How to Talk About the Body? The Normative Dimension of Science Studies

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Falsification

During the conference that provided the occasion for this issue of *Body & Society*, I did a little test and asked everyone to write down what the antonym of the word 'body' was. In the long list I compiled, apart from predictable and amusing definitions like 'antibody' or 'nobody' the most arresting for me were: 'unaffected' and 'death'. If the opposite of being a body is dead, there is no life to expect apart from the body, especially not an after-life, nor a life of a mind: either you have, you are a body, or you are dead, you have become a corpse, you enter into some sort of macabre body count. This is a direct consequence of Vinciane Despret's argument (in this issue) drawing on William James on emotion: to have a body *is to learn to be affected*, meaning 'effectuated', moved, put into motion by other entities, humans or non-humans. If you are not engaged in this learning you become insensitive, dumb, you drop dead.

Equipped with such a 'patho-logical' definition of the body, one is not obliged to define an essence, a substance (what the body is by nature), but rather, I will

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argue, *an interface that becomes more and more describable as it learns to be affected by more and more elements.* The body is thus not a provisional residence of something superior – an immortal soul, the universal or thought – but what leaves a dynamic trajectory by which we learn to register and become sensitive to what the world is made of. Such is the great virtue of this definition: there is no sense in defining the body directly, but only in rendering the body sensitive to what these other elements are. By focusing on the body, one is immediately – or rather, mediately – directed to what the body has become aware of. This is my way of interpreting James's sentence: 'Our body itself is the palmary instance of the ambiguous' (James, 1996 [1907]).

Since discussion of this topic is notoriously difficult, I want to try to approach it by theorizing not the body directly but rather 'body talk', that is, the many ways in which the body is engaged in accounts about what it does. Under what conditions can we mobilize the body in our speech in such a way that we are not immediately led to the usual discussions about dualism and holism? I will do this in two successive ways. First, I want to show the immense difference it makes in body talk if one uses propositions (which are articulate or inarticulate) instead of statements (which are true or false). This will allow me to give back to the body all the material impedimenta that make it sensitive to differences. Then, and more extensively, I will present a different normative definition of what it is to speak scientifically about the body. This 'political epistemology' drawn from the work of Isabelle Stengers and Vinciane Despret will allow me to reach a conclusion as to the conditions under which we can maintain some 'freedom of speech' in body talk: an essential right, I will argue, in the coming time of what has been called bio-power.

Articulations and Propositions

We first have to understand what 'learning to be affected' could mean. I will start with a very simple example, the training of 'noses' for the perfume industry through the use of '*malettes à odeurs*' (odour kits) as described by Geneviève Teil (1998). The advantage of this example is that it is much less dramatic than the medical cases often automatically associated with discussions about the body (see Hirschauer, 1991) while remaining closely associated with the question of aesthetics and skills (see Gomart, this issue), and retaining a close contact with hard-core chemistry.

The odour kit is made of series of sharply distinct pure fragrances arranged in such a way that one can go from sharpest to the smallest contrasts. To register those contrasts one needs to be trained through a week-long session. Starting

with a dumb nose unable to differentiate much more than 'sweet' and 'fetid' odours, one ends up rather quickly becoming a 'nose' (*un nez*), that is, someone able to discriminate more and more subtle differences and able to tell them apart from one another, even when they are masked by or mixed with others. It is not by accident that the person is called 'a nose' as if, through practice, she had *acquired* an organ that defined her ability to detect chemical and other differences. Through the training session, she learned to have a nose that allowed her to inhabit a (richly differentiated odoriferous) world. Thus body parts are progressively acquired at the same time as 'world counter-parts' are being registered in a new way. Acquiring a body is thus a progressive enterprise that produces at once a sensory medium *and* a sensitive world.

