Preface

I wrote this book because I feel that as we move forward, it sometimes helps to step back—to take in the larger picture. Today, technology advances so rapidly that conjecture about a near future where computers move far beyond humans in intelligence is no longer science fiction. Many now take it as a given that within our lifetimes a "Singularity" will occur, after which the destiny of planet Earth (and some boldly predict, the entire universe!) will belong to the machines that we are busily creating today. We will pass the baton to our creation, in other words.

Predictions (and warnings) about technology overtaking humans go back at least as far as Mary Shelley's *Frankenstein*, which was published two centuries ago. However, today—with machine learning, Big Data, the "cloud," etc.—they have begun to appear more plausible.

But how concerned should we be? After all, technology has *always* played an immensely transformative role in society. In fact, there has never been a truly revolutionary technological breakthrough that didn't change not only our culture and our physical surroundings, but also the way humans think. Agriculture, architecture, the printing press, the automobile, mass media, etc.; all have had an enormous impact. Will AI be uniquely *more* revolutionary, or is it just the next destination along a long, long journey?

That is the question that this book considers, without attempting a clear-cut answer. A few decades from now, we will have our answer. Either AI will have taken over, and robots far more intelligent than Einstein will be everywhere, or humans will still be the dominant intelligence on the planet, using AI to

transform our world (as we have already begun to do), while remaining in charge of it.

Until we know, we will have to keep pondering, and guessing. That makes this era—the dawn of The Age of AI—mysterious and exciting, as well as a bit scary! Mostly, I feel it is uncertainty about just how far AI will go that makes us uneasy about it. I began teaching a course at the University of Yokohama to help my students form clear-headed ideas about AI by placing it in its proper historical context, alongside other breakthrough technologies. I approached Kinseido with the proposal to turn that course into a textbook, and they kindly consented. This book, and the overview of technology spanning millennia that it provides, is meant to help students make educated guesses about where we are headed.

Andy Boerger

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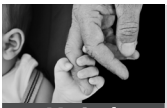
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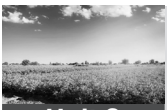
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Unit 2

Extending Both Muscle Power and Brainpower

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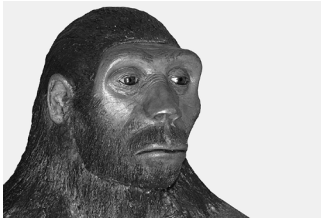
Today, we have computer programs that can defeat any chess master, or *igo* (a more difficult game) master. In the near future, AI is predicted to greatly enhance the power of the human brain. By connecting our own brains to AI technology, we will be able to learn more quickly than any humans in history. Each of us in the future may become an "Einstein." This has parallels to how our ancestors deep in the past began to use *tools* to greatly enhance the power of the human body; the very beginning of our technological journey.

Long ago, we used tools to build stronger "bodies" for ourselves; bodies that could lift, carry, dig, hunt, etc., far more effectively than what was permitted by our own muscular limitations. *Manual tools*, the first technology, separated hominids from other species and showed that the natural world could be manipulated.


Homo habilis

Some of the oldest tools displayed in the British Museum in London are arrowheads from around two million years ago. These were fashioned by *homo habilis*, ancestors of *homo sapiens* who dwelled in a region that is now part of Tanzania. With the emergence of *homo sapiens* (around 200,000 years ago) we find the shape of arrowheads and other simple stone tools being modified over time for specialized purposes. From very early on, *homo sapiens* was an innovator.

As familiarity with tool use grew, so did familiarity with the "master tool" that ran all the others: the human brain. A positive feedback loop between man and tools jumpstarted our evolution and caused us to become, primarily, a technological species.

We used our brains to conceptualize what tools could be and do. Moreover, the use of the tools refined our brain power. Just as small children develop their brains by playing with building blocks, early human tool use developed key regions in the brain related to higher thought, and planted the seeds of *reasoning* in us. Eventually we learned to think and plan *together*, in groups, to achieve greater results than could be achieved individually, giving rise to civilization. Hunting tribes of *homo sapiens* grew from just a dozen or so members to eventually numbering in the hundreds. Tool use enabled us to develop a skill that has been part of every technological development since: *Organization*.

