

IF THE “HUMAN” IS FINISHED, WHAT
COMES NEXT?: A REVIEW ESSAY

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N. Katherine Hayles. *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics.* Chicago: The University of Chicago Press, 1999.

IN *STEPS TO AN ECOLOGY OF MIND*, THE ANTHROPOLOGIST and scientist Gregory Bateson repeatedly uses a simple example to challenge taken-for-granted assumptions about the body and the self. Consider, he says, a blind man with a stick. “Where,” Bateson asks, “does the blind man’s self begin? At the tip of the stick? At the handle of the stick? Or at some point halfway up the stick?”¹ If you answer the handle, if you assume that the man is defined by his physical boundaries, then, according to Bateson, you are wrong. In fact, for Bateson, “these questions are nonsense” because in the cybernetic viewpoint he is advocating, individuals are pathways for information; they are part of communicational systems “whose boundaries do not at all coincide with the boundaries either of the body or of what is popularly called

¹ Gregory Bateson, *Steps to an Ecology of Mind* (Chicago: The University of Chicago Press, 2000) 318.

the 'self' or 'consciousness.'"² The stick is an important pathway of information for locomotion, and so no boundary line between the stick and the man can be relevant to the communicational network of which both are part. In cybernetic theory, neither the boundaries of the body nor the self are stable; informational feedback loops can be both internal and external to the subject. Both humans and machine, in this view, are *essentially* information patterns, and so the distinction between them is blurred and even erased. Although the pioneers of cybernetics sometimes shrank from the implications of their theory for understanding human beings, others were not so shy, including science fiction writers and later theorists in the tradition.

Gregory Bateson was an important figure in the early stages of cybernetics and his blind-man-with-stick example nicely captures something of the radical implications of the theory for thinking about subjectivity. More recently, the cybernetic tradition has merged into new research programs in artificial life, cognitive science, and virtual technologies. In these fields, the underlying assumptions about human beings continue to evolve and be transformed. Indeed, according to N. Katherine Hayles and other scholars, the new assumptions represent a break with the rational and unified subject of post-Cartesian philosophy (the "human") sufficient to warrant the term "posthuman." In this sense, the "post" in posthuman refers to the superseding of one definition of the human with another. However, there is an alternative meaning of posthuman that takes the radical implications of the cybernetic tradition much further. In this more common meaning, the "post" in posthuman refers to the overcoming of human biological limitations by technological transformation. Humans will, in large part, become machines. In some visions of this "postbiological" future, intelligent machines even displace the human race entirely.

If talk of a postbiological future sounds like something right out of science fiction, well, it is. The cybernetic tradition has never been limited to scientists; it has also grown and been nurtured within popular cul-

² Bateson 319.

ture through science fiction, and the cultural implications of human-machine interfaces have been most clearly drawn out there. Accordingly, it seems fitting to begin with a work of science fiction. The posthuman, however, is also far more than science fiction, and N. Katherine Hayles, in her important and demanding book, *How We Became Posthuman*, sketches a story of how technological visions in real science are spurring a fundamental re-thinking of what it means to be human.

Fusing Humans and Machines

Arthur C. Clarke's first novel, *Against the Fall of Night*, was a disappointment to him, so he decided to rework it. A long sea voyage from England to Australia in 1954 and 1955 gave him the opportunity, and *The City and the Stars* was published in 1956. In the preface, Clarke notes that the progress of science had made some of the ideas expressed in his first book, begun in 1937, seem naïve, while opening up "vistas and possibilities quite unimagined" earlier. "In particular," he writes, "certain developments in information theory suggested revolutions in the human way of life even more profound than those which atomic energy is already introducing."³ Some of these developments, according to Ed Regis in his delightfully engaging and highly informative *Great Mambo Chicken and the Transhuman Condition*, were contained in the work of Claude Shannon, whom Clarke met in 1952, and whose mathematical theory of communication suggested, in Regis' words, "a deep link, never before noted, between man and machine."⁴ In *The City and the Stars*, Clarke endeavored to work out some implications of these ideas.

