How We Became Posthuman: Ten Years On
An Interview with N. Katherine Hayles[1]

Abstract:
This interview with N. Katherine Hayles, one of the foremost theorists of the posthuman, explores the concerns that led to her seminal book *How We Became Posthuman* (1999), the key arguments expounded in that book, and the changes in technology and culture in the ten years since its publication. The discussion ranges across the relationships between literature and science; the trans-disciplinary project of developing a methodology appropriate to their intersection; the history of cybernetics in its cultural and political context (particularly the impact of Norbert Wiener's work); the changed role for psychoanalysis in the technoscientific age; and the altering forms of mediated 'embodiment' in the posthuman context.

Keywords: cybernetics, embodiment, Freud, Lacan, literature, posthuman, science, technology

AP: What's the intellectual trajectory that took you from looking at literary texts into looking at science and technology, and in particular the posthuman?
KH: I started from the very beginning looking at both literature and science, so I don't know that I went from literary texts to scientific texts. They were always intermingled for me. I found that a really interesting way to combine my interest in literature and in science.
AP: So where does the interest in science and technology come from?
KH: I was a child of sputnik. Of course during the sputnik era there was a huge emphasis in American education to train scientists to compete with the Russians. I was just at that very young, impressionable age in which this idea somehow took hold. I also always appreciated the clarity and precision of science. I was very attracted to that. So I naturally began a scientific career. As I got deeper into scientific research, however, it seemed to me that the questions were getting narrower and narrower. At some point I simply felt I wanted

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to ask broader questions. So then I went back to my other love — literature.

AP: So did you initially look at science fiction texts? What were you looking for in literary texts?

KH: When I made the transition from science to literature, it was a huge shock; it was a shock to the system. I discovered that everything I thought I knew was wrong, and had to be re-learned in this new context. Even fundamental things like evidence: What counts as evidence? What counts as learning? What counts as argument? and so forth. At the beginning what I needed to do was to immerse myself in this new culture, and that had the effect of breaking my cultural set. It was a bit analogous to living abroad, I suppose. In this process, you begin to bring into view assumptions you didn't even know that you had, and now you have to think critically and sceptically about them. It works the other way as well, of course. My scientific training also made me sceptical of some of the things I was hearing in the literary field. So I straddled that line: sceptical of everything!

AP: And what got you particularly interested in notions of the posthuman?

KH: The books I had published were looking for ways to advance a methodology. That methodology stemmed from my belief that there are uncanny similarities between what literature is doing at a given time and what scientific fields are doing. When I first started work in literature and science, the only way to connect these methodologically were influence studies — the influence of Newton on an eighteenth-century poet and so forth. But I felt that was a very limited approach and could only account for a few instances. It certainly could not account for the phenomena that I thought I saw, parallels between fields that basically were not talking with each other. I worked through that problem with several different books. By the time I came to the *Posthuman* book, enough had been done in science studies to reveal to me a new kind of approach. That approach consisted of finding crucial branching points in the history of science where different models were competing, where it wasn't clear at the time which model would be superior. So, instances where you couldn't explain the success of a given model by saying: 'Well, clearly this model was right and the other model was wrong.' I discovered in the history of cybernetics, in fact, the inverse case, where the model that seemed more fully able to account for the complexities of human being had lost out to a much simpler and less adequate model. So that seemed to me an excellent point for a case study of the kind that I wanted to launch.

JM: Was the simpler model cybernetics?

KH: In a sense, the simpler model was the Wiener-Shannon version of information theory. In a larger sense, the simpler model was the insistence that if the effects of one field were showing up in another field, then it had to be through direct routes of influence. My idea from the beginning was that both fields were reacting to larger cultural concerns. Though there might be occasional side-tracks from one field to another, what one really needed to get at was the underlying cultural matrix that was catalyzing different kinds of expressions in different fields. What's crucial here, I think, is a methodology that not only can account for the parallels but, equally important, can account for the very significant differences that emerge in a field like literary studies versus some scientific field — let us say cybernetics. I wanted a methodology that would be flexible enough to do both those things — to account for the parallels, but also say: 'These underlying questions are worked out in very different ways and very different answers are found to be satisfactory in different fields.'

