innovate

H. Sapiens Digital:
From Digital Immigrants and Digital Natives to Digital Wisdom

by Marc Prensky

The problems that exist in the world today cannot be solved by the level of thinking that created them.
—Albert Einstein

In 2001, I published "Digital Natives, Digital Immigrants," a two-part article that explained these terms as a way of understanding the deep differences between the young people of today and many of their elders (Prensky 2001a, 2001b). Although many have found the terms useful, as we move further into the 21st century when all will have grown up in the era of digital technology, the distinction between digital natives and digital immigrants will become less relevant. Clearly, as we work to create and improve the future, we need to imagine a new set of distinctions. I suggest we think in terms of digital wisdom.

Digital technology, I believe, can be used to make us not just smarter but truly wiser. Digital wisdom is a twofold concept, referring both to wisdom arising *from* the use of digital technology to access cognitive power beyond our innate capacity and to wisdom *in* the prudent use of technology to enhance our capabilities. Because of technology, wisdom seekers in the future will benefit from unprecedented, instant access to ongoing worldwide discussions, all of recorded history, everything ever written, massive libraries of case studies and collected data, and highly realistic simulated experiences equivalent to years or even centuries of actual experience. How and how much they make use of these resources, how they filter through them to find what they need, and how technology aids them will certainly play an important role in determining the wisdom of their decisions and judgments. Technology alone will not replace intuition, good judgment, problem-solving abilities, and a clear moral compass. But in an unimaginably complex future, the digitally unenhanced person, however wise, will not be able to access the tools of wisdom that will be available to even the least wise digitally enhanced human.

Moreover, given that the brain is now generally understood to be highly plastic, continually adapting to the input it receives, it is possible that the brains of those who interact with technology frequently will be restructured by that interaction. The brains of wisdom seekers of the future will be fundamentally different, in organization and in structure, than our brains are today. Future wisdom seekers will be able to achieve today's level of wisdom without the cognitive enhancements offered by increasingly sophisticated digital technology, but that wisdom will not be sufficient, either in quality or in nature, to navigate a complex, technologically advanced world.

Digital Extensions and Enhancements

We are all moving, by fits and starts and each at our own speed, toward digital enhancement. In many ways, we are already there; digital enhancement is or will soon be available for just about everything we do. This includes—and here is the important part—cognition. Digital tools already extend and enhance our cognitive capabilities in a number of ways. Digital technology enhances memory, for example, via data input/output tools and electronic storage. Digital data-gathering and decision-making tools enhance judgment by allowing us to gather more data than we could on our own, helping us perform more complex analyses than we could unaided, and increasing our power to ask "what if?" and pursue all the implications of that question. Digital cognitive enhancement, provided by laptop computers, online databases, three-dimensional virtual simulations, online collaboration tools, PDAs, and a range of other, context-specific tools, is a reality in every profession, even in nontechnical fields such as law and the humanities (Exhibit 1).

We are already becoming dependent on these enhancements. As philosophers Andy Clark and David Chalmers (1998) argue, "extended cognition is a core cognitive process, not an add-on extra," as "the brain develops in a way that complements the external structures and learns to play its role within a unified, densely coupled system" ("3. Active Externalism," ¶17). As I recently heard a teenager say, expressing this idea more colloquially, "If I lose my cell phone, I lose half my brain." Many would express the same sentiment in regard to a PDA or a laptop computer; we are already embracing a basic level of digital enhancement, and we will accept ever more sophisticated enhancements as technology continues to develop.

These developing technologies, which will connect us more directly to their power by linking to our brains directly, are already here or on the horizon. Two recently released devices, one produced by Smart Brain Technologies and another by Emotive Systems, allow players to control the action in video games using their minds; NeuroSky is working on another version of the technology. The U.S. Air Force is experimenting with using similar technology to train pilots in hands-off flying (Satnews Daily 2008). Other emerging digital tools promise to facilitate communication and enhance understanding; for example, voice-stress analysis tools will allow users to perceive deception and automated translation utilities will help create translations free of human bias. As these tools become widely available, digital enhancement will become even more vital for everyone.

Digital Wisdom

What should we call this emerging digitally enhanced person? Homo sapiens digital, or digital human, perhaps. The key to understanding this development is to recognize that it includes both the digital and the wise. As digital enhancements develop, so too will the concept and practice of wisdom.

