

Microsoft Research
Faculty
Summit
2016

Supporting Big Tasks through Microtasks

Chair: Andres Monroy-Hernandez (Microsoft Research)

Presentations:

- Jaime Teevan (Microsoft Research)
- Jeff Bigham (Carnegie Mellon University)
- Michael Bernstein (Stanford University)

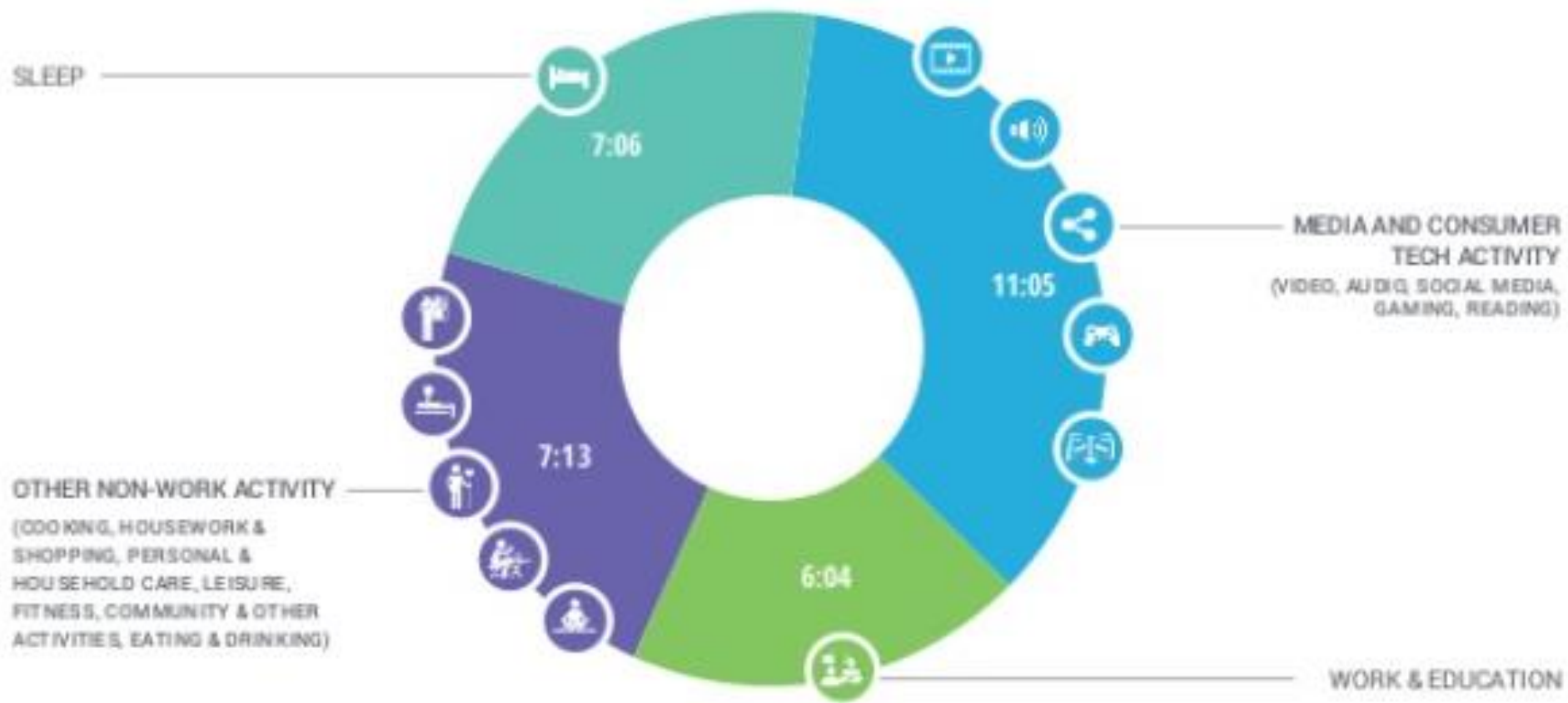
Discussion (build from *The Future of Work: Societal Challenges*)





Average Employed Adult Daily Behavior, U.S., 2014, Hours : Minutes

TOTAL: 31 HOURS 28 MINUTES





mi·cro·pro·duc·tiv·i·ty

/'mīkrō prōˌdæk'tivətē/ noun

The transformation of large productivity tasks into a set of smaller microtasks that can be completed individually in short bursts of time with limited context.

Key Aspects of Microproductivity

Task Structure – Break tasks into microtasks

- State of art: Examples of many complex tasks can be broken down
- Emerging: Workflow creation, composition, reuse; context maintenance

Task Completion – Make it easy to complete microtasks

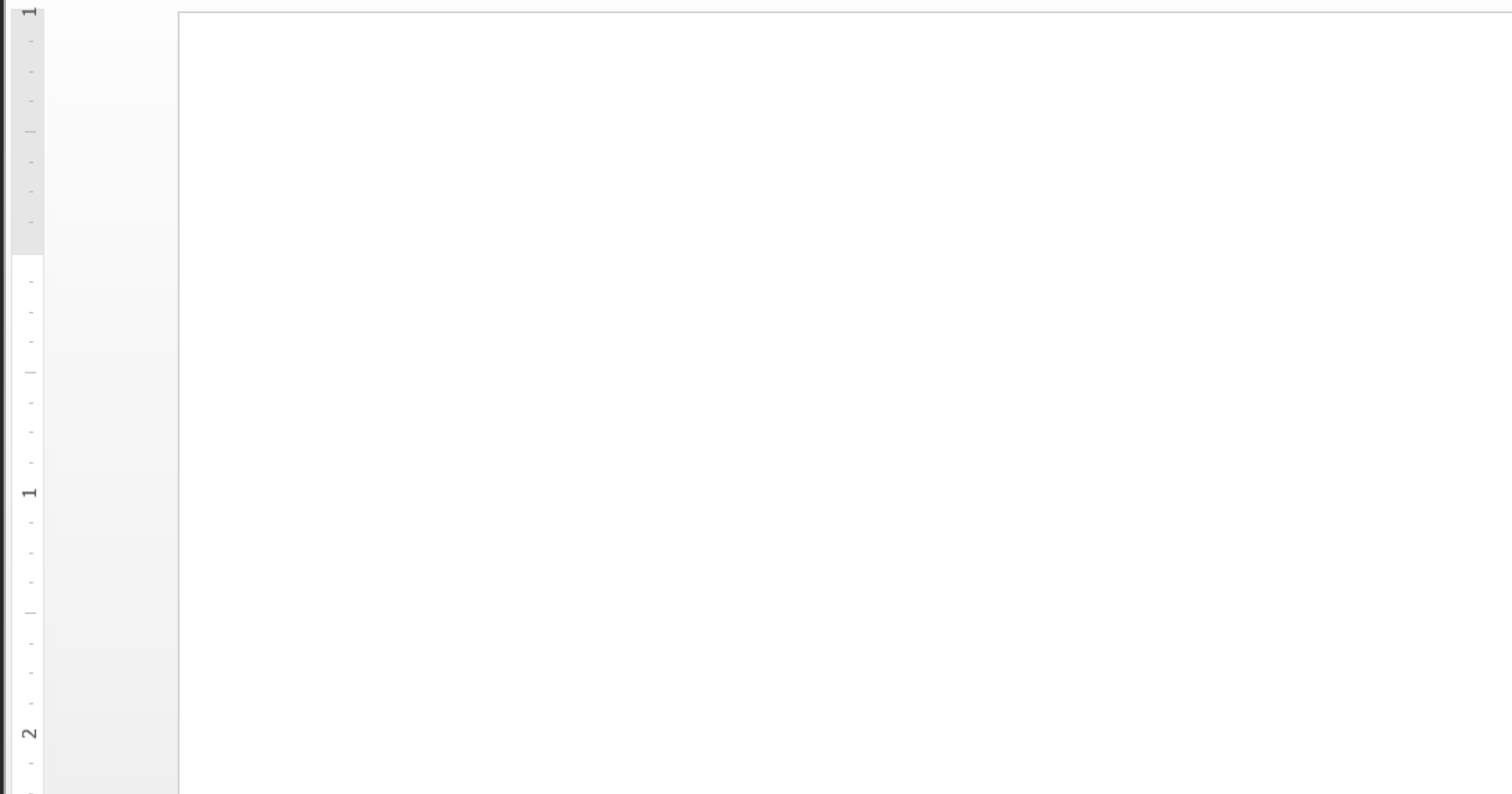
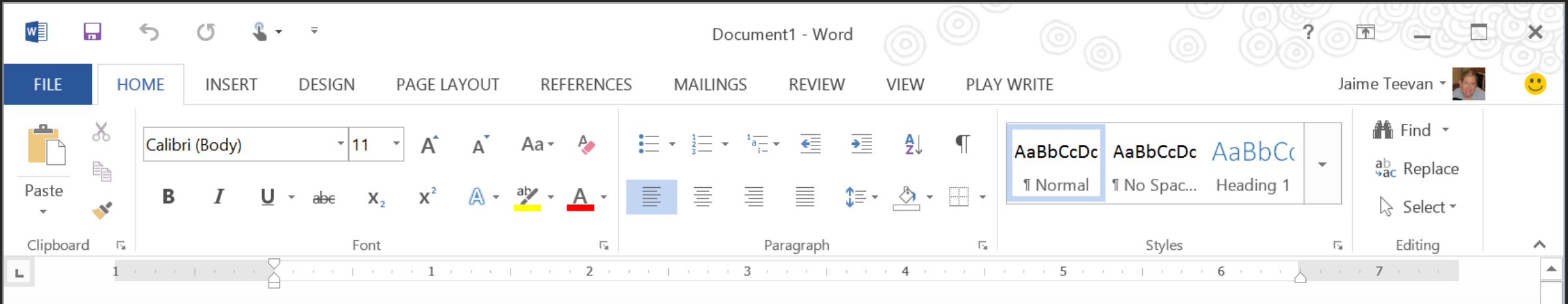
- State of art: Microtasks easier, especially during mobile micromoments
- Emerging: Workflow search and application; microtask prioritization

