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Onward from the Digital Child

As I compose this introduction, one of my children is playing on a hand-held video game that contains more memory than the first computer I had access to in graduate school. My other child is on-line to her friends somewhere on the Internet. At the same time, 300 lieutenant colonels and colonels are converging on Carlisle, Pennsylvania, to begin their formal education in senior leadership at the US Army War College. I am imagining how these events intersect. Perhaps 30 years from now, when the generation of digital colonels in the Army War College Class of 2026 embark on a well-worn path in Eisenhower's footsteps, we will see the effects of the Information Age that started for them when they were playing video games and "surfing the net" as kids in 1996.

Perhaps the future will look much as it does today and did 500 years ago. A colleague reminds me that with the tremendous advancements in technology, organizations, and doctrine, command is still very personal.[1] He writes, "Consider Schwarzkopf, alone in his bunker, making the decision to start the ground war in the Gulf, and contrast the moment with Eisenhower on the eve of D-Day. The modern general has state-of-the-art technology light years ahead of what Eisenhower had available to him, yet both faced the same questions--*Is it time? Has enough been done to ensure the success of the attack?* Both had huge staffs manned with the best minds they could assemble; both sought and used the best intelligence they had available to them, but the decision to commit forces to the offensive in the end was largely intuitive, personal, and private--*In my judgment, the time is right*." In the end, it could be argued, all great commanders are the same. They adapt the technology of their times in a highly personal, reflective space where machines can extend, but never supplant, the human dimension of their leadership.

My colleague's point is clear: there will always be a human dimension to leadership. The most successful commanders will be those who possess a few basic traits: courage, intellect, and a cultivated sense of intuition. If that commander doesn't even know how to turn on a computer, it matters not. That is a comforting speculation, and there are abundant examples in the biographies of the great captains to support it. Yet, I have a nagging concern for that batch of "digital generals" 35 years from now.[2] I wonder if the cultural transformation between now and then might be so profound, so revolutionary, that these future leaders will follow along the path described above? I also wonder if high technology might have a corrosive effect upon their command, in the way that "management" might have corrupted leadership to produce the zero-defects mentality.

I am not a Luddite; I embrace technology for its extensions to my senses, my muscles, and my intellect. But I am a child of the late 1940s, and my view of technology is conditioned by my experience, constructed in a Newtonian culture of linear, cause-and-effect relationships and predictable consequences. I learned from television as it developed, but spent as much time with radio and records, books and newspapers to form a worldview. I have experienced (and circumscribed) technology as an exciting stream of tools which could improve without necessarily perturbing the natural order of things. It was only recently that this relationship has been exploded by technology's capacity to interact with and remodel human events in real time (exemplified by the effects of televised combat and talk-show politics that shape public opinion and mold policy), fulfilling Marshal McLuhan's prophesy that "the medium is the message"[3] while shifting social attitudes and behavior. From that perspective, one must ask whether technology's ultimate effect upon future senior leaders could go far beyond providing an enhanced warfighter toolbox. Is something else there that will transform the human dimension of the "digital general" too?

The Medium Might Rewrite the Message

It is difficult to understand a revolution from the inside-out. We comprehend change through historical trends and visualize the unfamiliar through familiar patterns. Thus, the "revolution in military affairs," considered a qualitatively new capability to see, understand, and respond to a changing military situation, is being framed and understood in the "traditional" language of computer systems. One view is that the microprocessor is another powerful tool to integrate knowledge, a *system-of-systems* to help dissipate the fog of war.[4] But what if the microprocessor is but an icon for a more fundamental conceptual revolution that is occurring? What if technology is shaping a real social and cultural transformation? Could the Information Age be more than improved tools? Can other changes be far behind?

In his essay on military decisionmaking in the Information Age, Professor Thomas Czerwinski forecasts a transition to a style of "command by influence" in which the military leader would communicate mission-type orders through symbolic imagery rather than voice or text, leveraging subordinates' initiative to exploit chaos through greater situational awareness.[5] I speculate that the digital general some 35 years from now might not just communicate differently but will actually *think differently* from his or her predecessors, because conceptual behavior itself is evolving during the Information Age.