AP: What were the theoretical tensions you were trying to balance in developing your methodology in *How We Became Posthuman*?

KH: It seems to me that literature has much to contribute to the discussion of how the underlying dynamics of a cultural moment are working. You see one expression of it in the sciences. The cyberneticians were unusually inventive and broad-ranging in the methodologies that they followed. But at the same time, writers are equally inventive. They're as sensitive to underlying cultural pressures as the scientists are. And they have much more scope, typically, in how they can entertain these issues, in how they can imagine the issues being addressed. I think the literature of a period is extremely revealing of how these general, underlying concerns become expressed in the work of a particular writer or group of writers, how the specificity of that cultural context can help to explain what's going on, but also how these underlying issues equally work to form the final artistic or scientific product. I believe that in scientific fields, the constructive role that literature can play is much misunderstood. Scientists typically do not fully grasp that literature can be a powerful resource for thinking about what's really at stake in scientific endeavours.

AP: What, specifically, is misunderstood?

KH: Look for example at the work of Philip K. Dick: Philip K. Dick is not a great writer on a sentence-by-sentence level. He was working under tremendous financial pressure and his texts are often carelessly constructed. But he had a profound vision of de-centering the human

subject and letting something else emerge — probably, in my view, because he didn't really believe in reality. From a scientific point of view, of course it doesn't make any sense to say you don't believe in reality. What does make sense is that what we take for reality has certain assumptions built into it that may turn out to be highly questionable. Dick was keying in on exactly the assumptions that would in fact turn out to be subverted in the work of first-order cybernetics and then second-order cybernetics. Dick saw more clearly — and I would even say more vividly — than the cyberneticians did what was really at stake in the cybernetic paradigm. He expressed it very powerfully, not only through visions of the future but also through expressions of affect, how people would *feel* about the cybernetic paradigm, what kinds of emotions and deep unconscious responses it would unleash. The idea that affective forces might be at work in the de-centering of the human subject is implicit in the cybernetic texts. And yet, because the cyberneticians were writing in the scientific tradition, they didn't deal directly with the affective consequences. That's how works like Dick's can serve as a resource to understand the full implications of a scientific paradigm.

AP: Just briefly, what does 'the posthuman' mean in general terms?

KH: I use the term to describe a historical phenomenon, something that occurred in ideas about the human from roughly the 1930s to the present. One could, I think, sensibly talk about the posthuman in the Renaissance, one could talk about the posthuman in the medieval period — in fact there is a new journal that's proposing to do precisely that. As I was using it, however, it was referring to twentieth-century developments in which an Enlightenment inheritance that emphasized autonomy, rationality, individuality and so forth, was being systematically challenged and disassembled — in a whole variety of fields, among them cybernetics.

AP: So could you just give me one example of in what way that disassembly manifested itself?

KH: Consider the work of roboticist Rodney Brooks. He argues that intelligence should not be thought of as evolving at the top, but rather at the bottom, and that intelligence emerges first through direct engagements with the world through sub-cognitive or non-cognitive systems. He started building robots not on the 1960s model of AI where you try to have a whole representation of the world, but rather by using, as he says, 'the world as its own best model'. He developed a whole architecture of robotics in order to do that. At the same time, biologists were beginning to think in similar terms about human

cognition. What this meant was that for Brooks, some cognitive scientists, and some philosophers, consciousness was understood as an epiphenomenon. What people meant by 'epiphenomenon' was that it was an emergent property arising from the interactions of more fundamental properties, and that the fundamental properties not only gave rise to consciousness but also had a large impact on its workings. Consciousness in this view is not, Descartes to the contrary, evidence of existence but rather a late-comer to the party that arrogates to itself centre stage while actually taking its cues from more fundamental actors that it literally cannot see but that nevertheless guide, constrain and enable its operations.

