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Cognitive Technology—Replacing or Augmenting Knowledge Workers?

By Thomas H. Davenport

One of the hottest topics in economics is whether new, more cognitively-oriented technologies are one of the causes of the slow improvement in employment. Are tools like artificial intelligence, machine learning, and “cognitive computing” engines like IBM Corp.’s Watson replacing human labor—now and in the future? [Tyler Cowen](#), [Erik Brynjolfsson](#) and [Andy McAfee](#), and most recently [Fortune’s Geoff Colvin](#) have weighed in on this issue. They all believe that the effect is real and potentially quite dramatic. Even previous skeptics like Larry Summers are beginning to be persuaded.

I don’t think there is much doubt that low-level jobs have been replaced by transactional automation, and the authors above make a good case that middle-level ones (for example, drivers, pilots, ship captains, skilled factory workers) are highly endangered by autonomous vehicles and robots. I am most interested, however, in what were traditionally considered the highest-level knowledge worker jobs: lawyers, doctors, financial professionals and analysts, architects, professors and the like. There is plenty of reason to believe that these jobs are endangered too. Mr. Colvin suggests that while technology won’t replace them in total, it will reduce the numbers of such jobs dramatically. He suggests, for example, that the glut of law school graduates is attributable to technology, but I don’t think there is much evidence for that. He also suggests that the way to ensure continued employment in these roles is to focus on human relationships and motivational skills—perhaps the one thing we still do better than smart machines.

One of the great clichés of cognitive business technology—and remember, clichés can often be true—is that it should be used not to replace knowledge workers, but rather to augment them. And there are certainly examples of this being true. We’ve had, for example, technologies to help radiologists find breast cancers in mammography images for a while, but there is little evidence that any have lost their jobs. Instead, smart machines are used as an automated “second pair of eyes” to augment radiologists’ experience and judgment. In that situation, hospitals and medical practices are probably concerned about machines being sued for malpractice, so the lesson for humans is to find a job with high potential lawsuit potential.

In the vast amount of automated decision-making in financial services (loan origination, insurance policy origination, credit fraud detection, and so forth), it is certainly true that lower-level jobs have been eliminated because of such systems. However, experts typically retain their jobs to review and refine the rules and algorithms in automated decision systems. The lesson

here for a human wanting to keep a job is to become an expert—though one wonders how to do that if there are no entry-level jobs.

In data analysis, many companies are adopting machine learning tools to automatically fit statistical models to data. A human analyst relying on manual hypothesis testing can typically create only a few models per week, but machine learning can create thousands of models a week. So why are there still [hundreds of thousands of jobs open for quantitative analysts and Big Data specialists](#)? In this case, the lesson seems to be to choose a career with growth and complexity. Even though machine learning can make analysts much more productive, there is so much work to do that nobody's going to be laid off in this field anytime soon. And even though machine learning systems can do a lot of the grunt work, data modeling is complex enough that humans still have to train the systems in the first place, and check in occasionally on them to see if they are making sense.

In financial services, algorithms are increasingly [taking over the roles of deciding what trades to make](#), and [what recommendations to make to investors](#). However, there isn't much evidence that financial services jobs are falling because of technology. Instead, employment in finance seems to [track the level of the S&P 500 pretty closely](#). Both are rising right now, albeit slowly. Maybe the reason we need so many financial knowledge workers is to provide oversight to all of these automated systems. Another possible lesson might be to choose a field that is undergoing an increase in regulation; somebody has to prove to the government that automated systems are fair and that fraud isn't being committed.

In short, I would conclude that in the field of high-end knowledge work, it's still unclear whether the ultimate fate of workers is to be replaced rather than to be augmented by technology. If there is any overall lesson, it is to make sure you are capable of augmenting an automated or semi-automated system. If the decisions and actions you make at work are remarkably similar to those made by a computer, that computer will probably be taking your paycheck before long. To prevent that, you must understand how these systems perform their jobs. You need to understand how they work, know their strengths and weaknesses, examine them regularly to make sure their decisions are good, and be able to document and improve them. It's probably not a bad idea to improve your human relationship skills, but you may also want to address your ability to have meaningful relationships with computers.

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