

A conversation with Michael Webb, April 3, 2015

Participants

- Michael Webb – PhD Candidate in Economics, Stanford University and Research Associate, Institute for Fiscal Studies (IFS)
- Holden Karnofsky – Managing Director, Open Philanthropy Project

Note: These notes were compiled by the Open Philanthropy Project and give an overview of the major points made by Michael Webb.

Summary

The Open Philanthropy Project spoke with Michael Webb of Stanford University as part of its investigation into the potential economic impacts of job automation. Conversation included discussion of which areas are likely or unlikely to become automated soon, factors that influence the adoption of automation technologies, advances in robotics, and potentially neglected areas for automation.

Consequences of automation

It's not at all obvious that progress in automation is good for society in the short/medium term, given the potential job losses involved. A philanthropist interested in this topic should perhaps fund research into this question before focusing on increasing automation.

Professor Carlota Perez (London School of Economics) has argued that, following major technological revolutions, there are typically a few decades of significant worker dislocation and unemployment, during which time the economy reorganizes and eventually produces new jobs at a similar skill level to that of the dislocated workers (though often too late for the individuals in question). Whether or not the current technological boom will follow this pattern is an important unknown.

Likely areas of automation

In general, the areas most likely to be automated soon are industries with large workforces performing a limited number of tasks for which technologies that could be used for automation already exist. These might include:

- **Retail cashiers:** between 2007-2014, the number of retail cashier jobs in the UK decreased by more than half, primarily as a result of the introduction of automated self-checkout machines. Cashier workers were not unionized, and as a result there was no organized resistance to the shift to using machines. A high rate of job turnover also allowed companies to easily replace employee positions with machines. Mr. Webb thinks it is likely that a similar shift will occur in the US.
- **Ancillary tasks to licensed professions** (e.g., paralegal work, medical imaging): these fields are often non-unionized and involve highly standardized tasks.

- **Security services, incl. law enforcement and surveillance:** as above.
- **Oil and gas:** many routine tasks are dangerous and very costly; the industry has the money to invest.
- **Education:** Massive Open Online Courses are advancing rapidly, though it is unclear whether teachers and other educators will lose their jobs or whether the nature of their jobs will simply change.

In many areas, machine learning (ML) technology that could enable automation has already been developed and is at a translational stage, needing a lot of application-specific details to be worked out.

Potential barriers to automation

Two key factors that might make a field less likely to become automated are:

1. Unionization, which could enable organized resistance by workers to the adoption of automation technologies. (In the limit, however, the success of unions in securing high wages for workers increases the incentive for firms to find ways of replacing human labor altogether.)
2. Regulation/licensing. Especially in self-regulating professions, there may be institutional barriers to the adoption of automation technologies. For example, ML algorithms could in principle replace many functions of doctors (especially diagnosis), but medical institutions might decide not to allow them in order to protect doctors' employment. Similarly, there are ML systems that can produce legal briefs as well as humans, but they might not become widespread if the legal profession decides their use would not be in the best interest of lawyers.

Robotics

Mr. Webb believes that robotics programs (e.g., at DARPA [the Defense Advanced Research Projects Agency] and the Massachusetts Institute of Technology) are making rapid and significant progress. Currently, the most significant bottleneck for robotics in terms of widespread job automation is manual dexterity (though Mr. Webb thinks this may be solved very soon). In principle, there is very little that could not eventually become automated.

Expensive, difficult, or dangerous tasks are most likely to be robotically automated first, such as:

- Standardized tasks in construction
- Many jobs within the oil and gas industry
- Hazardous material removal
- Manufacturing and assembly line work

There is an especially strong capacity and incentive to automate in industries dominated by a few large employers with high labor costs whose employees perform only a small number of different jobs, e.g., fast food. (There is already at

least one business in the Bay Area, Momentum Machines, developing a robotic hamburger-maker.)

Mr. Webb has not extensively considered the impact of robotics on agriculture, but his perception is that agriculture is already a fairly efficient area in terms of labor, with a small number of people doing a lot of varied tasks.

Unlikely areas of automation

It may be particularly important to the public that humans perform certain jobs, and these may be less likely to become automated, e.g.:

- Actors, musicians, and celebrities
- Politicians
- Judges and juries
- Some aspects of medicine (e.g., informing patients of diagnostic results)

Skilled humans working in tandem with automated systems are likely to outperform automated systems alone in many cases. Thus, competitive fields (e.g., finance) in which incremental improvement leads to greater profits may be less likely to fully eliminate human involvement (as opposed to areas without much marginal return on improvements beyond a particular performance threshold).

Tasks requiring motion in non-standardized environments (e.g., plumbing) may be especially difficult to automate.

Mr. Webb cautions that past predictions about which areas are unlikely to be automated have often been incorrect (e.g., predictions against computer chess and self-driving cars). Mr. Webb thinks that, even for some tasks that appear difficult to automate, there may potentially be innovative solutions to slightly different automation problems that end up accomplishing the same goal. Such breakthroughs can be difficult to anticipate. In many cases, the details of specific applications are a much more important bottleneck than fundamental work on machine learning.

Neglected areas

There may be some areas that lack strong economic incentives for automation but would nevertheless be beneficial to automate.

It could be useful to use a firm-level dataset such as Compustat to identify those industries that contain the greatest number of different companies, as these may potentially be the most impactful areas for philanthropic funding to promote coordination around investment in and adoption of automation technologies (as mentioned above, industries with only a few large companies already have stronger capabilities and incentives to automate).

Laboratory science

It could be beneficial to automate some aspects of laboratory work in, e.g., biology. For example, cell counting, which currently takes many person-hours, would likely be easy to automate, but Mr. Webb does not know of attempts to do this.

Psychotherapy

There are currently automated cognitive behavioral therapy (CBT) systems that some trials suggest are as effective as human therapists. It could be beneficial to further improve CBT programs and scale up their use, especially for people who are unable to afford a human therapist. The demand for psychotherapy currently significantly exceeds the supply of human therapists.

Public service delivery

Governments, being monopoly providers of public services with no profit incentive and high levels of risk aversion, are in general unlikely to be at the vanguard of innovation in automation technologies. This suggests an important role for philanthropic investment in this area. The US government civilian employment functions with the highest monthly payroll [[March 2013](#)] are, in descending order, the postal service (\$4bn/month), defense, hospitals, health, Homeland Security (incl. TSA and CBP functions), natural resources, police protection, financial administration, judicial and legal, and social insurance administration (\$0.4bn/month).

Other people to talk to

- Venture capitalists, about areas where innovation in automation technology seems likely or promising
- Researchers at DARPA (though their work might be confidential)

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