For a billion years humans have lived a tranquil existence in the vast city of Diaspar. Under a canopy of eternal daylight, the citizens go

³ Arthur C. Clarke, *The City and the Stars & the Sound of Mars* (New York: Warner, 2001) no pagination in introductory material.

⁴ Ed Regis, *Great Mambo Chicken and the Transhuman Condition: Science Slightly Over the Edge* (Reading: Addison-Wesley, 1990) 149.

about their lives free of troubles and worries. There is no shortage of anything they need. Inhabitants spend their time pursuing the arts, intellectual interests, and a myriad of virtual recreational possibilities. Having conquered matter, they have no need to work. They simply frame the appropriate thought, and whatever is necessary or desired materializes. Having engineered the body to perfection, all are beautiful and free of "those ills to which the flesh was once heir."⁵ In fact, they have "virtual immortality." At some point, eons earlier, the ancestors of Diaspar learned how to store themselves on computers (as a pattern of electric charges). "We do not know," according to one of the novel's characters, "how long the task took. A million years, perhaps."⁶ But the secret, this character tells us, was in recognizing that: "A human being, like any other object, is defined by its structure—its pattern. The pattern of a man, and still more the pattern which specifies a man's mind, is incredibly complex."⁷ Eventually humans "learned how to analyze and store the information that would define any specific human being—and to use that information to recreate the original."⁸ Further, the character argues that the "way in which information is stored is of no importance; all that matters is the information itself. It may be in the form of written words on paper, of varying magnetic fields, or patterns of electric charge. Men have used all these methods of storage, and many others."⁹ Because humans are "disembodied patterns" of information, in other words, the material substrates they might occupy are interchangeable.

Not only death but also birth has been abolished in Diaspar. The number of inhabitants is therefore fixed. At any given moment, however, only a fraction of the total population is actually living and walking the streets. The rest are enjoying an "interval of nonexistence." Each person lives a thousand years. At the end of this allotted span, people return to

⁵ Clarke 25.

⁶ Clarke 18.

⁷ Clarke 18.

⁸ Clarke 18.

⁹ Clarke 18.

the Hall of Creation. Their bodies cease to exist, and their minds are transferred to the Memory Banks of the Central Computer, where they will be stored for some “apparently random” length of time. Then one day, they will awaken in new bodies and leave the Hall of Creation to begin a new “cycle of existence,” carrying forward those memories from previous cycles they had decided to save. In this way, the population of the city remains constant, and each person gets a fresh start with new friends and different interests.

In addition to storing matter and minds and regulating the population level, the Central Computer is also the final authority over the city. Although Diaspar has a ruling body, the Council, it seldom needs to meet and is itself subordinate to the Central Computer, into which the original designers of the city have programmed all that is needed for an eternal existence. As humans merge with machine in the Hall of Creation, so the machine merges with the human. “It was difficult,” according to the novel’s narrator, “not to think of the Central Computer as a living entity, localized in a single spot, though actually it was the sum total of all the machines in Diaspar.”¹⁰ Still, even if “not alive in the biological sense, it certainly possessed at least as much awareness and self-consciousness as a human being.”¹¹

In a new introduction to *The City and the Stars* written in 2000, Clarke notes that more than once he has felt “involved in a self-fulfilling prophecy.”¹² We do not yet have computers with self-consciousness, nor can human minds be stored on computers. But while these futuristic speculations were science fiction in the 1950s, it did not take long before the computer revolution and the same developments in information theory that inspired Clarke were leading others to conclude that such man-machine fusions were in fact scientifically possible.

¹⁰ Clarke 69.

¹¹ Clarke 69.

¹² Clarke, no pagination in introductory material.