AP: One way into, one route of looking at, the posthuman would be through genetics and biology. I wondered why you chose the route specifically of cybernetics. What drove you to that choice for your book?

KH: I didn't feel that I had the time to acquire sufficient expertise and background in both of those two major strains. I had to choose one over the other. That is a limitation of my own, a result of the resources I had available compared to what I could realistically expect to accomplish. Since I had a much firmer training and background in computation and in cybernetic-type concerns, I chose that rather than the biological strain. However, it was clear to me from the beginning that the biological strain was equally important. It was more just a personal choice, trying to fit my resources to the problem.

AP: So if you could just talk us through, then, what cybernetics is, some of the history of it and why you think it went out of favour . . .

KH: Cybernetics has had a curious history. When it first began in the late 1940s and on into the 1960s, the people who were working in the paradigm they called cybernetics thought that it would be a revolutionary advance that would initiate a new way of thinking about things and a new kind of science. By the time we got to the mid-1960s, however, this initial impulse had played itself out and cybernetics had almost ceased to exist as a recognized academic specialty: there were no departments of cybernetics — or very few; there were no courses in cybernetics, no majors in it. Yet, here we are in 2009 still talking about cybernetics, and not talking about it as a historical phenomenon — or not only as a historical phenomenon — but as a contemporary concern. So what happened? What is it that happened in this curious story of cybernetics? In my view, cybernetics was born when the idea — the ancient idea — of the feedback loop was joined with the notion of information. Suddenly one had a much more powerful concept than

either one working by itself. That explosion — that spark — is what ignited the initial work in cybernetics. But that doesn't really explain why cybernetics ceased to exist and yet we still talk about it. I think what happened is that cybernetics was characterized from the beginning by the bringing together of very diverse fields, and specialists in these fields found a common language through the notion of feedback loops, the communication of information and so forth. Relatively quickly, after this initial burst of enthusiasm they discovered that they could not continue to do work in their fields in such general terms. I think that's why cybernetics died out as an independent discipline on its own. But it didn't mean that the *influence* of cybernetics died out. In fact, what it meant was that cybernetics was incorporated — fundamentally incorporated — into the thought of all these different fields, and there it continued to flourish, although it was often not couched as cybernetics, or in cybernetic terms. For the same reason, cybernetics continues to be a subject of concern for us who work in cultural and critical studies, because its implications have remained potent. That is, the implications of large-scale complex systems characterized by communication- and information-flows with multiple feedback loops giving rise to emergent properties have proved to be extremely powerful. This approach to complex systems has become fundamental in fields like Artificial Life, for example, in neurobiology, as another example, in understanding ecological concerns, as still another example. So the basic approach of cybernetics found homes in many different disciplines, and that way of thinking continues to inform thought in the social sciences and humanities as well.

AP: Do you think there's a sense in which the development of the concept of information as defined by Wiener and others is a kind of forgotten history? Because there has been a lot written about genetics and the posthuman, the biological. And only very recently — after your book, in a way, came out — people have started looking, and uncovering, this deep and very ingrained history. Do you think there's a sense that this has been overlooked, and that there's a forgotten history coming out?

KH: Not to me. It probably depends on what you read! But if you're reading along lines of computational strategies, computational thinking, computational paradigms, Wiener has always been important. In the circles in which I move, Wiener was never forgotten. He was always recognized as being important. But, part of the problem here, I think, is that some of the relevant materials are only available in certain selected libraries so it's not possible to encounter

them all in published form. And even the published form of the Macy conferences is extremely diffuse. It's not an easy topic to research.

