see it belonging to. We are just asking for your judgment. Travel tips are very hard to categorize. Please don't be discouraged. If you think a tip has a problem or is too hard to categorize, check the "poor" box (this should be rare).

Flights are cold, make you uncomfortable, and dehydrate you. So wear long pants (dark), have a backpack and a jacket accessible. Don't eat a lot (long flights). Baby vegans feel unwell after traveling for 10 hours, so don't breastfeed on your cracked hands, drink water.

Baggage of all sorts - use for dirty clothes, liquids, maximize their size, minimize charges (check bags, etc). Bring a couple of empty plastic bags for trash, etc.

Using Osmosys, AntiHunting, Etiquette, or other technologies, etc - charge to your phone to protect you at total desolation, where you may not have access to water. Remember, Asia.

Pick the best category for a travel tip

Instructions:

Read the following travel tip, and tell us which category it fits. First free to use your judgment. In general:

- Pick categories whose name make the most sense to you.
- Pick broad categories rather than narrow categories.
- Avoid subjective categories such as "funny tips".
- Good questions are important for spotting and representing new.

Task:

Flights are cold, make you uncomfortable, and dehydrate you. So wear long pants (dark), have a backpack and a jacket accessible. Don't eat a lot (long flights). Baby vegans feel unwell after traveling for 10 hours, so don't breastfeed on your cracked hands, drink water.

Category	Score
How to handle the long flights	0
Travel organization and conveniences	0
International Rights	0
Packing essentials	0

Categorize Tips for Traveling

Instructions:

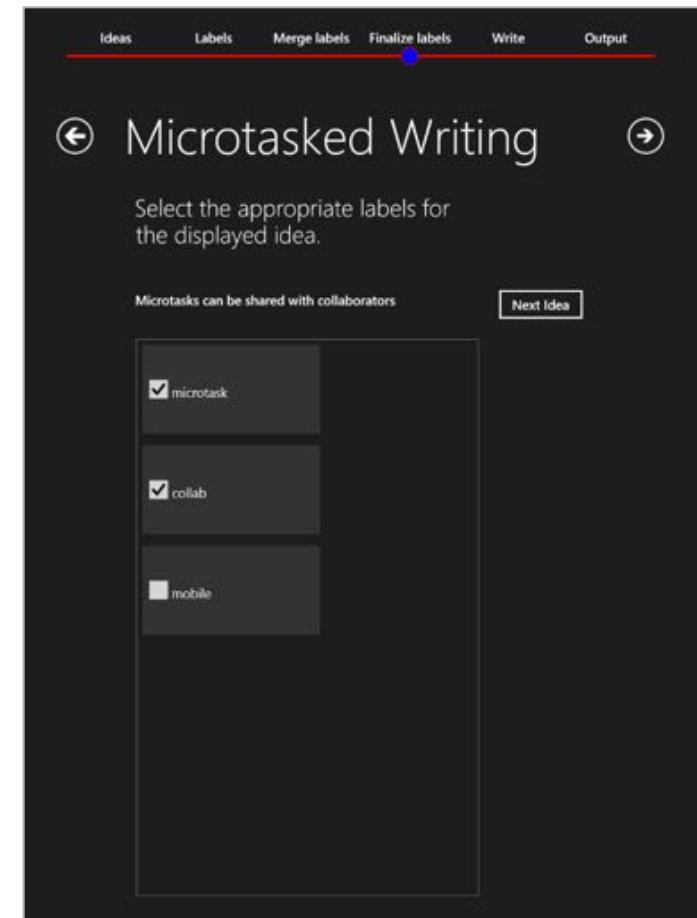
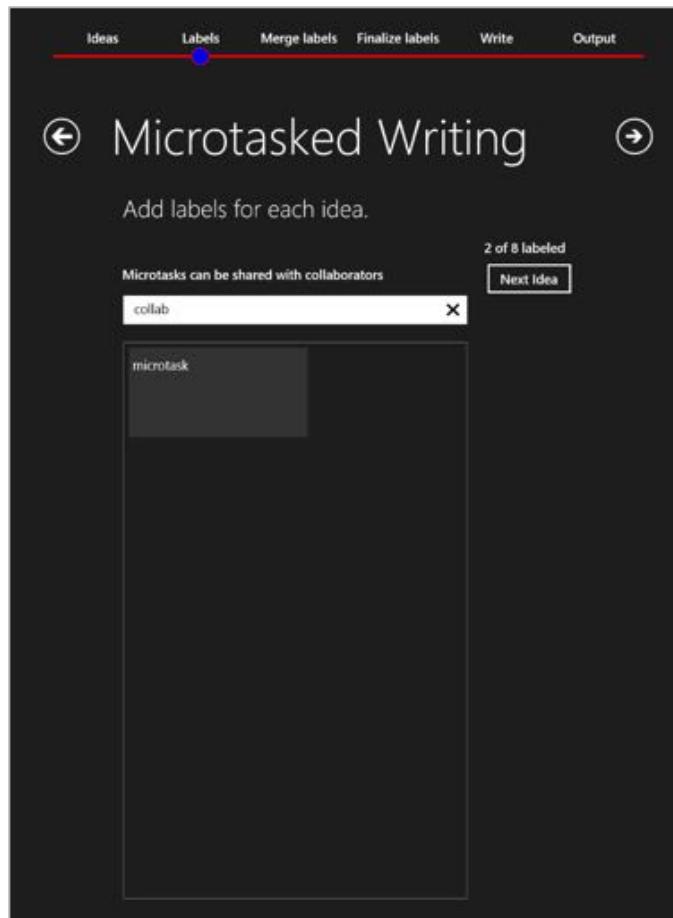
Read the tip below, then read the suggested categories for it. For each suggested category, say whether you think the tip fits or doesn't fit.