Wisdom, as any search will quickly show, is a universal but ill-defined concept. Definitions of wisdom fill entire volumes. The Oxford English Dictionary suggests that wisdom's main component is judgment, referring to the "Capacity of judging rightly in matters relating to life and conduct, soundness of judgment in the choice of means and ends" (OED 1989). Philosopher Robert Nozick (1990) suggests that wisdom lies in knowing what is important; other definitions see wisdom as the ability to solve problems—what Aristotle called "practical wisdom" (Wikipedia 2009). Some definitions—although not all—attribute to wisdom a moral component, locating wisdom in the ability to discern the "right" or "healthy" thing to do. This is, of course, problematic since agreement on moral issues is frequently difficult to come by. So wisdom cannot be conclusively defined without a consideration of context. One interesting definition of wisdom that is particularly useful in this discussion comes from Howard Gardner (2000), who suggests that wisdom may be seen in the breadth of issues considered in arriving at a judgment or decision. Combining these sources, we can define wisdom as the ability to find practical, creative, contextually appropriate, and emotionally satisfying solutions to comlicated human problems (as Solomon famously did with the baby problem). Many see it as a more complex kind of problem solving.

As technology becomes more sophisticated, developing the capacity to help us make moral and ethical choices as well as more pragmatic decisions, what we call "human wisdom" will reach new levels. Some of that evolution will arise from the breadth of resources available to the wisdom seeker. More development will emerge from wider access to more experience, provided by hours of exposure to realistic simulation, similar to that required for today's airline pilots and astronauts. It is also possible that reflective capabilities will themselves be enhanced; we are already seeing some evidence of this possibility in the speed with which video game players review previous games, searching for ways to improve before beginning the next game. Future technological tools will allow people engaged in making judgments and decisions to evaluate their decisions very quickly in light of collective past experience, just as today financial strategies can be backtested on the historical market. And given the enhanced communications possibilities, wisdom will certainly involve a lot more sharing and testing of ideas while they are in formation than is possible today.

Homo sapiens digital, then, differs from today's human in two key aspects: He or she accepts digital

enhancement as an integral fact of human existence, and he or she is digitally wise, both in the considered way he or she accesses the power of digital enhancements to complement innate abilities and in the way in which he or she uses enhancements to facilitate wiser decision making. Digital wisdom transcends the generational divide defined by the immigrant/native distinction. Many digital immigrants exhibit digital wisdom. Barack Obama, who grew up in the pre-digital era, showed his digital wisdom in enlisting the power of the Internet to enhance both his fundraising ability and his connection with the American people. Understanding that his judgment is enhanced by his ability to get instant feedback from his closest friends and advisors, he has refused to give up his BlackBerry. Rupert Murdoch, a self-confessed digital immigrant (Murdoch 2005), has also shown digital wisdom in recognizing the need to add digital news-gathering and dissemination tools to his media empire.

The point is that while the need for wise people to discuss, define, compare, and evaluate perspectives is not changing, the means by which they do so and the quality of their efforts are growing more sophisticated because of digital technology. As a result, the unenhanced brain is well on its way to becoming insufficient for truly wise decision making. When we are all enhanced by implanted lie detectors, logic evaluators, and executive function and memory enhancements—all of which will likely arrive in our children's lifetimes—who among us will be considered wise? The advantage will go, almost certainly, to those who intelligently combine their innate capacities with their digital enhancements.

Wisdom Enhancement

So how can digital technology enhance our minds and lead to greater wisdom? One way to answer this question is to consider where our unenhanced wisdom fails us and explore how technology can enhance our capabilities in those arenas.

As unenhanced humans, we are limited in our perceptions and constrained by the processing power and functioning of the human brain. As a result, we tend to go astray in our thinking in ways that limit our wisdom; for example:

- We make decisions based on only a portion of the available data.
- We make assumptions, often inaccurate, about the thoughts or intentions of others.
- We depend on educated guessing and verification (the traditional scientific method) to find new answers.
- We are limited in our ability to predict the future and construct what-if scenarios.
- We cannot deal well with complexity beyond a certain point.
- We cannot see, hear, touch, feel, or smell beyond the range of our senses.
- We find it difficult to hold multiple perspectives simultaneously.
- We have difficulty separating emotional responses from rational conclusions.
- We forget.

