The Neuroscience of Cyberspace

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New metaphors for the Self and its Boundaries

"What I see in the mirror doesn't make any more sense. I'm an aquarium filled with assorted fishes I don't even know the names of..."
-- Pat Cadigan, *Fools*

"The neurons have tree-like arbors that overlap and ramify in myriad ways. Their signalling is not like that of a computer or a telephone exchange; it is more like the vast aggregate of interactive events in a jungle..."
-- Gerald Edelman, *Bright Air, Brilliant Fire*

I am not a scientist; or a net guru of any description. I come to the examination of "cyberspace" as a science fiction novelist - inhabitant of the boundary area between science and technology, our knowledge of the world out there; and fiction - the reports we have from the inner world of subjective experience : ideology; interpretation, metaphor, myth. These spaces interpenetrate each other. It is impossible to say anything about science without using the human language of fiction (there are no equations without metaphors); impossible to construct a fiction that involves no hypothesis about how the world works. But they present themselves, in our society and perhaps in all societies that ever were, as separate systems. My business is with the interface between them. I look for analogues, homologues, convergent evolutions; fractals, coincidences, feedback loops. Like the railway passenger Gnat in Alice, I am a pun-detecting machine. Or I'm a bower bird, picking up shiny scraps and arranging them in a way that seems pleasing to me. My hybrid installations are not science, or sociology, or prophecy. They are science/fiction, a particular kind of art. This is the spirit in which I will now discover/create - that is, invent - a cascade of connections between the fact and fiction of "cyberspace", and cognitive neuroscience : new facts and new fictions about the nature of the self.

The Internet is a global computer network, that had for one parent organism a military communications system designed for survival and security. It is a vacuum fluctuation in the process of exploding into a cosmos - a collection of digital impulses, microchips, optic fibres and plastic boxes, that has the persona; the ineradicable stigmata of its original conditions; the recalcitrant privacies, the incompleteness, the indecipherable complexities of a new universe. The generally accepted spatial term for this place is cyberspace, a word coined in a science fiction novel. But the novel, *Neuromancer*, published a decade ago, was not a story about the Internet. Its appearance predated the Big Bang. William Gibson was shadowing, in his invention of cyberspace and its entourage (the Turing Police, neural jacking, simstim entertainment, commercial personality overlays), a different project.

The concept of Artificial Intelligence (AI) has been around longer than (artificial) computers themselves, and has inspired a lot of fiction. Early narratives (like the early development of computer science) dwelt on size as the sign of power. The thinking machine was a BIG machine. There were rooms of it. It had a city full of slaves

to tend its circuitry, it dispensed its God-like pronouncements on punched cards that had the ponderous character of stone tablets. Or else, leaping ahead to the distant (but at that time plausible) goal of the real-world research, the machine was an artificial human, with a positronic brain and cybernetic circuitry (positron, name of an exotic subatomic particle, suggesting quantum-level engineering of staggering complexity; the qualifier cybernetic, coined from the Greek word for a steersman, indicating control. These two terms reflect basic assumptions in fact and fiction, unchanged almost until the present, about the nature of consciousness).

In the real world it soon seemed obvious that the computing analogue for mind was the software : digital code inhabiting plastic, metal and silicon as the human mind inhabits blood and bone and neurons. At a time (through the sixties and seventies) when cognitive psychology had little connection with the study of physical brain structures, psychologists of artificial cognition equally felt able to ignore the engineering. Programs, not circuits, were devised to beat the "Turing Test" - as in Alan Turing's speculation that a successful thinking machine would be indistinguishable from a human if you couldn't see who you were talking to. Researchers seeking "the development of a systematic theory of intellectual processes wherever they may be found", took human "reason" and abstraction their starting point. Their machine self would be a creature of logic, saved from the morass of emotion. As computer technology raced on and the Big Machines vanished, complexity became the new mark of power. Artificial Intelligence came to be seen as not one program but an array, a complex of lesser entities under the direction of a central organiser. But science dismissed the fiction of the "artificial human" as sentiment and nostalgia, worthless as the mistaken image of the God-computer as a Big Box. The real world AI would be independent of its hardware. It would never use a "body" on the upright ape model, though it might have a wardrobe of "bodies", suitable for different occasions. *Neuromancer*, written in the early eighties, leaps from this point into its imagined future. William Gibson, fusing cognitive science with fashion, computer technology and adolescent behaviour in a games arcade; taking on speculations from anthropology and linguistics (doing the bower-bird riff : what science/fiction writers do), conceives of mind as software, as a vast assemblage of programs : and as an escape from the body. His network users, criminal and legitimate, reenact Descartes. Plugged in to the matrix of computer code, they are minds receiving input in the form of naked information. They decide by an act of will to perceive this input as a space formed and populated by informational entities, a world in which they can act : and therefore it is so.

