Connecting the Humanities and the Sciences: Part 3: The Partnership*

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There is, however, another possibility: that the partnership between humans and technology will always be more powerful than purely artificial intelligence. Call it the Ada Lovelace approach. Machines would not replace humans, she felt, but instead become their collaborators. What humans — and humanists — would bring to this relationship, she said, was originality and creativity.

The past fifty years have shown that this strategy of combining computer and human capabilities has been far more fruitful than the pursuit of machines that could think on their own.

J.C.R. Licklider, an MIT psychologist who became the foremost father of the Internet, up there with Al Gore, helped chart this course back in 1960. His ideas built on his work designing the America's air defense system, which required an intimate collaboration between humans and machines.

Licklider set forth a vision, in a paper titled "Man-Computer Symbiosis," that has been pursued to this day: "Human brains and computing machines will be coupled together very tightly, and the resulting partnership will think as no human brain has ever thought and process data in a way not approached by the information-handling machines we know today."[i]

Licklider's approach was given a friendly face by a computer systems pioneer named Doug Engelbart, who in 1968 demonstrated a networked computer with an interface involving a graphical display and a mouse. In a manifesto titled "Augmenting Human Intellect," he echoed Licklider. The goal, Engelbart wrote, should be to create "an integrated domain where hunches, cut-and-try, intangibles, and the human 'feel for a situation' usefully coexist with… high-powered electronic aids."[ii]

Richard Brautigan, a poet based at Caltech for a while, expressed that dream a bit more lyrically in his poem "Machines of Loving Grace." It extolled "a cybernetic meadow / where mammals and computers / live together in mutually / programming harmony."[iii]

The teams that built Deep Blue and Watson later adopted this symbiosis approach, rather than pursuing the objective of the artificial intelligence purists. "The goal is not to replicate human brains," said John E. Kelly, IBM's Research director. "This isn't about replacing human thinking with machine

thinking. Rather, in the era of cognitive systems, humans and machines will collaborate to produce better results, each bringing their own superior skills to the partnership."[iv]

An example of the power of this human-machine symbiosis arose from a realization that struck Kasparov after he was beaten by Deep Blue. Even in a rule-defined game such as chess, he came to believe, "what computers are good at is where humans are weak, and vice versa." That gave him an idea for an experiment. "What if instead of human versus machine we played as partners?"

This type of tournament was held in 2005. Players could work in teams with computers of their choice. There was a substantial prize, so many grandmasters and advanced computers joined the fray. But neither the best grandmaster nor the most powerful computer won. Symbiosis did. The final winner was not a grandmaster nor a state-of-the-art computer, but two American amateurs who used three computers at the same time and knew how to manage the process of collaborating with their machines. "Their skill at manipulating and 'coaching' their computers to look very deeply into positions effectively counteracted the superior chess understanding of their grandmaster opponents and the greater computational power of other participants," according to Kasparov.[v] In other words, the future might belong to those who best know how to partner and collaborate with computers.

In a similar way, IBM decided that the best use of Watson, the *Jeopardy!*-playing computer, would be for it to collaborate with humans, rather than try to top them. One project involved reconfiguring the machine to work in partnership with doctors on cancer diagnoses and treatment plans. The Watson system was fed more than two million pages from medical journals, 600,000 pieces of clinical evidence, and could search up to 1.5 million patient records. When a doctor put in a patient's symptoms and vital information, the computer provided a list of recommendations ranked in order of its level of confidence.[vi]

In order to be useful, the IBM team realized, the machine needed to interact with human doctors in a humane way — a manner that made collaboration pleasant. David McQueen, the Vice President of Software at IBM Research, described programming a pretense of humility into the machine. "We reprogrammed our system to come across as humble and say, 'here's the percentage likelihood that this is useful to you, and here you can look for yourself.'" Doctors were delighted, saying that it felt like a conversation with a knowledgeable colleague. "We aim to combine human talents, such as our intuition, with the strengths of a machine, such as its infinite breadth," said McQueen. "That combination is magic, because each offers a piece that the other one doesn't have."[vii]

This belief that machines and humans will get smarter together, playing to each other's strengths and shoring up each other's weaknesses, raises an interesting prospect: perhaps no matter how fast

computers progress, artificial intelligence may never outstrip the intelligence of the human-machine partnership.

Let us assume, for example, that a machine someday exhibits all of the mental capabilities of a human: it appears to feel and perceive emotions, appreciate beauty, create art, and have its own desires. Such a machine might be able to pass a Turing Test. It might even pass what we could call the Ada Test, which is that it could appear to "originate" its own thoughts that go beyond what we humans program it to do.

There would, however, still be another hurdle before we could say that artificial intelligence has triumphed over human-technology partnership. We can call it the Licklider Test. It would go beyond asking whether a machine could replicate all the components of human intelligence. Instead, it would ask whether the machine accomplishes these tasks better when whirring away completely on its own, or whether it does them better when working in conjunction with humans. In other words, is it possible that humans and machines working in partnership will indefinitely be more powerful than an artificial intelligence machine working alone?

