Centre for Science Studies
Lancaster University

Machinic Pleasures and Interpellations (*)

John Law

Passion, erotics, and Method. The embodiment of knowledges. Their embodiment and performance in marked subjects. In marked subjects that are also disciplinary subjects, disciplinary subjects that perform themselves in places such as the social analysis of technology. In disciplines which prefer to perform themselves as if they were products of erotically unmarked subjects. How to make sense of this embodiment? How to understand the performance of subject-object distributions? The framing of knowledges, object and subjects?

Locating the ethnographer is a topic of consuming interest in post-modern times (1). There are many ways in which we might do this, but in this paper I suggest that we might use Louis Althusser's structuralist notion of interpellation, his way of talking of the production of subject-object distinctions in a process of instant recognition (2) – of instant recognition, fixed points, and of the way in which the two go together. For there are, no doubt, many interpellations, fixed points that have made us into the subjects that we are. Indeed we cannot deconstruct all our subjectivities at the same time. And it may be that parts cannot be deconstructed at all. But neither does this mean that we are bound to accept and perform all our interpellations; nor reproduce all the distributions that we recognise as natural; that recognise us as natural.

Which is why we might, let me say should, investigate the ecology of interpellation. Why we might consider the ecology of subject-object distribution and explore how it is we are called to become knowing subjects, and how it is that objects are constituted in particular ways, that they are known in particular ways. The aim would be to learn something of the analytical and

political obviousnesses thereby being made – and how they might be warped, queered and changed.

So this is the question. How do objects interpellate us? But it is in the nature of things that there are many objects and many subjects. To make something of this multiplicity I will tell stories which attend to the question of pleasure (which is not to say that machines don't interpellate painfully; or indeed in quite other ways). So these are stories of machinic pleasures, a small selection of the variety of machinic pleasures (3). And since I am concerned with military technologies and the ways in which they and the stories which we tell about them might embody blindnesses, and in particular the blindnesses of boys' games, many though not all indeed have to do with military technology.

Machinic Heroism (4)

The erotics of heroism. Fliers and their machines.

In his book The Right Stuff Tom Wolfe (5) tells about Chuck Yeager. He was the doyen of the test pilots of the ultra-fast aircraft which might have become the first US spacecraft had matters gone differently. Had the US not in the end opted for the missile technologies of the Mercury program.

Yeager had been through all sorts of adventures. Not to mention trials and tribulations. He had flown higher and faster. He had taken all sorts of risks. He had been severely injured. He and his friends had driven fast cars through the desert. They had drunk themselves to insensibility countless times. And they had fucked (and I use this mechanical and agency-asymmetric term advisedly) whenever and wherever the opportunity arose. But none the less – or therefore – they, and Yeager in particular, were the particular embodiment of 'the right stuff'. 'The right stuff' being the pilots' own description of what it took to undertake this form of dangerous and skilled flying. And, being the embodiment of the right stuff, Yeager scorned those who lacked it. Including those who volunteered for the NASA Mercury space program.

Dicing with death; heroism; the business of pushing the limits; flying faster, further, higher than anyone else. A reckless but skilled disregard for personal safety. Skill and competence securing invulnerability. Or so it is performed, this well-recognised economy of heroism.

It seems so simple, and, or so it is usually suggested, very male – male, that is, in a particular way. So it is simple, and yet not so simple, partly because there are many malenesses (6), and partly because this form of heroism no doubt has many components. One, the pleasures of a form of male camaraderie, male bonding, homosociality. Two, a sense of transcending time in combat. Three, a sense that, in invincibility, the fighting life is nothing more than a game, something to be played. Four, the performance of an intimate connection between the pleasures of the body and those of the technological, the machinic, in which the machine becomes an object of desire (7). Five, a strong connection between pleasure and death (8). And, six, a sense of being, well, not quite human. Stanley Rosenberg cites a Vietnam pilot thus:

> 'We don't see dead bodies, wounded people, guys shot up. If you don't come back, you don't come back. You just have burnt metal on the side of a mountain, a distant flame. No broken bodies.' (Rosenberg :1993:62)

Out-of-the-body experiences: I'll talk more of these shortly, for it seems that they come in many forms, and are linked to many forms of pleasure. Here I simply want to note the detachment, the potential for detachment, from the body implicit in this quote. There is a kind of indifference in this heroism, indifference to the fate of the body. The pilot transcends the mundanities of this world. The resonances of the words 'a distant flame': do I imagine too much, or is this a concentrated icon for transcendence, for surpassing, as the dictionary puts it, human experience? A spiritual sensibility that arises from the immunity of the body to the cares of the world? From its translation to another place, to other pleasures (9)?

Suppose this form of machinic erotics were important to us. Suppose that we were interpellated in this way. Then what would this mean? How would such machinic erotics work? How would such an interpellation shape the knowing of technologies, of military aircraft, their narrative performance? And what would they stop us from seeing or being?

The obvious: like other combat narratives they would perform a world composed in a series of dualisms. First, between ourselves and the foe, 'the threat'. Second, between the natural world and our machine-body skill, nature and culture (10). And third, between the elect and the rest who labour, trapped in bodies, mortal bodies, on the ground, bodies that do not go elsewhere and are removed from the promise of that distant flame.

But what does dualism mean for the structure of our narratives?

To start, there is a simple answer. It will make Others, objects that are Other, Othernesses that are necessary to our own narrative imaginings but alien to them. Like 'the threat', or like natures too, in their usual Western location as the Others of culture, the Others that allow us to be our selves. So there will be the performance of dualisms rather than continuities, divisions of labour rather than labours of division. This is the first danger, that we will make narratives that are mistakenly complete around imagined others.

Second, we will be interpellated as outsiders, for <u>we</u> will never partake of that magic, the magic of flying. But this reduces us to reproducing the erotics of flying at second hand (in which case how do we resist colonisation? (11)) or ignoring these and dealing with the technicised repressions (of which more in a moment). For telling of charisma is always awkward, and whatever else might be said of it, military flying is a charismatic performance (12).

Third, there is the business of technicised repression. There is, that is, the need for seemingly technical reasons for faster, higher, more perilous, more demanding, aircraft. Aircraft that are seen as desirable or, indeed, as unavoidable. I fear this, at any rate for the narratives of the military flying and its machines. For the <u>Boy's Own Paper</u> narratives have disappeared and we are left with stories of technical or strategic need. For instance, there is an aircraft I have studied, the TSR2. This was a tactical strike and reconnaissance aircraft conceived for the British Royal Air Force. Its flying attractions were most important for in 1957, when it was being dreamed up, it looked as if this was likely to be the last combat aircraft for the Royal Air Force. So a lot of the men liked flying fast machines but (this is the point) this was never told in the official documents which were instead parsed in a technicised language that left no room for the pleasures of heroism. My conclusion: we need to be on our guard against technical narratives. This is not because they are wrong, or because they are not performed. Indeed they run through, help to constitute, and are performed by the fabric of the machinic. We need to beware of them because they also eclipse an important version of the erotic. Air force generals are not supposed to want heroes; they are instead supposed to want effective military action, even body counts. Which suggests that in technicised distributions, justifications, narratives, the thanatological erotics of heroism will be concealed, made private – or distributed out of the texts and into visual material, into depictions of the aircraft, where they perform themselves, without speaking in words, in 'aesthetic' form. Which distinction, 'aesthetic'/'technic' is another distribution, interpellative collusion, we could well do without (13).