The key element that I want to underline in this brief description is the kit itself, the '*malette à odeurs*' which plays in the hands of this specialist the role of the *de facto* standard. Although it is not a part of the body as traditionally defined, it certainly is a part of the body understood as 'training to be affected'. As far as progressive sensation is concerned, the kit is coextensive with the body. The specialist has bottled up contrasts in a systematic way. Through his kit and his ability as a teacher, he has been able to render his indifferent pupils attentive to ever more subtle differences in the inner structure of the pure chemicals he has managed to assemble. He has not simply moved the trainees from inattention to attention, from semi-conscious to conscious appraisal. He has taught them to be affected, that is *effected* by the influence of the chemicals which, before the session, bombarded their nostrils to no avail – effect and affect come from *facere* and are cases of what I have called factishes, that is something that includes an active act of construction in 'facts' as well as in 'fetishes', hence the neologism (Latour, 1996). Before the session, odours rained on the pupils without making them act, without making them speak, without rendering them attentive, without arousing them in precise ways: any group of odours would have produced the same general undifferentiated effect or affect on the pupil. After the session, it is not in vain that odours are different, and every atomic interpolation generates differences in the pupil who is slowly becoming a 'nose', that is someone for whom odours in the world are not producing contrasts without in some ways affecting her. The teacher, the kit and the session are what allow differences in the odours to make the trainees do something different every time – instead of eliciting always the same crude behaviour. The kit (with all its associated elements) is part and parcel of what it is to have a body, that is to benefit from a richer odoriferous world.

It is crucial to find an accurate way to describe this 'learning to be affected', because I want to contrast it with another model that may become parasitic on

my description. In that model, there is a body, meaning a subject; there is a world, meaning objects; and there is an intermediary, meaning a language, that establishes connections between the world and the subject. If we use this model, we will find it very difficult to render the learning by the body dynamic: the subject is 'in there' as a definite essence, and learning is not essential to its becoming; the world is out there, and affecting others is not essential to its essence. As to the intermediaries – language, odour kits – they disappear once the connection has been established since they do nothing but convey a linkage. More worrisome will be the qualification of the connection itself: if we use the subject–object model we will be tempted to ask the question: *how accurate* is the perception by the nose of the odours registered in the kit? We will soon be obliged to recognize that huge differences in the kit are not registered by every nose and that, conversely, some are sensitive to contrasts that have no correspondence in the chemical structure of the purified fragrances. In trying to solve this question of discrepancies among the various accounts, we will thus be tempted to split odours into two: first, odours as they reside in the world – registered by chromatographs and chemical analysis and synthesis (more on this below) – and, second, odours as they are sniffed by an unreliable, wavering and limited human apparatus. We will end up with a world made up of a substrate of *primary qualities* – what science sees but that the average human misses – on top of which subjects have simply added mere *secondary qualities* that exist only in our minds, imaginations and cultural accounts. In the course of this operation, *the interesting body will have disappeared*: either it will be the nature in us, the physiological body, that is, the chemistry of the nose receptors connecting directly with the tertiary structures of the pheromones and other aerosols, or it will be the subjective embodiment, the phenomenological body that will thrive on the lived-in impression provided by something 'more' than chemistry on our nose. No matter how alive we make this supplement of attention, it will always refer only to the depth of our subjection to ourselves, no longer to what the world is really like. This is what Whitehead (1920) has called the 'bifurcation of nature'. Either we have the world, the science, the things and no subject, or we have the subject and not the world, what things really are. The stage is prepared for lengthy discussion of 'the' mind–body problem – and an endless series of holistic arguments to 'reconcile' the physiological and the phenomenological bodies in a single whole.