The evidence that a threshold may have been crossed is found in a steady worldwide rise in intelligence test performance. The psychologist James Flynn first demonstrated that IQ has been going up ever since testing began. The "Flynn effect" is now well documented in many technologically advanced countries: the average gain is about three IQ points per decade, more than a full standard deviation since the last generation of military leadership was born. According to the report of a task force established by the American Psychological Association,[6] the consistent intelligence score gains documented by Flynn seem much too large to be explained by simple increases in test sophistication. Yet, their cause is presently unknown. According to the task force, the most plausible explanation is based upon striking cultural differences between successive generations: the population is increasingly urbanized; television exposes us to more information and more perspectives on topics than ever before; children stay in school longer; and everyone is exposed to new forms of experience. In short, *complexity of life may produce corresponding changes in complexity of mind.*

It will be no surprise to one who has watched school-age children "surf the net" that information technology has jolted our culture, promoting access to ideas and immediacy to events, leading to mastery of resources. Without leaving his room, a 12-year-old can "cyberchat" or correspond worldwide with e-mail pals, download a computer game, compile references from university libraries for homework papers, or view a music video.

Adults are often astounded at their children's facility with this high technology. To someone who witnessed a social transformation driven by television, this capability is considered revolutionary, a "paradigm shift." But paradigms shift only on the margin--to the youngster who played Super Mario Brothers® or Sonic the Hedgehog® at age five, this new information technology is just an incremental change, a step up from the SegaÔ or NintendoÔ, but hardly a revolution in his or her eyes; something "cooler" will always come along. Keep in mind that these children are the senior leaders in the "Army After Next"; their grandchildren will be even more dissimilar to us.

Transformed Minds, Transformed Culture

As technology transforms the culture, it also shifts expectations and perceptions, and this is the heart of the conceptual transformation from pre- to post-microprocessor generations. Let me enumerate a few elements of this shift:

Information management and manipulation are replacing knowledge acquisition and inference. The exponential growth of information and the methods for acquiring it have transformed the meaning of expertise. In the past, an expert was the repository of facts. Experts "learned" how to become experts by acquiring those facts and by learning how to distinguish truth. But there are now too many facts, too much stored information, too many sources. Experts are now defined by their ability to recognize underlying patterns so that new facts can be acquired and integrated. Experts learn how to match these underlying patterns or heuristics to new data sources in order to advance composite knowledge.

Within the Internet, for example, some of the most active enterprises are "World Wide Web search engines." These programs range from simple semantic filters which dredge related items from the millions of pages of stored data, to

keyword systems which group and retrieve sources according to underlying patterns and themes. As a cursory examination of these systems will demonstrate, there is no shortage of information on any imaginable subject; one such system boasts access to 50 million pages of information. Hence, it is becoming ever more important to know what to ask for, and increasing status is being accorded to those who can efficiently frame a search strategy to a question while avoiding becoming overwhelmed by the possible answers. Likewise, information manipulation has become a central academic objective--rather than presenting students with a static set of facts, instructors are challenging their students to learn the interrogation process themselves to harvest their own answers. The result is a generation that is comfortable navigating numerous, complex data sets.

Of course, there are risks in this activity. On the Internet, information is plentiful but not necessarily genuine or reliable. Searching is a recursive project which involves trial and error. Most "search engines" score the accuracy of a selection, or "hit," by the likelihood that the result matches the search template. This is not, I would assert, analogous to finding the truth. Accuracy of retrieval is generally determined by how well a piece of information is indexed for retrieval, not by its internal validity. Consequently, on the Internet it is possible to retrieve erroneous information correctly, and to deceive others with bogus "facts" or rumor freely distributed throughout cyberspace.

The real problem of going from inference to data management is that as much emphasis can be placed on the process as on the product of a search. That could engender a shaky practice: seek until you find, but generally accept what meets your expectations. The corollary, "If you didn't find it, you didn't ask for it the right way," can shape the process of inquiry into merely proving one's expectations, a cybernetic prejudice that suspends critical analysis and evaluation of the results. A related pitfall is uncritical acceptance of results, i.e. confusing process for product: "If my search strategy returned an answer, it must be a correct one." The perils of uncritical thinking are compounded by some innate characteristics of the Internet: it is voluminous, it is uncensored, and it can be counterfeit. With so much information available, efficiency has priority over reliability, hence the popularity of the search engines. Yet, there is rarely a day that counterfeit material is not posted somewhere (or reposted, multiplying its weight to the search engines). Unfortunately, the information age provides no easy answer to this problem, but presents an abundance of hazards for the uncritical thinker who uses technology to make his decisions. "Let the buyer beware!" will take on more significance in a data-intensive Information Age.