Some of these failures arise because we do not have access to necessary data, while others stem from our inability to conduct complex analyses, derive full understanding from the ever-increasing volumes of data available to us, understand others fully, or access alternative perspectives. All of these factors reduce our capacity to judge situations, evaluate outcomes, and make practical decisions wisely. Fortunately, available and emerging digital tools can allow us to overcome these deficiencies and attain true digital wisdom.

Enhancing Our Access to Data

The human mind cannot remember everything; detailed, voluminous data are quickly lost. In some ways, this is good in that it forces us to be selective, but it also limits our analytical capacity. Digital technology can help

by providing databases and algorithms that gather and process vast amounts of data far more efficiently and thoroughly than the human brain can. Expert systems are one example of sophisticated digital tools that can help humans access a wider array of data. These systems gather the expertise of hundreds of human experts in one program in order to provide a more thorough assessment of a given situation than even a highly trained and experienced professional might be able to offer. One example of such a system is the Acute Physiology & Chronic Health Evaluation (APACHE) system, which helps doctors allocate scarce intensive-care resources to those patients most in need (Exhibit 2).

Few would consider it wise to use an expert system such as APACHE as the only decision maker; expert system technology is both imperfect and still in development. But would it be wise for a human to make the decision without at least consulting it? Wise decisions often involve not just ethical considerations but also tradeoffs; in the context of a complex, delicate decision, such as the one to remove a patient from intensive care, those tradeoffs can be difficult to assess. Expert systems and other sophisticated analytical tools allow for a fuller understanding of the risks and benefits inherent in such a decision.

Enhancing our Ability to Conduct Deeper Analyses

In an article provocatively titled "The End of Theory," writer Chris Anderson (2008) describes how the massive amounts of data now being collected and stored by Google and others is allowing a new type of scientific analysis. In many cases, scientists no longer have to make educated guesses, construct hypotheses and models, and test them with data-based experiments and examples. Instead, they can mine the complete set of data for patterns that reveal effects, producing scientific conclusions *without* further experimentation because they can rely on analysis of a complete, digitally stored data set. In a similar way, Google's advertising tools draw valid and useful conclusions about what works in advertising without actually knowing anything either about what is advertised or about the projected consumers of the advertising. The software draws conclusions based purely on sophisticated analyses of available data; the analyses improve as the amount of data increases (as it does exponentially), and the analysis tools improve as well. This is the same principle, according to Anderson, that allows Google to "translate languages without actually 'knowing' them (given equal corpus data, Google can translate Klingon into Farsi as easily as it can translate French into German)" (2008, ¶5). Here, too, the tools will improve as more data becomes available. Imagine what will happen when the entire universe of everything ever written is available for analysis.

This approach reverses the generally accepted nature of the human/machine coupling. Rather than the mind imagining possibilities that the data confirm or deny, the data announce facts and relationships and the human looks for explanations or—as Google does with advertising—simply uses the relationships to achieve a goal without knowing or caring why they exist. Surely, such ability should lead us to question what wisdom is in such situations and to consider the relationship between mind and machine in producing wisdom in a digital future. Future wisdom will involve as much skill in eliciting relationships as in imagining them.

On the other hand, there are areas where a human mind's ability to imagine relationships will be crucial to attaining digital wisdom. From warfare to architecture to politics, asking "what if?" has always been critical to understanding complex systems, and human wisdom has always included the ability to what-if well. While simulation, practiced for thousands of years in sandbox, mechanical, and thought experiments, is a sophisticated way to explore possible interpretations of data, unenhanced humans are limited in the number of options and end states that they can explore in this way. Pairing human intelligence with digital simulation allows the mind to progress further and faster. A person's ability to create, interpret, and evaluate the models underlying the simulations plays a large role in his or her ability to use them wisely. In the future, more sophisticated simulation algorithms will allow humans to exercise their imaginative capacity in ever-more complex what-if constructions, allowing for more thorough exploration of possibilities and, in turn, wiser decisions. With the introduction of modern simulation games such as *Sim City, Roller Coaster Tycoon,* and *Spore,* this kind of digital wisdom enhancement already begins at a very early age.

