

# The Future of Human Labor

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## A Look at Manufacturing and War

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We consider changes in labor through two cases that purport to embody the future: the manufacture of Tesla cars and military deployment of drones.

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## Introduction

In recent work, we have studied how organizations extract free and low-cost labor from ubiquitous computer-mediated activities such as participation in social media, search, video gaming, shopping, and online reviewing—activities that have become part of our everyday lives only since the 1990s, affording vital new sources of labor at low cost to organizations.<sup>1</sup> In *Heteromation and Other Stories of Computing and Capitalism*, we note that “Generating [economic] value [through computing]...summons intelligent human labor from the masses across global networks of billions of nodes.” We “users” readily engage in activities such as sharing personal data, writing reviews of products, books, films, restaurants, and travel, producing YouTube videos, sustaining gaming communities, completing Mechanical Turk tasks, and performing self-service labor. Although our labors generate wealth for organizations, we do not share in governance. No proposals for replacing traditional unions with their bargaining power and ability to be heard at the table have emerged. We argue that work is increasingly disadvantageous to labor.

In part, our lack of voice occurs because computer-mediated labor, if not completely hidden, tends to be pushed into the background. In the foreground are computing machines. Today’s wealthiest and most influential companies such as Google, Facebook, and Amazon have constructed business models around what we call “heteromated” labor, that is, labor that combines the capacities of humans and machines within a narrative celebrating machines. Human labor is obscured; we are naturalized as users rather than wealth-producing workers.

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<sup>1</sup> Ekbia, H. and Nardi, B. *Heteromation and Other Stories of Computing and Capitalism*. Cambridge: MIT Press. 2017.

Heteromation centers on free or low-cost labor, but it is not the only important type of computer-mediated labor. In this article, we explore other technologized work that has brought the return of the 12-hour workday, significant psychological and physical stress, and relative powerlessness as workers. As members of SIGCAS, we are an important line of defense in noticing these developments, and calling attention to them. We should be concerned about how the technologies we design, those we use on a daily basis, and those we understand because of our privileged position as technologists, impact society.

We discuss two cases of computing intensive labor and the labor relations they engender, one in the industrial sector and one in the military. With no irony or self-doubt, these paradigms style themselves as “the future.” In this article, we question what kind of future it will be.

### Case One: Tesla, “The Factory of the Future”

Manufacturing is not a site that would typically come up in discussions of computing, unless the topic is something like “the factory of the future”—an epithet used by Wired to describe the electric car maker Tesla’s 500,000 square meter plant in Fremont, California (Rundle 2016). Starting with an exultant description of “a very large, white box” that houses a hydraulic stamping press, which “happened to be the largest in North America,” the Wired article goes on to tell us that the humongous machine can stamp out “a new car panel once every six seconds, or 5,000 per day, with up to 10,000 tons of force out of an aluminum coil that weights 9, 071 kg when it shows up at the factory.” The description is accompanied by impressive and futuristic-looking images of the stamping machine and other robotic equipment, with close-to-no hint of the 6,000 people who work at the facility—as if this “factory of the future” only runs on machines.

To see the presence and status of humans at Tesla, we have to look elsewhere—at reports, for instance, of the high number of injuries in its plants, which stand at twice the industry average (*The Guardian*, May 24, 2017); at reports that its subcontractors pay as low as \$5 an hour to their workers (*The Guardian*, May 16, 2016); and at accounts of 12-hour shifts and widespread complaints by workers over “pain, injury, and stress” (*The Guardian*, May 17, 2017). These reports have triggered responses from Elon Musk, Tesla’s CEO, who has reacted strongly to the issues, promising corrective actions.

In explaining the long shifts and poor safety conditions at Tesla, Musk makes two conflictive observations, which speak to a deep contradiction in the so-called “startup economy.” The first observation has to do with market valuation of startup companies. Tesla’s current value exceeds, at more than \$50 billion, that of the traditional automobile manufacturing giant Ford (it even briefly exceeded General Motors’s in April 2017). Describing this market capitalization as “unwarranted,” Musk asserts, “I do believe this market cap is higher than we have any right to deserve,” pointing out that his company produces just 1% of GM’s total output. This logic is meant to provide justification for Musk calling Tesla “a money-losing company,” concluding that, “This is not some situation where, for example, we are just greedy capitalists who decided to skimp on safety in order to have more profits and dividends and that kind of thing. It’s just a

question of how much money we lose. And how do we survive? How do we not die and have everyone lose their jobs?”