AP: When you talk about it not being a forgotten history from the background that you came from, are you talking about your scientific background, or are you talking about your background in literary studies? Because I'm not aware of too many literary theorists who have used cybernetics, or who have explored that history, let's say in the last thirty years.

KH: It's absolutely true that literary traditions, and even cultural studies traditions, did not especially key in on Wiener as a central figure — particularly by the time of the 1980s or the 1990s, when it seemed as though cybernetics had played itself out. So I agree that he was in that sense somewhat of a forgotten figure. Although, as I said, in computational circles he was always a major figure.

AP: So what do you think makes Wiener particularly useful in terms of an idea of critique, if we're talking through the idea of cybernetics as a kind of critical term, or a critical set of terms?

KH: Wiener is useful for people who work in cultural studies and science studies because he is such an ambivalent figure; many different threads run through his writing, and, I would venture to say, his thought. In some sense, for example in Peter Galison's analysis, he can be seen as a kind of 'puppet' of the military establishment. In other senses he was very humanitarian and very concerned about things like the military encroachment on the technological sphere. And of course that makes for an infinitely interpretable and very interesting set of stories. So he's not a simple figure, he's not a simple thinker. And certainly his oeuvre is not a simple oeuvre, so I think that is part of the appeal.

AP: In terms of a critical engagement with him in terms of, let's say, the theory of information, what have you taken from Wiener, in terms of being useful to cultural studies or media studies or literary studies?

KH: Wiener of course is useful because he articulated some of the central ideas of cybernetics; to me, the notion of the feedback loop only starts to achieve its full potential in the period of Wiener's thought and life. It then continues to amplify, to be applied in different ways, and becomes one of the major threads that leads to complexity theory. I think that the whole idea of being located within a large-scale complex system characterized by multiple recursive feedback loops has a lot of potential. Because Wiener was one of the first to articulate feedback loops as communications and as ways to bootstrap into complexity, he becomes an important figure in that trajectory.

AP: Could you give me an example of one area where that conceptualization of feedback has been, or would be useful in that respect?

KH: The early cyberneticians like Stafford Beer and others were beginning to think about coupling biological systems in an environmental sense with human purposes. Andy Pickering has recently been writing about this history of early British cyberneticians, not only to remind us of it but also to propose it as a more constructive and less compromised version of how science can be done. One of the projects that Beer and others toyed with was the idea of coupling a pond full of crustaceans to a factory to serve as a kind of control system to run the factory. They were extremely inventive in imagining ways in which feedback loops operating in complex systems could be integrated with mechanistic systems such as a factory to perform certain tasks. So the feedback loop became a way to couple the uncontrollable and the complex with clearly-defined goals that nevertheless might be harnessed to that complexity. That thread became important in the founding of ecology, in the sense that ecology as a discipline studies the consequences of interactive systems of feedback loops on a global scale. Of course, the idea that feedback can control the uncontrollable has, in ecological contexts, proven to be a tragic illusion. Rather, we are now in a global situation in which feedback loops are driving ecological systems out of balance, with potentially catastrophic consequences for humans and other species.

AP: In your book you talk about Wiener's defence of the human subject. But there's also a kind of more radical aspect to the way one would think about the subject that also comes out of Wiener. I wonder if you could just talk me through those two sides of what cybernetics gives us, firstly maybe talking about the liberal-humanist Wiener, and then talking about the more radical Wiener.

KH: The liberal-humanist aspect of Wiener comes through in his defence of the individual, and more broadly, in the idea that cybernetics allows a way for human agents to couple with large-scale systems that they otherwise might not be able to control. All that is about human-centredness, human goals, the preservation of human autonomy and individualism, so it fits in with the liberal-humanist view of the subject. On the other hand, as soon as you begin to envision the human actor as a component of a large and complex system with other agents also at work within that system, there's an inevitable tendency to de-centre the human subject, and then, in second-order cybernetics, to realize more fully that even the place

of the observer in such a system has implications, with the system capturing and affecting the observer even as the observer tries to position himself outside the system. This de-centering aspect is there in Wiener, working right alongside his defence of liberal ideas. Of course, to be fair to Wiener, he's working in the very period when Eisenhower would warn of the rise of the military-industrial complex. I think Wiener saw that also, and he saw the dangers of that, and he thought the antidote to that was the liberal-humanist subject. That there could be other ways to resist that tendency I think was not fully explored in his thought.