Task:

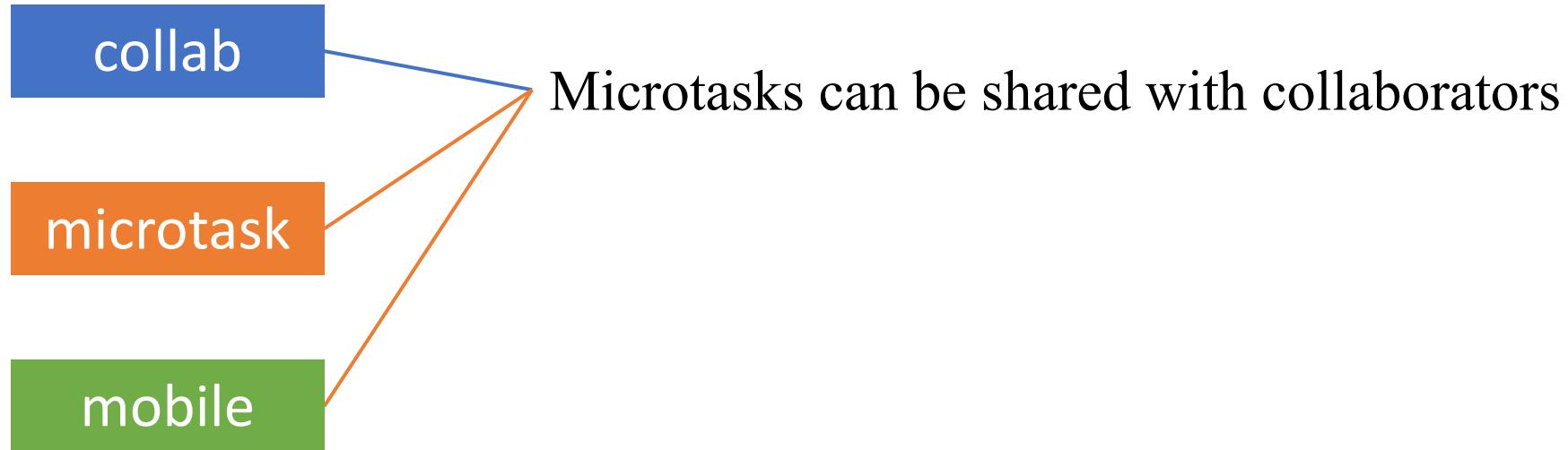
Flights are cold, make you uncomfortable, and dehydrate you. So wear long pants (dark), have a backpack and a jacket accessible. Don't eat a lot (long flights). Baby vegans feel unwell after traveling for 10 hours, so don't breastfeed on your cracked hands, drink water.