When it comes to worker compensation, wage, and welfare, in other words, the charitable capitalist in Musk invokes the saving of jobs. On the other hand, a very different logic is used when facing investors:

“You really can’t have people in the production line itself. Otherwise you’ll automatically drop to people speed... There’s still a lot of people at the factory, but what they’re doing is maintaining the machines, upgrading them, dealing with anomalies. But in the production process itself there essentially would be no people.”



These contradictory observations are captured by a Tesla employee who anonymously made the following comments to *The Guardian*:

“From what I’ve gathered, Elon Musk started Tesla kind of like an app startup, and didn’t realize that it isn’t just nerds at a computer desk typing...You really start losing the startup feel when you have thousands of people doing physical labor.”

(In its public relations campaigns, Tesla describes workers like this as “outspoken.”) *The Guardian* article captures this contradiction in this manner:

“Tesla sits at the juncture between a tech startup, untethered from the rules of the old economy, and a manufacturer that needs to produce physical goods. Nowhere is that contradiction more apparent than at the Tesla factory, where Musk’s bombastic

projection that his company will make 500,000 cars in 2018 (a 495% increase from 2016) relies as much on the sweat and muscle of thousands of human workers as it does on futuristic robots.”

It is in dealing with this tension that people like Musk resort to a contradictory logic, where human labor is played up when it comes to money saving in the name of job protection, and is played down when it comes to technological hype (amplified, in the case of “green” startups, such as Tesla, with claims about the environment).

It is as if the new capitalist class wants to have its cake and eat it too.

### Case Two: Drones, “The War of the Future”

It is not only the new capitalists, however, who have this impossible desire. Some modern military leaders also have this tendency: they want their troops to fight without real fighting.

This tendency is most vividly embodied in drone warfare, where pilots sitting in air-conditioned control stations in front of multiple screens, joysticks in their hands, operate unmanned aircraft hovering across the globe over Afghanistan, Pakistan, Yemen, Iraq, and, more recently, Syria. The purpose of these operations is to identify potential enemy combatants, monitor their movements and activities, and, if confirmed through the ranks, target them with Hellfire Missiles whose namesake speaks quite accurately to their destructive power. This is what the pilots, along with their co-pilots who are largely in charge of monitoring the live video feeds and chats on the screens, do in 12-hour shifts, day in and day out—a monotonous job that can be overbearingly boring even for the most patient human being, let alone for people who are trained in simulation and gaming environments, the key feature of which is stimulation and excitement. A stimulating day in the life of a drone pilot, therefore, would be one which includes the pulling of the trigger to launch a missile, in which case the pilot has to stay on scene to witness the carnage they have created from the safety of their cubicle.

This brief description of how modern drone warfare is conducted should be adequate to convey the deep ethical, psychological, and professional issues such warfare raises. Professionally, drone pilots are often the subject of ridicule by their traditional peers—fighter pilots who literally have skin in the game because they are physically present in their planes, and think of drone pilots as video game warriors, second-class citizens of the military brotherhood.<sup>2</sup> Although fighter pilots themselves are at minimal risk, flying at fifty thousand feet, their very presence in the theater of war provides them with a sense of moral superiority which they do not hesitate to flaunt.

The very fact of physical-presence-but-from-a-safe-distance, however, makes a huge difference, not only professionally in the self-image of pilots, but also in their

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<sup>2</sup> Cullen, T. (2011). *The MQ-9 Reaper Remotely Piloted Aircraft: Humans and Machines in Action*. Doctoral Dissertation. Massachusetts Institute of Technology.

psychology. The nature of traditional air bombing is such that it isolates the pilot from the outcomes of his actions. Not so for drone pilots who are required to stay on the scene and to report their observations of their demolition of lives and property.

This is exactly where modern computing, communications, and video technologies come in. The organizational implication of the constant flow of audio, visual, and operational information is the need for hundreds and thousands of image and data analysts who have to make sense of the information, not to mention as many as 400 (depending on the type of drone) flight technicians and support staff involved in the operation of a single drone—facts that turn the notion of “unmanned warfare” into an oxymoron.