Regis, in *Great Mambo Chicken*, traces some of the proposals, which began as early as 1964. Each author insists in his or her own way that the mind is the essence of the person and the physical body dispensable; that it is possible, to quote an IBM researcher, to "implement the human being in alternative hardware"¹³; and that with the mind stored on a computer immortality would be achieved. Regis ends his survey with the then most influential of such proposals, that of Hans Moravec in his book *Mind Children*. Moravec, then director of the Mobile Robot Lab at Carnegie Mellon University, restates the basic premises of the earlier schemes, emphasizing the separation of the "message" (information conveyed) from the medium on which it is encoded. The "essence of a person, say myself," he writes, is "the *pattern* and the *process* going on in my head and body, not the machinery supporting that process. If the process is preserved, I am preserved. The rest is mere jelly."¹⁴

To Moravec, then, the mind—the pattern—might be separated from the brain—the machinery—without any loss of self. He views this separation as a technological possibility and suggests several possible methods for transferring the mind to computer databanks (a process now commonly called "uploading"), where it could be stored and transmitted. He also views this separation as desirable and necessary if humans are not to be left out of the "magical world to come" by the superintelligent robots who will otherwise displace us. With a "mind transfer" Moravec writes, "many of your old limitations melt away."¹⁵ You can "communicate, react, and think a thousand times faster"¹⁶; you can travel over information channels to anywhere such channels go; you can make backup copies of yourself; you can selectively merge another person's memories with your own; you can inhabit a marvelous robot body; and so on. In the coming "postbiological world" the possibilities are endless. The citizens of Diaspar had nothing on the mind children.

¹³ Regis 153.

¹⁴ Hans Moravec, *Mind Children: The Future of Robot and Human Intelligence* (Cambridge, MA: Harvard University Press, 1988) 117, original emphasis.

¹⁵ Moravec 112.

¹⁶ Moravec 112.

In a 1998 review of Moravec's follow-up book *Robot: Mere Machine to Transcendent Mind*,¹⁷ novelist Charles Platt argues that *Mind Children* secured Moravec's status as a "truly radical techno-visionary."¹⁸ For Platt, who writes science fiction, this was a compliment. Others were less impressed. The reviewer for *The New York Times*, M. Mitchell Waldrop, a science journalist, wrote that "'Mind Children' comes perilously close to the kind of uncritical gee-whiz that gives technological optimism a bad name."¹⁹ *The Washington Post* reviewer, Noel Perrin, a Dartmouth professor, said he "would guess it to be the most lurid book ever published by Harvard University Press," and that "it may seem easy to dismiss Moravec as yet another mad scientist."²⁰ According to Platt, "Joseph Weizenbaum, professor emeritus at MIT's Artificial Intelligence Lab, disliked Moravec's interest in 'perfecting' human beings and warned that *Mind Children* was as dangerous as *Mein Kampf*."²¹ It was Moravec's *Robot*, which carries his predictions about the social impact of intelligent robots even further, that in part prompted Bill Joy's famous *Wired* magazine article "Why the Future Doesn't Need Us."²² The other influence on Joy was inventor Ray Kurzweil's bestseller, *The Age of Spiritual Machines*. Like Moravec, Kurzweil foresees a future in which humans "will be software, not hardware,"²³ as we increasingly "port" ourselves to a new computing substrate and leave our "old slow carbon-based neural-computing machinery behind."²⁴ Joy, cofounder and chief scientist of Sun Microsystems, found these

¹⁷ Hans Moravec, *Robot: Mere Machine to Transcendent Mind* (New York: Oxford University Press, 1999).

¹⁸ Charles Platt, "Who Can Replace a Man?" *The Washington Post Book World* (8 November 1998): 9.

¹⁹ M. Mitchell Waldrop, "The Souls of the New Machines," *The New York Times* (1 January 1989): 10.

²⁰ Noel Perrin, "Anything We Can Do They Can Do Better," *The Washington Post Book World* (23 October 1988): 8.

²¹ Platt 9.

²² Bill Joy, "Why the Future Doesn't Need Us," *Wired* (April 2000): 238–62.

²³ Ray Kurzweil, *The Age of Spiritual Machines: When Computers Exceed Human Intelligence* (New York: Penguin, 1999) 129.