Enhancing Our Ability to Plan and Prioritize

As the world becomes more complex, planning and prioritization skills far beyond the capability of the unenhanced human brain will be required; digital enhancements will be needed to help us to anticipate second and third-order effects to which the unaided mind may be blind. The full implications of massive undertakings like human space travel, the construction of artificial cities in the Arabian Sea, the building of huge machines such as large hadron colliders, and complex financial dealings such as those that have recently wrought havoc on the economy cannot be fully perceived or assessed by even the wisest unaided minds. Alan Greenspan, for example, is widely considered one of our wisest financial gurus, and yet, his assessment of the fundamental workings of our economy was mistaken: "You know," he admitted in a Congressional hearing in October 2008, "that's precisely the reason I was shocked [by the economic downturn], because I have been going more than 40 years or more with very considerable evidence that it was working considerably well" (Leonhardt 2008). Humans will require digital enhancement in order to achieve a full understanding of these increasingly complex issues and a full sense of the practical wisdom of pursuing them. We currently do not have, in many areas, either the databases of past successes and failures, or the tools to analyze them, that are required to enhance our wisdom and collective memory—but we will going forward.

Enhancing Our Insight into Others

One of the greatest barriers to human understanding and communication is that we cannot see inside another person's mind. This limitation gives rise to unintended misunderstandings and allows people to employ all sorts of deceptive strategies, both consciously and unconsciously. Some of the ways digital technology is helping us overcome this barrier include various means of truth (or lie) detection, multimodal communications, and digital readouts of our own and others' brain waves. Already, researchers at Carnegie-Mellon University (CMU), using digital computer analyses of brain patterns captured by functional magnetic resonance imaging (fMRI) scans, are able to tell what a person is thinking about (Mitchell et al. 2008). It is likely, according to these researchers, that our children will, in their lifetimes, be able to read people's thoughts and even have access to direct brain-to-brain communication. While these developments will clearly raise ethical issues and privacy questions that will have to be addressed, there can be little doubt that as people gain access to and learn to take into account others' unspoken motives, thoughts, needs, and judgments in their own thinking, their wisdom will increase.

Enhancing our Access to Alternate Perspectives

The world is full of things we cannot perceive with our unenhanced senses, things that are too small, too large, too fast, too abstract, too dangerous, or too far away. Exploring these things through digital enhancements will certainly help expand both our understanding of these things and our knowledge of how they can help or hurt us. It will also expand our ability to assume multiple perspectives—to see things from more than one point of view—and, hence, our wisdom. The perception of things outside our normal sensory range can be enhanced digitally in numerous ways, from manipulable three-dimensional simulations to digitally monitored biofeedback controls that enhance mental and sensory states, which may also enhance memory and emotional control. Access to alternative perspectives can also be attained through increasingly sophisticated digital role playing, using simulations in which people can experience difficult and critical situations from various points of view.

There are undoubtedly other ways in which digital technology will enhance our understanding and wisdom. None of these tools will replace the human mind; rather, they will enhance our quest for knowledge and our development of wisdom.

Not everyone accepts the power of digital enhancement to make us both smarter and wiser. On its July/August 2008 cover, *The Atlantic* magazine asks "Is Google Making Us Stoopid?" Google serves as a stand-in for the Internet and digital technology more generally; the author's concern is that digital enhancements such as the Internet make our natural minds lazier and less able (Carr 2008a). While that is certainly something we should guard against, we must also bear in mind that new technologies have always raised similar objections; as Carr points out, in Plato's *The Phaedrus,* Socrates objects to writing on the basis that it undermines the memory.

In fact, what's happening now is very much the opposite: Digital technology is making us smarter. Steven Johnson has documented this in *Everything Bad is Good For You* (2005), in which he argues that the new technologies associated with contemporary popular culture, from video games to the Internet to television and film, make far more cognitive demands on us than did past forms, thus increasing our capabilities in a wide variety of cognitive tasks. As Johnson puts it, "Today's popular culture may not be showing us the righteous path. But it is making us smarter" (14). Socrates was correct in his fear that writing would diminish our memories but shortsighted in that concern. While we may remember less and memorize less readily than did humans in Socrates's day, the addition of writing has made us considerably wiser by expanding our collective memory and increasing ability to share information across time and distance.