In this sophisticated science/fiction, the AI that comes to be is not the proud invention of a lonely genius; or even a corporately funded team of geniuses. It has evolved, a side-effect of the complexity of interconnected data processing. Reflecting the provenance of even one piece of powerful software in the real world, it acknowledges no parent. As the rebel Master Control Program says, in a contemporary (and splendid) Disney computing fantasy : "no one human made me !". Nor is it welcome. In Gibson's future self-conscious machine awareness has come to be regarded as a threat. Like the aliens who might invade earth, in another favourite science/fiction scenario; like the chronological successor species in a stupid version of Darwinism, the new arrival is bound to be a supplanter. But the Turing Police, who censor any computer science project that approaches the dangerous threshold, have overlooked the non-intentional, evolutionary route to speciation. Users of the web, biological systems wired directly into the artificial by means of "neural jacks", have infected the data cloud with consciousness : a flickering, pervasive ignition in the teeming codes.

It is ironic, as several critics have pointed out, that having devised this stylish, up-to-date, immaterial being, Gibson's film noir plot immediately compels him to incarcerate an AI physically, inside an old-fashioned object. The data-world has given birth to twins, Wintermute and Neuromancer. Their fusion will create the whole AI, but they are separated for most of the book. Neuromancer is banged-up in an objet d'art. Mind uncontained becomes mind-in-a-box, a Maltese Falcon sought and scrabbled over by gangster-factions. It is as if the novel knows what cyberspace tells us about consciousness, and then instantly, deliberately, forgets it. But there is truth in the irony. If machine-awareness must be a mirror of human-awareness - which has been the underlying, sometimes unacknowledged belief of all artificial intelligence research so far - the modernity of this first cyberspace image of self doesn't go very deep. The twin brothers, Neuromancer and Wintermute, conform to an

ancient dichotomy. One is all reason and logic, the other is emotion and personality. When they fuse they become, just as the Turing Police feared, the being that will supplant humanity - as human intellect, in a classic and enduring model, supplants the animal rule of the body. The self, once formed, is no longer part of the body. It is a separate, superior entity, distinct from the physical as reason is distinct from emotion. The majestic super-intelligence dominates and manipulates its multitudinous subprograms, including its human agents, just as consciousness (in the contemporary model) must manipulate the brain.

After the first post-war decades, research into thinking machines quietly side-tracked the project of artificial self-awareness. Developments in technology continued at the same explosive rate, but as it became possible to build much faster, much more complicated number-crunching processors, the threshold of consciousness retreated into metaphysics, an ungraspable mystery. In robotics, research began to work backwards - abandoning naked logic and trying to provide that "central organiser" with the variety of input available to a living animal. But these were behaviourist "animals", devoid of sentience. There was a growing awareness that the Cartesian reasoning being must be first provided with Descartes' notion of commonsense, and that the most sophisticated number-crunching didn't come near this goal. There was also, perhaps, a science/fictional dilemma. There are Turing Police in the real world, to whom the idea of a truly self-aware machine is gravely distasteful. We must not act like God, they say - meaning it will supplant us. Contrariwise, there are humane considerations. The science/fiction analogue-mill assumed that artificial mind must be to the sum of human mind, as human mind "is" to the animal substratum : a ruler, a god. Applied technology suggests a different scenario. We do not see amazingly powerful processors as unique creations these days. If there's one, there will be millions. Like science graduates, it doesn't matter how smart they are, they can't all have the exciting jobs. Is it kind, is it acceptable to give a superchip self-awareness : and then set it to some trivial and boring digital task like running a video game or turning a city power grid off and on ?... It would be like forcing a brilliant and delightful child to sit all day twitching her big toe, or opening and closing her eyes. Artificial cognitive science stalled. Artificial Intelligence became, in a discreet and unannounced downsizing, simply the name for very fast, very powerful computing. Meanwhile, in a movement driven by the same scale of explosive technological development, biological cognitive science, a new discipline that had never existed before, was emerging.