The basis for learning is changing. In the pre-microchip generation, lessons learned were generated from directly experienced real-world consequences. The tutelage of mentors was prized because they had learned the tricks and traps of the trade through personal or vicarious experience and handed them down through education. The most valuable mentors were guardians of institutional memory, who could act like harbor pilots to guide novices to a solution because they knew where the shallow straits were located, perhaps because they had once run aground themselves. (One of the interesting sidelights here is the pressure for increased self-reliance caused by the disappearance of institutional memory, a result of force realignments and the inevitable attrition of seasoned veterans who stood in the past as mentors.)

By contrast, the information age has facilitated virtual reality--self-discovery through simulation of actual situations, events, and problems. Given data on the real-world parameters, computers can model sensory cues and contingencies, support gaming of choice alternatives, and simulate appropriate consequences. Moreover, these simulations can harmlessly mimic reality so that actual disaster is never experienced as a consequence. This is their key advantage, of course. Incremental learning or proficiency can be developed by stopping or restarting the process at will, completely erasing the damage of a previous mistake.

As data storage and processing power increases, the boundary between simulation and reality becomes even less distinguishable. Witness the power of computer animation in such popular films as *Jurassic Park*, *Forrest Gump*, and *Twister*, or the realism of mechanical simulation in the new Boeing 777 training module. In military affairs, this capability to simulate reality has been employed to construct a "virtual theater of war" which seamlessly combines real units and simulated ones to test doctrinal concepts and materiel effectiveness through simulated operational and tactical maneuvers.

When reality and simulation become indistinguishable, is there an indelible effect on the player that desensitizes him to the damage of real-world catastrophes? When harm and pain exist chiefly in cyberspace as immaterial states, can a

player fail to develop sympathy for real-world consequences? The allure of virtual reality could have a dark side--the blunting of the human sentiments to real war that is fought abstractly, in a manner not too different from counterpart recreational games. Could advanced technology, the increasing digitization of the battlefield, and the automation of combat systems transform the experience of war into another video arcade game, an abstraction defined by the movement and deletion of computer icons? In my opinion, the answers are not clear-cut, but today's most popular computer games have martial themes, and more are on the way. The story is told of an officer who, in the pitch of virtual battle, swore at his terminal, "Damn, I lost an icon!" as an overrun battalion was flagged by the computer. Even if the story is apocryphal, the potential for the response clearly exists in cyberwar.

Systematic decisionmaking is eclipsing intuition. Computers that beat chess masters prove that artificial intelligence and knowledge-based systems are capable of extremely sophisticated decisionmaking. Programs that apply experts' collective rules of thumb have even been shown to make more consistent, reliable decisions than humans in similar problem-solving situations. Yet most expert systems operate from data-hungry mathematical models. They illustrate the inseparable relationship between knowledge and intelligence--the more you know, the smarter you become; so to become smarter, you must know even more.

If the quantity of evidence determines the certainty of a hypothesis, then how much evidence is enough? The answer is determined by the amount of ambiguity in the problem, because computers reason in all-or-nothing terms and have limited tolerance for partial evidence. Uncertainty is resolved by redundant observations, so that more data is collected to resolve the uncertainty. Ironically, systems that can scan a situation in great depth and analyze in great precision can provide a decisionmaker with so much capability that he becomes addicted to the information and consequently paralyzed by it. Recently, the *Army Times* described a computer-assisted exercise during which a battle staff hadn't noticed it was being overrun by the enemy because the commander was preoccupied with obtaining more data from his battlefield computer.[7]

Through technology, it is not only possible to suffer paralysis by analysis, but also to neglect the intuitive skills that give commanders an important advantage in ambiguous situations. The author of a recent *Military Review* essay observes that intuition allows a commander to focus rapidly on feasible solutions when time for systematic analysis is unavailable.[8] This capacity is particularly important in peacekeeping, where the traditional combat decisionmaking model does not fit. But, as that writer notes, intuition comes largely from experience with a broad base of situations. Overreliance on structured systems might, indeed, stunt the growth of this intellectual capacity and severely limit a commander's options in unfamiliar scenarios. One of the worst possible outcomes would be the erosion of a leader's ability to use his own eyes and ears. While decision systems might present an unparalleled opportunity to eliminate risks, they could obscure a strategic leader's awareness of key inputs to the decisionmaking process which exist outside the range of data available through computers. Assessment of political and environmental conditions, for example, will rarely be carried out through the systems of sensors that will generate most of the input to Force XXI computers.[9]

A Hubris in the Information Age

One of the particular ironies of the Information Age is that the shifts in expectations and perceptions cataloged here may create and support superb battle staff officers, because these men and women of the future will know how to leverage powerful analytical tools for tremendous advantages in speed, precision, and effect. Yet, these transformations also could supply a hubris for the digital general because they make it more difficult to shift from the operational to the strategic level of leadership.

