

The Productivity Paradox: Understanding Tooling Biases in Crowdwork

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Crowdwork is facilitated by an ecology of software tools that aid crowdworkers in finding and managing human intelligence tasks. Prior studies of tooling have reinforced the importance of the software, noting that the vast majority of tooling is engineered by crowdworkers themselves. We report a small subset of findings from an online survey that suggests that the landscape of tooling in crowdwork has greatly expanded in recent years. We also observe a trend that suggests newer tools are not only introducing more advanced capabilities, but also becoming more payment-oriented. We conclude by presenting a research agenda centered around the nature of tooling in crowdwork as it relates to data quality, worker efficiency, and well-being.

Additional Key Words and Phrases: Crowdwork, Tooling, Productivity, Attention.

1 INTRODUCTION: THE ROLE OF TOOLING IN CROWDWORK

Crowdwork is an emergent work practice that centers around finding, managing, and completing human intelligent tasks (HITs). Crowdsourcing marketplaces (e.g., Amazon Mechanical Turk) allow requesters to arbitrarily create HITs that are deployed to an on-demand workforce of crowdworkers for completion. Modern practices for finding and “catching” HITs are largely augmented by software tools that are engineered by crowdworkers to drastically enhance their productivity [3], but this creates a *tooling bias*. Studies have shown that multitasking and divided attention contexts are common due to the work practice’s on-demand nature [2, 4]. Despite being designed to facilitate productivity, additional research has found that the software tooling used in crowdwork is “designed to interrupt” and can affect how people engage with their work in a number of negative ways (e.g., being repeatedly disrupted, keeping them tethered to work, etc) [10]. In this paper, we describe a paradox in which the productivity tools used by crowdworkers may, by design, introduce new barriers to being productive. We motivate our position with preliminary findings regarding the tools that crowdworkers use today and conclude by presenting a research agenda aimed at understanding the tooling biases in crowdwork through the lens of data quality, worker efficiency, and worker well-being.

2 ONLINE SURVEY

We conducted an IRB-approved Mechanical Turk survey aimed to understand the challenges and opportunities of engaging with crowdwork on mobile devices. Our settings required workers to have a 98% percent acceptance rate and have completed at least 10,000 HITs successfully. In other words, our study did not target casual workers, but those with advanced Mechanical Turk experience. Here, we report findings from the 151 responses to one of its questions:

Briefly describe the primary tools, scripts, etc. that you use as a crowdworker (e.g. MTurk Suite, Turkinator, etc). If you do not use tools or scripts, type “None”.

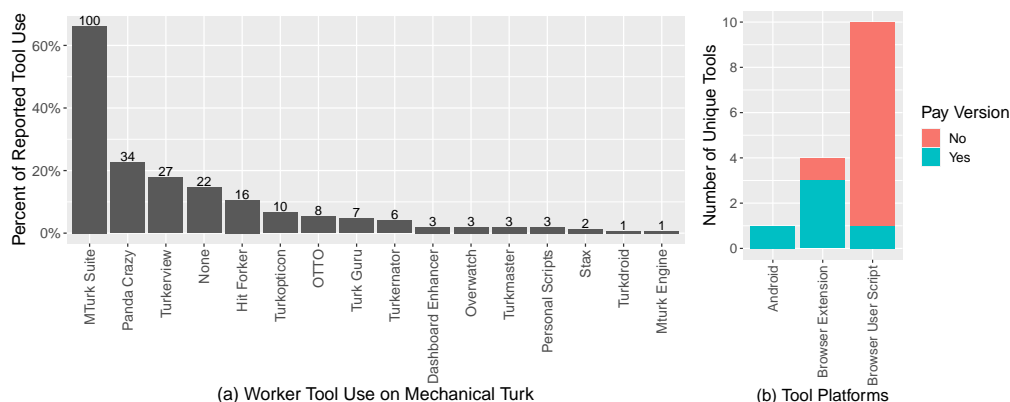


Fig. 1. An overview of (a) tool counts and percentages and (b) a stacked-bar chart of tools with and without subscription-tier models.

Responses were analyzed by enumerating unique tools, verifying the tool’s identity (e.g., online), classifying its target platform, and categorizing whether the tool requires payment. We then used each tools as a label to code each response.

2.1 Preliminary Findings

Our analysis of responses (see Figure 1 (a)) yielded 16 unique actively-used tools reported by participants. Kaplan et al. [3] surveyed and Williams et al. interviewed [10] MTurk workers, showing that they use various strategies and tools. Our preliminary results echo their findings of a growing trend towards a multiplicity of tool use, both paid and unpaid (see Figure 1 (b)). One of the most striking details in our findings is that 85.4% of respondents use at least one tool. From Figure 1 we see that MTurk Suite (66.2%) and PandaCrazy (22.5%) are the most actively used tools. TurkerView (17.9%) and HITForker (10.6%) are the next most prominent tools utilized by workers. Our preliminary review of these tools indicate that many the features they offer are largely the same: tools for finding and catching “good” HITs. These features create multi-tasking environments and may interrupt users. While 14.6% participants did not use a tool, 48.3% used only one tool and 37.1% of respondents use more than one tool. Our data shows 19.9% use 2 tools, 4.0% use 3, 1.3% use 4, 1.3% use 5, and one participant uses 6 tools. The ecosystem of tooling practice exacerbates multitasking and interruption issues like memory failures [8], attention shifting [7], disruption [6]. Benbuan et al. [1] showed from the analysis 76% of computer based task switching centered on distracting activities. Additionally, it makes it difficult to research because of the potential interaction among tools. It is unclear whether adding additional tools and customization for HIT catchers and finders creates more opportunities for workers at an individual level or overwhelms them.