Now that we are aware of the alternative description, and thus of the trap into which it is so easy to fall, let us try to steer our account away from this entropic trough and keep it as far as possible from equilibrium . . . 'Overcoming the mind–body dualism' is not an aboriginal Big Question: it is simply the effect of

not holding to a dynamic definition of the body as 'learning to be affected'. This is especially salient when we compare what happens to a pupil learning to become a 'nose', with what happens to her teacher devising his odour kit through a long enquiry among 2000 untutored 'noses', and with what happens to the chemists when they try to build instruments and apparatus to register chemical differences in the various disciplines surrounding the industrial branch of perfume manufacturing. Each of these different actors can be defined *as bodies learning to be affected by hitherto unregistrable differences through the mediation of an artificially created set-up*. The sentence is clumsy, but we should remember that it is perilously easy to fall into the alternative provided by the tradition of 'body talk'. Clarity here would be misleading. The pupil needs the one-week session and the kit; the professor benefits from his life-long expertise and the 2000-person test; the organic chemists are equipped with their chromatographs; the industrial chemical engineers possess their plants. All those artificial set-ups are simultaneously *layered* to make my nose sensitive to differences, namely, to be moved into action by the contrast between two entities.

With this other account, I do not have to distinguish between primary and secondary qualities: if I, an untutored nose, need the odour kit to become sensitive to contrast, chemists need their analytical instruments to render themselves sensitive to differences of one single displaced atom. They too acquire a body, a nose, an organ, through their laboratories this time, and also thanks to their conferences, their literature and all the paraphernalia that make up what could be called the *collective body* of science (Knorr-Cetina, 1999). We, the laymen, might not register the same differences. There may exist many discrepancies among untutored noses, but that is not to say that we should draw *one big cut* between my subjectivity and their objectivity, because organic chemists too will slightly and productively disagree among themselves. As to process engineers in charge of perfume manufacturing, they too will elicit many contrasts among them, and also between chemists and organic chemists, against 'noses', and between 'noses' and consumer panels, etc.

The lesson to be drawn from this little example is that bodies are our common destiny because there is no meaning in saying that without my body I could smell better, that without the kit I could become a better nose, that without a laboratory analytical chemists could do better chemistry, or that without plants better fragrances could be industrially produced. . . . A direct and unmediated access to the primary qualities of odours could only be detected by a bodiless nose. But the opposite of embodied is dead, not omniscient.

One way I have found to talk about those layers of differences is to use the word *articulation*. Before the week-long session, the pupils were inarticulate.

Not only in the sense of a conscious and literary sophistication, of their ability to speak about the odours; but they were also inarticulate in a deeper and more important sense: *different odours elicited the same behaviour.* Whatever happened to the world, only the same obstinately boring subject manifested itself. An inarticulate subject is someone who whatever the other says or acts always feels, acts and says the same thing (for instance, repeating *ego cogito* to everything that affects the subject is a clear proof of inarticulate dumbness!). In contrast, an articulate subject is someone who learns to be affected by others – *not by itself*. There is nothing especially interesting, deep, profound, worthwhile in a subject 'by itself', this is the limit of the common definition – a subject only becomes interesting, deep, profound, worthwhile when it resonates with others, is effected, moved, put into motion by new entities whose differences are registered in new and unexpected ways. Articulation thus does not mean ability to talk with authority – we will see in the next section that authoritative talk may be employed to repeat always the same thing – but being affected by differences.

The main advantage of the word 'articulation' is not its somewhat ambiguous connection with language and sophistication, but its ability to take on board the *artificial and material* components allowing one to progressively have a body. It is not inappropriate to say that the odour kit 'articulates' pupils' perceptions with fragrances by the industry and demonstrations given by the professor. If difference is what generates meaning, to have pure odours bottled in little flasks and opened on schedule, beginning with starkest contrast so as to end up, after many repetitions, with smaller ones, is a way of giving a voice, that is a meaning, to whatever conditions generate odour tasting. The local, material and artificial setting cannot be construed as a mere intermediary, especially not as the arbitrary symbolization by a subject of an 'indifferent' world, but as what allows, *because* of the artificiality of the instrument, the differences of the world to be *loaded into* what appeared at first arbitrary sets of contrasts. Once we have gone through the training session, the word 'violet' carries at last the fragrance of the violet and all of its chemical undertones. Through the materiality of the language tools, words finally carry worlds. What we say, feel and act, is geared on differences registered in the world. Resemblance is not the only way to load words into world – the proof being that the word violet does not smell like violet any more than the word 'dog' barks – but that does not mean that words float arbitrarily over an unspeakable world of objects. Language has immensely more resources for being rooted in reality than mimesis. Contrary to Wittgenstein's famous saying (that day, he should have remained silent!), what cannot be said can be articulated.