This is the first interpellation: by machinic heroism and its accompanying deletions.

Virtual Combat

I forget the name of the game. Perhaps it was Doom. I don't know. But I was invited to play it on a friend's computer. He plays it at work at the end of the working day that is, for a few minutes, before going home each evening.

The graphics were, as they say, stunning. I found myself interpellated into a character – a role, a role in a world of rooms and corridors, of galleries and open spaces, where I killed or got killed. There were various tasks. I forget the details, but I think that the aim was to win through to the next level of the game. And to do this, well, there were various needs and resources. For instance, there were supplies to pick up, power sources, keys to go through locked doors, more powerful weapons. And, all the while, there were beasts of various sorts, cyborgs, warriors, I don't know what, trying to kill me. And I had to fight back. I had to zap them before they zapped me.

My friend said that I played it well for the few minutes that I played it, but it didn't seem to give me any particular buzz. On the contrary, I found that it was making me anxious. I was glad when it was time to go.

Many have written about the pleasures of computer games and cyberspace (14). No doubt such pleasures are complex – though they often have to do with control. But to tell of 'control' tout court is too simple, for this comes in a variety of forms. For instance, there is the total control of a simplified universe. I'll talk a little about this later. Or there is visual power, the control of the eye that detaches itself from a surface made flat. Perhaps there is something of this in computer games – as there is, also, of the exertion of control again resistance (which is the more usual definition of power) (15). And then, perhaps similarly, there is control as an aspect of combat, virtual combat, which is what I want to attend to here, because in the computer game the combat is not entirely 'real'. Since (note this, for it is the crucial move) it takes place in a space that is made both real and unreal. That allows, performs, both the reality and the unreality of combat.

Real and unreal. It is made real because it is, after all, there, because a subject-position within the space of combat is made, and a contest ensues, a deadly contest, one in which there is a winner and a loser. So it is real but unreal too. It is unreal because it is also disembodied because, the subject position, winner or loser, is one that can be renounced. For the embodiment in the game (the game, note that) is voluntary. It is like the process of waking up from a dream, when you realise that you are not who you thought you were, except that here the switch between subject-positions, between disembodiment and embodiment, is two way, oscillatory. Which means, inter alia, that combat games may be understood as technologies for performing pleasure while limiting pain. Technologies for moving in and out of bodies that permit involvement and lack of involvement. Both.

Ambivalent embodiment/disembodiment, no doubt the phenomenon is common. I've already said that I think pleasures often relate to out-of-body experiences. And these aren't necessarily linked to combat. Imaginaries of all kinds might (forgive me) be imagined. And the gradations, the slopes, between that which is real and that which is not, well there are many possibilities, many promises, there too (16). But in the less promising ambit of combat we need to add risk, the relationship between subjectivity, skill, strategy and danger. We need, that is, to add the possibility of victory or the risk of destruction to the knowledge that destruction is virtual, cost-free, disembodied. That it is located in a form of combat which ends at the end of the day, because the body is not, as they say, on the line, because it may flip to its other place outside the game.

The erotics of virtual combat. Where do we find these? Yes. In the computer game. Perhaps the sports arena, a world constituting itself in terms of 'teams', 'matches' and 'scraps' (17). Or, again, in fiction and film. And finally, in simulations of war, from the toy soldiers on the floor of the Victorian middle-class nursery, through the detailed neo-gothic worlds created by the contemporary inventors of Games Workshop (18), to the chilling 'real life' simulations played by military strategists like the games of nuclear strategy played at the Rand Corporation and described by Carol Cohn (19).

From the zapping of the arcade game to the 'body count' via the harsh realism of the war game, the core of my suggestion is this: there is an erotics, a specific interpellative erotics, of strategic combat that performs itself via simulation in an instability between embodiment and disembodiment. Which means that the subject is performed as a body with blood, but in a bloodless and body-free zone in which pain is transient, in which there is never real pain, bodily pain, either for subject or (and no doubt this is even more sinister) for object-foe. This is a place where there are thrills but few consequences, where one may play at hero. That is the point: it is a place where one may play at hero, play at the radical distributions of activity/passivity which are always implied in combat. Hope of winning. Fear of losing. Being disaggregated. With – but then without – the body, without the danger that comes to the body in combat (20).

Suppose we were interpellated in this way, into the oscillatory pleasures of virtual combat, what would our narratives look like?

Here are some suggestions. First, they would make centred subjects. These would be subjects that are calculative and strategic, because they manage resources to rebuff and

overwhelm resistance, and subordinate other efforts, imaginings, to the goal of victory by means of a set of moves that form a part of the larger effort to win. This is a centred subjectivity, subjectivity made as a site of a particular kind of (rational?) action, where failure to centre is indeed failure, failure to order and sort hierarchically, and where passivity, quietness, decentredness, unassimilability, none of these are conceivable subject-positions (21).

Second they would <u>homogenise</u> the agonistic field. For the subject interpellated into that field might perform complex puzzle-solving, and resolve large logistical problems. But in 'the last instance', the field, the arena, the bounded area of the simulation, performs itself as flat. Yes it is, to be sure, a complex flatness with rules, strategies, links and feedbacks. But it is nevertheless flat like computer code, or the space of a computer screen, or the descriptive scenarios of the war game, or the strategic map in the war room. These are all places where matters can be imagined and joined together to perform a world unto themselves in which, oxymoronically, there is no place for the unassimilable, the ambivalent, that which resides in mystery. These are, indeed, places where there <u>is</u> no mystery (22).

Third, they would <u>dis-embody</u>, and thereby make themselves irresponsible. For the interpellated subject is both real and not real. It is real because it <u>is</u> a world, an 'invented world', an object, an object that makes itself real. And it is yet not real. Because? Because it is, well, because it <u>is</u> only a simulation – which affords it with the pleasures of combat but without the consequences. So we have an oscillatory subject, a subject that can be both utterly serious and utterly unserious, irresponsible (23). The point is a little different to that made by Donna Haraway about the god-eye trick (24), for the pleasure is not one of pure exteriority. But even so, the argument points in the same direction – which suggests that we will <u>beware of oscillatory</u> simulations, of the bodily pleasures of representation which remove us from our bodies and endow us with the capacity, the need, the desire, whatever, to run risks without taking them. To act without having to take the consequences of our actions seriously. To be heroes without more than temporary pain.

