Productivity Decomposed: Getting Big Things Done with Little Microtasks

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Abstract
It is difficult to accomplish meaningful goals with limited time and attentional resources. However, recent research has shown that concrete plans with actionable steps allow people to complete tasks better and faster. With advances in techniques that can decompose larger tasks into smaller units, we envision that a transformation from larger tasks to smaller microtasks will impact when and how people perform complex information work, enabling efficient and easy completion of tasks that currently seem challenging. In this workshop, we bring together researchers in task decomposition, completion, and sourcing. We will pursue a broad understanding of the challenges in creating, allocating, and scheduling microtasks, as well as how accomplishing these microtasks can contribute towards productivity. The goal is to discuss how intersections of research across these areas can pave the path for future research in this space.

Author Keywords
Microtasking; microwork; selfsourcing; crowdsourcing; wait-learning; productivity.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Definitions

Microproductivity: The transformation of large tasks into smaller microtasks for productivity purposes.

Task Decomposition: The process of breaking large tasks down into microtasks such that each microtask contributes towards the overall goal.

Task Completion: The completion and aggregation of microtasks. Involves motivating people to complete microtasks, designing where and when to embed microtasks, and managing attention.

Task Sourcing: The sourcing of tasks and microtasks to an actor to complete. For example, a microtask could be completed by the task owner, peers, the crowd, or automation.

Background

Accomplishing meaningful goals efficiently is often a challenge, especially given the time and resource constraints that people often have. Tasks such as organizing a photo collection, writing a report, or studying for a standardized exam are hard to start because they seem to require long, uninterrupted periods of effort to make meaningful progress. However, research shows that concrete plans with actionable steps enable people to complete their tasks better and faster [11]. Breaking a large task down into a series of smaller, microtasks with scoped context also leads to higher quality work, makes the task easier, and supports recovery from interruption [6].

Successful approaches of decomposing tasks into smaller microtasks already exist, ranging from manual to algorithmic [3]. We believe that *microproductivity*, or the transformation of information work into micro-work, will have a significant impact on when and how people work, enabling individuals to efficiently and easily complete large tasks that currently seem challenging. The rapid developments in micro-work, micro-volunteering, and micro-learning open up new frontiers for the future of microproductivity. This workshop seeks to bring together researchers interested in 1) the *decomposition* of larger tasks into microtasks, 2) the *completion* and aggregation of microtasks, and 3) the *sourcing* of tasks and microtasks. We believe that the intersection of these communities will give rise to new opportunities.

Task Decomposition

One challenge to supporting productivity through microproductivity lies in figuring out how to successfully decompose complex tasks into their component pieces. On crowd platforms, microtasks are increasingly being composed to accomplish complex tasks that are not obviously achievable via standalone microtasks, such as taxonomy creation [7], itinerary planning [15], and writing [3]. In education, large lesson plans can be intelligently decomposed into a sequence of shorter exercises that are adaptively scaffolded to aid the learner from one exercise to the next [4]. This workshop focuses on large tasks that can be decomposed into smaller, possibly independent microtasks where the outcome of each microtask contributes towards the overall productivity.

While it is not obvious how to decompose all tasks, there are a number of common aspects to many information tasks that could be decomposed in common ways. For example, preparing a presentation, organizing notes, and structuring ideas into a report outline all involve organizing content into a hierarchy. Likewise, reading a paper, changing a document into a presentation, and creating an executive summary for a whitepaper all involve distilling and synthesizing key points from information. Several successful approaches to decompose these common subtasks already exist [3], which could be shared, reused, and composed into more complex workflows.

In providing structure to open-ended goals, task decomposition enables people to do things they may not be able to otherwise. For example, people without domain expertise can currently make progress on tasks like filing taxes or producing a will simply by filling out a form. Intentional use of context can help people identify creative solutions and draw unexpected connections [14]. Furthermore, short, concrete tasks

Definitions

Micro-moment: Brief segments of time wherein microtasks can be completed.

can also easily incorporate aspects of quality assurance and course correction.