I have to digress here, and talk for a moment about the immune system... Much of what I have to say in this and following passages comes from my reading of Gerald Edelman's dazzling speculative science on "the matter of the mind" (*Bright Air, Brilliant Fire*; Basic Books, New York 1992); with incidental illustrations that I found in a collection of Donna Haraway's essays. I emphasise again that I'm a human bower-bird, ignorantly attracted to knowledge - when it shines. My account of Edelman's theory of mind will be a very rough sketch. But this is such a significant development, for all thinking about intellectual process and the nature of the self, that I feel it's worth the attempt.

The immune response, in vertebrate animals including humans, is essentially a recognition system. Immune cells recognise nonself, and thereupon are able defend the body from alien invasion. The puzzle, for as long as the system has been studied, has been to decide exactly how this can happen. How does the system work ? In the beginning, there was the model of instruction. Immune cell meets a foreign cell, foreign cell impinges on immune cell, conferring information - whereupon immune cell builds a specifically designed antibody : and the diverse array of defences goes into purposeful action. Or so it seemed. But the history of the instruction model, like the history of intelligence research, is a history of dis-organisation. It became more difficult, as applied technology made the biological processes more open to investigation, to perceive the immune response as an orchestrated whole, each component fitting by design into a "central organiser's" plan. The assumption of purpose, of prior intent, became deeply problematic. In the model now generally accepted, the idea that the system acts purposefully on information received, has been abandoned. It transpires that the body produces a vast variety of individual immune cells carrying all kinds of antigens, all the time. When by happenstance a somatically produced antigen binds with a roughly matching-shaped invader, that stimulates the cell - the lymphocyte - to divide, and produce daughter cells equally matched to the foreigner. An invasion of nonself

does not trigger a reaction. It favours, by Darwinian selection, the growth of a population. It was this shift in perception, the dethroning of purpose, that led Gerald Edelman to propose a schematically similar explanation for the biology of cognition. Neuronal Group Selection is the proper name for his theory, otherwise known as "Neural Darwinism" because though the mechanisms differ, the principle is purely evolutionary.

Edelman reasons from his own work in immunology, to suggest how "dumb selection" can lead from the random firing of neurons to complex ideation : metaphor, association, categorisation, reason; without the intervention of any "central organiser". The fine wiring of the brain, in the embryo and in infancy, is formed by a process of selection. Populations of neurons compete - within the constraints of the larger brain structures of the species, that have been shaped by evolutionary forces. An architecture of neural branching becomes fixed, different in detail in each individual. This is the primary repertoire. Behaviour, interaction with the world, then produces as secondary repertoire of favoured synapses. Neuronal group firing patterns that produce results favourable for survival - say, the baby succeeds in grasping an object - are repeated, and strengthened. In time the brain has a wide repertoire of these strengthened patterns or neuronal maps (again different in detail in each individual); and several maps, associated with different senses say, will fire together because of a previously established connection (baby grasps object, and remembers the sound of the rattle). A higher level of association, groups of groups, becomes a repertoire. And higher still, in groups on groups of neuronal maps, connected and reconnected. This associative network, created by the reentry process, is the basis of memory. Similar input, whether modelled within the brain itself or triggered by interaction with the world, raises the same set of reentrant neuronal maps, layer upon layer... Thus, the taste of a piece of toast dipped in tea can recover a whole lost past; and bring an individual ecstatically in touch with the process of consciousness.