In one way the story is an old one. It tells of the anodyne character of technicised language, which is the stock-in-trade of military planners. It tells of the 'body count', the balance sheet of war, of 'deep interdiction', 'air superiority', armed reconnaissance', 'close air support' (25), or 'collateral damage'. But this language has to do not only with the elision of the bodily pain of the 'foe'. It also performs the oscillatory interpellation of virtual combat which secures bodily pleasure without bodily pain, and so enacts a special sort of narrative blindness (26).

This is a second form of machinic pleasure, that of virtual combat. I believe that it performs itself both in the web of our narratives and in the web of narratives of those whom we study. And perhaps it is particularly dangerous because it may be that simulation is the opiate of the intellectuals (27).

Passivity

This is somewhat different. I have talked about it with a number of people, men and women, and many though not all of them experience it, as do I, though in diminishing degree. It is a kind of thrill mixed with a small dose of fear when the aircraft in which we are travelling starts its take-off.

It is waiting at the end of the runway. The pilot runs through his final pre-flight checks and applies full throttle to the engines. The noise mounts through a whine to a full-throated roar, the fabric of the cabin creaks, the windows crackle, and suddenly we are being pressed back into our seats as we accelerate into the take-off run. This is the greatest moment of excitement, the first few seconds of the takeoff, all that power, all that potential, the punch in the small of the back. And then the excitement diminishes as, gathering speed, the nose wheel lifts, and a second later the main undercarriage also lifts off the runway. With a clunk the wheels are retracted. We are airborne, and suddenly there is much less noise.

The routine is one of utter banality. It happens thousands and thousands of times a day, and the reactions vary. Some are simply terrified, sweating as they grip the armrests, knuckles white. Others simply seem to be oblivious to what is going on. Perhaps they have flown two hundred or five hundred times this year already. At any rate they read calmly, all the way through take off. The noise, the acceleration, none of this seems to make any palpable

difference. Yet others are thrilled, no doubt in some version or other of the way I described my declining pleasure above. But what is the character of this fading interpellation? To think about this I want to return to Tom Wolfe and tell another of his stories.

He disapproved of those who opted into the NASA program. They were, he said, like 'spam in a can'.

Well, right he was, in a way. They were like spam in a can. The first astronaut was a chimpanzee who was given various little tasks to do during the brief flight which had nothing whatsoever to do with the control of the mission. And the humans that followed in the cramped Mercury cabins were little, and only a little, different. Indeed, they'd spent much time arguing with the administration about their role. Could they have a window to look out of? Could the controls be re-designed to allow them some piloting role? The administration gave way on both points, but the concessions were minor. Sitting, as they did, on top of a huge three-stage set of rocket boosters controlled from a bunker at Cape Canaveral, they simply went up if the mission worked at all. With, of course, the knowledge that if something went wrong that was likely to be the end of it all.

Spam in a can. Yeager's insult catches something important about the Mercury program. But it also works for the passengers in a civilian aircraft because the two circumstances are similar. We are also spam in a can. Crushed together inside a cabin, and belted into our seats, we can hardly move and have not the faintest possibility of controlling anything. But all the while huge physical forces are working their best or their worst upon our bodies – are experienced in or by our bodies. There is a heaviness that is irresistible, a weight that binds us to our seats, together with the knowledge or the fear that if something goes wrong there is nothing to be done. Our bodies will be broken beyond repair.

So what is the pleasure, the pleasure of this performance? No doubt there are many possibilities but I want to think about distribution, the distribution of agency, and the way in which that distribution plays across the body and its others.

Agency: oxymoronically, this is the capacity to act. But what does this mean? The answer is that it is capacity to initiate, the capacity to control, and the ability to make a difference. Stick with the last of these, the ability to make a difference. In virtual combat, as in heroic agency the subject is constituted so that it can make a difference. But this is not the case here. This is the point: nothing we do will make any difference. We have been distributed from activity to passivity. The locus of agency has been taken away and it has been distributed into materials beyond the body. Spam in a can.

And the pleasures? Well, there is an economy here, an economy that turns around the renunciation of agency. I guess that there are at least three interrelated parts to this economy.

One: there is the fact that there is no possibility of acting. But this is an interpellative distribution which is not necessarily a matter for despair or pain. For with the inability to act come the pleasures, the luxuries, of fatalism, of waiting, of waiting for the machinic, the natural, the divine, to act on and through the body. So there are the pleasures of fatalism, fatalism which has been understood so negatively in most Western discourses, so negatively and therefore so wrongly. For it is indeed its own form of pleasure, its own form of comfort, this distribution into passivity.

Two: there is the matter of caring, for there are pleasures in being cared for, of being looked after, of being held up, in the belly of the monster or by the wings of the divine. The word 'trust' is bandied around much too easily in social theory, but I need to use it here, for there are pleasures in trusting enough to 'allow' the distribution of agency out of the body into other materials, the hands of a carer, the belly of a technological whale, or a machinic mother (28). These are the pleasures of being cared for. Again, we don't have this very well in focus in the larger discourses of contemporary Western culture where such pleasures are often discursively built as a regression, or into the asymmetrical gendering complexes that divide public from private – which divisions may, in a world constituted in such asymmetrical terms, be all right in so far as they go. And no doubt link with its rejection in the form of heroism and other forms of control, and with the endless discourses about 'enterprise'. But I take it that we might treat passivity, the non-performance of agency, as an interpellative erotics in its own right, which expresses itself in many places, including the public domain.

Three: there is the luxury of non-responsibility. Note that: not <u>ir</u>responsibility which implies a distributive moral judgement which for the moment I want to avoid. Not <u>ir</u>responsibility but <u>non</u>-responsibility – that is of not being required to take responsibility for anything, for others or, indeed (and this is the crucial point here) for oneself. All of which is intimately linked to the performance of agency. So it is something like this: that agents are built up as moral last resorts. They are created as locations which may have to account for their actions to themselves, to others, to God because they could have acted otherwise, because (as the narrative runs) they had a choice. But held in the belly of the machinic mother, the machinic whale, rendered passive for a moment, there is no choice. Spam does not choose. Rather, it is carried. And if any errors and derelictions are being committed, then these are being made somewhere else, distributed to the Other. And it is the Other, some component of the Other, that will be made accountable (29).

Fatalism, being cared for, non-responsibility, the distribution of agency and its adjuncts into and out of the body. Again, pleasure plays on in-body/out-of-body ambiguities and oscillations. It is like heroic agency and virtual combat, but here the performance is different, for in those cases pleasures have to do with the ways in which subjectivity distributes itself in a form of oscillation, into the body, and out again. But here that which moves is no longer subjectivity. Instead, it is <u>agency</u> – while subjectivity is obstinately located in the body throughout. Into the pleasures of passivity and non-responsibility of agency. Whereas it is agency that flits to and fro. Into and out of the flesh.

And what, then, would this mean for our narratives?

Answering this question could take us a long way from machines – for instance, into political philosophy. So I will try to make a simple answer in two parts.