Interesting research questions related to task decomposition include:

- What are the best ways to create workflows of microtasks from a larger task goal?
- What factors should be considered when deciding how to decompose a task?
- How can the context necessary for the large task be encapsulated into each individual microtask?
- What aspects of a task cannot be decomposed?

Task Completion

Once a task is decomposed into its component microtasks, each individual microtask must be completed. With the ubiquity of device usage, microtasks have the potential to contribute towards productivity during micro-moments of spare time. Recent research suggests that microtasks can be effectively completed while waiting for an instant message response [5], while on mobile phones [8][13], and in shared, ubiquitous locations such as vending machines and kiosks [9]. Because microtasks are self-contained and short, they may also be more robust to interruptions [6], which occur both in desktop settings and in mobile environments. Since micro-moments occur within or between existing activities, the future of microproductivity will involve determining which micro-moments are more suitable for microtasking, and how microtasks ought to be designed to support bite-sized interactions during fleeting moments [5].

Microtasks not only make it possible to make incremental progress toward a larger goal, but also have the potential to yield an early sense of accomplishment. Research shows that concrete progress with frequent feedback can help reinforce a sense of self-efficacy [2]. Completing microtasks could provide motivational benefits in addition to functional efficiency, encouraging continued productivity beyond an isolated moment.

The cognitive and motivational dimensions of microtasks have been explored in a broad spectrum of domains, ranging from attention and interruption management [1] to education [5] and game design [10]. We believe that the intersection of these communities will help establish common metrics of success, and give rise to new opportunities for research.

Interesting research questions in the task completion space include:

- How to motivate people to perform microtasks?
- How can microtasks be designed so as to be resilient to interruptions?
- How can microproductivity be encouraged without being disruptive to a user's existing activities?
- When and where should microtasks be embedded?
- Can microtasks be used to build knowledge?
- How can we measure outcomes and contribution towards a large task?

Task Sourcing

While many believe that information tasks like writing can only be performed by skilled information workers, it is possible to pull out the repeatable subcomponents from these tasks to be performed by the task owner (*selfsourcing* [12]), peers (*friendsourcing*), or the

Definitions

Selfsourcing: The practice of the task owner completing their own tasks, where the specific tasks performed typically short, require limited context, and are algorithmically mediated.

Friendsourcing: The practice of completing tasks by the task owner's friends and/or colleagues, where the specific tasks performed typically short, require limited context, and are algorithmically mediated.

Crowdsourcing: The practice of completing tasks by using a large group of remote workers, where the specific tasks performed typically short, require limited context, and are algorithmically mediated.

crowd (*crowdsourcing*). While microtasking may have originated with the crowd, it may produce as large or even larger an impact on our own process of doing information work, for example. Once a task is subdivided into its component microtasks, these microtasks can be allocated to actors depending on the required level of expertise and familiarity with the task. For example, in a writing task, peers could rephrase a sentence in different ways, crowd workers could vote on the best ones, and the task owner could select the final rephrasing for integration into a larger document.

With the growth of machine intelligence, microtasks could also be automated in cases where people are observed to perform the same work repeatedly. By incorporating automation as one form of task sourcing, microtask systems can potentially develop automation techniques in combination with human intelligence.

In addition to enabling new channels of productivity, task allocation also raises many questions regarding who should perform which task, when they should be allocated, and how context ought to be transferred in cases where the actor is unfamiliar with the task but coordination is needed. Interesting questions related to task sourcing include:

- Who should perform a microtask?
- What is the impact of the actor on the task structure?
- How can context be provided to actors at different levels of familiarity with the task?
- What are the tradeoffs between performing tasks individually versus distributing microtasks across multiple performers and later aggregating the results?

