Working for the Machine

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For years, your computer has been a tool for getting work done. When work arrived from your boss or colleague, you sat down to a blinking cursor and used your computer to write the report, or create the spreadsheet, or send the email. Work arose from the world. It got done on the computer.

That relationship, happy or unhappy as it was, is giving way to one that is far more transformational. The computer no longer is just our tool for doing work: it is becoming an instrument that gives us work. Online, networked societies have embarked on a massive shift to take work online, and that means an algorithm may be your next boss, or at least be your task matchmaker. Ask an Uber driver, who is told where to be and when by software. Or ask workers on Amazon's Mechanical Turk marketplace, who execute information tasks for hours a day at piecework rates. Already marketing professionals, programmers, house cleaners, administrative assistants, and more are available on-demand and accessible by algorithms and applications.

While we have been spending our time reading and debating social media and volunteer crowdsourcing efforts, the entire foundation of our economy has shifted its weight. Work has become digital and networked. Any work now done at a computer could be done remotely by members of "the crowd." Economists have estimated that about 20 percent of United States jobs could be sent down the wire, to the tune of 45 million full-time jobs.

Imagine yourself in 10 years. You wake up, turn on your laptop from your digital co-working space, and log in to work. The work platform recalls your skills and abilities, then matches you immediately to a team of other experts around the world. The system tells today's team that a client wants help putting together a marketing plan for a new product. You've never met your teammates, but they all have stellar reputations, so you jump in using Skype, Dropbox, and an online team room. A week later, the platform has connected you with a different team to collaborate on a documentary. A year later, you've joined a digital organization that has hundreds of people but no physical headquarters—one that elastically brings in new skills as it needs to navigate the marketplace.

Our research group at Stanford's Computer Science department has been building the tools and infrastructure for "flash teams" like these to arise from expert crowdsourcing marketplaces. Whereas most paid crowdsourcing today consists of tiny tasks (e.g., Mechanical Turk) or single contractors (e.g., Upwork), we demonstrated that computation could dynamically

summon teams of expert workers and successfully scaffold their processes. Flash teams can translate napkin sketches into working software in a day, create short video animations in two days, even combine multiple teams' efforts to create an entire online learning platform and associated video content in under 24 hours. This effort signals a shift to complex, interdependent work at scale on the Web. The computer is its mediator and its enabler.

However, we need not look far to see why digital work could be a bad thing. Uber drivers are already suing and demonstrating for better representation. Researchers at Carnegie Mellon have reported that some drivers act in ways to counter their algorithmic overlords—for example, flipping their availability on and off during slow periods in order to keep the algorithm from assigning pick-ups too far from their current location. (The longer a driver has been available with no jobs, the larger the algorithm automatically grows their availability radius.) Workers on the Mechanical Turk platform have at times seen their income stream cut off by changing platform policies or capricious requesters who reject their work without just cause.

Why is this future so frightening to us, when so many industries are already scientifically managed? What we are witnessing is a shift in focus: we've grown accustomed to the digital control of blue-collar, physical laborers such as assembly lines and trucking. However, what began with outsourcing, and then crowdsourcing, is now becoming the digital mediation of white-collar desk jobs. Suddenly we see ourselves in that machine, and that sight troubles us. What does it mean when your administrative job, or your mid-level management job, or your programming job becomes a commodity?

To counter these forces, we need to understand what the digital equivalent of the labor union will look like. How do you pursue collective action when your jobs last hours at most, people are constantly entering and leaving the workforce, and it's difficult to enforce any joint decisions? Our group at Stanford, alongside collaborators at the University of California–San Diego and workers on Amazon's Mechanical Turk, has been building software to help workers on Mechanical Turk pursue collective action, but the road is littered with failures. If you've ever tried to come to a decision with 100 people on a high-stakes issue using just email, you'll know what I mean.

If we focus, we can glimpse a future where online work can enable us to solve problems more effectively and in more fulfilling ways than organizations today. Could an online work platform help you advance your career by learning new skills? Could an online organization create the next iPhone or summer blockbuster? Could it enable citizens who are caring for dependents part-time or cannot live in metropolitan hubs to participate as full members of top companies?

Online work is coming. In many ways, it is already here. Can we build a future of work that we want to live in quickly enough to see it avert the future that we don't want to live in?

Bio: Michael Bernstein is an assistant professor of computer science at Stanford University, where he co-directs the Human-Computer Interaction group and is a Robert N. Noyce Family Faculty Scholar. His research focuses on the design of crowdsourcing and social computing systems.