²⁴ Kurzweil 126.

blithe visions of the end of the human race as we know it to be deeply dystopian and alarming enough for him to suggest that we move to relinquish, through government ban, some of the technologies that might bring them about.

The critical reactions to Moravec, Kurzweil, and others of their persuasion tend to focus on the sensational claims about a soon-to-be-realized fusion of human and machine. Of course, the incorporation of machines into human bodies happens all the time, be it pacemakers, artificial joints, cochlear implants, or other prosthetic devices. As much as ten percent of the U.S. population may be "cyborgs" (for cybernetic organism) in this sense, but unlike the science fiction image of the cyborg—the vastly enhanced Six Million Dollar Man, for example—the overwhelming majority of such interventions are simply to compensate for deficiencies in normal functioning. Kevin Warwick, the cybernetics professor at the University of Reading, who in 1998 began implanting chips with transmitters in order to monitor and affect his biological responses, is a rare bird.²⁵ The capacity of medical prosthetics to disrupt traditional categories or destabilize the human/machine boundary seems limited. The prospect of intelligent machines becoming our evolutionary heirs and people uploading themselves into computers (to become "ex-humans" in the language of Moravec's *Robot*), however, is a different matter. Now we are talking about a radical violation of boundaries, a cyborg vision of complete fusion, and even the end of *Homo sapiens*. If we grant such prospects a status beyond science fiction, then the reactions of a Weizenbaum or Joy become more understandable.

What critics typically do not contest is the underlying view of the human person that informs such extreme posthuman visions. The machine metaphor for thinking and talking about the human body has a long history. Anthropomorphism, the attributing of human characteristics to animals and inanimate things, is also a very common tendency. Pet owners, for instance, do it all the time. But in Moravec, Kurzweil, and others, metaphor has been effectively replaced with

²⁵ See Kevin Warwick, "Cyborg 1.0," *Wired* (February 2000): 145–51.

equivalence, an equivalence achieved not so much by giving human characteristics to cybernetic machines as by redefining what being human means. This redefinition has implications much wider than dreams of uploading, and it is not limited to the popular science writings of “radical techno-visionaries.” Rather, it informs a nascent, yet clearly discernable shift toward a new model of subjectivity. In *How We Became Posthuman*, N. Katherine Hayles traces how this model arose and the forms it is beginning to take. Inspired by *Mind Children* and its “nightmare” uploading scenario, Hayles wanted to know how mind came to be conceived as utterly disconnected with embodiment. Pursuing this question, she was “led into a maze of developments that turned into a six-year odyssey.”²⁶ She soon found that in his assumptions Moravec was “far from alone” (1).

Fighting to Define the Posthuman

The essays that comprise *How We Became Posthuman* tell three interrelated stories that span the years from 1945 to the present. The first, and most central, is how “*information lost its body*” (2), that is, how it came to be conceptualized as a kind of “immaterial fluid” that can flow unchanged across various material substrates and around the globe. The second story is how “*the cyborg was created as a technological artifact and cultural icon*” (2) in the postwar years. And the third and still unfolding story, deeply interwoven with the first two, is how “*a historically specific construction called the human is giving way to a different construction called the posthuman*” (2). To tell these stories, Hayles goes back to the theories, researchers, and artifacts in the cybernetic tradition to explore those moments when choices were made for disembodiment and alternative interpretations were rejected. Along the same historical trajectory, she also examines, in parallel with the scientific texts, important contemporaneous works of science fiction, such as

²⁶ N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago: The University of Chicago Press, 1999) 2. Subsequent references to this work will be made parenthetically in the text of this essay.

Bernard Wolfe's *Limbo* of the 1950s and Philip K. Dick's novels of the 1960s, that were influenced by cybernetics and share many of its assumptions. These texts are important, she argues, because they touch on issues "that the scientific texts only fitfully illuminate," such as "the ethical and cultural implications of cybernetic technologies" (21). In addition, the literary texts also "actively shape what the technologies mean and what the scientific theories signify in cultural contexts" (21).