The psychological implication of these technologies is subtler. With their precise cameras, fast links, and multi-channel networks, these technologies provide the pilots a close-up view of the outcomes of their own actions, as well as the actions of troops on the ground who are exposed to psychological risk and hardship. The extremity of these images and the grip that they might have on a person’s mind is such that they cannot leave them behind when they go home at the end of a shift. As Heather Linebaugh, a former drone imagery analyst, wrote in *The Guardian*, questions such as the following start to eat away at the worker: “How many women and children have you seen incinerated by a Hellfire missile? How many men have you seen crawl across a field, trying to make it to the nearest compound for help while bleeding out from severed legs?” “When you are exposed to it over and over again,” the former analyst adds, “it becomes like a small video, embedded in your head, forever on repeat, causing psychological pain and suffering that many people will hopefully never experience.”

Although sometimes described as PTSD, the psychological effects of these experiences are unknown.<sup>3</sup> They are novel enough for some experts to be unsure of their exact nature, raising doubts about the application of our existing knowledge and categories to these new realities. New technology brings about, among other things, new maladies and predicaments.

These psychological experiences lead, in turn, to ethical issues, which have been the subject of commentary from various directions. The French philosopher Grégoire Chamayou calls the ethics of this kind of asymmetric warfare a “narcoethics”—an unbalanced situation where the right to kill is not reciprocated by the right or possibility to be killed. The long-term implications of this kind of ethics, should it become the dominant mode of warfare, are not difficult to fathom. The effects of these professional, psychological, and ethical issues are manifest in the trouble that the U.S. Air Force is facing in recruiting and retaining drone pilots for the labor of computer-mediated warfare. Military leaders might learn that even the most advanced technology cannot enable one to have one’s cake and eat it too—you cannot fight without exposing yourself to the risks of the fight. Most fundamentally, however, drone warfare highlights a very basic fact about the indispensability of human labor in the operation of even the most advanced technology.

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<sup>3</sup> The Brookings Institution (2012). *Combat Stress in Remotely Piloted/UAS Operations*. Washington D.C.: Anderson Court Reporting.

## Conclusion

Unlike heteromated laborers, the factory and drone workers make decent wages. But there is a striking commonality among these varied types of workers: organizations tend to hide their labor, pushing it into the background, narrativizing computers as the ones doing the real work. This strategem tends to render workers and their needs less visible, and organizations less accountable. Tesla says that “in the production process there would be no people”—despite the presence of 6,000 living, breathing humans in the Tesla factory in Fremont, some working 12-hour shifts under unsafe conditions. Yes, the Tesla statement denotes, strictly speaking, “the production line” (a “line” that probably cannot be delineated very clearly). But the rhetorical burden of the message to investors is a reassuring one that pesky humans will only be on the sidelines caring for the machines which are actually producing the cars (as in the Wired photo, too).

Military experts (past masters at producing memes to disguise inconvenient truths) take a similar tack. They speak of “unmanned warfare” even though drone deployment relies on human pilots, data analysts, flight technicians, and support staff. Some of these employees work, like the Tesla factory personnel, 12-hour shifts. Some are subject to acute psychological distress of a type for which psychologists do not yet even have a name.

Are we, in this article, cherry picking examples of computer-mediated work with problematic outcomes? Yes, maybe, but when you look around even cursorily, they are not hard to find. These instances portend regressive trends amplified by other developments such as zero-hour contracts and the gig economy.<sup>4</sup> Research on crowdwork, one of the most heavily studied examples of computer-mediated labor, has found that crowdworkers (such as Mechanical Turkers) are often underpaid, mistreated, thought of as cogs in a machine rather than as people, and undervalued in terms of their expertise.<sup>5</sup> We seem to make category errors when machines and people mix, and the smarter the software and hardware, the more susceptible we are to these errors, forgetting about the special dispensations reasonable ethics require for flesh and blood workers. In the book we describe problems that arise in the heteromated labor of graphic designers, video game “modders” (who write and distribute free software modifications for games), citizen scientists, and those who work with social robots. It seems to us there is ample reason to believe that computing and the military-industrial complex sometimes bring out the worst in each other, occasionally in quite disturbing ways.