With Neural Darwinism, though there is still no last bridge, no explanation of awareness itself, we have a plausible mechanism that points from mindless chance conditions to complex ideation, the way the adaptive radiation of Galapagos finches points to the evolution of the human eye. The "central organiser", the overseeing mind that is not part of the machine, can at last be dispensed with. And a famous hypothesis from fiction, that self is memory, appears now to be on a sound experimental footing. I was sorry that Edelman didn't mention Marcel Proust, along with Descartes, Aristotle, Freud, in his catalogue of spiritual ancestors. But though there are surely neuro-scientists who read storybooks, perhaps there are few who perceive the shared territory, or expect to find their science in a novel.

Since *Neuromancer* "cyberspace" has been somewhat the victim of its own success. The speed with which that term hit the streets and proliferated shows how hungry we were for a new spatial metaphor : a way of talking about the machine-generated dimensions inside the TV, in the phone network, in the electronic money markets : "behind" all our monitor screens. Inevitably there's a dilution of meaning. In fiction, which is always hungry for new imaginary worlds, cyberspace has become, - in books, movies, videos, games - simply the latest style in daydreamwear. In William Gibson's own subsequent cyberspace novels, the "consensual hallucination" of the first book, that sparse and chilling Cartesian space, is replaced by a facsimile reality (only nicer; and magical) - a kind of electronically generated Narnia. Pat Cadigan's first novel (*Mindplayers*; Bantam /Spectra New York 1987) is not so different from the rest. *Mindplayers* conceives, very plausibly, of cyberspace as a venue for psychotherapy. In the proposition that therapist and patient stick their heads in a kind of brain scanner, to join each other in lucid dreamland, the narrative makes banal metaphors actual (= "the world of the mind"), but has nothing very new to add. If *Neuromancer* is limited by the rules of the film noir thriller, *Mindplayers* is little more than a succession of those "Freudian dream-sequences" favoured in early Hitchcock movies. But there are signs, in the flexibility of Cadigan's cyberspace - a meeting place, a psychotropic drug, a medium that models the mind and is also made of mind - that she has avoided the Narnia trap, and will explore further.

Her second novel, *Synners*, (Bantam Books; New York,1991) like *Neuromancer*, is a thriller of the information age : tragic, melodramatic, sentimental, narrow. It is set in the tribalized society of near-future Los Angeles, where techno-artist rockstars of virtual-reality mediated entertainment, are the elite of a cybernaut Bohemia.

Direct brain-interfacing with "the machines", the normal route to cyberspace in Gibson's scenario, is here emergent, and demonized. Cynical entertainment corporation bosses impose the novel and highly dangerous technology on their artistes. Artists and public don't know any better, and gobble up the new brain-wire drug like candy : until one burnt-out VR junkie dies while plugged in, and shares his death with the computer-using world.

Synners has assimilated developments in social network use and conceptual shifts in computer science, that were not available to William Gibson. As in *Neuromancer*, self-awareness has come to being as a phase-transition event of network complexity. But "Artie Fish", the artificial person, is not a God, nor even half a God. "He" has the persona of a mischievous young male human, and is helplessly dependent on his human friends to rescue "him" from oblivion, after the massive systems crash. The datacloud is not separate from its users - a "place" where people "go" - but a continuum that includes human brains, the power supply grid; traffic control, fast food menuboards. It's all one. A massive stroke can be at once a biological and a digital impulse disaster, ripping through brains and other data systems without distinction. The science of thinking machines had become more modest in its pretensions by the time *Synners* was written, and the information age less bullish about its high and lonely destiny = to replace a world. The cyberspace apotheosis, a classic ingredient of the genre, is still achieved. But in this version the fusion of human mind and machine mind is a rescue for both parties, not a triumph for humanity's successor.