In telling these stories, Hayles has two principal goals. The first is to contest the "systematic devaluation of materiality and embodiment" (48) that runs throughout the cybernetic tradition and now informs the cultural perception of virtual technologies. In her deft analysis, there was nothing inevitable or technologically determined about the process that led to the separation of information from materiality and to the equating of humans and computers. It was the result of historically specific negotiations in historically specific cultural contexts. Hayles demystifies those negotiations, showing, for example, how decisions about how to conceptualize information that were appropriate in an engineering context got extrapolated into wider contexts where they led to unwarranted conclusions, and how theory building often proceeded by first inferring simplified abstractions from the particularity and complexity of the world and then turning around and identifying those abstractions as the general form from which the particularity and complexity derive (a move Hayles calls the "Platonic backhand").

At the same time, her history is a "rememory," showing how voices arguing for the importance of embodiment were present throughout the tradition and had to be overcome to arrive at abstractions like bodiless information and dreams of uploading. These alternative voices are resources for and give hope to her second goal: to "recover a sense of the virtual that fully recognizes the importance of the embodied processes constituting the lifeworld of human beings" (20). Hayles wants to embrace the possibilities of information technologies and recognizes that doing so will leave our experience and understanding of subjectivity changed. For many, the posthuman means "envisioning humans as information-processing machines with fundamental similarities to other kinds of information-processing machines, especially intelligent computers" (246). This is the basic version of the posthuman as

a model of subjectivity that Hayles challenges. But this is not, she argues, the only view, and she suggests another possibility, one where mind and body are a unity.

The posthuman signals important shifts in underlying assumptions away from the model of the liberal humanist subject of Enlightenment thought. In order to elucidate these shifts, Hayles uses C. B. Macpherson's classic text, *The Philosophy of Possessive Individualism: From Hobbes to Locke*, to identify the qualities of the "human" in that tradition. We are human in the liberal humanist view because we possess ourselves. "The human essence," Macpherson writes, "*is freedom from the wills of others*, and freedom is a function of possession" (as quoted in Hayles 3). This freedom presumes an autonomous self with a free will and agency that can be clearly distinguished from the "wills of others." Further, the liberal subject is identified with the rational mind and with consciousness as the seat of identity. Although still a nascent concept and complexified by the multiple contexts in which it is arising, the posthuman challenges these presumptions. Rather than an autonomous "natural" self, the "posthuman subject is an amalgam...of heterogeneous components, a material-informational entity" whose boundaries are not stable but shifting (3). This "collective heterogeneous quality," in turn, undercuts individual agency because it "implies a distributed cognition located in disparate parts that may be in only tenuous communication with one another" (3–4). Finally, the posthuman complicates the liberal humanist notion of self-will "because there is no a priori way to identify a self-will that can be clearly distinguished from an other-will" (4). In one important respect, however, the posthuman continues the liberal tradition. The emphasis remains on cognition not embodiment, though not in their wildest dreams would Hobbes or Locke have thought of the human body in posthuman terms: as an "accident of history rather than an inevitability of life" (2) or as the "original prosthesis" that could be extended or replaced with "other prostheses" (3).

Hayles does not seek to recuperate the liberal humanist subject—far from it. She is concerned with overcoming the mind/body split and is in broad agreement with criticisms coming from perspectives, such as those of feminism and postcolonial theory, that see the liberal human-

ist construction of subjectivity as deeply implicated in efforts to dominate and oppress. In fact, for her, the greatest mistake would be to graft "the posthuman onto a liberal humanist view of the self" (286–7), which is what she thinks Moravec is trying to do. Hayles see the posthuman as an opportunity to get "out of some of the old boxes and [open] up new ways of thinking about what being human means" (285). And now is the time. The liberal humanist subject is being dismantled, and no successor has yet clearly emerged. Many parties are contesting, but what "trains of thought" will constitute the posthuman have not "been laid down so firmly that it would take dynamite to change them" (291). Granted, Hayles says, some "current versions of the posthuman" are deeply problematic, even pointing "toward the anti-human and the apocalyptic," but not to worry, "we can craft others" (291).