The first is this: passivity, and particularly the pleasures deriving from passivity, will be repressed. For the lesson is this. The body, or so it seems to me, recognises an interpellation into passivity that is discursively much less easy to practice, at any rate in the world of projects and military technologies. Or, to put it more precisely, the body recognises in passivities pleasures, physical and more, where the narratives of agency recognise only failures. These may be failures, perhaps, in technical competence, and/or, in moral responsibility (as in the phrase 'I was only following orders') which are therefore pressed to the margins or pasted on afterwards in a performance of moral denunciation – which, however, though it happens, also misses the point. For if the interpellation into passivity is a pleasure in its own right, then the question is how far those pleasures are present in the performance of military machinics. Which, is not, I think, a question that appears in the narratives of warplanes. But we don't know why. We don't know how far such interpellative pleasures are repressed by other narratives of military interpellation, narratives about the right stuff. All of which, however, suggests that would be wise, as Sharon Traweek perhaps implies, to be suspicious if we find that we are performing stories in which the only passive human agents are those who have failed in one way or another (30).

The second fixed point is different. It is that it might be wise to be suspicious if we find, or more particularly find ourselves performing, narratives in which it is only possible to be active if one is a person. It is, of course, a semiotic, and in particular an actor-network, saw, that the demystification of the world should not act as a fixed point in the narratives and that others – such as aircraft – may indeed act to perform the pleasures of passivity on, or in relation to, the human subject. Here I simply want to note that the distribution of agency, the way in which it moves, is not simply a matter of analysis, but also of practice, and the practice of pleasure. Agents, non human agents, may be imagined as pleasuring human and passive subjects. Which is, however, a narrative form rather far removed from those which perform themselves in the dominant stories about military aircraft.

So this is a third form of machinic pleasure: passivity, renunciation of agency, and lying in the arms of the machine.

Enumeration

It is a bookshop, perhaps Dillons, the big Dillons in London, though any bookshop will do. You are interested in technology, in machine technologies, and specifically in military aircraft. You ask for directions and are sent to a corner, a rather large corner somewhere downstairs with a lot of shelves and a lot of books, a very large number indeed. They are books on military aircraft.

Very good. You have found what you are looking for. And you start to browse. But then you discover that few, perhaps none, are organised in a way that has anything to do with the social shaping of technology. And indeed that equally few have anything to do with the narratives of history – though if you are lucky you may, perhaps, find some histories of the Royal Air Force, or accounts of aerospace companies. For the shelves are filled, filled with descriptions of aircraft types. There are books which list, describe, and illustrate the aircraft of the Royal Air Force; or the US Air Force; or Western fighting aircraft; or helicopters; and then there are books which describe the different versions of specific aircraft; the Harrier jump jet; the Tornado; the Mirage IV; the Jaguar; the F111 series, or whatever.

If you look at these books, to be sure, they vary. Some are full-length monographs which describe the design process and the evolution of a particular aircraft type. Works of this kind are substantial. They may not make use of the disciplinary apparatus of STS, but their concerns are recognisable in that mode. But many books are much smaller. They may, for instance, take the form of compendiums of different aircraft types; they contain many colour photographs, often supplemented by line drawings of the plans or profiles of the machines; and they offer a brief technical description, often biased in favour of that which may be quantified; size, role, power plant; maximum speed; typical mission and cruise speed; maximum altitude; armament; something (though perhaps not very much) on the electronics of the aircraft; mission and ferry range; manufacturer; the names or serial numbers of different versions; physical differences between these versions; and differences, also, in terms of role and armament; the numbers of each manufactured; etiquettes and forms of camouflage; and then a chronology organised around a number of specific dates; dates of first flight; dates of introduction into different air forces; dates or circumstances of combat; and (if this has taken place) dates of withdrawal from service.

So what, here, are the narrative fixed points?

I want to propose an answer in terms of a series of absences – for these are descriptions which do not answer what one might take to be the standard narrative questions about the connections between things, events or objects. I think they fail to do so in two particular ways. First, they tell us virtually nothing about <u>why</u> a particular aircraft came into being. Why it was needed. Why it took the form that it did. Why it was introduced, or indeed not introduced. There is, then, no explanatory chronology, but merely a series of dates. No causes. Second, they tell us virtually nothing about <u>how</u> it was that matters related to one another. For instance, the relationship between types. Between components of the aircraft. Between the aircraft and what we like to call its Others. They do not, that is, offer a recognisable semiotics of technology.

No why; no how. So what is left? The answer is an overwhelming concentration on <u>what</u>. A concern on what it, the object in question, is. And then on what it looks like.

So what is the subject interpellated by such publications? The response is going to be this: that we are in the presence of a <u>subjectivity of enumeration and distinctiveness</u>. For these publications make, perform, a world of objects that fall into groups or classes (though the notion of class implies a semiotic concern with the character of difference that I am not persuaded is working in the present case). And the pleasure is in <u>enumerating</u> the objects, <u>distinguishing</u> between them, knowing them apart, knowing them apart, or so I guess, comprehensively and often visually in terms of recognition (31).

This means that the object is flattened, rendered passive. It is placed, as it were, within an array provided for it by a two-dimensional cabinet of curiosities, like the classical episteme explored by Foucault (32). So the subject position? It is tempting to say that this is another version of the god-eye view, and this certainly catches something. But to leave it there does not do justice to its specificities. For this is a form of optics that is not analytical but is rather

syncretic. This is because the pleasure has little to do with the links between different specificities, their mechanisms and, crucially, it has little to do with intervention or control. Indeed, while sustaining an engagement with the world, it may be understood as a renunciation of control. There is no desire to intervene, to make a difference. Rather, the pleasure is in recognition of something that is, that is out there. And in particular, it is in the recognition of specificities. Note that this is not a recognition of detail – for detail is hierarchically ordered through echelons. It is, as it were, specificity after this has been rendered small. Whereas the pleasure here is not tiered. Rather it is flat. The eye looks onto the specificity of a surface made of detail.

So the subject position is achieved in recognition. This is not the 'land-ho' recognition of the hero but the impress of a plan, a set of specificities already in the world onto the receptive surface of the subject, a surface like an ordered set of photographic plates. It will achieve the pleasures of its subject-position by recording, by recognising, by enumerating, by completing its recognition – by knowing its place in the world and reminding itself of its place, in the act of recognition.

I doubt whether this is a subject-position very strongly performed within the narratives of the air forces of the world or in those of the students of science, technology and society. But I include it because, at least in the UK, this pre-modern version of pleasure is so common, and because it interacts with the larger narratives of control, system, heroism in ways that may complement those larger narratives. I include it, in other words, because it is a form of machinic pleasure that performs an intertextual political problem.

Completion

The Tern Valley Steam Festival takes places, once a year, in a field outside the small town where I live. It brings together enthusiasts for old machinery. Giant traction engines, vintage lorries, motor bikes, belt-driven threshing machines, old cars. Some of these are aesethetically interpellative – they are, at least in many eyes, quite beautiful. But my interest is drawn to other forms of pleasure, for there is a whole section of the festival given over to small engines of one kind or another.