Task Sharing – Allocate microtasks to the right person

- State of art: Reduces overhead in collaborating with colleagues, crowd
- Emerging: Automated task allocation; support for task marketplaces

Task Automation – Learn microtasks via hybrid intelligence

- State of art: Humans and machines have complementary abilities
- Emerging: Models for when AI systems can benefit from human input



Microsoft Word

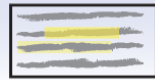
C# and Visual Studio Tools for Office

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

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


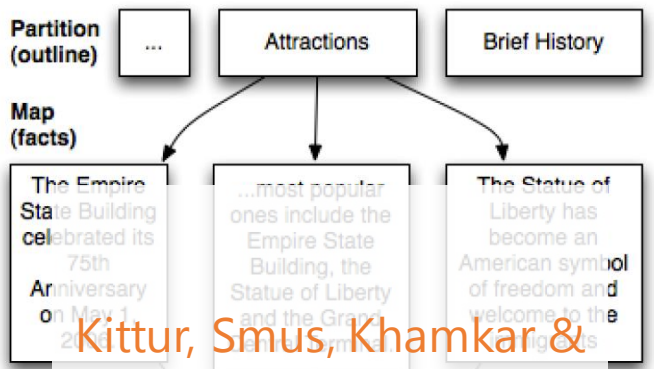
Find overlapping areas (patches)

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 significant..."

Soylent, a prototype crowdsourced word



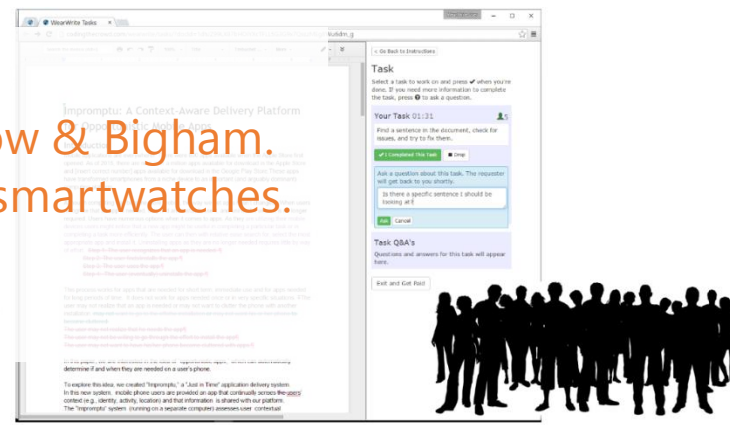
Kittur, Smus, Khamkar & Kraut. CrowdForge: Crowdsourcing complex work. **UIST 2011.**

Ask most people who plan to travel to New York City what they want to see. They are 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.



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

give instructions
provide feedback
complete tasks
ask questions



Crowd Workers

Mechanical Turk
Javascript, Java and TurKit

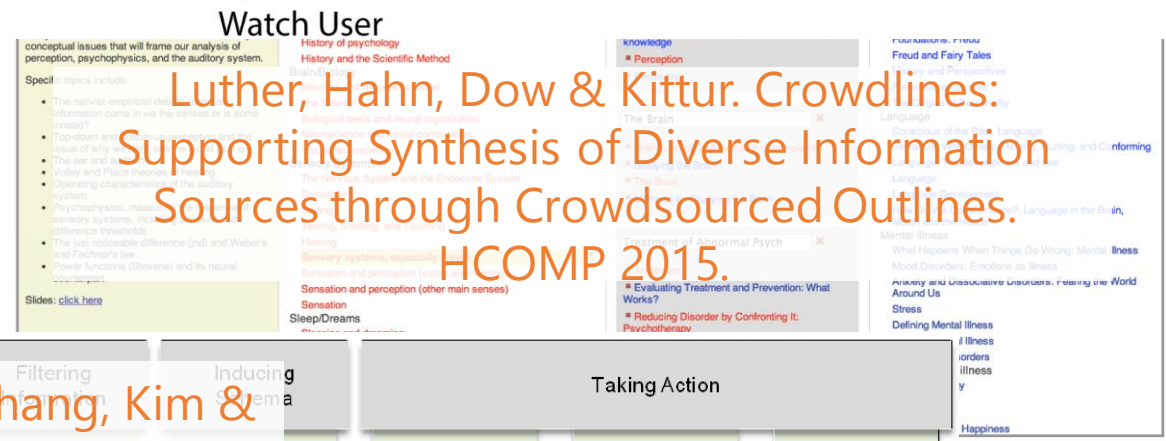
Find
"Identify at least one area that can be shortened without changing the meaning of the paragraph."