Category	Fit	Don't Fit
How to handle the long flights	0	0
Travel organization and conveniences	0	0
International Rights	0	0
Packing essentials	0	0

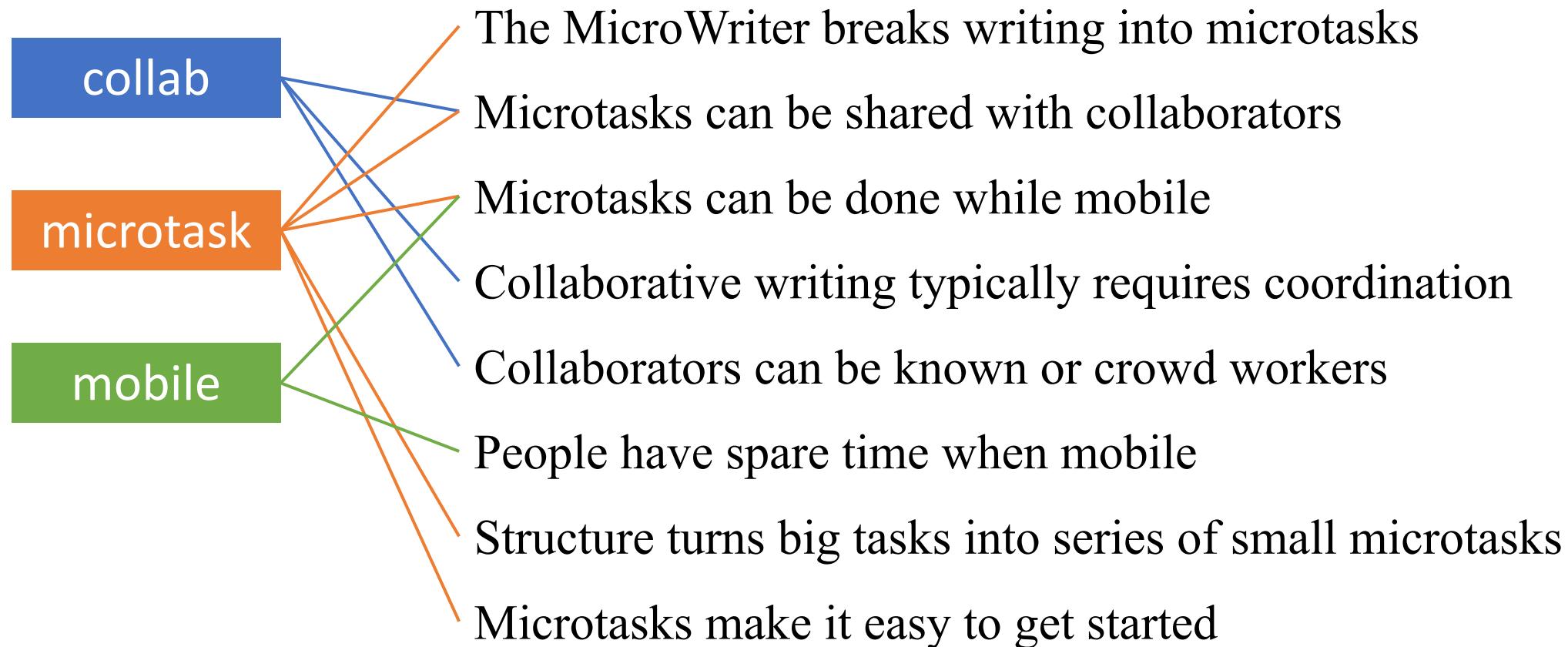