If one looks at these carefully, the way in which they are displayed seems to follow a formula. Those who own them set them up on stands or tables. They feed them with fuel, for instance with coal and water – and then they run, the engines that is. But it isn't enough that they run. It is also important, or so it appears, to show that they are capable of doing work, work made visible. So they are arranged to pump water which they draw up a pipe from a bucket and then squirt out of a tap so that it falls back into the bucket. And, completing the cycle, is sucked up the pipe once more. Round and round and round.

For some reason the water (I assume it is water) is almost always green: a lurid fluorescent green.

Putting one of these machines on display appears to be the excuse for a family outing, a weekend away from home. For the people, often older couples, who run them often seem to have brought a caravan. They sit and drink tea and they watch over their machines. And you watch them.

What are the erotics here? I have an hypothesis, for I am distantly interpellated. My hypothesis is that it is an erotics of machinic completion. Everything is, as it were, self-contained, self-feeding, self-regulating. The machines pump water in a closed circuit. Figuratively (not literally to be sure) it seems that they feed themselves. And the isomorphism of (self-feeding) owners and machines is, well, rather striking. Self-reliance, autonomy, and within that autonomy the performance of perfect control.

Perfect control. The dream of a machine so perfect that it no longer depends on its environment for anything; so perfect, in other words, that it is autonomous; so perfect that it maintains itself. There are so many possible tropes here. Cybernetics; the epistemic regimes in high energy physics described by Karin Knorr-Cetina (33); large technical systems, centres of calculation and their translations (34); one thinks, in general, of foundational régimes; régimes, that is, that can defy time, defy entropy, and perform themselves immutably and reliably, for ever.

The pleasures, then, are those of control; control through regulation; through self-regulation; through domestication; inclusion within the system of anything that might previously have disrupted; through the colonising of the Other (35). And there is another implication: that of flattening. For the self-regulating system might be heterogeneous. This is what actor-network theory is all about. But it cannot be radically heterogeneous in the sense intended by Lyotard (36). It cannot, that is, be imagined without being assimilable – which means, once again, that the unassimilable is, well, unassimilable.

But if we are interpellated in this way, if we recognise and respond to the need for perfection, then what are the fixed narrative points?

The simplest answer is that if we're interpellated like this then we will tend to perform autonomy, perfection, integration and feedback, as opposed to anything that might 'disrupt' that autonomy. This means that the fixed points will turn around a dualism, order/disorder (37). We won't be good at coping with or telling of incompleteness, for we will tend to imagine it as disruption which might be ironed out if only we were to make another effort.

This sounds drearily familiar. Indeed I suggest that it turns up in one form or another both in our own narratives and in those performed within and through the objects that we study. This is something to be noted: the myopia of a commitment to perfection, to holism, to coherence, to integration that is implied in the modern project. For if I take the case of the steam machines this is because they are not so far removed from many of the stories performed for other much larger and more contemporaneous projects. The only difference is one of scale. The fields round Market Drayton are host to a modest version of modernism, one that really can resist entropy and achieve completion for a day or two.

Extension

He guided us in the woodwork class; his name was John; large; gentle; he didn't give us lessons, us the neophytes, but he suggested projects; objects that we might make; bird boxes; plate racks; whatever.

I suppose that there were twenty of us. And he wandered round, offering advice. Helping where it was needed. He had a knack of being on hand just before one was about to make an irreparable mistake. And he also knew about tools, for instance, about the plane. For it turns out that planing wood is not a particularly straightforward matter. If you go at it with the enthusiasm of the beginner, you end up with a nice smooth surface but one that is also gently curved. But what to do?

There is advice, advice that can be given orally. Apply a gentle pressure in the middle of the piece of wood. Reduce that pressure towards each end of the plank. Or, press just a little on one side of the plane here; and the other side there. With practice, with this advice, and with a guiding hand, some of us slowly acquired the skill, embodied the skill, that was need to plane a piece of wood; and plane it satisfactorily; smooth, flat and square.

What is the logic here, the logic of machinic, or should I say technical, love? For it is, to be sure, at least at the outset when it is being acquired a pleasure, a rich source of pleasure.

The argument I want to make is that it is the pleasure of prosthesis, that of the extension of the body, the smooth extension of the body into what Philip Fisher, talking of art and still life painting, calls the hand-made space (38). The hand-made space is the place where the boundary between the body and the tool is no longer distinct; where there is hand-eye co-ordination; where there is, to be sure, a kind of control. But it is where the control is limited, limited, as it were, to the end of the arm and its extension. And where (most important) the control depends on, performs, a kind of continuity. For if it might be said that the plane is 'controlled', this is no longer the experience, or at any rate only a part of it. For instead, or as well, the plane has become a part of the body – or the body extends into the plane.

Continuity. Which implies a distribution, some kind of decentred version of agency across person-and-plane.

So it is with many tools. Woodworking tools, Violins, bicycles, motor cars, wheelchairs, for all I know aircraft. But if we were interpellated this way, then what could it mean? How would the fixed points perform themselves?

I would want to be very careful of holistic eulogies, humanistic celebrations, and of narratives that attempt seduction by taking us on detours into the love of craft. For these continuities between body and matter, of course they are important. Indeed their narration is an important thread in technology studies and performs itself in all sorts of ways through machinic materials. But such narratives still need to be resisted, at any rate if they lead us in the direction of craft-and-gemeinschaft telling of whole subjects and a cosy relationship between the human subject and her tools - instead of, for instance, telling about cyborgs with their decentering and their multiple subjectivities (39).

Beauty

The military aircraft that I was studying, the TSR2, had endless teething troubles. There were problems with the undercarriage and potentially fatal difficulties with the engines. But no member of what they like to call the 'the general public' knew anything of these difficulties. So what we saw on a day in the autumn of 1964 was an aircraft taking off on its first flight. Not any old aircraft, but a white aircraft, an aircraft that was sleek, swept-back, a set of cutting edges and sharp angles. What we saw was, let's say it, an object of beauty accelerating down a runway, and then soaring into the air. For if the television showed it taking off, then the stills in the newspapers caught it at the moment of lift-off with the wheels perhaps a metre from the tarmac. And the stills froze the aircraft for ever so, suspended like a bird between heaven and earth. Suspended. Frozen.

Or floating.

Interpellation? To be sure, the word 'beauty' is a give-away here. To 'recognise' the beauty of a machine is to be interpellated. It is the performance of a subjectivity that stands in an aesthetic relation to an object. The Mona Lisa; Le Corbusier's Unité d'habitation; the Forth Railway Bridge.

The term 'aesthetics' is troublesome; it is too closely related to an essentialist philosophy of beauty (40). But, without getting bogged down in aesthetics, we may still ask about the consequences of interpellation by machinic beauty. About the effects of the aesthetic appreciation of an aircraft.

No doubt there are various possibilities, but I want to imagine two: contemplation; and redemption.