Worries that ubiquitous GPS systems might diminish our map-reading ability or that spell checkers and calculators will result in a generation that cannot spell or do mental math are similarly shortsighted. Every enhancement comes with a trade-off: We gave up huge mental memory banks when we started writing things down; we gave up the ability to tell time by the sun when we began carrying pocket watches. But we gained a set of shared cultural memories and a more precise notion of time that fueled the Industrial Revolution. Digital wisdom arises from the combination of the mind and digital tools; what the unenhanced mind loses by outsourcing mundane tasks will be more than made up for by the wisdom gained. Wisdom, and particularly practical wisdom, must be understood in light of the digital enhancements that make it stronger.

Being Digitally Wise

So what constitutes digital wisdom? What habits do the digitally wise use to advance their capabilities and the capabilities of those around them? Can digital wisdom be taught?

Examples of digital wisdom are all around us. Leaders are digitally wise when they use available techniques to connect with their constituents for polling and to solicit contributions and encourage participation, as Barack Obama did so well in the 2008 U.S. presidential campaign. Journalists are digitally wise when they take advantage of participative technologies such as blogs and wikis to enlarge their perspectives and those of their audience. Nicolas Carr exhibited digital wisdom in posting his notes and sources for his *Atlantic* article on his blog in response to reader requests for more information (Carr 2008b). Digital wisdom can be, and must be, learned and taught. As we offer more courses in digital literacy, we should also offer students guidance in developing digital wisdom. Parents and educators are digitally wise when they recognize this imperative and prepare the children in their care for the future—educators by letting students learn by using new technologies, putting themselves in the role of guides, context providers, and quality controllers, and parents by recognizing the extent to which the future will be mediated by technology and encouraging their children to use digital technology wisely.

The digitally wise distinguish between digital wisdom and mere digital cleverness, and they do their best to eradicate digital dumbness when it arises (Exhibit 3). They know that just knowing how to use particular technologies makes one no wiser than just knowing how to read words does. Digital wisdom means not just manipulating technology easily or even creatively; it means making wiser decisions because one is enhanced

by technology. Therefore, the digitally wise look for the cases where technology enhances thinking and understanding. No digitally wise leader would make any major decision, no digitally wise scientist would come to any conclusion without digital tools enhancing their own thinking. They may rely on intuition, but that intuition is informed, inspired, and supported by digital enhancements and by the additional data digital tools provide. Those who are truly digitally wise do not resist their digitally enhanced selves but accept them gladly, even as they make careful judgments about what digital enhancements are appropriate and when.

Being digitally wise involves not only enhancing our natural capabilities with existing technologies but also continuously identifying additional areas where our natural human tools—even when they are developed to a very high level—cannot do the job unaided. As new digital tools appear, especially ones that take hold in a strong way, the digitally wise seek them out actively. They investigate and evaluate the positives as well as the negatives of new tools and figure out how to strike the balance that turns tools into wisdom enhancers. The digitally wise also realize that the ability to control digital technology, to bend it to their needs, is a key skill in the digital age. As a result, they are interested in programming, in the broadest sense of the word, that is, in making machines do what people want them to do.

Conclusion

Within the lifetimes of our children, more powerful digital mental enhancements—the embedded chips and brain manipulations of science fiction—will become a reality just as gene manipulation, long considered a far-off dream, is with us now. Just as we have begun to confront the ethical, moral, and scientific challenges presented by genetic medicine, we will have to confront the issue of digital wisdom sooner or later, and we will be better off doing it sooner. Many of these enhancements will bring ethical dilemmas, but the digitally wise will distinguish between true ethical issues (Is the enhancement safe? Is it available equally to all?) and mere preferences and prejudices.

Nobody suggests that people should stop using and improving their unaided minds, but I am opposed to those who claim the unenhanced mind and unaided thinking are somehow superior to the enhanced mind. To claim this is to deny all of human progress, from the advent of writing to the printing press to the Internet. Thinking and wisdom have become, in our age, a symbiosis of the human brain and its digital enhancements.

I do not think technology is wise in itself (although some day it may be) or that human thinking is no longer necessary or important. It is through the interaction of the human mind and digital technology that the digitally wise person is coming to be. I believe it is time for the emerging digitally wise among us, youth and adults alike, to embrace digital enhancement and to encourage others to do so. With our eyes wide open to enhancement's potential harm as well as its benefits, let us bring our colleagues, students, teachers, parents, and peers to the digital wisdom of the twenty-first century.