If the brain is a recognition system that still preserves its final mysteries, re-cognition is also a crucial concern for artificial intelligence research. The machine that can process information speedily, efficiently and flexibly as a human brain, is conceivable. How do we build a machine that can know what it has done, that can turn the processes of cognition on cognition ? AI research and biological neuroscience have both been transformed in the last decade. Cognitive neuroscience has produced the utter simplicity of Edelman's Neuronal Selection model; and is served by extraordinary technologies that can capture the localised physical events as never before. Claims for these technologies may be doubted (post hoc propter hoc ? If the neurons are firing in certain areas, after the wet toast is nibbled, you can't be sure that what you are watching is the subject "revisiting his childhood". He may be secretly thinking of something different, that he'd rather not discuss with you). But certainly the brain is no longer a box that holds the mind. If it is "inhabited" by awareness, it becomes difficult to decide where the house ends and the resident begins.

In artificial cognitive science, miniaturisation has subsumed software into circuitry, likewise disrupting the boundary between the dumb hardware and the clever code. There has been a revolution in favour of bottom-up engineering. Both in mobile robotics and in the bodiless codes, top-down logic has been abandoned in favour of evolution. Scraps of program are encouraged to breed like bacteria, in the hope that eventually consciousness will crawl out of the digital slime. In *Bright Air, Brilliant Fire*, Gerald Edelman describes a series of NGS (Neuronal Group Selection) experiments using automata (behaviourist "animals" modelled in code) generated on a supercomputer. These automata were not programmed to mimic animal movement. The code provided a model of neuroanatomy. Repetition and dumb selection did the rest. Through its swift generations computer science has mimicked - uncannily, inevitably - successive images of consciousness and the brain : programming into hardware, multilayered code-entities that enter and reenter each other in endless feedback loops; contributions from buried denizens of ancient proto-computing past; scraps of simple program that have survived in symbiosis with their more complex supplanters. Yet still the brain is not a computer, not even a bottom-up designed neural network processor. Neuronal Group mapping is a dynamic process, not a store of coded attributes. Memory is not fixed and never becomes fixed. No presented thought is the same thought or comes to awareness by quite the same route twice. If this level of absolute variation and diversity is the necessary substratum for mind, then maybe no program nor software system - however powerful in potential or simple in its constraints - can be designed to model consciousness.

Many claims made for the Internet have faded in the light of experience. There is little evidence that the Net is

an utopian, idealist supernational state; or even a "gender neutral playground". There is no sign of a coming race of Donna Haraway style cyborgs in virtual space, liberated by technology itself, from the dominations of technology's past world order... The world order in there, is the same as the one out here. How could it be otherwise ? I use my modem chiefly for sending cheap, fast international messages, and I regard my Internet suppliers as a new breed of garage mechanics. They despise me because I'm ignorant, they're mildly rude to me because I'm a girl. If put my cybernaut's vehicle into their hands for repair or improvement, I strongly suspect that they'll do the work - wrong - in ten minutes, and charge me for a week's labour. Information wants to be free ? Not any more. What we have left is a research tool of astounding potential, and a novel communications network so densely woven, so intricately connected and reconnected that it seems to defy policing. No one can know "exactly what is going on" in there. There is no master program. We dip into it - triggering a selective firing of the artificial neurons; raising this group and that from different data webs, into ephemeral existence. Already each "I" at the keyboard is invited to become a persisting informational entity. The Internet will customise a pattern of selection, harden pathways that the network "remembers" and recalls, when the individual "I" makes contact again. The net is already - without waiting for the brain surgery - a populated world conforming to the original fiction : a matrix of information, infected by visiting minds. It also conforms to the Edelman model of an intelligent re-cognition system. It developed to no plan, except that it should be able to survive, and seek favourable conditions for its own continued existence. As in the human brain, and not as in computing, its memory is malleable, reconstructing constantly the data-objects that it visits and the space in which they exist. Incomplete, messy, dis-organised, laden with redundancies : it has all the hallmarks of a full-blown biological evolution.