Beauty: in the construction being made here, it is visual; a specific form of optics. But what is the optical subject-position? Answer: it is contemplative. For it is a form of optics that removes us some distance from the object. I use the term 'some distance' advisedly, for if we move too far we do not see the object of beauty at all, while if we are too close, again we do not see it. We begin, instead, to see something of its 'detail', perhaps of its mode of construction. We begin, to use Oliver Cromwell's phrase, to see things warts and all. But the construction of a contemplative subject in the middle distance, this is a recipe for passive admiration, for scanning in the absence of action. It is a kind of passivity (41).

Contemplation. This is the production of a particular subject-position. But after contemplation comes redemption: the act of fulfilling; of rescuing, reclaiming; of being delivered, in the Christian message, from sin (42). So redemption has to do with making whole, with joining together and, it follows, with absorption, with being united. This is, I think, the interpellative character of the vision of this aircraft, the TSR2 taking off. To use Louis Althusser's terms, it has to do with joining the subject to the Subject, a Subject which can transcend divides, divides between knowing subject and the Object and, not least, between heaven and earth. Between the soaring freedom of the skies and the imprisonment in the mundanities of the earthly body (43).

Contemplation demands distance and passivity, both. And the passivity, ironically, makes a space for absorption, absorption into an imagined whole, an essential whole. Which suggests that we are in the presence of another in-body/out-of-body oscillation, and perhaps one that shares some features with heroism, the first of the machinic pleasures.

Is this a trouble for the narratives of technology? The answer is: I don't know. It is, of course, a huge pitfall for the narratives of art, the aesthetic search for redemptive beauty against which so much contemporary art theory struggles. And it is also, as is obvious, a gender-heavy trope. In the male vision the object of beauty, the Subject, is performed as one version or another of the Madonna. But in technology I am less sure. For if it, technology, carries redemptive narratives – and those of heroism certainly fall into this category – then I am less sure that these are likely to be passive and contemplative.

But what I <u>do</u> think is this. Perhaps strangely, this aircraft, the TSR2 interpellated me in part in this way. The recognition which performed me as a passive subject when I encountered it again years later in a museum and decided to study it as an STS object had partly to do with redemption (44). A sense of the possibility of being rendered whole, in the act of being absorbed. A redemption that returned me twenty years. To the obscure sense of loss that I encountered when the cancellation was announced. To a place suspended, most beautifully, between heaven and earth

I was, of course, quite wrong. Quite wrong, because it is not possible to both to contemplate the possibility of redemption through beauty and to anatomise that beauty, not, at any rate, in the same narrative. But that is another story.

Conclusion

I found myself pressed into the subject of machinic interpellations in the course of a project on military aviation. I have touched on this from time to time above – for a number of the examples have to do with the aircraft which I was studying, the TSR2. As I explored the narratives of this aircraft project I started to become suspicious, both of the narratives themselves, and the links between those narratives and my own interest in the aircraft. This is a story that I explore more fully elsewhere, but this suspicion led me to ask as I have in this paper: how are subjects interpellated by machines? What are the pleasures of machines? What, in particular, are the male pleasures that are made in the knowing and telling of machines? And what are the obviousnesses and the blindnesses?

Suspicious I was of myself and the narratives of military technology. But equally suspicious, I was, of those narratives which told in a simple way about male machinic pleasures as if these were either straightforward or uniformly undesirable. My sense, and it is a sense that I have tried to illustrate and explore in this piece, is that the interpellations of machinic erotics are complex and specific. It is also that many of those pleasures are innocent enough. While to be sure, some, perhaps many, are not. So, or so I am suggesting, it is important to search through the complexities of specificity if we are to understand what it is that makes desire, the love of the machinic – or indeed repulsion. And if we are to understand this then we also have to come to terms with the fact that certain kinds of relations come before their telling. That certain kinds of relations <u>frame</u> our narratives, whatever it is that we tell about machines. And it is with this thought, indeed, that I want to stop. That there is indeed every reason to be suspicious of our machinic narrations. For these, too, make the silences of desire. And we might well attend to those silences.

Footnotes

(*) I am grateful to the following who, knowingly or unknowingly, have helped to create the intellectual and political space that has allowed me to write this piece: Ruth Benschop; Brita Brenna; Michel Callon; Bob Cooper; Mark Elam; Donna Haraway; Bruno Latour; Nick Lee; Annemarie Mol; Ingunn Moser; Marilyn Strathern; Sharon Traweek; Helen Verran-Watson.
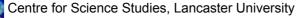
(1) See, for recent attractive examples in STS, Gusterson (1995a; 1995b), Stone (1995a) and Traweek (1988; 1995a;1995b).

(2) See Althusser (1971a).

(3) Other machinic pleasures would include those of bricolage. And torture.

(4) I am grateful to Mark Elam from whose extensive studies I draw the term 'heroic agency'.

(5) Tom Wolfe's (1980) book, <u>The Right Stuff</u>, describes the early stages of the US space program. And, in particular, the difference in erotics between those who believed that space

craft should be manned by pilots who would fly them into space, and those who, whether wishing this or not, ended up sitting, as it were, in the noses of huge fuel tanks which would boost them into space without any intervention on their part at all. For a very brief discussion, in the context of the masculinity of culture, see Wajcman (1991).

(6) A point argued by many authors. But see, for instance, de Lauretis (1987).

(7) Note that there is evidence that the erotics of military aircraft have been subject to change, at least in the United States. Stanley Rosenberg, exploring the narratives of World War Two bomber pilots, and comparing them with those of USAF pilots in Vietnam, observes that pleasures become increasingly entangled with the machine itself. The Yeager pattern, telling of drinking and whoring, is replaced by an explicit technological erotics. See Rosenberg (1993).

(8) This is again commented on in the paper by Rosenberg (1993).

(9) Talk and performance: what is the relation here? Interviews of the British Tornado pilots responsible for some of the most hazardous low-level missions in the Gulf War (which appeared in the second part of a four part series called 'Thunder and Lightning' Broadcast by BBC1 at 10.45pm on Tuesday 9th January, 1996) revealed that there were long, long moments when they were terrified. Is transcendence a luxury for the officers' mess?

(10) Allucquère Rosanne Stone suggests that nature is a strategy for maintaining boundaries, keeping technology visible, and so distinguishing it from our 'natural' selves. In the very specific context of military flying, this interesting suggestion perhaps works better for pilots of the Yeager generation than those who flew in Vietnam or the Gulf. See Stone (1991).

(11) At any rate the stories that I know in STS tend to avoid performing themselves in this way — though they are about missiles rather than about combat aircraft, where the possibilities for the erotics of heroic death are limited. See Donald Mackenzie's (1990) study of missile guidance technology; and the much earlier study of the Polaris program by Harvey Sapolsky (1972).

(12) I explored some of the difficulties of dealing with charisma for the investigator in Law (1994), though the context was very different.

(13) There is evidence that the technicised narratives of military machines are juxtaposed with visual material which tells a different, heroic and gendered story. I develop this argument in Law (2001).