In the worst case, an officer corps mesmerized by high technology could produce a generation of senior leaders that is so insecure without their computer models and decision systems that they could not step beyond them. That could have dire consequences:

Reluctance to "break out of the box." When any formal data system becomes a leader's primary commodity for strategic decisions, the demand for hard evidence can become the enemy of hunches, eventually suppressing new perspectives on a situation. A senior leader's experience shouldn't be entrapped by rigid analytical systems that force a choice from options in all of which ambiguity is a common circumstance. In fact, strategic leaders need some personal

distance from hard data in order to sample other channels of reality, such as having face-to-face discussions to sound out the feelings behind the pros and cons of an issue.

Death of the metaphor. Just as there are plentiful examples where critical scientific breakthroughs have occurred while the right brain (our intuitive, pre-verbal cognitive resource) was operating ahead of the pack, strategic vision requires an ability to think in metaphors, to seek related patterns in unrelated objects, situations, and events. True, our future senior leaders will have access to more information. The successful ones will be those who are best able to sort out the important from the interesting. The development and testing of analogies--the patterns that allow leaders to see the important under data overload, is a skill that could waste away under a sterile diet of expert systems and virtual reality simulations.

Fear of risk and error. I doubt that the best microchip will ever exceed the value of "Kentucky windage" in decisionmaking, but the illusion of omniscience from multisensory information systems might make our leaders fear the "guesstimate," preferring to avoid risking mistakes by substituting certainty models for their intuition.

The Way Ahead or the Way Out?

No one can reliably predict whether technology-driven changes will necessarily impair the human dimension of senior leadership; possible negative consequences are so averse, however, that it is important to plan to prevent them. That implies at least two steps: first, to monitor the penetration of "digital thinking" in our youth and assess its effects on the young solders who operate our battle systems. Second, to assert the value of intuition, risk-taking, and creative thinking throughout our professional military education process. The first step recognizes that we may not yet see the phenomenon in our current commanders--they come from a different generation of technology and culture. With the real leading edge of the cultural revolution completing elementary school, we must plan now to meet this generation at the doorway, prepared to stress values that might be submerged in their experience and prepared to cultivate abilities that will make them effective "digital generals" in their own time.

NOTES

1. Colonel Len A. Fullencamp, Department of National Security and Strategy, US Army War College, personal communication, 1996.

2. This is an arbitrary date, set to match the 45- to 50-year-olds in 2026 who are today's elementary school students.

3. Marshall McLuhan and Quentin Fiore, *The Medium is the Message* (New York, Simon & Schuster, 1989).

4. William A. Owens, "System-of-systems," *Armed Forces Journal*, January 1996, p. 47.

5. Thomas J. Czerwinski, "Command and Control at the Crossroads," *Marine Corps Gazette*, October 1995, pp. 13-15.

6. Ulric Neisser (Chair), Gwyneth Boodoo, Thomas J. Bouchard, Jr., A. Wade Boykin, Stephen J. Ceci, Diane F. Halpern, John C. Loehlin, Robert Perloff, Robert J. Sternberg, and Susana Urbina, "Intelligence: Knowns and Unknowns," *American Psychologist*, 51 (February 1996), 77-101.

7. This was a sidebar to an article by Sean D. Naylor, "Digitized Force: Better, but Not Smaller; Technology Promises to Change the Way Battles are Fought," *Army Times*, 23 October 1995. See also Thomas Czerwinski's assessment of the three common command systems--by direction, by plan, and by influence--in terms of their reliance on varying mixes of data and intuition for decisionmaking. He links the three in their approach to uncertainty and its influence of the commander. ("Command and Control at the Crossroads," in this issue of *Parameters*, pp. 121-32.)

8. Dane L. Rota, "Combat Decision Making in Operations Other Than War," *Military Review*, 76 (March-April 1996), 26.

9. See, for example, the experience of the authors of "Declaring Victory: Planning Exit Strategies for Peace

Operations," in this issue (pp. 69-80). The analytical process they used to plan for relinquishing full responsibility for the "stable, secure environment" in Haiti to local police was highly structured and carefully managed. Yet their greatest need was for what they called "political situational awareness," which proved very difficult to acquire.

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Reviewed 21 August 1996. Please send comments or corrections to carl_Parameters@conus.army.mil.