THE THE FUTURE OF WORK PART 3: AN EXAMPLE OF ARTIFICIAL INTELLIGENCE

We don't have a clear definition of artificial intelligence, but we have some examples. One is machine translation, the subject of an article in the New York Times Magazine recently, *The Great A.I. Awakening* by Gideon Lewis-Krause (the"AI Article"). It's a beautiful piece of science writing. The author had the opportunity to see how employees of Google developed a neural network machine translation system and implemented it. It's long, but I highly recommend it. Rather than try to summarize it, I will draw out a few points.

The idea of neural net systems was inspired by our current understanding of the way the human brain works. There about 100 billion neurons in the average brain at birth. As we age, connections among neurons increase, so that each can be connected to as many as 10,000 other neurons. Thus, there are trillions of possible connections. Many of these are pruned as we age because they are not used. Many of the remaining connections are used to maintain the body, and to manage specific human processes, like the endocrine system, or to monitor for balance and pain.

One way to think about AI processes is to see them as pattern-matching systems. Until recently we didn't have the processing power to handle even a tiny fraction of the brain's connections, so the early efforts at simulating the brain were bound to fail. On the other hand, computers have been used for the purposes of matching patterns in relatively small sets of data. Here's a technical example. One of the main lessons of the AI Article is that it takes massive amounts of processing power and massive amounts of data to begin to approach the

connective power of the brain, Google also needed new mathematical theories to make it possible.

The astonishing thing is that the number of people needed to create those theories and do a preliminary setup is so small: maybe 10 all told. The full implementation required a team of 100 or so. More people were needed to create a new chip and get it working, and to install the new processors into the Google system, but again, the number seems to be in the hundreds, and it isn't clear that there were that many new jobs.

The task was made easier by the fact that Google had a huge library of documents translated between languages. These served as training materials for the translation project. Google has a huge library of images, youtubes, and other materials suitable for training. There won't be many jobs created in this area either.

These are two of the categories of new jobs identified by the White House in the report discussed here. There don't seem to be many new openings in new fields, but who knows. And there is nothing here likely to create jobs for anyone but the most educated people, though, of course, there may be jobs created in related fields.

The new platform created by these small teams can be adapted for many different problems. Doubtless as those ramp up there will be some new jobs, but it seems unlikely that there will be a hiring burst. Instead, we will see a war of dollars as the big tech companies compete world-wide for the top talent. The AI Article says that the Google team includes people from around the world. We get one or two of the personal stories, and they are amazing.

The AI Article gives a good introduction to the way neural networks work. I caution readers that these parts are metaphorical, and it is unlikely to be useful to try to try to reason with those metaphors, either to extend them, or to make predictions about the future. The metaphor is

not the thing. It is merely an aid to understanding the thing for those with little or no background. I link to a couple of pieces here that can be used to gain a deeper understanding of neural networks and deep learning.

At the end of the AI Article, there is a discussion of two possible ways of understanding consciousness. One view sees consciousness as something special beyond the mere physical actions of the brain. It finds it's origins in the mind-body dualism of Descartes, and is a disparagingly referred to as The Ghost in the Machine. Religious people might see it as the soul, or the Atman; but I'm not sure that's right. The other view dissolves this problem, and sees consciousness as an emergent phenomenon that arises from the complexity of the connectivity in the brain. The AI Article doesn't go into this area in much detail.

> And yet the rise of machine learning makes it more difficult for us to carve out a special place for us. If you believe, with Searle, that there is something special about human "insight," you can draw a clear line that separates the human from the automated. If you agree with Searle's antagonists, you can't. It is understandable why so many people cling fast to the former view.

For those interested in pursuing this matter, see *Consciousness Explained*, by Daniel Dennett. The linked Wikipedia article gives a brief description of the book along with Searle's objections to it.

I don't know enough to have an opinion about any of this, but I hope other people are thinking about one aspect of this problem. In Western Liberalism, it is a given that there is something special about human beings, and about each of us individually. I don't know how much of that arises from Christianity, with its emphasis on the relation between, and the likeness of, each individual to the Creator.

There is something bound to be unnerving in the combination of a) the idea that our individual selves are just complications of our individual brains, and b) our increasing ability to model that complication in our electronic gear. I don't have any immediate apocalyptic idea about this, not least for the reasons in this presentation. But every new idea about human beings has been twisted by despots and demagogues for their own purposes. It's danagerous to pretend that isn't going to happen with these ideas.