3 A RESEARCH AGENDA FOR UNDERSTANDING TOOLING BIAS

Our use of the term *tooling bias* refers to the issues caused by using software tools that augments the work practices and outputs of crowdwork. Our preliminary analysis suggests that more recent tools are not only more sophisticated in their capabilities and features, but their potential for advanced configuration may discourage use by less technically adept crowdworkers. Upon identifying a new work opportunity, HIT-finding tools notify crowdworkers about an opportunity (e.g., with an audio alert), which requires crowdworkers to make an immediate judgement about whether they should accept the opportunity or leave it. Williams et al. reported that the notification can be cognitively challenging to manage under specific circumstances (e.g., when a crowdworker's HIT queue is already at capacity). In summary, we hypothesize that by using tools that are designed to become increasingly more disruptive, aspects of crowdworkers' work practices are not benefiting, but rather being *harmed* by these tools. Given this context, we discuss three important directions for understanding tooling biases in crowdwork: (1) Data Quality, (2) Worker Efficiency, and (3) Worker Well-being:

3.1 Understanding Tooling Bias and Data Quality

Characterizing the reliability of crowdworkers and the data that they subsequently produce is a central and on-going problem of interest for crowdsourcing researchers, practitioners (e.g., requesters), and crowdsourcing marketplaces. Researchers can explore how specific tool designs (i.e., with unique notification approaches) affect the quality of data produced by crowdworkers. Potentially, notification approaches may create a sampling bias. Participants with HIT Catchers may be over represented in surveys that offer a reasonable reward.

3.2 Understanding Tooling Bias and Worker Efficiency

Understanding how crowdworkers' time and attention can be optimized is of interest to requesters and crowdworkers alike. Prior studies of information work theorize that people are most productive (i.e., efficient) when they are experience fewer interruptions [5]. Researchers should examine the extent to which tool-based interruptions impact the efficiency of crowdworkers not only at the task-level, but also at the level of their work practice.

3.3 Understanding Tooling Bias and Worker Well-being

Recent advances in productivity tooling in information work suggest that efficiency and well-being are intertwined [9]. Therefore, understanding how tools can be redesigned with notification policies that incorporate notions of well-being (e.g., notifications limited to the crowdworker's standard work hours) is an important pathway for consideration. As these systems are relatively new in information work at large, there is significant opportunity for innovation.

4 CONCLUSION

Crowdwork is facilitated by an ecology of software tools that aid crowdworkers in finding and managing human intelligence tasks. Prior studies of tooling has reinforced the importance of the software, noting that the vast majority of tooling is engineered by crowdworkers themselves. We report a small subset of findings from an online survey that suggests that the landscape of tooling in crowdwork has greatly expanded in recent years. We also observe a trend that suggests newer tools are not only introducing more advanced capabilities, but also becoming more payment-oriented. We conclude by presenting a research agenda centered around the nature of tooling in crowdwork as it relates to data quality, efficiency, and worker wellbeing.

REFERENCES

- [1] Raquel Benbunan-Fich and Gregory E Truman. 2009. Technical opinion Multitasking with laptops during meetings. *Commun. ACM* 52, 2 (2009), 139–141.
- [2] Sandy JJ Gould, Anna L Cox, and Duncan P Brumby. 2016. Diminished control in crowdsourcing: An investigation of crowdworker multitasking behavior. *ACM Transactions on Computer-Human Interaction (TOCHI)* 23, 3 (2016), 1–29.
- [3] Toni Kaplan, Susumu Saito, Kotaro Hara, and Jeffrey P Bigham. 2018. Striving to earn more: a survey of work strategies and tool use among crowd workers. In *Sixth AAAI Conference on Human Computation and Crowdsourcing*.
- [4] Laura Lascau, Sandy JJ Gould, Anna L Cox, Elizaveta Karmannaya, and Duncan P Brumby. 2019. Monotasking or multitasking: Designing for crowdworkers' preferences. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. 1–14.
- [5] Gloria Mark, Daniela Gudith, and Ulrich Klocke. 2008. The cost of interrupted work: more speed and stress. In *Proceedings of the SIGCHI conference on Human Factors in Computing Systems*. 107–110.
- [6] Gloria Mark, Shamsi Iqbal, Mary Czerwinski, and Paul Johns. 2015. Focused, aroused, but so distractible: Temporal perspectives on multitasking and communications. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing*. 903–916.
- [7] Gloria Mark, Shamsi T Iqbal, Mary Czerwinski, Paul Johns, and Akane Sano. 2016. Neurotics can't focus: An in situ study of online multitasking in the workplace. In *Proceedings of the 2016 CHI conference on human factors in computing systems*. 1739–1744.
- [8] Brid O'Conaill and David Frohlich. 1995. Timespace in the workplace: Dealing with interruptions. In *Conference companion on Human factors in computing systems*. 262–263.
- [9] Alex C Williams, Harmanpreet Kaur, Gloria Mark, Anne Loomis Thompson, Shamsi T Iqbal, and Jaime Teevan. 2018. Supporting workplace detachment and reattachment with conversational intelligence. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. 1–13.
- [10] Alex C Williams, Gloria Mark, Kristy Milland, Edward Lank, and Edith Law. 2019. The perpetual work life of crowdworkers: How tooling practices increase fragmentation in crowdwork. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–28.