If so, then "man-machine symbiosis," as Licklider called it, will remain triumphant. Artificial intelligence need not be the holy grail of computing. The goal instead could be to find ways to optimize the collaboration between human and machine capabilities — to let the machines do what they do best and have them let us do what we do best.

If this human-machine symbiosis turns out to be the wave of the future, then it will make more important those who can stand at the intersection of humanities and sciences. That interface will be the critical juncture. The future will belong to those who can appreciate both human emotions and technology's capabilities.

This will require more than a feel for only science, technology, engineering, and math. It will also depend on those who understand aesthetics, human emotions, the arts, and the humanities.

Let's look at two of the most brilliant contemporary innovators who understood the intersection of humans and technology: Alan Kay of Xerox PARC and Steve Jobs of Apple.

Alan Kay's father was a physiology professor and his mother was a musician. "Since my father was a scientist and my mother was an artist, the atmosphere during my early years was full of many kinds of ideas and ways to express them," he recalled. "I did not distinguish between 'art' and 'science' and still don't." He went to graduate school at the University of Utah, which then had one of the best computer graphics programs in the world. He became a fan of Doug Engelbart's work and came up with

the idea for a Dynabook, a simple and portable computer, "for children of all ages," with a graphical interface featuring icons that you could point to and click. In other words, something resembling a MacBook Air or an iPad, thirty years ahead of its time. He went to work at Xerox PARC, where a lot of these concepts were developed.

Steve Jobs was blown away by these ideas when he saw them on visits to Xerox PARC, and he was the one who turned them into a reality with his team at Apple. As noted earlier, Jobs's core belief was that the creativity of the new age of technology would come from those who stood at the intersection of the humanities and the sciences. He went to a very creative liberal arts college, Reed, and even after dropping out hung around to take courses like calligraphy and dance. He combined his love of beautiful lettering with his appreciation for the bit-mapped screen displays engineered at Xerox PARC, which allowed each and every pixel on the screen to be controlled by the computer. This led to the delightful array of fonts and displays he built into the first Macintosh and which we now can enjoy on every computer.

More broadly, Jobs was a genius in understanding how people would relate to their screens and devices. He understood the emotion, beauty, and simplicity that make for a great human-machine interface. And he ingrained that passion and intuition into Apple, which under Tim Cook and Jony Ive continues to startle us with designs that are profound in their simplicity.

Alan Kay and Steve Jobs are refutations of an editorial that appeared a few months ago in the *Harvard Crimson*, titled "Let Them Eat Code," which poked fun at humanities-lovers who decried the emphasis on engineering and science education. The *Crimson* wrote:

> We're not especially sorry to see the English majors go. Increased mechanization and digitization necessitates an increased number of engineers and programmers. Humanities apologists should be able to appreciate this. It's true that fewer humanities majors will mean fewer credentialed literary theorists and hermeneutic circles. But the complement — an increased number of students pursuing degrees in science, technology, engineering, and math — will mean a greater probability of breakthroughs in research. We refuse to rue a development that has advances in things like medicine, technological efficiency, and environmental sustainability as its natural consequence. To those who are upset with the trend, we say: Let them eat code.[viii]

Let me remind the *Crimson* editors that Bill Gates, who focused relentlessly on applied math and engineering when he was at Harvard, produced a music player called the Zune. Steve Jobs, who studied dance and calligraphy and literature at Reed, produced the iPod.

I hasten to add that I deeply admire Bill Gates as a brilliant software engineer, business pioneer, philanthropist, moral person, and (yes) humanist in the best sense. But there may be just a tiny bit of truth to Steve Jobs's assertion about Gates: "He'd be a broader guy if he had dropped acid once or gone off to an ashram when he was younger." At the very least, his engineering skills may have benefited a bit if he had taken a few more humanities courses at Harvard.

Endnotes

[i] J.C.R. Licklider, "Man-Human Symbiosis," *IRE Transactions on Human Factors in Electronics*, March 1960.
[ii] Douglas Engelbart, "Augmenting Human Intellect," Prepared for the Director of Information Sciences, Air Force Office of Scientific Research, October 1962.
[iii] First published in limited distribution by The Communication Company, San Francisco, 1967.
[iv] Kelly and Hamm, 7.
[v] Kasparov, "The Chess Master and the Computer,"
[vi] Why Cognitive Systems? IBM Research Website http://www.research.ibm.com/cognitive-computing/why-cognitive-systems.shtml.
[vii] Author's interview.
[viii] "Let Them Eat Code," Harvard *Crimson*, Nov. 8, 2013.

[*Note: This essay version has been partitioned and subtitled by the editors in order to facilitate student interaction. It may not conform in all details to the lecture transcript.*]