The decisive advantage of articulation over accuracy of reference is that there

is no end to articulation whereas there is an end to accuracy. Once the correspondence between the statement and the state of affairs has been validated, it is the end of the story – except if a gnawing doubt about faithfulness is introduced to corrupt the quality of the correspondence. There is no such trauma with articulation because it does not expect accounts to *converge* into one single version that will *close* the discussion with a statement that would be nothing but a mere replication of the original. There is no gnawing doubt about the faithfulness of the articulation either (although deep moral scruples are encountered, as we shall see, when distinguishing inarticulate from articulate states of affairs). In a beautiful case of paradoxical madness, those who imagine statements simply corresponding to the world pursue an aim that is utterly self-contradictory: they want to be silent and tautological, that is, exactly repeat the original in the model, which is of course impossible, hence the constant effort and the constant failure, and the constant unhappiness of epistemologists.

Articulations, on the other hand, may easily proliferate without ceasing to register differences. On the contrary, the more contrasts you add, *the more differences and mediations you become sensible to*. Controversies among scientists destroy statements that try, hopelessly, to mimic matters of fact, but they feed articulations, and feed them well. If you add to the training session that revealed so many discrepancies among noses, all the controversies among physiologists about the olfactory and gustatory receptors, the discussions will not stop, nor will they become aimless, as if judgement of taste had lost direction by losing its bedrock of primary qualities: they will simply have become more interesting. This will be all the more so, if you now add to the session the cultural history of odour detection in the way that Corbin has pioneered (Corbin, 1998), or if you add the weight of commercial and industrial strategies trying to corner markets through perfume differentiation. The more mediations the better when acquiring a body, that is, when becoming sensitive to the effects of more different entities (see the 'materiology' of the French philosopher François Dagognet; especially Dagognet, 1989). The more you articulate controversies, the wider the world becomes.

This is a result totally unanticipated by the traditional picture of subjects registering the world through accurate statements about it and converging on one world. 'Ah', sighs the traditional subject, 'if only I could extract myself from this narrow-minded body and roam through the cosmos, unfettered by any instrument, I would see the world as it is, without words, without models, without controversies, silent and contemplative'; 'Really?' replies the articulated body with some benign surprise, 'why do you wish to be dead? For myself, I want to be alive and thus I want more words, more controversies, more artificial settings,

more instruments, so as to become sensitive to even more differences. My kingdom for a more embodied body!'

The real impact of the notion of articulation is not felt, however, as long as one does not say *what* is articulated. It cannot be 'words', as if articulation was a purely logocentric term. The odour kit is not made of words, nor is the professor, nor is the institution that allows trainees to be educated in having a nose, nor is the chromatograph, nor the professional bodies of organic and synthetic chemistry. It cannot be 'things' if by this we mean a substance defined by primary qualities, for instance the tertiary structure of perfumes or the DNA code for manufacturing olfactory receptors, because then the bodies that are affected by those differences will have entirely disappeared and, with them, the articulation. Working in the vicinity of Isabelle Stengers's Whitehead, I have acquired the habit of using the word *propositions* to describe *what* is articulated. The word 'proposition' conjugates three crucial elements: (a) it denotes obstinacy (position), that (b) has no definitive authority (it is a *pro*-position only) and (c) it may accept negotiating itself into a *com*-position without losing its solidity.