Workshop Scope

Our hope is that the workshop will draw together people from communities that are interested in supporting people to accomplish large tasks through small microtasks, so that we might better understand the developments that are happening related to task decomposition, completion, and sourcing. This includes people who study cognition and attention management, personal information management, micro-learning, crowdsourcing, and the future of work.

Although relevant, the workshop will not directly focus on developing platforms to support microwork, collective worker actions, or microtasking where each task is entirely independent or does not contribute towards a larger task. It will also not focus on general task management where the tasks do not involve microtasks in any way.

Workshop Structure

The one-day workshop will support the sharing of current research efforts in the area of microtasking and productivity as well as brainstorming about the future. We intend to bring together and establish a community of researchers who are exploring relevant areas and create an agenda towards promoting research in new domains that can benefit from microtasking.

Workshop Goals

- Bring together people from disparate communities with a shared interest in microproductivity.
- Support the sharing of existing efforts related to microproductivity within this emergent community.
- Enable participants to understand their own existing research in a new way through the lens of microproductivity.

- Identify common themes to carry forward in research, such as shared tasks or problems.
- Develop a vocabulary for understanding ways to measure microproductivity outcomes and how they contribute towards the larger goal.
- Create artifacts (e.g., workshop report, annotated bibliography, or edited volume) that help communicate the work being done to others.

Pre-Workshop Plans
We aim to have approximately 30 people participate in the workshop. Participants will be recruited through direct invitation and an open call for participation.

Invitations: Invitations will be extended to researchers who have been actively working in areas of job design, productivity, crowdsourcing, self-sourcing, micro-learning, and task management.

Call for participation: Additional participants will be identified based on 2-page position papers that interested parties will be asked to submit. A call for submissions will be distributed via common channels, including CHI-ANNOUNCEMENTS and Twitter. Position papers should include the discussion of an important aspect of microproductivity, a brief biography, and an overview of how the author's work relates to the space. These will be curated by the workshop organizers.

Workshop Agenda
The morning session of the workshop will build a common vocabulary and understanding of existing work happening across multiple fields related to microproductivity. The afternoon session will support active brainstorming and collaboration. Throughout the workshop, participants will explore microproductivity themselves by microtasking the note taking experience.

Morning session:

- Introduction: The organizers will provide a brief overview of the workshop including the motivation and the expected outcomes. Attendees will introduce themselves and share their interests.
- Invited talks: We will invite a limited number of speakers to provide a brief overview of key areas relevant to the topic. Presentations will be limited to 20 minutes, with at most 10 minutes for discussion.
- Preparation for Breakout Sessions: Introduce the discussion areas. Break into groups.

Afternoon session:

- Breakout Sessions: Attendees will break out into four to five person groups to prototype solutions to a single productivity macro-task (for example, writing a report). Given this shared macro-task, each group will explore a different aspect of how it might be supported via microtasking, including issues related to: 1) Task decomposition, 2) Task completion, or 3) Task sourcing, and propose metrics for measuring success.
- Reports: Each breakout group will give a ten minute report of what they discussed.
- Group brainstorming: The goal of this session is to determine future directions and identify new domains where microtasking can apply. We also intend to identify other areas of relevant research where our research can be impactful or benefit

Organizers


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from existing knowledge, e.g. attention management or personal information management.
- Summary and wrap up: Finally, we will wrap up with a summary of the topics that were determined as most important next steps.

Microtasked note taking:

During the workshop participants will be directed to a website that will provide a structured form to support microtasked note taking. Through the form, participants can either enter a new idea or tag an existing idea to provide some structure to the ideas that are generated. Participation will be encouraged via a leaderboard that will reflect the number of microtasks performed by each participant. This experience will both allow participants to experience what it is like to use short bursts of time during their spare moments to be productive, and help create a real-time record of the workshop.

Post-Workshop Plans
Following the workshop, the organizers will gather the following information:

- Structured notes by the organizers reflecting the workshop's discussion and conclusions,
- Microtasked notes recorded by participants in real-time during the workshop and organized according to the tags associated with each idea, and
- An annotated list of relevant literature.