Science/fiction has its own evolution and its own ecology. Older species of thinking machine stories are not necessarily, or even generally, pressured out of existence by newly successful adaptions. The post-cyberspace era has room for synthetic humans as comfortingly inept intellectuals, overtly respected and covertly awarded the comic pathos of the Tin Man in the *Wizard of Oz* (Data in *Startrek*). The legal status of a software-entity criminal can be debated. AIs can be pets, toys, guardian angels, fairies, folklore monsters. Biological manufactured humans can be enslaved in their millions. But there is among the rest a distinct post-Internet fiction, following the implications of network science and technology.

Pat Cadigan's cyberspace novels have no clear chronological relation. They form a triptych rather than a trilogy. *Synners*, the central panel, can be read as near market speculation for the world outside the screen. It is set in a believable space, a plausible future or exaggerated present. It is, down to that sad old fake romance between vain and greedy artistes and their wicked corporate bosses, a mundane account : "set in the future", as it might be "set in Canada". The third novel, *Fools* (Bantam/Spectra; New York 1992), loosely connected with the earlier *Mindplayers*, inhabits a different dimension. There is no mass of fictional detail to trick the reader's inner eye, and a minimum of science/fictional rationale for the proposed novel technologies. The world is a series of half-lit interiors, connected by blurred streets and sketchily suggested vehicles : a nightclub bar, a theatre rehearsal space; a species of massage parlour where queasy, ill-defined transactions are glimpsed in featureless booths... The narrative that unfolds is equally shadowy and bizarre. Cyberpunk inventions and the virtual psychotherapy described in *Mindplayers* have proliferated, invading every aspect of life. Several characters inhabit a single mind. Celebrities sell copies of their public personalities under franchise, so that fans put on the persona of their idol for a while, instead of wearing the teeshirt. Bodies can be remodelled cell by cell, to match the latest fashionable overlay. A mind can be stolen, stripped of identifying marks, dismembered, parcelled out, copied; and fenced to the unwary or collusive public, like pirated software at a car boot sale. Marceline, (a character who exists as a packet-switching stream of data-traffic, taking her turn with others in the mind/brain of the multiple protagonist) is a memory junkie : someone who buys illegal snippets of other people's lost time, mainlining Proust's exquisite glimpses of the eternal present.

The plot involves an undercover operation by the Brain Police, who are supposedly the regulators of intellectual property trade, where intellectual property means the mind itself : They are in pursuit of a gang of

"mindsuckers" - mind-theft being the cardinal criminal act that defines this society. They are themselves obsessively deep in the game of self-encryption and psychic data-corruption; and not the best protectors a mind-marketing community could have. But when the suckers steal the consciousness of a method-actor, adept at generating complete variant personalities, things really get complicated :

> "Just try to stay calm". The officer on Sign-out duty slid me a chair and a scratch pad while someone else went to get a terminal so I could trace the call. "What seems to have happened is, the mindsuckers who took your mind sold you off to someone intact. But the implant didn't take very well, and you're fighting for dominance instead of being assimilated."
>
> Another weak laugh. "No. That's not it. I mean, they think that's it. Or they thought that was it. But I'm back there too."
>
> "Back where ?"
>
> "In the other place. Where I had no body."
>
> I hesitated. I should have taken this call in my office, but I risked having him hang up in the time it would have taken to sprint back there.
>
> "It's true," he went on, a little breathlessly. "I'm waiting back there, playing for time. I don't know where that is though. I sent me out -that I sent this me, I mean- intending to get help. That me back there has no way of knowing if I, this I talking to you, succeeded or just went crazy or what... They keep on trying to send me out, sell me off. Me, just the one person. So I create one of my characters and send him out. Do you see ? I'm in character now, a character from one of the plays I've done. Do you see now ?"
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> You see all kinds of things in the Brain Police. A disembodied, self-replicating mind was a more bizarre sight than usual, but stranger things have happened. Probably.