(14) See, for instance, Sherry Turkle (1984), and Allucquère Rosanne Stone (1991).

(15) Michael Heim writes: 'Our fascination with computers is more erotic that sensuous, more deeply spiritual than utilitarian. Eros, as the ancient Greeks understood, springs from a feeling of insufficiency or inadequacy. While the aesthete feels drawn to casual play and dalliance, the erotic lover reaches out to a fulfilment far beyond aesthetic detachment' (Heim :1991:61).

(16) I take the term 'imaginary' from Helen Verran-Watson (1994). For further discussion of the political implication of real/non-real dualisms and the ontological politics (or epistemic imaginaries) that might exist between real and non-real see Law (1995).

(17) Sporting metaphors are ubiquitous in military worlds. See, inter alia, Cohn (1993).

(18) To mix styles, here one is tempted to say that the neogothic engorges itself with the baroque. There is a whole economy of pleasure here, performed for instance in the novels of Tolkien, which resides in the exhaustion of detail, its mastery. I will discuss this briefly below.

(19) See Cohn (1993).

(20) The relationship between subjectivity and body is a matter of intense debate, and is considered by other contributors to this volume. But see, for a summary, Allucquère Rosanne Stone's (1991). Though arguing that subjectivity is in a process of profound change, she returns us, in the end, to the body.

(21) Which means that the narratives of virtual combat are hierarchical. That, they distinguish between means and ends. Where the ends are given. By the interpellation. And the means? They have to be assembled. As they say, 'resourcefully'. This suggests that questions of

ethics or politics are pushed beyond the framework of the game. Become Other, a part of the unassimilable.

(22) The move involves a conversion of uncertainty, indeed of mystery, into risk. Which may, at least in the ideal case, be calculated.

(23) The play between representation and the reality/not reality of the referent. Between the making of a subject within the world and one that lies outside it. How is this achieved? It seems that there are two great possibilities. The first starts from a place which performs no 'real' outside world. And strives to create, perform realism. Using, for instance, the 'stunning graphics' of the computer game. Thereby creating, as they say, a 'virtual reality'. A virtual reality which performs a subject-position within that reality. That is the first approach. And the other? This contrariwise, performs itself as a representation of a pre-existing world. Which simulates it. Simulates something that was (as they say) already there. And does so 'realistically'. While, at the same time, detaching itself. Detaching itself from that world. The logic of these various possibilities has been explored at some length by Jean Baudrillard. See Baudrillard (1988a).

(24) See Haraway (1991a).

(25) All terms common to the discourses of military flying in the 1960s. I have taken them from Stanley Rosenberg's account of pilot values in the Vietnam War. See Rosenberg (1993).

(26) My position is related to the important argument about the dangerous anodynity of military language. For a recent example of this see Robins and Levidow (1995) is. Note, however, that I have not here made the argument that simulation is inhumane. There is, to be sure, no doubt that anodyne and dehumanising language is often used to remove military and genocidal action from the discomfort of moral discourse. And there is the corresponding argument that combat should always take bodily form (for a science fiction example see Tepper (1989)). But here I am concerned, specifically, with the pleasure of virtual combat which I believe, as I have argued, to relate to in-body/out-of body oscillation, and the irresponsibility that this performs.

(27) Following Weber, Colin Campbell (1987) makes the argument that ascetic Protestantism generated the possibility of an intense interior life which led, not only, to economic activity but ultimately, via several displacements, to consumerism. Many of the pleasures being described here seem to depend on such an imaginative life.

(28) I am grateful to Annemarie Mol for discussion in which she pointed out the link between responsibility, irresponsibility, and parenting. The metaphor is creatively developed by Sara Ruddick (1993) in her exploration of the character of control. She points out that parents - and no doubt particularly mothers in a society that is predominantly patriarchal - can have power to control their children, and that responsibility arises in not abusing that power. She uses this as a metaphor for thinking about war and peace, recommending an approach based on such caregiving.

(29) Which is the space where irresponsibility performs itself. Where agents that had a choice, or better, can be performed as having a choice, chose to do that which was wrong.

(30) Her point is a comment on the dominant narrative style of high energy physics: 'nature coupled with genius authorises science'. (Traweek : 1995a:217).

(31) It would be wrong to imagine that the erotics of enumeration are specifically technological. Though there are many machinic versions (another example would be 'train spotters', an interpellative phenomenon common at least in the UK) some kinds of bird watchers are no doubt interpellated in much the same way. Why the interpellation by this as opposed to that? I have no idea.

(32) See Foucault (1970), and for an analogous discussion in the context of high energy physics, Traweek (1995a).

(33) See, for instance, Knorr-Cetina (1996).

(34) On large technical systems, see Hughes (1979); on centres of calculation Latour (1990).

(35) On the 'undiscovered continent' implied in such colonising, see Lee and Brown and (1994).

(36) See Lyotard and Thébaut (1985).

(37) An argument beautifully mounted by Bob Cooper. See his (1986).

(38) See Fisher (1991), Chapter 8.

(39) As, for instance, in the celebrated essay by Donna Haraway (1991b), though see also Stone (1991; 1995b).

(40) I am grateful to Michel Callon and Antoine Hennion for discussion on this point.

(41) Two comments. First, in optics usually the object is imagined as passive. See the massive review of the supposed French distrust of the eye in Jay (1993). But reading Michel Foucault on subjectivity suggests that matters are not that simple. See, for instance, Foucault (1979; 1982). Second, the point is, no doubt, related to what Donald MacKenzie has called the 'certainty trough'. 'Between those very close to the knowledge-producing technical heart of programs, and those alienated from them or committed to opposing programs, lie the program loyalists and those who 'simply believe what the brochures tell them'.' (MacKenzie: 1990:371)

(42) On the iconography and narrative structure of Euro-American technological, scientific and personal story-telling, and its links to it Judaeo-Christian precursors see Haraway (1997).

(43) It would be possible to make much more of business of losing weight. Of floating. In the first instance, in a specifically physical mode. Thus after take-off the engines are throttled back. This is a pleasure that a substantial number of passengers, men and women both, appreciate. Moving in and out of clouds. Out of and into the sun. So far removed from the ground. Seemingly independent of the pull of gravity. Like a bird. The body removed from its usual constraints. Another out-of-body experience. But one, indeed, with religious and transcendental connotations. See Bruno Latour's (1995) study of the Assumption and its depiction in art.

(44) Museum? Amongst the various links I would make to the literature here I would count: Donna Haraway's powerful account of the dioramas of great apes mounted at the American Museum of Natural History (see Haraway :1989). For the particular case of TSR2 see Law (2000 and 2001)

References

Althusser, Louis (1971a), 'Ideology and Ideological State Apparatuses (Notes towards an investigation)', pages 121-173 in Althusser (1971b).

Althusser, Louis (1971b), Lenin and Philosophy and Other Essays, London: New Left Books.

Baudrillard, Jean (1988a), 'Simulacra and Simulations', pages 166-184 in Baudrillard (1988b).