These three features are entirely missing in the idea of 'statements referring to matters of fact through the fragile bridge of correspondence'. Matters of fact are obstinate, not negotiable. As to the statements, the best they can do is to disappear into tautology, the copy being nothing more than the model. The worst defect of the notion of statements, however, is their constitutive unhappiness: when they interpret matters of fact, statements say nothing as long as they do not say the thing *itself*. This they cannot do, of course, thus they are always missing their targets, feeling insecure and empty, and, as a consequence, they never provide good instruments to load the world into words and only leave in their wake angry and frustrated epistemologists. With statements one can never compose a world at once solid, interpreted, controversial and meaningful. With articulated propositions, this progressive composition of a common world (see below) becomes at least thinkable (Latour, 2004).

To say that odours are propositions articulated in part by the training session, the odour kit and all the other institutions, is not to say that they are 'things' – primary qualities – named in 'words' by the (arbitrary or socially constrained) labelling activity of a human subject. This is the key philosophical difference the reader might have to provisionally accept if we want to theorize the body in a new way. The articulation of the perfumes does something *to the odours themselves*, which is at once obvious if one takes into account the enormous mass of transformations they undergo in the hands of the chemical industry and fashion cultures, and hard to swallow since we risk losing the obstinate obduracy of chemicals which are 'out there' whatever we, humans, do to them. Let us be

careful here, and keep our account away from the attraction of 'good sense' (so different from common sense). The ugly head of social constructivism – that is, idealism – appears *only* when the traditional description of statements and matters of facts is being staged: if a statement errs it has no reference; if it refers accurately, it might as well not exist at all since it is purely redundant. Only about statements do we raise the question 'Is it real or constructed?', a question that seems not only profound but also morally and politically crucial to maintain a liveable social order. For articulated propositions, such a query is totally irrelevant and slightly quaint since the more artificiality, the more *sensorium*, the more bodies, the more affections, the more realities will be registered (Latour, 2002). Reality and artificiality are synonyms, not antonyms. Learning to be affected means exactly that: the more you learn, the more differences exist.

This is not the place to develop those metaphysical points (but see Latour, 1999 and Stengers, 1996). At this point, we only need an image or a metaphor to focus on the body problem. To say that the world is made of articulated propositions is to imagine first *parallel* lines, the propositions, flowing in the same direction in a laminar flow and then, because of some clinamen, generating intersections, bifurcations, splitting, that produce many eddies transforming the laminar flow into a turbulent one. The only advantage of this rudimentary metaphor is to help us contrast with the other venerable metaphor of a *face-to-face* meeting between a subjective mind speaking in words about a world out there. This metaphor, no less crude than mine, has the enormous disadvantage of forcing us to imagine no other relation but that of a zero-sum game between representations in the mind and reality in the world. In this tug-of-war, whatever the mind adds to its representations, it is lost for the world that becomes simply misrepresented; whenever the world is accurately represented, the mind and its subjectivity are made redundant.

Among articulated propositions, on the other hand, there is no such zero-sum game. Each one of the participants may gain by becoming more sensitive to differences. To name such a world, I will employ the term *multiverse*, put to such good use by James: the *multi*verse designates the *uni*verse *freed from its premature unification*. It is exactly as real as the universe, except the latter can only register the primary qualities while the former registers all of the articulations. The universe is made of essences, the multiverse, to use a Deleuzian or a Tardian expression (Tarde, 1999),[1] is made of *habits*. This does not mean, as we shall see in the final section, that we abandon unity, since we do not go from one universe to multiple worlds – we still talk about *the* multiverse – but that we do not want a unification which would have been done on the cheap and without due process. To become well 'versed' into the world, to make it turn – *vertere* – all at once,

we suspect, requires a lot more work than the utterly implausible imposition of primary qualities.