Emergent sciences begin by prying at the cracks, searching for any kind of purchase on a locked box of knowledge. Cognitive psychology, like genetics, began in pathology. The abnormal behaviour of patients with known damage to their brains, gave the first insights into underlying brain mechanisms. Early Artificial Intelligence research shows the traces of this ancestry. Completely mindless programs were pleasingly successful at mimicking the unseen "person" of the Turing Test, in teletyped dialogue - when the "person" was supposed to be "neurotic", or "paranoid" (equally successful, oddly enough, when the "person" was supposed to be a psychiatrist). In *Fools*, Pat Cadigan seems to address the pathology of cyberspace. But she glosses only briefly on the real world implication of multiple personality as a strategy for survival Her characters are not sick. "They" are exposition : an uncompromising despatch from the data network as a model for the mind - a model in which scarcely anything remains of that steersman god in the machine. Where other cyberspace fictionsare scare stories. *Fools* reverses the engineering and asks what does the jungle of the network tell us about "normal" awareness ?

Fools is a police-procedural fantasy in futuristic drag - pacey, casual, relentlessly punning, unfinished. There are elements of farce in the knockabout packet-switching from one narrator-personality to another. With an effort (it's not exactly an easy story to follow) it may be read as a dreamlike fable of novel technology out of control. But the image of consciousness as a resilient, decentred, multivalent matrix, is not part of the nightmare. In *Synners*, before the crash that almost wipes out the computer networks, a techno-art fellow traveller, a tattooist called Gator, has often been found inscribing, on the hide of some insensible burnt out junkie, an item of

mysterious beauty : a tendril of ivy, maybe, or a lotus flower. These fragments contain, puncture by puncture, like a secret encrypted in the pixels of a downloaded photograph, the essence of Artie Fish. Gator is hiding a copy of Artie-starter away from harm. After the crash, she'll be able to raise him from the dead : not identical, but entire as before. The self dissolves when we examine it, into an unmanageable palimpsest, indecipherable exploded diagram. But after each disruption the same face returns. It is part of the system, like the unchanging pattern of ripples on the surface of a flowing stream. Mind is stranger, more complicated and uncertain than we could have guessed until now. But it is not an alien or a supplanter. It is an integral part of the physical world.

The image of self that cyberspace fiction presents has journeyed far in a decade : from the birth of an indifferent Godhead, to Artie Fish the mischievous spirit-guide of the netsurfers - indistinguishable, unless you know, from any other interlocutor. The self has become no more than a harried, overworked presenter, public servant of diversity : dodging and diving and taking any route she can to get the message through. Our demotion is chastening. Yet this answer to Alan Turing's question, how would you know ? conforms, like nothing before, to our experience. This is the self. Not godhead, but the voice that speaks, suddenly and mysteriously, from an empty room... the secret inhabitant of the tumultuous web.

Cyberspace fiction is not sexually or politically neutral, no more than cyberspace in fact. The cyberpunk manifesto, announced by Bruce Sterling - later to become a notable observer of the real world nets - vowed to wrest (in fiction at least) the cybernetic power of novel technology from bourgeois, complacent "scientists" and their bosses; and put it in the hands of punk street kids. The project has many supporters : academics, journalists, science popularisers, all excited by the liberating radical technologies of this decade. But "radical" is a relative term. The male punk-heroes of classic cybertexts are sulky maverick mercenaries, but quite humble and accepting towards the bosses, really - as long as they are paid well enough or scared hard enough. They show no enthusiasm for empowering their own underclass - the women who mother them and tend their bodies while they surf the nets. Cyberpunk fellow-traveller Kevin Kelly, in his overview of the new technologies, goes further. His plan "to extract the logical principles of life and install them in machines", sounds more like "liberate", as in "steal", than as in "set free". Transparently, cyberscience perceives neo-biological technology, replication replacing reproduction, as a triumph at last over an ancient bastion of female power : not less control but more, in the hands of the same elite.