Baudrillard, Jean (1988b), Selected Writings, Cambridge: Polity Press.

Benedikt, Michael (1991), Cyberspace: First Steps, Cambridge Mass.: MIT Press.

Campbell, Colin (1987), The Romantic Ethic and the Spirit of Modern Consumerism, Oxford: Blackwell.

Cohn, Carol (1993), 'Wars, Wimps and Women: Talking Gender and Thinking War', pages 227-246 in Cook and Woollacott (1993).

Cooke, Miriam and Angela Woollacott (eds.) (1993), Gendering War Talk, Princeton: Princeton University Press.

Cooper, Robert (1986), 'Organization/Disorganization', Social Science Information, 25, 299-335.

de Lauretis, Teresa (1987), Technologies of Gender: Essays on Theory, Film and Fiction, London: Macmillan.

Dreyfus, Hubert L. and Paul Rabinow (eds.) (1982), Michel Foucault: Beyond Structuralism and Hermeneutics, with an afterword by Michel Foucault, Brighton: Harvester.

Fisher, Philip (1991), Making and Effacing Art: Modern American Art in a Culture of Museums, New York, Oxford University Press.

Foster, Susan Leigh (1995) (ed.), Choreographing History, Bloomington and Indianapolis: Indiana University Press.

Foucault, Michel (1970), The Order of Things: an Archaeology of the Human Sciences, London: Tavistock.

Foucault, Michel (1979), Discipline and Punish, Harmondsworth: Penguin.

Foucault, Michel (1982), 'The Subject and Power', pages 208-26 in Dreyfus and Rabinow (1982).

Galison, Peter and D. Stamp (eds.) (1996), The Disunity of Science. Boundaries, Contexts, and Power, Stanford: Stanford University Press.

Gray, Chris Hables (ed.) (1995), The Cyborg Handbook, New York and London: Routledge.

Gusterson, Hugh (1995a), 'Becoming a Weapons Scientist'. pages 255-274 in Marcus (1995).

Gusterson, Hugh (1995b), 'Short Circuit: Watching Television with a Nuclear-Weapons Scientist', pages 107-117 in Gray (1995).

Haraway, Donna (1989), Primate Visions: Gender, Race and Nature in the World of Modern Science, London: Routledge and Chapman Hall.

Haraway, Donna (1991a), 'Situated Knowledges: the Science Question in Feminism and the Privilege of Partial Perspective', pages 183-201 in Haraway (1991c).

Haraway, Donna (1991b), 'A Cyborg Manifesto: Science, Technology and Socialist-Feminism in the Late Twentieth Century', pages 149-181 in Haraway (1991c)

Haraway, Donna (1991c), Simians, Cyborgs and Women: the Reinvention of Nature, London: Free Association Books.

Haraway, Donna J. (1997), Modest_Witness@Second_Millenium .FemaleMan©_Meets_Oncomouse™: Feminism and Technoscience, New York and London: Routledge.

Heim, Michael (1991), 'The Erotic Ontology of Cyberspace', pages 59-80 in Benedikt (1991).

Hughes, Thomas P. (1979), 'The Electrification of America: the System Builders', Technology and Culture, 20, 124-161.

Jay, Martin (1993), Downcast Eyes: the Denigration of Vision in Twentieth-Century French Thought, Berkeley: University of California Press.

Knorr-Cetina, Karin D. (1996), 'The Care of the Self and Blind Variation: the Disunity of Two Leading Sciences', Galison and Stamp (1996), 287-310.

Latour, Bruno (1990), 'Drawing Things Together', Lynch and Woolgar (1990), 19-68.

Latour, Bruno (1995), 'The Assumption' Paris: mimeo.

Law, John (1994), Organizing Modernity, Oxford: Blackwell.

Law, John (1995), 'Against Politics', mimeo, Keele University.

Law (2000), On the Subject of the Object: Narrative, Technology and Interpellation, Configurations, 8, 1-29.

Law, John (2001), Aircraft Stories: Decentering the Object in Technoscience, Durham, N.Ca.: Duke.

Lee, Nick and Steve Brown (1994), 'Otherness and the Actor Network: the Undiscovered Continent', American Behavioural Scientist, 36, 772-790.

Lynch, Michael and Steve Woolgar (eds.) (1990), Representation in Scientific Practice, Cambridge, Mass: MIT Press.

Lyotard, Jean-François and Jean-Loup Thébaut (1985), Just Gaming, Manchester: University of Manchester.

Mackenzie, Donald (1990), Inventing Accuracy: a Historical Sociology of Nuclear Missile Guidance, Cambridge, Mass.: MIT Press.

Marcus, George E. (ed.) (1995), Technoscientific Imaginaries: Conversations, Profiles and Memoirs, Chicago: University of Chicago Press.

Robins, Ken and Les Levidow (1995), 'Socializing the Cyborg Self: the Gulf War and Beyond', pages 119-125 in Gray (1995).

Rosenberg, Stanley D. (1993), 'The Threshold of Thrill: Life Stories in the Skies over Southeast Asia', pages 43-66 in Cooke and Woollacott (1993).

Ruddick, Sara (1993), 'Notes Towards a Feminist Peace Politics', pages 109-127 in Cooke and Woollacott (1993).

Sapolsky, Harvey (1972), The Polaris System Development: Bureaucratic and Programmatic Success in Government, Cambridge, Mass.: MIT Press.

Stone, Allucquère Rosanne (1991), 'Will the Real Body Please Stand Up?: Boundary Stories about Virtual Cultures', pages 81-118 in Benedikt (1991).

Stone, Allucquère Rosanne (1995a), 'Innocence and Awakening: Cyberdämmerung at the Achibe Research Laboratory', pages 177-195 in Marcus (1995).

Stone, Allucquère Rosanne (1995b), 'Split Subjects, Not Atoms; or, How I Fell in Love With My Prosthesis', pages 393-406 in Gray (1995).

Tepper, Sheri S. (1989), The Gate to Women's Country, London: Bantam Press.

Traweek, Sharon (1988), Beamtimes and Lifetimes: the World of High Energy Physics, Cambridge: Harvard.

Traweek, Sharon (1995a), 'Bodies of Evidence: Law and Order, Sexy Machines, and the Erotics of Fieldwork among Physicists', pages 211-225 in Foster (1995).

Traweek, Sharon (1995b), 'Bachigai (Out of Place) in Ibaraki: Tsukuba Science City, Japan', pages 355-377 in Marcus (1995).

Turkle, Sherry (1984), The Second Self: Computers and the Human Spirit, New York: Simon and Schuster.

Watson-Verran, Helen (1994), 'Re-Imagining Land Title and Ownership: Working Disparate Knowledge Traditions Together', paper presented at the 'Working Disparate Knowledge Systems Together' Seminar, Deakin University, 26-27th November, 1994.

Wajcman, Judy (1991), Feminism Confronts Technology, Cambridge: Polity Press.

Wolfe, Tom (1980), The Right Stuff, London: Jonathan Cape.