Bernstein, Little, Miller, Hartmann, Ackerman,

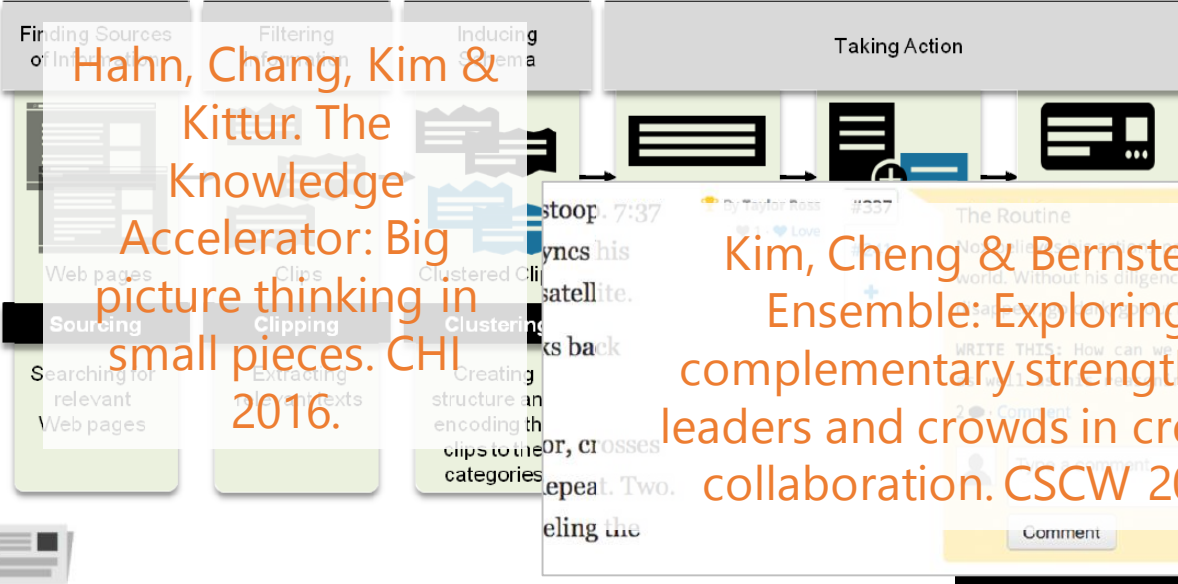
Fix
"Edit the highlighted section to shorten its length without changing the meaning of the paragraph."

Karger, Crowell & Panovich.

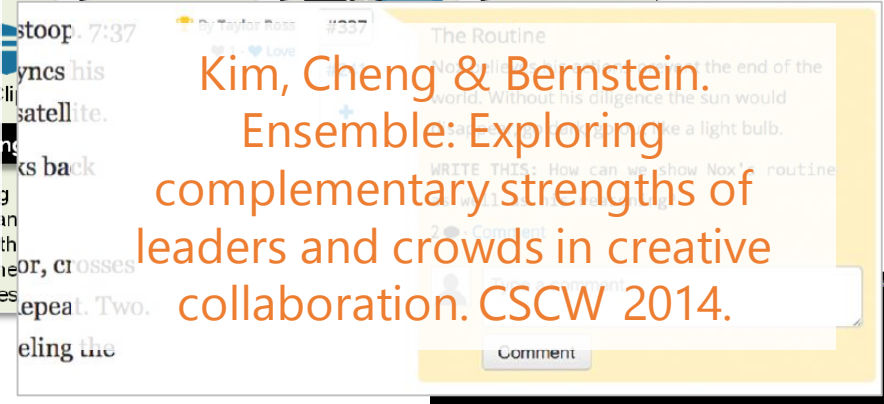
Verify
"Choose at least one rewrite that has significant improvement over the original."



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

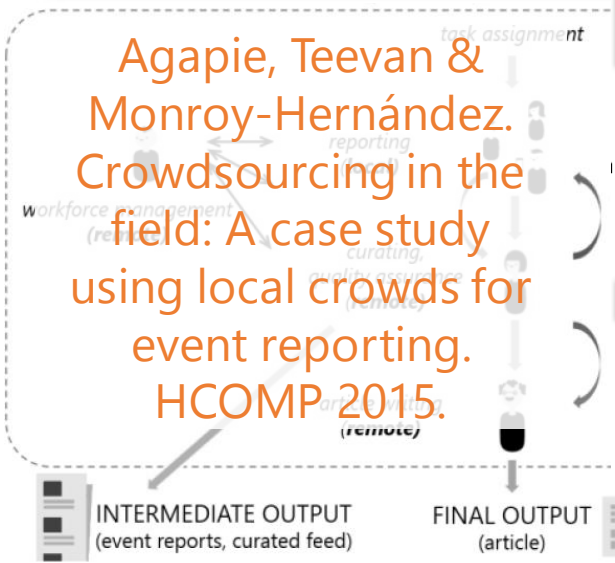


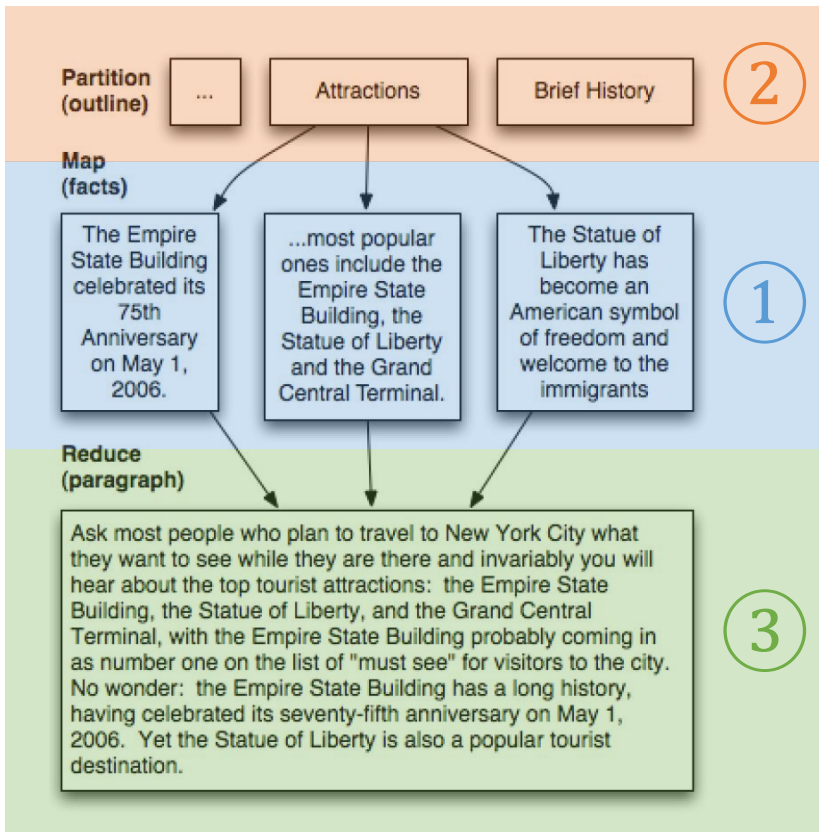
Hahn, Chang, Kim & Kittur. The Knowledge Accelerator: Big picture thinking in small pieces. **CHI 2016.**



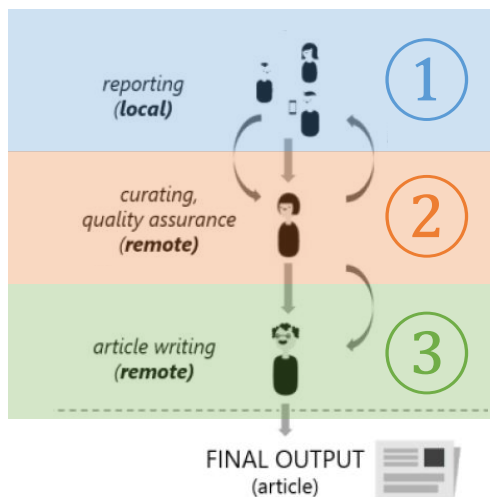
Kim, Cheng & Bernstein. Ensemble: Exploring complementary strengths of leaders and crowds in creative collaboration. **CSCW 2014.**