Now that we have displaced the problem of having a body into 'accounting for a multiverse of articulated propositions' (to use my jargon), we have to devote some attention to a difficulty that could ruin all our efforts at redescription and let the body tumble down into the trough of ordinary 'body talk', broken into physiology and phenomenology. It might all be very well to speak of propositions instead of statements, but *what is the difference between badly and well-articulated propositions*? As long as we do not answer this question, the definition of a body as 'learning to be affected' will appear as one more plea for multiplicity, another postmodern attempt at breaking the ordinary way of talking about nature and society, body and soul.

At this point, we have to acknowledge that the traditional description of statements, matters of facts and correspondence, was able to tackle this normative question fairly well: if a statement does not correspond to a state of affairs, it's false, if it does, it's true. If the cat is on the mat, the statement 'The cat is on the mat' is verified. No matter how implausible and unworkable such a description of the act of reference is, it will always be preferred to articulated propositions simply because it appears, on the face of it, to deal with the difference between true and false – not to say good and bad – that the other new and more realistic description fails to do. It is with this objection that I want to take issue in the next section, by doing a bit of what I could call *political epistemology*. Once this excursus is completed, I will be able in the conclusion to propose another solution to theorizing the body.

The Stengers–Despret Falsification Principle

If the world is made of propositions, and if the action of knowledge is conceived as articulation, we are not left without any normative stance. On the contrary, it might be possible to recast a falsification principle that would be more fine-tuned, more discriminatory and more sharp-edged than the one devised by Karl Popper. From the writings of Isabelle Stengers and her colleague Vinciane Despret, a coherent picture for an alternative normative political epistemology emerges which can be summarized as follows.[2]

The Scientific is a Rare Ingredient of Science

First, 'knowing' is not the automatic outcome of an all-purpose general methodology: it is, to the contrary, a rare event. Although it is crucially important to distinguish bad from good science, what is scientific from what is not, there is no

way to make this distinction once and for all, and especially no way to dictate in advance for all fields of inquiry whether they have a vocation for being scientific or whether they will always fail, whatever they do. Through the seven (small) volumes of her *Cosmopolitics*, Stengers insists that the rare success of a given science is not easily transportable to any other instance. This is especially true when moving from the natural sciences to the social or human ones (more on this below). *Knowing interestingly is always a risky business which has to be started from scratch for any new proposition at hand*. This first feature is already at odds with most normative urges in philosophy of science. Although many epistemologists would agree that the dream of a general scientific methodology is a fallacy, they would nonetheless wish for principles general enough to guarantee that some domains of inquiry are more scientific than others *in toto*. Popper's project was devised, for instance, to make sure that a sharp demarcation was made between science and non-sense, and to distinguish among the sciences the good apples from the rotten ones. The Stengers–Despret shibboleth aims at cutting into not only the sciences (even the hardest ones) but also at accepting as well-articulated, interesting endeavours what the other principles would place far *beyond* the boundaries of science altogether. There is nothing surprising about these disputes: by definition, political epistemologies are made to disagree on those limits, including about the demarcation between science and politics (Latour, 1999).

Scientific Means Interesting

Second, to be scientific, in the new definition given by Stengers and Despret, knowledge has to be *interesting*. As has been noted by so many studies of scientists at work, to the qualification 'Is it scientific?', scientists often add the query: 'Maybe so, but is it interesting?' Fecundity, productivity, richness, originality are crucial features of a good articulation (Rheinberger, 1997). 'Boring', 'repetitive', 'redundant', 'inelegant', 'simply accurate', 'sterile', are all adjectives that designate a bad articulation. It is thus important to devise a touchstone that captures the most discriminating, sharp-edged notion used by the scientists themselves, instead of using those that might impress the unwashed but that are never used by the white-coats at the bench. The notion of articulation lends itself easily to this goal because of its linguistic meaning. To oppose inarticulate to articulate knowledge is, in effect, to oppose tautological to non-redundant expressions. Instead of saying 'A is A', that is, repeat the same expression twice, an articulate scientific laboratory will say 'A is B, is C, is D', *engaging what a thing is in the fate or destiny of many other things as well*. This feature is in contradistinction with the correspondence theory of scientific truth which is condemned, at best,