AP: In *How We Became Posthuman* you write about how recent technological developments have fundamentally changed the nature of signifying processes. And in your book you say we have shifted towards an economy of 'flickering' rather than, as for Lacan for example, 'floating' signifiers. So I suppose the question is within that context: have psychoanalytic models of signification lost purchase in the face of technological change? Is psychoanalysis fit for purpose given the kind of technological environment we live in today?

KH: I would hardly position myself as an expert on Lacan. Nevertheless, I am aware that Lacan did have a serious engagement with cybernetics. I think that Lacan actually anticipated certain later developments in cognitive science and neuroscience in the sense that he had the vision of the unconscious as essentially a mechanistic process — a mechanistic process which threw up certain ideas but itself was almost entirely mechanical in nature. In this way, I think he moved profoundly away from Freud; from a contemporary viewpoint, one might look at Freud and say that Freud's vision of the unconscious was what the conscious would imagine the unconscious to be: profoundly anthropomorphic and saturated with assumptions that really arise with consciousness. But if you move with Lacan to a 'mechanistic' view, which I believe was influenced for him by cybernetics, you now get a picture of cerebral and sub-cerebral processes working in a mechanistic way, which nevertheless creates consciousness as an emergent property. In a certain way, Lacan was very much in tune with, say, a philosopher like Daniel Dennett who, in *Kinds of Minds*, argues that the only possible way consciousness could arise is precisely out of cellular, low-level mechanistic processes. Though he doesn't call these non-cognitive processes 'the unconscious', you could equally well call them 'the unconscious', and then you have something that's close to Lacan's vision.

AP: So in your distinguishing between a signifying economy of 'flickering' and maybe a Lacanian one of 'floating' signifiers, I wonder if you could just talk me through what the difference would be.

KH: When I coined the term 'flickering' signifier, I was trying to suggest that the model of signifier and signified that informs Lacan's thought was not adequate to fully encompass the situation in which language itself is underlaid by code. In fact, today everything but face-to-face communication is mediated by code: whether we're talking on the cell-phone or in an interview such as this, code is operating at some level to enable communication to take place. We are now, I think, in a different linguistic situation certainly than Freud imagined, than Saussure imagined, than Lacan imagined. So the question is: How should we fundamentally change our idea of signification when language is bound up with code in the integral way that it is today? This involves the question of addressee. If we're working only in the realm of human language, then the addressees for human language are of course other humans; if we're working at the level of code, the addressees are dual, humans and intelligent machines. Programmers and software engineers have, of course, evolved a number of ways to handle this double address. Nevertheless, the fact that it is a double address has a very significant impact on how language operates and what language means. By getting away from the floating signifier, which is still entirely linguistic, I was trying to move to a different kind of theoretical position that would begin the interrogation of what it means to have this 'dance' between code and language.

AP: Could you say in very basic terms what the idea of 'flickering' entails, then, as a theoretical concept?

KH: What it means for me is that the linguistic, material form is not stable, that the linguistic, material form is a surface manifestation of what is fundamentally processual. The surface manifestation always depends on processes, and processes that are proceeding at timescales far, far greater than human apprehension can comprehend. Now we have a situation in which we have the linguistic surface, then we have the level of accessible code, and under that we have multiple levels of inaccessible code, and then we have the hardware and all of the infrastructure that goes along with transmitting the code. 'Flickering' is meant to indicate that the apparent stability of a screen image is underlain by a profoundly processual apparatus operating at vastly different timescales than the apparent stability of the surface image would indicate.