② Organize Content

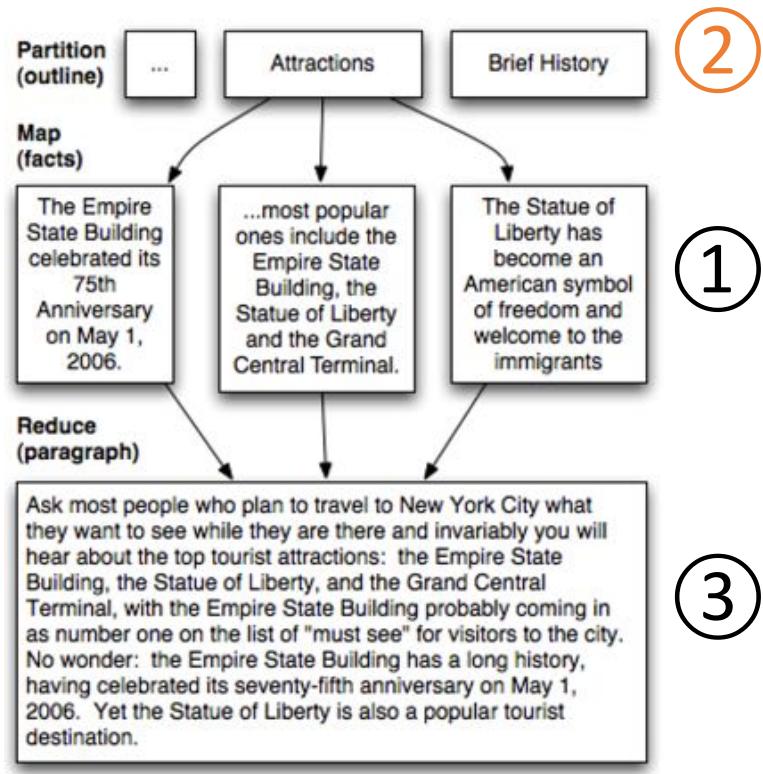


② Organize Content

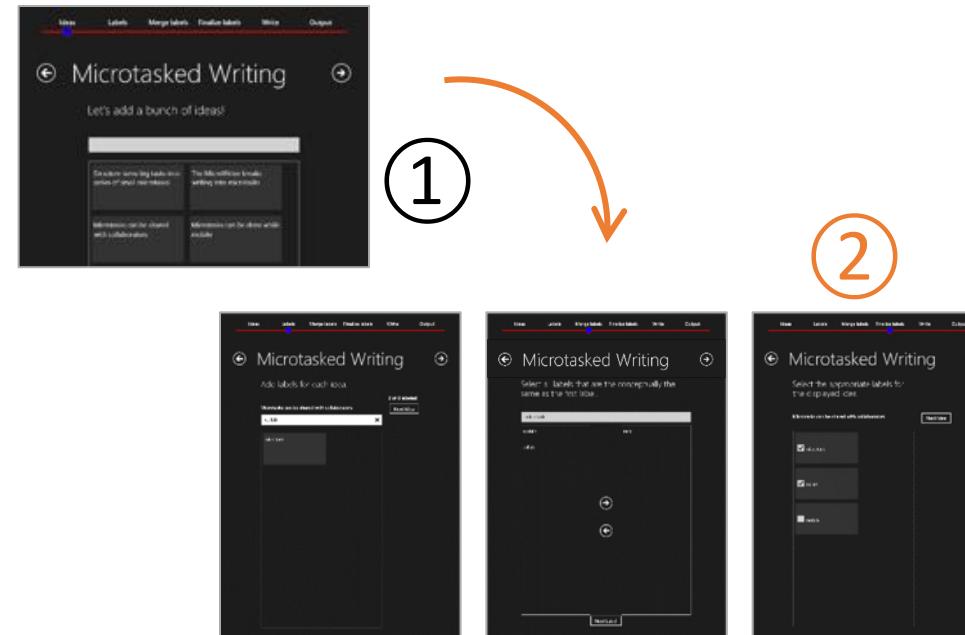
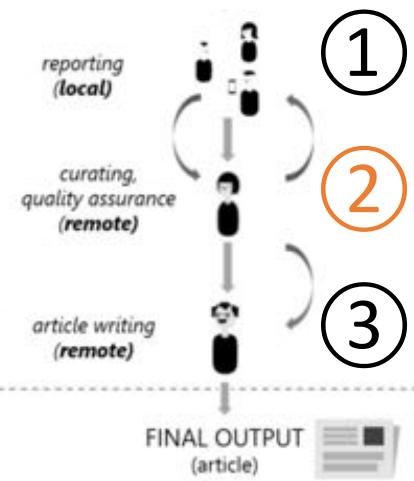