Toward the posthuman, Hayles is both unafraid and optimistic. She is unafraid because human being is embodied and the body is a "resistant materiality" that cannot be left behind. Moravec and his ilk may deny it, but others, such as researchers in evolutionary biology, affirm that the complexities of embodiment "affect human behaviors at every level of thought and action" (284). Thus Hayles concludes that human embodiment itself establishes a clear "limit to how seamlessly humans can be articulated with intelligent machines" (284). Further, she writes in another place: "Human mind without human body is not human mind. More to the point, it doesn't exist" (246). The interface between humans and intelligent machines does undermine the old liberal humanist subject, she maintains, but we need not fear apocalyptic scenarios.

Hayles is optimistic about the possibility of crafting an embodied version of the posthuman because her analysis of the history of cybernetics shows that the posthuman does not require the emphasis on disembodiment it has acquired. She is also optimistic because she believes that the common assumption that "pattern" (information) and "presence" (physicality) are opposites and exist in an antagonistic relationship is not required either. With information technologies, she argues, pattern tends to dominate presence, making pattern seem the essential reality. Hence, for example, "money is increasingly experienced as informational patterns stored in computer banks rather than as the presence of cash" (27). This dominance, however, does not make the physical world dis-

appear; “information in fact derives its efficacy from the material infrastructures it appears to obscure” (28). There is an “illusion of erasure” (28) here but we don’t have to be tricked by it. Rather, she argues, we might better see “pattern and presence as complementary rather than antagonistic” (49). Doing so defeats false polarities and suggests new avenues for rethinking the human-machine interface.

How, then, in Hayles’ view should we envision the posthuman? Recall that Hayles wants to get “out of some of the old boxes.” In the old boxes, the “self is envisioned as grounded in presence, identified with originary guarantees and teleological trajectories, [and] associated with solid foundations and logical coherence” (286). This is the account, in her view, that underwrites projects of domination and must be abandoned lest we repeat the mistakes of the past. Indeed, in many contexts, this account is mostly dead already (hence, one meaning of the past tense in the book’s title). While not proffering a complete alternative, she argues that the posthuman provides resources for the construction of one. In this conception of the human,

emergence replaces teleology; reflexive epistemology replaces objectivism; distributed cognition replaces autonomous will; embodiment replaces a body seen as a support system for the mind; and a dynamic partnership between humans and intelligent machines replaces the liberal humanist subject’s manifest destiny to dominate and control nature. (288)

Hayles allows that “this is not necessarily what the posthuman will mean” (288, original emphasis), but only what it *might* mean.

What’s Next?

But, what in the end, does it mean? What, as a practical matter, are the implications of emergence replacing teleology or distributed cognition replacing autonomous will? Hayles doesn’t provide much in the way of real world examples, and the ones she does use aren’t particularly illuminating. Early in the book she says that she now finds herself saying things

like "Well, my sleep agent wants to rest, but my food agent says I should go to the store" (6). This is certainly an odd way to talk, and Hayles draws significant conclusions from it. "Each person," she claims, "who thinks this way begins to envision herself or himself as a posthuman collectivity, an 'I' transformed into the 'we' of autonomous agents operating together to make a self" (6). A better example, which Hayles doesn't use, comes from Mary Catherine Bateson's book *Composing a Life*. Reflecting on her life, Bateson, the daughter of Gregory Bateson and a minor figure in Hayles' book, was disgruntled by her struggles to bring coherence to her disparate experiences. Moving away from the "stubborn struggle toward a single goal," she adopted a more fluid, protean approach to life as "an improvisatory art."²⁷ A roughly similar view can be found in some of the psychological literature, popular and professional, which calls for dropping the older notion of life stages and even for celebrating "multiple selves." In the multiple personality disorder literature, for example, some multiples celebrate their ability to dissociate creatively and so reject therapy that seeks to integrate their alters. People are definitely talking about themselves in new ways. But what does it mean for how they think about themselves, say, as moral agents? Hayles thinks that "serious consideration needs to be given to how certain characteristics associated with the liberal subject, especially agency and choice, can be articulated within a posthuman context" (5), but then leaves it at that. Without specificity about the implications of her alternative, it is hard to judge what is gained and what is lost in her vision.