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





- 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

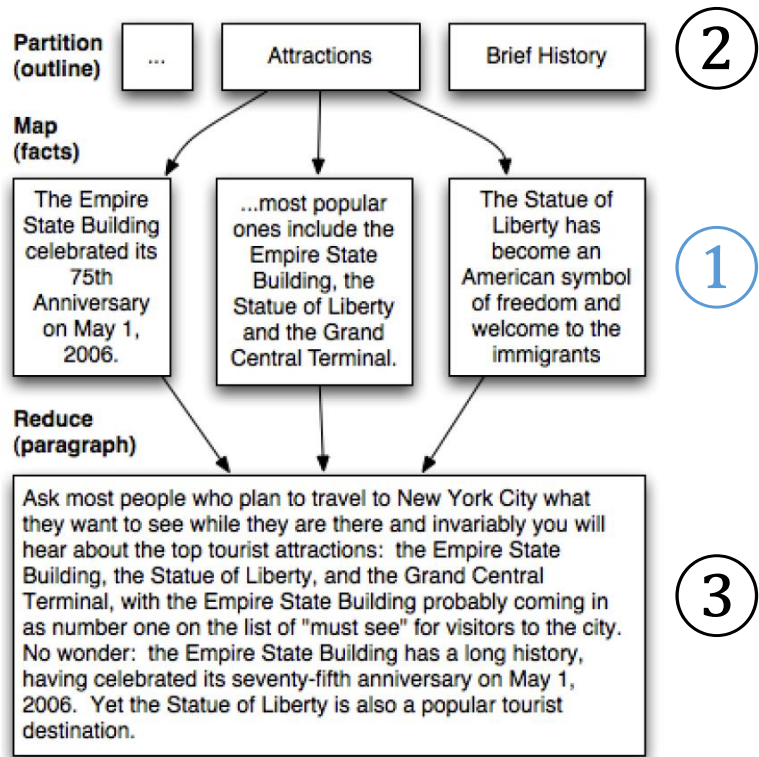
People have spare time when mobile

Structure turns big tasks into series of small microtasks

Microtasks make it easy to get started

① Collect Content

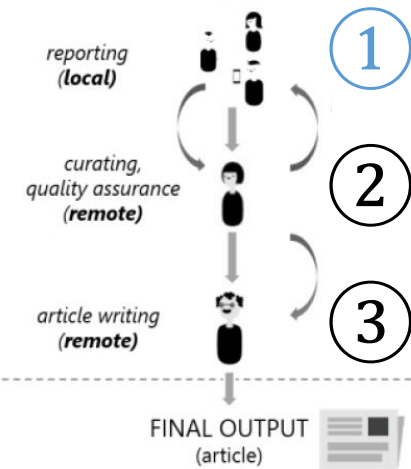




- ① Collect content
- ② Organize content
- ③ Turn content into writing



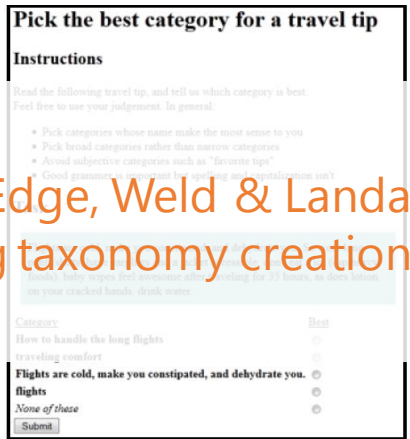
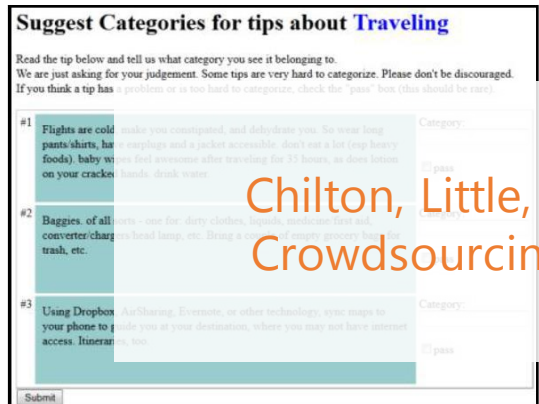
①



①

②

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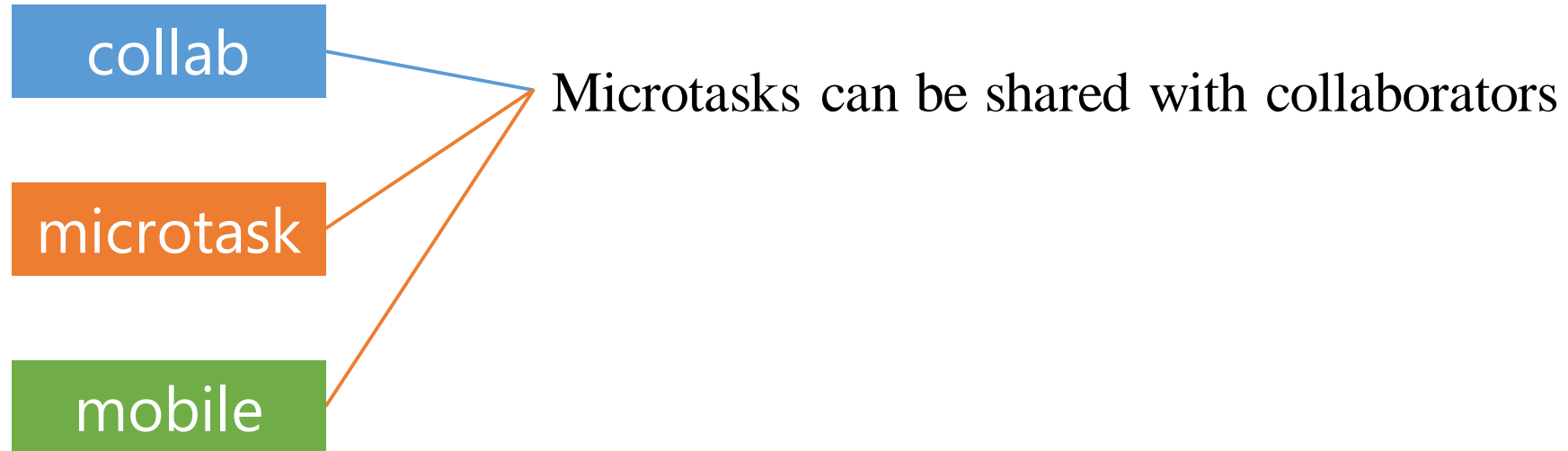


Chilton, Little, Edge, Weld & Landay. Cascade: Crowdsourcing taxonomy creation. CHI 2013.