We can see organization emerging by looking at *agriculture*, considered the most important early technological development. Tool use began roughly two million years ago, but it was only about ten thousand years ago where we see the development of agriculture on a large scale. With agriculture, human beings found it necessary to *organize* at scales and in ways they had not done previously.

The earliest agricultural tools were stones used to scratch at the earth for planting seeds. These were tools already being used by hunter-gatherers to dig for roots and insects. As with arrowheads, these tools gradually grew more specialized. Hoes, plows, shovels, etc., were invented and refined into the specialized farming equipment that can be seen in ancient Egyptian artwork dating back thousands of years.

As our tools got better, so did our organizational skills. We organized topography, digging furrows and irrigation channels, and built storage spaces for seeds, etc. We organized time itself, planting and harvesting according to pre-planned schedules based on the seasons. Early farming communities organized space and time in more sophisticated ways than not only other species, but rival hunter-gatherer societies as well. Thus, our brains adjusted, learning to think more logically, plan more long-term, innovate and modify to increase yields, etc. In other words, the ways we use our brains today, in business, government, science, and education, were seeded in us by our agricultural lifestyle.

Similarly to agriculture, architecture also changed both our outer/geographical space and our inner/mental space. When food is a moving target, as it generally is for hunter-gatherers, domiciles tend to be temporary. They can either be broken down

and reassembled elsewhere or simply abandoned. Animal skins (draped over branches) and straw were the most common early home materials, and continue to be today for the remaining hunter-gatherer tribes.

Pyramid of Giza

In early agricultural communities, tools not only for farming, but also for building became necessary, further stimulating our rapidly developing brains. In addition to the plows, shovels, etc., that were needed to farm, early humans developed bricks, hammers, nails, saws, etc., in order to erect structures that were durable and permanent (how permanent? Why, look at the Pyramids of Giza, still standing proudly six thousand years later!)

This was an exciting time in human history, when dozens of specialized tools were invented and improved upon in rapid succession across early agricultural settlements spanning the globe. All the while, the "master tool," the human brain, developed, separating itself from the brains of other species through the continual mental challenges that the technological lifestyle provided. Our partnership with technology had begun.

Exercises

A **Choose the definition of the words as they are used in the essay.**

1. enhance	**a**. similarity
2. parallel	**b**. place where a person lives
3. manual	**c**. operated by hand
4. conceptualize	**d**. form an idea
5. domicile	**e**. improve the quality of

B **Choose the correct answer to complete each sentence.**

1. The author states that the use of tools by early man
- **a**. enabled them to defeat other animals.
- **b**. developed and refined the human brain.
- **c**. began with the emergence of *homo sapiens*.

2. According to the author, agriculture
- **a**. emerged very early in human history.
- **b**. challenged humans to increase their organizational capabilities.
- **c**. was rejected by most hunter-gatherer tribes.

3. Architecture developed as an outgrowth of agriculture because
- **a**. agricultural tools were also used to build homes.
- **b**. tents and thatched huts had to be abandoned in farming communities.
- **c**. agriculture made permanent settlements possible.

C Discuss the topics.

1. The species *homo sapiens* has existed for more than 200,000 years, but agricultural communities have existed for only about 10,000 years. Why do you suppose it took such a long time for agriculture to appear?

2. Think of the tools that you use on a regular basis, either manual or digital (or a combination of the two); how are they different from early human tools, and how are they the same? Can you think of ways that the tools you use affect your thinking?

3. Many educators today fear that less exposure to manual tools in early education risks stunting a child's brain. Do you feel that children in today's technological society are not getting enough exposure to simple hand tools such as scissors, building blocks, etc.? If you were an educator, how would you address the situation?