Hayles' lack of specificity, however, should not be allowed to obscure the important work of *How We Became Posthuman*. Her history of how "information lost its body" is just the sort of "rememory" that we need if we have any hope of resisting a disembodied model of subjectivity. Despite her optimism, she documents convincingly the cultural perception that information is distinct from and more essential than materiality, that "pattern" does not depend on any particular embodiment. Moravec, as Hayles says, is "far from alone," and it is easy to add to the

²⁷ Mary Catherine Bateson, *Composing a Life* (New York: The Atlantic Monthly Press, 1989) 4, 3.

list: Norbert Wiener, father of cybernetics, proposing as early as the 1950s that it was “theoretically possible to telegraph a human being” (1); molecular biology treating “information as the essential code the body expresses” (1); artificial life researchers, along with figures in nanotechnology, virtual reality, artificial intelligence, and cognitive science, treating humans as information processing machines; science fiction from Arthur Clarke to the contemporary cyberpunk literature, as well as popular science writers like Ray Kurzweil, defining humans as patterns that could be immortal with the right hook-up; and the technologies of everyday life, from ATMs to the Internet, reinforcing the impression that pattern is predominate over presence. There’s even the conservative writer Tom Wolfe telling the 2002 graduating class of Duke University that we mustn’t “kid ourselves.” The “bottom line of neuroscience,” he avers, is that: “We’re all concatenations of molecules containing DNA, hard wired into a chemical analog computer known as the human brain, which as software has a certain genetic code.”²⁸ All these and others contribute to a powerful reductionistic illusion about human being, an illusion that Hayles helps us to unmask.

Further, although Hayles does not draw out the comparison, in her insightful mapping of key assumptions of the emerging posthuman, we can see parallels with the more familiar, though no less multifarious concept of the postmodern. The posthuman and the postmodern proceed along different lines, but both reach strikingly similar conclusions about human subjectivity. Like the posthuman, the postmodern challenges the liberal humanist subject in fundamental ways. The postmodern, too, emphasizes a reflexive epistemology, the disruption of boundaries, and the rejection of teleology. Like distributed cognition, the postmodern emphasizes a “dispersed subjectivity,” and the postmodern views the self as multiple rather than stable and centered, much like the notion of the self as an amalgam of heterogeneous components. Moreover, in the postmodern the body is also devalued, its materiality, to quote Hayles, “is secondary to the logical or semiotic structures it encodes” (192). What

²⁸ As quoted in Jacques Steinberg, “Commencement Speeches; Along With Best Wishes, 9/11 Is a Familiar Graduation Theme,” *The Washington Post* (2 June 2002): 38.

makes this parallelism noteworthy is the sharply different sources of these two accounts. The postmodern has its roots in the analysis of discourse in the humanities and has often been vigorously attacked by scientists or dismissed as an intellectual fad. The posthuman, by contrast, is arising from cutting-edge science itself. That both are imagining human subjectivity in similar ways is significant because it suggests deeper cultural shifts are at work, shifts that remain unexplored.

Compared with the postmodern, the posthuman may prove to be the more consequential carrier of these shifts. It is coming from science, which still retains immense authority. Even more importantly, it is arising hand-in-hand with powerful new technologies. "Given market forces already at work," Hayles foresees that it is all but "certain that we will increasingly live, work, and play in environments that construct us as embodied virtualities" (48). Ray Kurzweil, meanwhile, predicts that "the primary political and philosophical issue of [this] century will be the definition of who we are."²⁹ Both are right, and Hayles' signal contribution is to show us that we need not be passive bystanders, that we can actively and constructively intervene.

²⁹ Kurzweil 2.