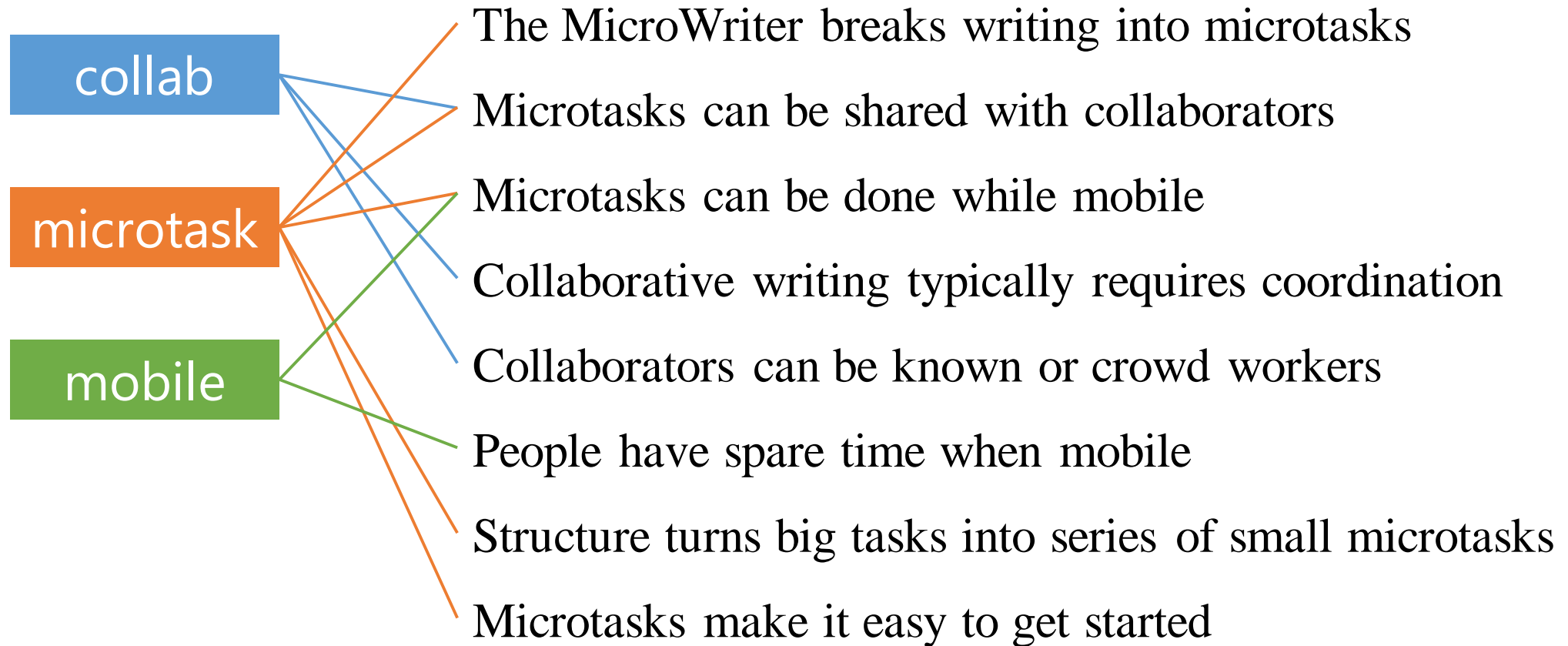
② Organize Content

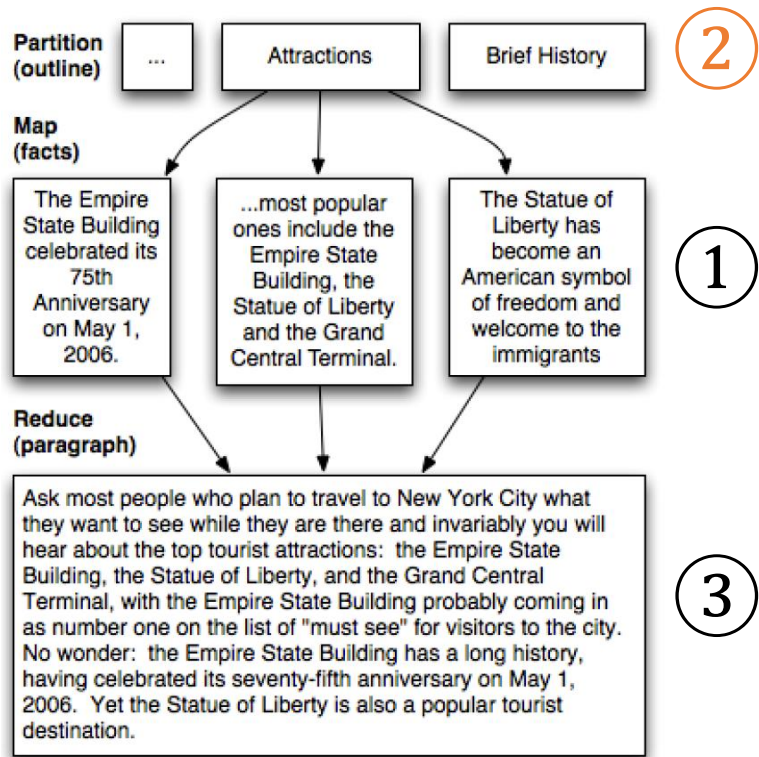


② Organize Content



② Organize Content

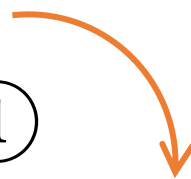




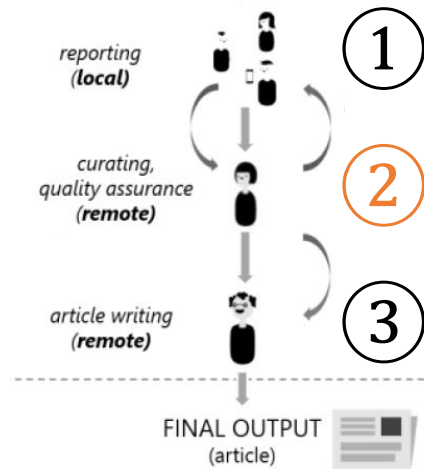
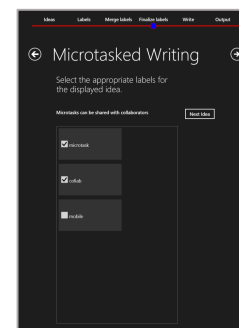
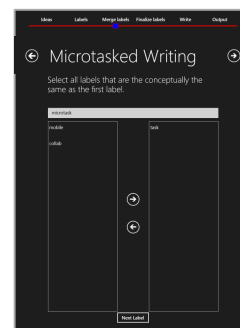
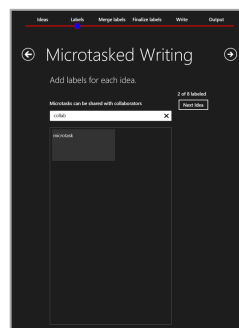
- ① Collect content
- ② Organize content
- ③ Turn content into writing