to tautology: it does nothing more, as we saw above, but repeat the original with as little deformation as possible ('A is A'). Such a defect, by itself, would be sufficient reason for discarding the theory, which has been kept in place for no other reasons than political ones (Latour, 1999). Does the Stengers–Despret shibboleth differ, on this point, from the Popperian criterion? Not much so far, since Popper too could say that propositions have to be interesting, that is, that they should be able to put the theory at risk. To see the difference between the two touchstones, we have to turn to the third feature that defines the type of risk with which each criterion is concerned.

Scientific Means Risky

To be interesting (thus scientific, thus is in a position to hope for the possible but never guaranteed event of a good articulation) a laboratory has to put itself at risk. It does not simply mean, as in Popper or Lakatos, that it should look for those experimental instances that are most able to jeopardize the theory. This, according to Stengers and Despret's principles, *is not risky enough* – even if one could eliminate all the other difficulties pointed out by Kuhn and many psychologists about the utter implausibility of a falsificationist attitude among practising scientists. The real risk to be run is to have the questions you were raising *requalified* by the entities put to the test. What is to be falsified is not just the empirical instance of the theory, but also the theory, the very research programme of the imaginative scientist, the technical apparatus, the protocol. Instead of asking the comminatory question: 'Do you answer "yes" or "no" when I ask you a question?' (with falsification only able to hope for a 'no' reply that starts the search again, while 'yes' replies would prove nothing), the Stengers–Despret criterion requires the scientist to say: 'Am I asking you the right questions? Have I devised the laboratory setting that allows me to change as fast as possible the questions I ask depending on the resistance of your behaviour to my questioning? Have I become sensitive to the possibility of your reacting to artifacts instead of to my questions?' (see Stengers, 1997b, 2000). Popper's falsificationist principle abandons only the false dream of correspondence, but it keeps in command the scientist who still possesses the formidable privilege of raising the questions in his or her own terms, as in Kant's schoolmaster fantasy. Stengers and Despret's principle requires the scientists also to jeopardize this privilege of being in command. The two quality checks are not the same: one may raise falsifiable questions and thus pass Popper's exam, but fail pitifully when faced with Stengers and Despret's requests.

Look for Recalcitrance in Humans and Non-humans

Phrasing the risk-taking of a good articulation in that way reveals the fourth original feature of Stengers and Despret's touchstone: it tries to be applicable to both natural and social sciences at once. Not because it imagines a general-purpose methodology – see the section on 'The Scientific is a Rare Ingredient of Science' (p. 214) – but precisely because it does *not* imagine a general methodology that would either dismiss the social sciences as hopelessly unscientific or submit them to the mere importation of the apparently more successful methods of the natural sciences. Social sciences may become as scientific – in Stengers and Despret's new sense – as the natural sciences, on the condition that they run the same risks, which means rethinking their methods and reshaping their settings from top to bottom on the occasion of what those they articulate say. Stengers and Despret's general principle becomes: *devise your inquiries so that they maximize the recalcitrance of those you interrogate*.

Now, the truly revolutionary insight of Stengers and Despret's epistemology is to have shown that this motto is paradoxically harder to apply to humans than non-humans. Contrary to non-humans, humans have a great tendency, when faced with scientific authority, to abandon any recalcitrance and to behave like obedient objects, offering the investigators only redundant statements, thus comforting those same investigators in the belief that they have produced robust 'scientific' facts and imitated the great solidity of the natural sciences! The only true discovery of most psychology, sociology, economics, psychoanalysis, according to Stengers and Despret, is that, when impressed by white coats, humans transmit objectivation obediently: they literally mimic objectivity, that is, they stop 'objecting' to inquiry, in contrast to *bona fide* natural objects which, utterly uninterested by the inquiries, obstinately 'object' to being studied and explode with great equanimity the questions raised by the investigators – not to mention their laboratories! This result, although totally counterintuitive (see for instance the opposite lesson drawn in Hacking, 1999), makes perfectly good sense: the social sciences have not been thwarted in their development by the resistance of humans to being treated as objects, but by their complacence about scientistic research programmes which makes it *more* difficult for the social scientists to quickly detect the artifacts of the design in the case of humans than in the case of non-humans . . . Human science laboratories rarely explode!