② Organize Content

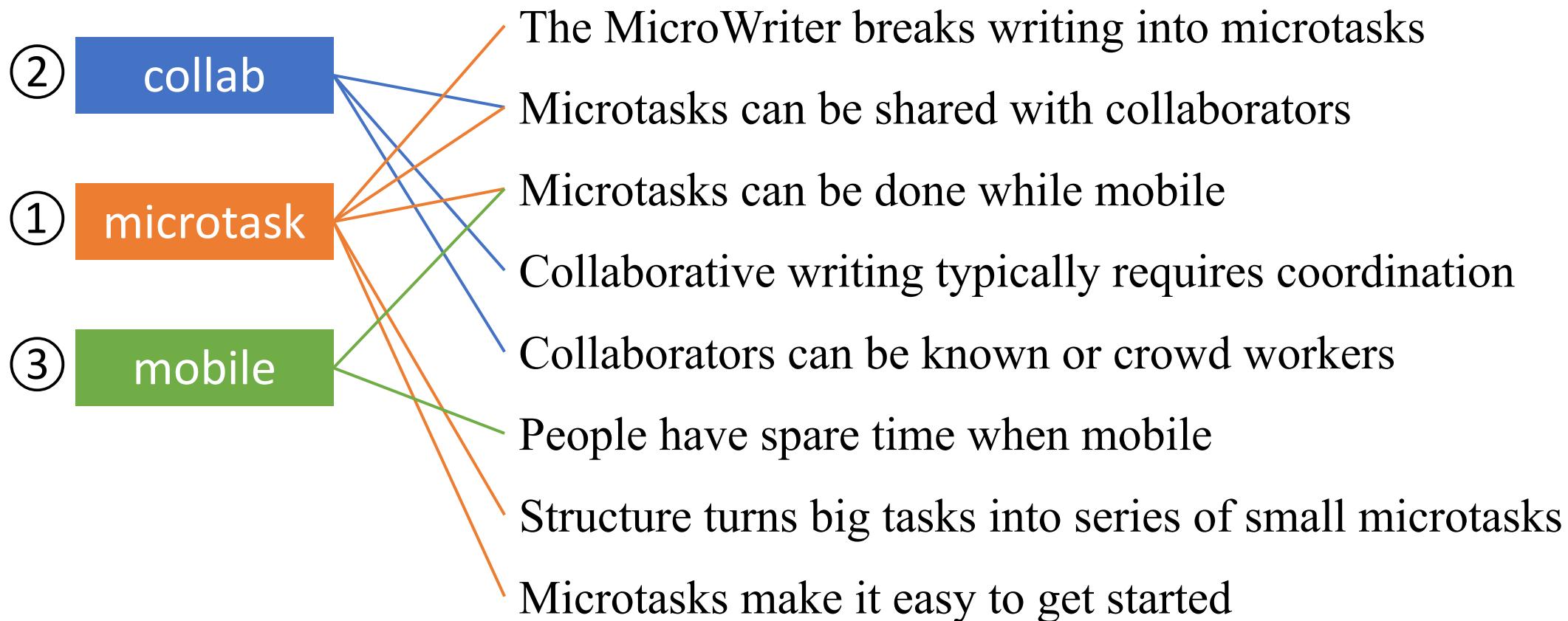




- ① **Collect content**
- ② **Organize content**
- ③ **Turn content into writing**