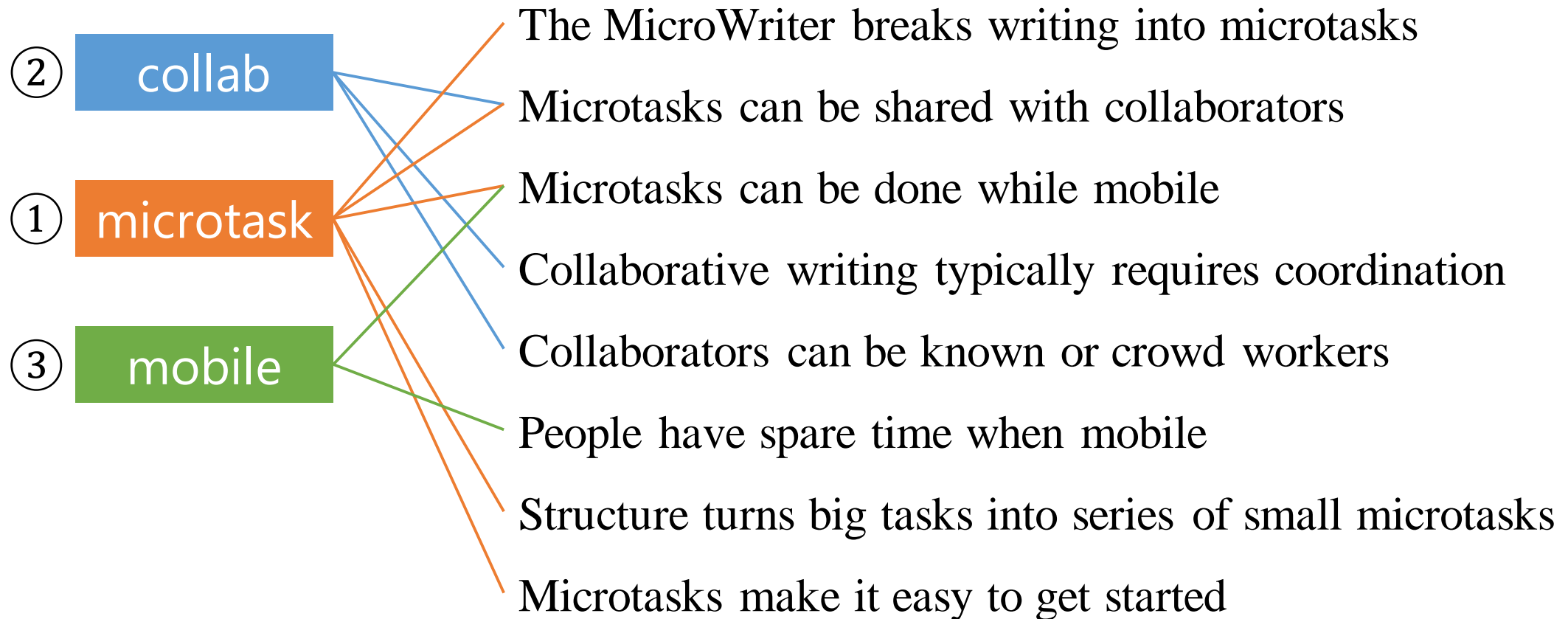
①



②



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 screenshot shows a dark-themed user interface for a writing task. At the top, a horizontal progress bar is divided into six segments: 'Ideas', 'Labels', 'Merge labels', 'Finalize labels', 'Write', and 'Output'. A red line runs through the segments, with a blue dot positioned under the 'Write' segment, indicating the current step. Below the progress bar, the title 'Microtasked Writing' is centered, flanked by left and right navigation arrows. Underneath the title, the instruction 'Write a paragraph using these ideas...' is displayed. A white rectangular box contains the following text: 'Microtasks can be shared with collaborators', 'Collaborators can be known or crowd workers', and 'Collaborative writing typically requires coordination'. To the right of this box is a button labeled 'Next Idea'.

Ideas Labels Merge labels Finalize labels **Write** Output

← Microtasked Writing →

Write a paragraph using these ideas...

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

Next Idea

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.

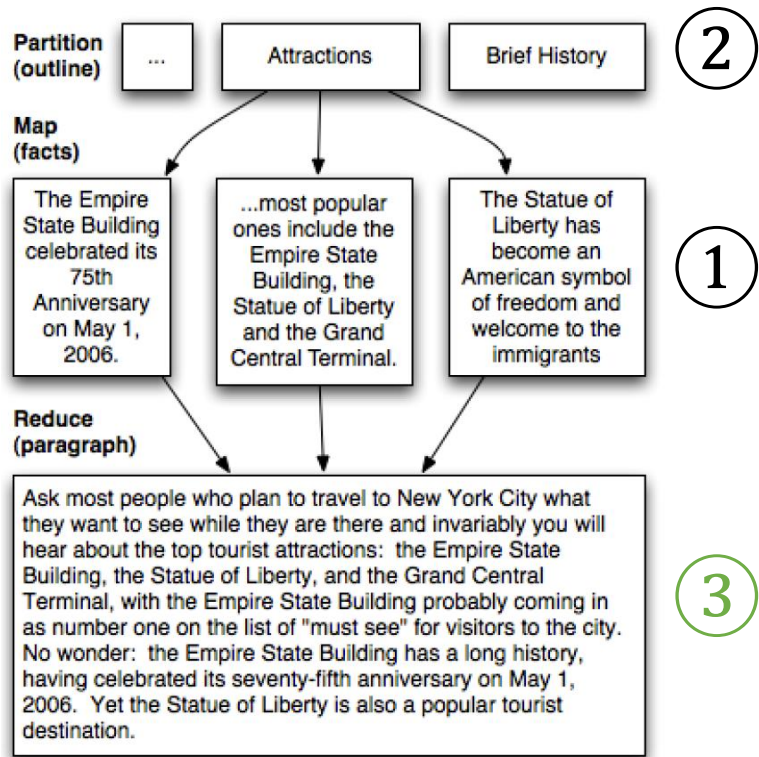
③ Turn Content into Writing

- 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.

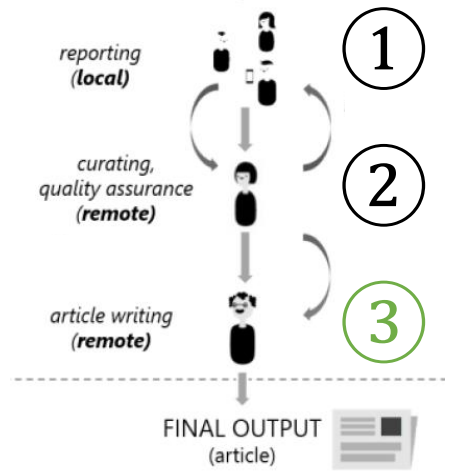


②

①

③

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



Microproductivity for Writing

Task Structure – Break tasks into microtasks

- The MicroWriter's simple writing workflow creates reasonable output
- Also explored: workflows for cleaning up written text

Task Completion – Make it easy to complete microtasks

- Microtasks can be done while mobile or in atypical situations
- Easy to start microtasking, thoughtful ordering supports engagement

Task Sharing – Allocate microtasks to the right person

- Studied microtasks sharing with: collaborators, crowd workers
- Reduces need for coordination, but context transfer important

Task Automation – Learn microtasks via hybrid intelligence

- Natural language processing techniques used to support microtasks
- Workflows allow people to use imperfect NLP algorithms

Extra Slides

Microproductivity Publications from MSR

- Microproductivity

- Teevan, Iqbal, Cai, Bigam, Bernstein, Gerber. [Productivity decomposed: Getting big things done with little microtasks](#). CHI 2016.
- Cai, Iqbal, Teevan. [Chain reactions: The impact of order on microtask chains](#). CHI 2016.
- Cheng, Teevan, Iqbal, Bernstein. [Break it down: A comparison of macro- and microtasks](#). CHI 2015.
- Teevan, Libeling, Lasecki. [Selfsourcing personal tasks](#). CHI 2014.