AP: That really neatly brings us onto the next question, which is about bodies and technology and the idea of embodiment. In How *We Became Posthuman*, embodiment seems to be a mediation between theoretical invention on the one hand, and technical application — the practical way that these things actually are manifesting in the real world. And I was just wondering whether that would be your theory of technology, if you have a theory of technology, in *How We Became Posthuman*. I wonder if you could just talk me through that idea of embodiment in relation to technology — how the two are intertwined and interconnected.

KH: Embodiment as I thought about it for the *Posthuman* book and then later has, for me, two very distinct connotations. One is human embodiment, or we could even say more broadly 'biological' embodiment. There I was particularly concerned with the complexity of human embodiment and the intimate and highly elaborate feedback systems between different parts of the body, in the way that Antonio Damasio in *Descartes' Error* and other books has elaborated. There is also a different sense of embodiment — embodiment of material artifacts. In a field like literary studies, it's all too tempting to regard the world as fundamentally a discursive formation, with not very much attention to the material resistance of objects within that world. In literary studies this takes the particular form of thinking of books as a transparent medium. That's where issues around embodiment come close to home for every humanities scholar — you write a book and then it appears to you as an object, or rather enters the horizon of your consciousness as an object when it comes back from the publisher replete with a 'thingness' you can't ignore. One way to pursue this interest in material artifacts, then, was via a path that involved paying much more attention to the materiality of the artifacts with which we're intimately concerned, books of course, but also digital artifacts as they became integral to the humanities as well. There are obviously very complex relationships between embodied processes in a human and the material artifacts with which we engage. That too, I think, is a subject for re-thinking a lot of traditional positions.

AP: Just carrying on with that theme of the body, one of the things you point out in your conclusion to *How We Became Posthuman* is precisely this idea of the underestimation of the complexity of what you call this 'sedimented' history of the body, which provides a resistant point to discourse. I wonder if you could just talk me through what you would probably update of the book given that it's been ten years since you published it.

KH: When I wrote in the *Posthuman* book about the 'sedimented' nature of the body, I was thinking particularly of two radically different realms of discourse: one is the way in which anthropologists and paleoanthropologists think about human culture, and the other is the way in which humanities and cultural studies communities think about human culture. From an anthropologist's point of view, the present moment — and by 'the present moment' I mean all of recorded history — is a mere eye blink and can scarcely account for the complexity of the human organism. In fact, most anthropologists would agree with the proposition that we all walk around with Pleistocene brains. I was constantly encountering the assumption in cultural and literary studies that a change in a discourse formation could instantly change the body. I thought: 'Well, you know, both of these cannot be right at the same time'! It seemed to me that cultural and literary studies had not paid nearly enough attention to this sedimented history of the body and what that meant for human culture, and why we can have, in the twentieth and twenty-first century, tribal cultures and cultural formations flourishing in the middle of present-day Los Angeles. Why would that be the case, and how could you explain that? It was those kinds of conflicts I was thinking about particularly when I wrote about the sedimented history of the body. I still stand by that position, that embodied materialities are resistant to our ideas about them, including the ways in which we construct them in discursive systems. As Bruno Latour points out, they have their own agencies, their own realities, their own view of the world. However, the sedimented history of the body also has to be put in the context of the adaptability of the brain. Recently I've been looking at the other side of that picture, which is the extent to which the brain is capable of adapting to new kinds of environments, particularly information-intensive environments, and what effects that neural plasticity might have. One of the revisions I might make to the *Posthuman* book in retrospect would be to balance the emphasis on the sedimented history of the body with the idea of the continuing adaptation of the human brain to contemporary environments.

NOTES

1 This interview was conducted on 7 October 2009 as part of a visit to The University of Nottingham by N. Katherine Hayles under the auspices of the Science Technology Culture Research Group (STC) and the Centre for

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