What would we do differently? At a minimum, workers should be guaranteed the protections won by unions throughout the 20th century, including reasonable hours, safe working conditions, and a share in governance of what is, after all, a shared enterprise in

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<sup>4</sup> Berg, J. and De Stefano, V. It’s Time to Regulate the Gig Economy. openDemocracy. April 18, 2017. <https://www.opendemocracy.net/beyondslavery/janine-berg-valerio-de-stefano/gig/it-s-time-to-regulate-gig-economy>

<sup>5</sup> Silberman, S., Tomlinson, B., Ross, J., Irani, L., Zaldivar, L. Responsible research with crowds: pay crowdworkers at least minimum wage. *Communications of the ACM*. 2017.

which both labor and management play their essential respective roles. We seem instead to be going back to a bad future, that one where workers were not treated very well.

Let us consider some concrete steps forward. Silberman et al. advocate that crowdworkers be paid minimum wage<sup>6</sup>. Yes, we still have to argue for this! We have to argue for minimum wage despite the fact that in the U.S. at least, minimum wage is a pittance. Crowdworkers usually work for far less as they are classed as independent contractors and employers can legally pay very low rates. Many crowdworkers “earn a living through crowdwork”—it is not always merely extra cash for discretionary spending as Silberman et al note. Some of the Tesla subcontractors are reported to be paying sub-minimum wages—the issue is not just about crowdwork. (U.S. federal minimum wage for a 50-week year works out to \$14,500, a mind-bogglingly low sum considering how much of a person’s time it takes to earn it, and how little it buys. Crowdworkers work at rates *lower* than this.) Certainly, researchers who employ crowdworkers should pay minimum wage, out of basic human decency, and keeping in mind that crowdworkers spend 18 minutes of every hour of work finding the next task as Silberman et al. have documented.

Silberman et al. suggest another step forward, and that is to learn from the workers who are doing the work and use this knowledge to foster shared governance. “Outspoken” Tesla employees, for example, rightfully point to the physical nature of the work and the need to understand that it’s not just people typing at desks—serious physical injuries can and do result from the nature of the manufacturing labor. This reality indicates the need for planning and foresight on the part of both labor and management. The revelations of drone workers should provoke a conversation about whether anyone at all should be asked to pore over images of death as their job, and indeed, whether we shouldn’t just stop killing each other to moot the whole question. Experienced crowdworkers have developed deep expertise that can be recognized, leveraged, and compensated. For example, through online worker forums, they help newer crowdworkers learn to work more efficiently (currently with no compensation for this training and support). Experienced crowdworkers can tell when an employer task is badly structured and could be improved—or they could if employers asked them<sup>7</sup>.

Another concrete step is for us in the SIGCAS community to focus our research on these and related issues and not shy away from their political nature.<sup>8</sup> We’re all in this together. Let’s not let computing backslide us into 19th century norms for work hours and unsafe, unfair working conditions<sup>9</sup>. Let’s insert computing into work processes in positive ways

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<sup>6</sup> Silberman, S., Tomlinson, B., Ross, J., Irani, L., Zaldivar, L. Responsible research with crowds: pay crowdworkers at least minimum wage. *Communications of the ACM*. 2017.

<sup>7</sup> Silberman, S., Tomlinson, B., Ross, J., Irani, L., Zaldivar, L. Responsible research with crowds: pay crowdworkers at least minimum wage. *Communications of the ACM*. 2017.

<sup>8</sup> Ekbia, H. and Nardi, B. (2016). Social Inequality and HCI: The View from Political Economy. *Proceedings CHI’2016*.

<sup>9</sup> Berg, J. and De Stefano, V. It’s Time to Regulate the Gig Economy. openDemocracy. April 18, 2017. <https://www.opendemocracy.net/beyondslavery/janine-berg-valerio-de-stefano/gig/it-s-time-to-regulate-gig-economy>

that respect the humans who essential to their function and celebrate human contributions rather than worshipping machines. Consider that Wired picture of the Tesla factory—reverently hushed and cathedral-esque, photographed in ethereal greys from the respectful distance of the supplicant. When Tesla management tells investors that the workers are just there to maintain and upgrade the machines, who or what is ascendant? Such questions remain for us as technologists to ponder as we attempt responsible design and constructive critique of the organizations to which our own labor contributes.