- Writing via microtasks

- Teevan, Iqbal, von Veh. [Supporting collaborative writing with microtasks](#). CHI 2016.
- Nebling, To, Guo, de Freitas, Teevan, Dow, Bigam. [WearWrite: Crowd-assisted writing from smartwatches](#). CHI 2016.
- Teevan. [Selfsourced writing](#). CHI 2016 workshop on Productivity decomposed: Getting big things done with little microtasks.
- Greer, Teevan, Iqbal. [An introduction to technological support for writing](#). MSR-TR-2016-01, 2016.
- Agapie, Teevan, Monroy-Hernández. [Crowdsourcing in the field: A case study using local crowds for event reporting](#). HCOMP 2015.

- Crowdsourcing personal information tasks

- Cheng, Teevan, Bernstein. [Measuring crowdsourcing effort with error-time curves](#). CHI 2015.
- Organisciak, Teevan, Dumais, Miller, Kalai. [A crowd of your own: Crowdsourcing for on-demand personalization](#). HCOMP 2014.
- Lasecki, Teevan, Kamar. [Information extraction and manipulation threats in crowd-powered systems](#). CSCW 2014.

WearWrite

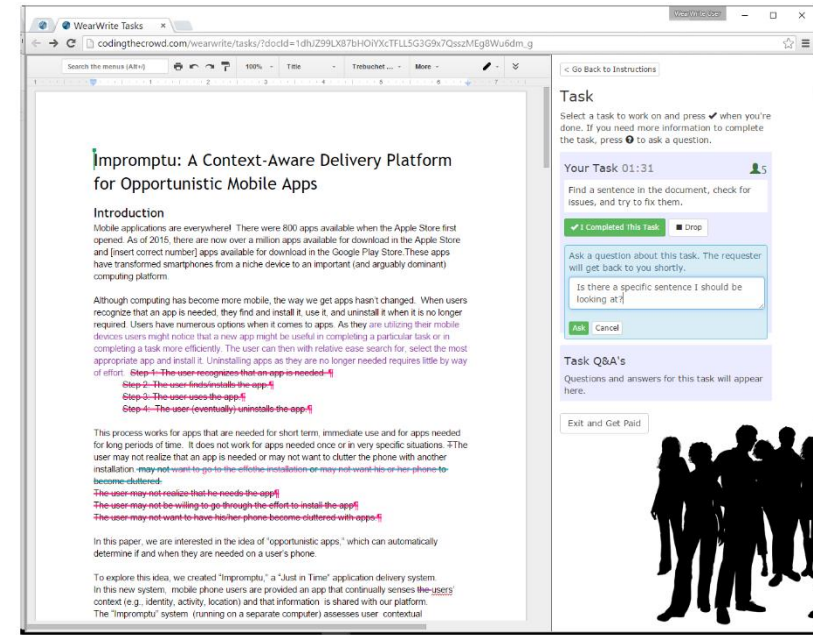


Watch User

give instructions
provide feedback

WearWrite

complete tasks
ask questions



Crowd Workers

WearWrite



Orchestrating the tasks from wearables

Introduction

- general problem area
- contribute to complex task like writing
- wearable tablet input new line wearables
- he could ride my running on taking

Problem being addressed

- aspects of writing that do not require
- orchestrate crowd heard from wearables
- used small fragment of time
- small fragment called micro moments
- in this paper we introduce a new method

Abstract

While there is a general increase in the global application of wearables technology, the majority of the world populations are yet to fully embrace these technologies, since large tasks such as writing use complex user interfaces not practical for small screens. However, shorter tasks which do not require expertise can be outsourced so that large projects can be managed from wearable technology. **WearWrite is a proof-of-concept implementation of this idea. It is essentially an app developed to connect with Google Docs so that instructions and feedback can be provided from the face of a watch.** Two preliminary trials tested the viability of such a system and the first draft of this paper was written using WearWrite.

Introduction

[3] Kim, J., Cheng, J., & Bernstein, M. S. (2014, February). Ensemble: exploring complementary strengths of leaders and crowds in creative collaboration. In *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing* (pp. 745-755). ACM.

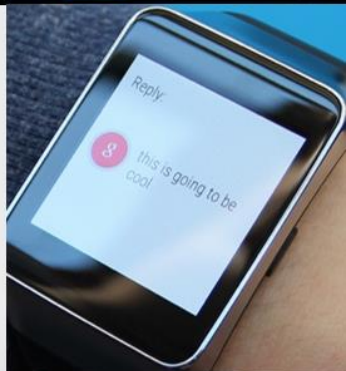
[4] Kittur, A., Smus, B., Khamkar, S., & Kraut, R. E. (2011). Crowdforge: Crowdsourcing complex work. In *Proceedings of the 24th annual ACM symposium on User interface software and technology* (pp. 43-52). ACM.

Anonymous
5:12 PM Today

Add: "WearWrite is a proof-of-concept implementation of this idea. It is essentially an app developed to c..."

Anonymous
4:37 PM Today Resolve

Are there any other papers we should cite??

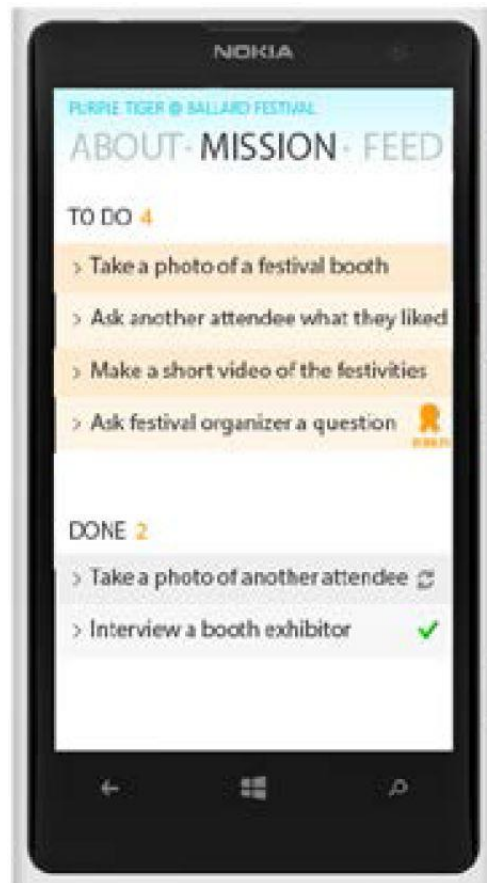


WearWrite

The image shows a screenshot of the WearWrite web application. On the left, a Google Doc titled "Impromptu: A Context-Aware Delivery Platform for Opportunistic Mobile Apps" is open. A black box labeled "Google Doc" has an arrow pointing to the document. The document content includes an introduction and a list of steps: "Step 1- The user recognizes that an app is needed-f", "Step 2- The user finds/installs the app-f", "Step 3- The user uses the app-f", and "Step 4- The user (eventually) uninstalls the app-f".

On the right, a task panel is displayed. A black box labeled "Timer" points to the "Your Task 01:31" header. A black box labeled "Workers" points to the "5" icon representing the number of workers. A black box labeled "Instructions" points to the task description: "Find a sentence in the document, check for issues, and try to fix them." A black box labeled "Questions" points to a question box containing the text "Is there a specific sentence I should be looking at?". A black box labeled "Q&A" points to the "Task Q&A's" section, which contains two questions from users: "mkbennett00: It's a long document and the instructions are vague." and "marmayyyy: Make it shorter and easier for the typical person to read." At the bottom of the task panel, there is an "Exit and Get Paid" button.