References

Anderson, C. 2008. The end of theory: The data deluge makes the scientific method obsolete. *Wired Magazine* 16 (7). http://www.wired.com/science/discoveries/magazine/16-07/pb_theory (accessed January 28, 2009). Archived at http://www.webcitation.org/5eBIPrc60.

Carr, N. 2008a. Is Google making us stupid? What the internet is doing to our brains. *The Atlantic* 301 (6): 56-63. http://www.theatlantic.com/doc/200807/google (accessed January 28, 2009). Archived at http://www.webcitation.org/5eBJxMMM3.

Carr, N. 2008b. "Is Google making us stupid?": Sources and notes. [Weblog entry, August 7.] *Rough Type.* http://www.roughtype.com/archives/2008/08/is_google_makin.php (accessed January 29, 2009). Archived at http://www.webcitation.org/5eFmKmnMx.

Clark, A., and D. J. Chalmers. 1998. The extended mind. *Analysis* 58.1: 7-19. http://consc.net/papers/extended.html (accessed January 28, 2009). Archived at http://www.webcitation.org/5eBEF2Ncm.

Gardner, H. 2000. *Intelligence reframed: Multiple intelligences for the 21st century*. New York: Basic Books.

Johnson, S. B. 2005. *Everything bad is good for you*. New York: Riverhead Books.

Leonhardt, D. 2008. Greenspan's mea culpa. [Weblog entry, October 23.] *Economix*. http://economix.blogs.nytimes.com/2008/10/23/greenspans-mea-culpa/ (accessed January 28, 2009). Archived at http://www.webcitation.org/5eBJTVMJi.

Mitchell, T., S. V. Shinkareva, A. Carlson, K. Chang, V. L. Malave, R. A. Mason, and M. A. Just. 2008. Predicting human brain activity associated with the meanings of nouns. *Science* 320 (May): 1191-1195.

Murdoch, R. 2005. Speech to the American Society of Newspaper Editors, April 13. http://www.newscorp.com/news/news_247.html (accessed January 26, 2009). Archived at http://www.webcitation.org/5e6jPyqgB.

Nozick, R. 1990. *The examined life: Philosophical meditations*. New York: Simon & Schuster-Touchstone.

OED. 1989. "Wisdom," definition 1a. *Oxford English Dictionary*, 2nd. ed. Oxford: Oxford University Press.

Prensky, M. 2001a. Digital natives, digital immigrants. *On the Horizon* 9 (5): 1-6. http://www.scribd.com/doc/9799/Prensky-Digital-Natives-Digital-Immigrants-Part1 (accessed January 28, 2009). Archived at http://www.webcitation.org/5eBDYI5Uw.

Prensky, M. 2001b. Digital natives, digital immigrants, part 2: Do they really think differently? *On the Horizon* 9 (6): 1-6.

http://www.twitchspeed.com/site/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part2.htm (accessed January 28, 2009). Archived at http://www.webcitation.org/5eBDhJB2N.

Satnews Daily. 2008. Hands off F-16 lands using Lockheed Martin computer control technology. *Satnews Daily*, December 11. http://www.satnews.com/cgi-bin/story.cgi?number=1057554591 (accessed January 28, 2009). Archived at http://www.webcitation.org/5eBFSBrSt.

Wikipedia. 2009. Wisdom. http://en.wikipedia.org/wiki/Wisdom (accessed January 26, 2009). Archived at http://www.webcitation.org/5e6jXGyZN.

COPYRIGHT AND CITATION INFORMATION FOR THIS ARTICLE

This article may be reproduced and distributed for educational purposes if the following attribution is included in the document:

Note: This article was originally published in *Innovate* (http://www.innovateonline.info/) as: Prensky, M. 2009. H. sapiens digital: From

digital immigrants and digital natives to digital wisdom. *Innovate* 5 (6). http://www.innovateonline.info/index.php?view=article&id=705 (accessed February 4, 2009). The article is reprinted here with permission of the publisher, The Fischler School of Education and Human Services at Nova Southeastern University.

To find related articles, view the webcast, or comment publically on this article in the discussion forums, please go to http://www.innovateonline.info/index.php?view=article&id=705 and select the appropriate function from the sidebar.