This information will be gathered into a workshop report and disseminated via the website and other appropriate sources. Additionally, depending on interest from participants, we may plan for a special issue or edited volume focusing on the topic of microproductivity.

We also plan to do some analysis of the logs produced during the microtasked note taking that will occurs during the workshop to see what insights can be learned from the group's experiences. This information will be shared with the community.

Workshop Website
Information about the workshop can be found at the workshop's website: http://aka.ms/microproductivity

Organizers

The microproductivity workshop is organized by six researchers who are actively involved in understanding and supporting microproductivity. A number of these organizers have successfully run relevant workshops at CHI and related venues (including CSCW, HCOMP, MobileHCI, SIGIR, ASIST, WWW).

Michael Bernstein: Assistant Professor of Computer Science at Stanford University. His research focuses on the design of crowdsourcing and social computing systems.

Jeffrey Bigham: Associate Professor at Carnegie Mellon University. Research interests include integrating crowd-powered systems with automation and accessibility.

Carrie Cai: Doctoral student in Computer Science at MIT. Her research focuses on *wait-learning*: helping people engage in educational exercises during wait time.

Organizers

Elizabeth Gerber

Shamsi Iqbal

Jaime Teevan

Elizabeth Gerber: Associate Professor at Northwestern University. Her research focuses on harvesting diverse and untapped human, social, and economic capital from distributed networks for collective innovation.

Shamsi Iqbal: Researcher at Microsoft Research. Expert in helping humans improve productivity in environments where many demands on their attention present conflicting challenges.

Jaime Teevan: Principal Researcher at Microsoft Research and affiliate faculty at the University of Washington. Research interests include selfsourcing, crowdsourcing, and personalization. (contact organizer)

Additionally, the following people actively collaborated on this proposal and served as part of the program committee for the workshop:

- Justin Cheng (Stanford)
- Lydia Chilton (UW)
- Mary Czerwinski (MSR)
- Laura Dabbish (CMU)
- Steven Dow (CMU)
- Darren Edge (MSR)
- Krzysztof Gajos (Harvard)
- Philip Guo (Rochester)
- Bonnie John (Cooper Union)
- Walter Lasecki (Michigan)
- Dan Liebling (MSR)
- Rhema Linder (Texas A&M)
- Gloria Mark (UC Irvine)
- Andres Monroy-Hernandez (MSR)
- Rob Miller (MIT)
- Michael Nebeling (CMU)
- Nuria Oliver (Telefonica)
- Peter Organisciak (UIUC)
- Niloufar Salehi (Stanford)
- Rajan Vaish (UCSC)
- Haoqi Zhang (Northwestern)

Call for Participation

Accomplishing meaningful goals efficiently is often a challenge, especially given the time and resource constraints that people may have. However, research shows that breaking a large macro-task down into a series of small, context-free microtasks leads to higher quality work, makes the task easier, and supports recovery from interruption. While task decomposition previously had to be done by hand, it is now often possible to algorithmically break complex tasks all the way down into microtasks that can take as little as a few seconds each to complete.

The transformation of information work into micro-work will have a significant impact on when and how people work. It will enable people to efficiently and easily complete tasks that currently seem challenging, through structured workflows via a process called *microproductivity*. The rapid developments in micro-work, micro-volunteering, and micro-learning open up new frontiers for the future of microproductivity. This workshop seeks to bring together researchers interested in decomposition of larger tasks into microtasks, completion and aggregation of microtasks, and sourcing of tasks and microtasks.

Submissions

We invite submissions of position papers, at most 2 pages in length in the ACM Extended Abstract format, that address one or more of the above topics.

Submissions should be sent directly to microproductivity@cs.stanford.edu.

At least one author of each accepted position paper must attend the workshop and all participants must register for both the workshop and for at least one day of the conference.

More details are available here: http://aka.ms/microproductivity

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