③ Turn Content into Writing



③ Turn Content into Writing

microtask

- The MicroWriter breaks writing into microtasks
- Structure turns big tasks into series of small microtasks
- Microtasks make it easy to get started

collab

- Microtasks can be shared with collaborators
- Collaborative writing typically requires coordination
- Collaborators can be known or crowd workers

mobile

- Microtasks can be done while mobile
- People have spare time when mobile

③ Turn Content into Writing

The interface features a horizontal navigation bar at the top with six items: Ideas, Labels, Merge labels, Finalize labels, Write, and Output. A red line with a blue dot is positioned under the 'Write' button, indicating it is the active step. Below the bar, the title 'Microtasked Writing' is displayed in large, white, sans-serif font, flanked by left and right arrows.

Below the title, a text instruction reads: "Write a paragraph using these ideas...".

A callout box in the bottom-left corner contains the following text: "Microtasks can be shared with collaborators", "Collaborators can be known or crowd workers", and "Collaborative writing typically requires coordination".

A "Next Idea" button is located in the bottom-right corner of the callout box.

③ Turn Content into Writing

collab

- Microtasks can be shared with collaborators
- Collaborative writing typically requires coordination
- Collaborators can be known or crowd workers

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

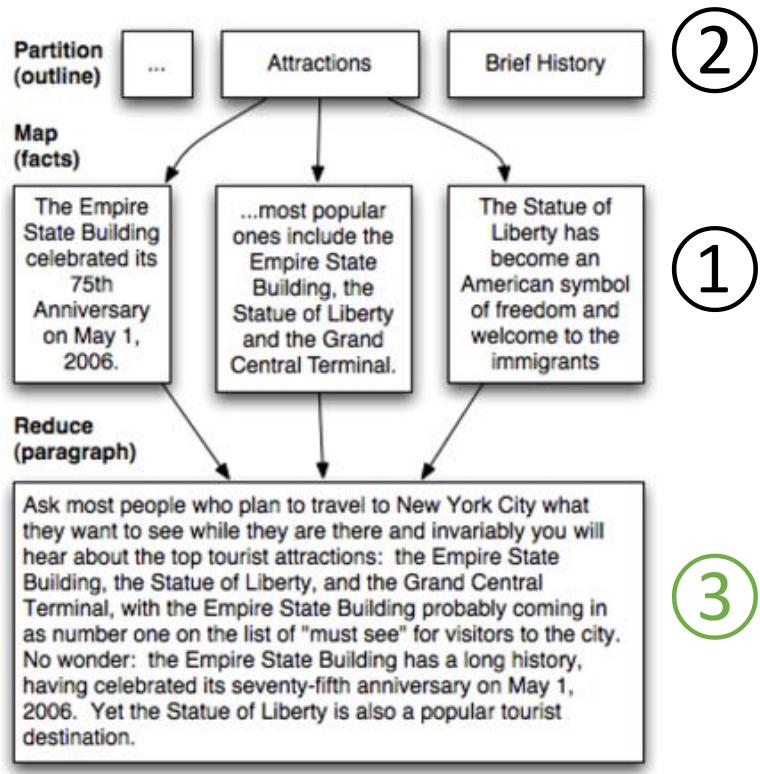
③ Turn Content into Writing

- Complete output:

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. However, 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.



②

①

③

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



Microproductivity: Designing Workflows for Yourself

Task Structure – Break tasks into microtasks

- What we know: Examples of many complex tasks can be broken down
- Still needed: What tasks can be broken down? How to capture context?

Task Completion – Make it easy to do microtasks

- What we know: Microtasking is easier, especially when mobile
- Still needed: When to break tasks down? How to prioritize microtasks?

Task Sharing – Get microtasks to the right person

- What we know: Reduce collaboration overhead with colleagues, crowd
- Still needed: Who is the best person to do a microtask?

Task Automation – Learn microtasks via hybrid intelligence

- What we know: Possible to incorporate automation into workflows
- Still needed: When can AI systems benefit from human input?

Discussion

- What tasks in your life do you think that might benefit through adopting microproductivity?
- How should you decompose the task? Can you share some of the microtasks? Can you automate some of the microtasks?