Eventful

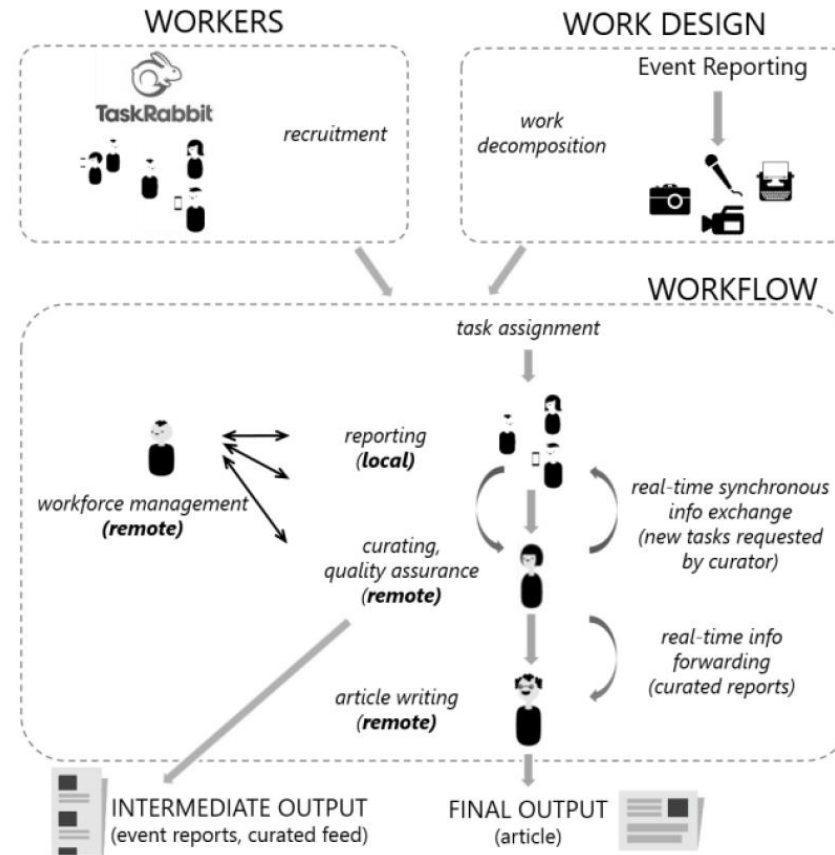


5 Things You Missed at Seattle Transit Reception: Expanding Rail



Streetcars along Broadway and Jackson will work with light rail to improve transit around the greater Seattle area. Conlin and McGinn also noted Broadway as an example of integrated bike/rail planning.

Eventful



Collaborative Writing with the MicroWriter



- 6 groups, active collaborators
 - 2 to 5 people in each group
 - Total number of people: 19

Stage	Coordination	Location	
Collect	Individual	Co-located	
Organize	<i>Initial</i>	Individual	Co-located
	<i>Merge</i>	Group	Co-located
	<i>Finalize</i>	Individual	Co-located
Write	Individual	Remote	



Writing with the MicroWriter

- Self-motivated report topics
 - System description
 - Overview of the group
 - Research plan
 - A rebuttal
- Time to write: 1 hour
- Length: 723 words on average
- Example: See *Discussion Section*

Ideas	Labels	Groups	Words
30	28	12	752
45	13	5	605
23	8	5	234
89	57	22	1160
37	15	7	801
21	13	4	789



Key MicroWriter Opportunities

- Easy to get started
 - *“It was a relatively fast way to divide the work and produce a great starting point... I think we’ll actually use this..”*
- Everyone got a voice
 - *“I felt the process enabled us all to contribute significantly.”*
- Intertwined contributions
 - *“Typically .. one of us would write a full draft and circulate. The tool changes this up a bit by producing an initial draft that is drawn up collaboratively.”*

Content:

- 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. Collaborators can be known colleagues, or paid crowd workers.



Key MicroWriter Challenges

- Writing via microtasks
 - Bottom-up organization unfamiliar
 - Tried to consider all of the implications of each micro-action
 - Label merging least favorite stage
 - People wanted to go back and correct errors
 - Opportunity: Liked the unexpected connections
- Coordination and collaboration
 - Individual nature of microtasks discouraged explicit collaboration
 - Hard to understand the content other people entered
 - Opportunity: Intentional task allocation



MicroWriter Summary

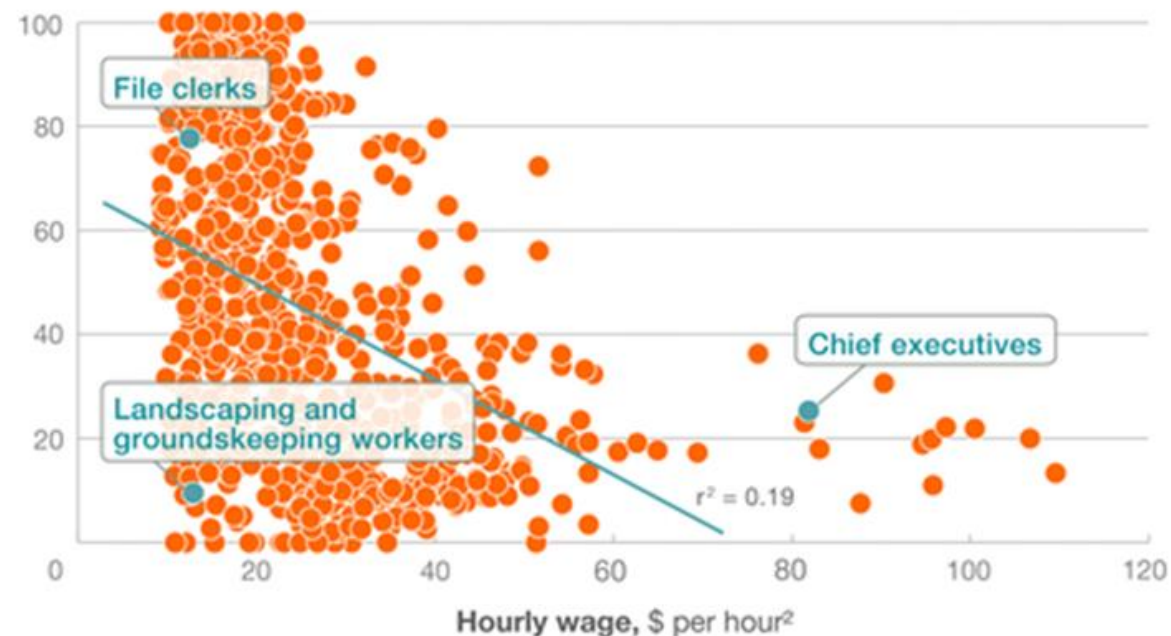
- Possible to decompose writing into a series of microtasks
 - Simple writing workflow creates reasonable output
 - Microtasks make it easy to start writing
 - Using a structured writing process is unfamiliar
 - Bottom-up organization creates unexpected connections
- Writing microtasks can be shared with known collaborators
 - Reduces the need for collaborators to coordinate work
 - Everyone gets a voice and helps produce the final product
 - The need to develop a shared understanding remains



The hourly-wage rate alone is not a strong predictor of automatability, despite some correlation between the two.

Comparison of wages and automation potential for US jobs

Ability to automate, % of time spent on activities¹ that can be automated by adapting currently demonstrated technology



¹Our analysis used "detailed work activities," as defined by O*NET, a program sponsored by the US Department of Labor, Employment and Training Administration.

²Using a linear model, we find the correlation between wages and automatability in the US economy to be significant (p -value < 0.01), but with a high degree of variability ($r^2 = 0.19$).

Source: O*NET 2014 database; McKinsey analysis

McKinsey&Company