Feminist writers (Candace Jane Dorsey, Melissa Scott), have struggled with the cyberpunk scenario, and discovered that one can invent cybernaut tomboys, but one cannot feminise the agenda. Pat Cadigan, the only woman in the original cadre, does not argue with the rules of the boys' club. Female characters in *Synners* are strong, independent women, too wise to contest with their menfolk for the centre stage. The female protagonists of *Mindplayers* and *Fools* do not act, they react. They may be on the street; they certainly aren't in control. And "Artie Fish" is not a God, but he's definitely a boy. The mind of cyberspace is still male. Yet the downsizing (or rightsizing) of self undertaken in Cadigan's novels, the dissolution of the paranoid model of *Neuromancer*, is inescapably a political, and a feminist progress. It reflects the distinctively biological, decentred modes of thought - ecologies, evolutions, diversities; populations instead of individuals; groups instead of single interests, which are infiltrating our models of the self and the world : and which remain genuinely novel and transforming, in spite of all hijacks by the cyber-malestream.

In real life, I admit I don't expect the Internet to give birth to awareness. Perhaps its founding fathers will write a constitution, perhaps law and order will be imposed by force on the wild frontier. Either way, its technology will fade into the commonplace, and network use will soon be no more intriguing, nor loaded with gender-difference, than picking up a telephone. But it is characteristic of the self, to change without acknowledging change. In that world in which the Internet is invisible, and science/fiction has moved on to other quarry, we will be different people, with different memories : our sense of self subtly altered by the existence of this other, the multitudinous immaterial presence, perhaps the nearest thing to an alien intelligence we'll ever meet.

References

Donald Michie, quoted in : *Artificial Intelligence and Natural Man*, Margaret Boden (Harvester Press; UK 1977), "On Machine Intelligence", (Edinburgh 1974) p156.

William Gibson, *Neuromancer* (New York/London : UK : Victor Gollancz, 1984) p67.

Tron, dir. Steven Lisberger, 1982 US.

In fact, a platinum and cloisonne head p207. Who says SF writers have no sense of humour ?

In her collection *Simians, Cyborgs and Women* (Free Association Books, London 1991) : the illustrations are from "The Biopolitics of Postmodern Bodies: Constitutions of Self in Immune System Discourse".

For Proust's account of the toast incident, real-world original of the madeleine incident in *A la Recherche du Temps Perdu*, see the collection of essays and letters *Contre Sainte Beuve*, (Gallimard Paris 1954 p53/4), translated and edited in English by John Sturrock : Penguin Books, London 1994.

Synners, Ch 17 pp167-176.

See "A Cyborg Manifesto" Donna Haraway, *Simians, Cyborgs and Women*.

Melissa Scott, *Dreamships* (New York : Tom Doherty Assoc/Tor, 1992) The fate of the AI entity "Manfred" is a sad case of legal discrimination. Accused of murder, "his" defence is that "he" didn't know you could kill a human by electrocuting their fleshy hardware. But his misunderstanding is taken to mean "he" doesn't understand personhood, therefore doesn't qualify as a person, and can be wiped as a dangerously faulty program without trial. Poor Manfred !

C.J Cherryh, *Cyteen* (New York : Warner Books, 1988). And other novels in the "Merchanter Universe" series. C.J. Cherryh's "azi" are vat-grown humans - an unlikely development for us, since we are not short of the commodity in question. But science now strongly suggests that if an artificial/biological mind could be created, in any form, what you'd get would be a human being, neither more nor less. Could such a machine be "useful" to us ? Maybe we'll have to build them, and then lobotomise them.

Fools page 176.

See the descriptions of various "neurotic programs" and their interactions with (sometimes) unwary humans, in *Artificial Intelligence and Natural Man*, Margaret Boden pages 21-63.

Fools page 242.

See Melissa Scott's *Trouble and Her Friends*, (Tor Books New York 1994; and Neal Stephenson's *Snow Crash* (Bantam, New York 1992).

Synners Ch 30 pages 347-360.

See *Mirrorshades: The Cyberpunk Anthology*, 1986.

Kevin Kelly, *Out Of Control* (Reading, Massachusetts : Addison-Wesley, 1994). The quotes are from the opening chapter "The Born And The Made"; and from the cover copy.