Provide Occasions to Differ

The paradoxical consequence of Stengers and Despret's philosophy of science is that 'scientific' means rendering talkative what was until then mute. It is the best way, so far, of honouring the word 'logos' that so many scientists have added to

their discipline – or the even more suitable word 'graphos'. If there is a physiology, a psycho-logy, a socio-logy, a glacio-logy, an ethno-graphy, a geo-graphy, etc., it is because there exist laboratory settings where propositions can be articulated in a non-redundant fashion. As the etymology of those disciplines nicely indicates, talking and writing is not a property of scientists uttering statements about mute entities of the world, but a property of the well-articulated propositions themselves, of whole disciplines.

This leads to the fifth feature of Stengers and Despret's falsification principle, which cuts savagely *inside* the sciences themselves – in contrast to all the other epistemologies which rank entire disciplines through one single pecking order, usually from theoretical physics down to pedagogy. Most protocols are said to be scientific because the scientists are *as little* engaged as possible in interacting with entities which are running with *as little* interference as possible from them. The popular ideal of science is thus made of a mute disinterested scientist letting totally mute and uninterfered with entities run automatically through sequences of behaviour. But, according to Stengers and Despret, such a common-sense set-up is a recipe for certain disaster (see Despret's article in this volume): a disinterested scientist abstaining from any interference with uninterested entities will produce totally uninteresting, that is, redundant articulations! The path to science requires, on the contrary, *a passionately interested scientist who provides his or her object of study with as many occasions to show interest and to counter his or her questioning through the use of* its *own categories.* This is where the Stengers and Despret shibboleth cuts differently from Popper's falsification principle: most set-ups that Popper would approve because they provide satisfactory instances of empirical falsification are taken as mere rubbish by Stengers and Despret because they fail to satisfy these three minimal conditions of scientificity: Is the scientist interested? Are the elements under study interested? Are the articulations interesting? This does not save or damn entire disciplines but selects out specific results, articles, scientists, laboratories inside disciplines which, instead of being ordered through one single pecking order, end up forming a sort of archipelago of heterarchic connections, thus forcing scientists, philosophers and lay people to decide, case by case, whether a given piece of science is valid or not (for a beautiful example of such an archipelago in the specific case of ethology, an intermediary case between natural and social sciences, see Despret, 2002; Strum and Fedigan, 2000).

Neither Distance nor Empathy

To realize the originality of Stengers and Despret's criterion we have to understand that it is not another plea for a more empathic or generous science that

would overcome the cold and reductionist harsh necessity of objectivity – and even less a typically more 'feminine' contribution to a 'male-dominated' epistemology. Stengers and Despret's criterion cuts and cuts as sharply as any male-devised shibboleth! What it does is immensely more productive than offering a plea for empathy, and this will be the sixth feature of their theory: it shows that *neither distance nor empathy* defines well-articulated science. You may fail to register the counter-questioning of those you interrogate, either because you are too distanced or because you are drowning them in your own empathy. Distance and empathy, to be useful, have to be subservient to this other touchstone: *do they help maximize the occasion for the phenomenon at hand to raise its own questions against the original intentions of the investigator* – including of course the generous 'empathic' intentions? It must be clear, according to this formulation, that abstaining from biases and prejudices is a very poor way of handling a protocol. To the contrary, one must have as many prejudices, biases as possible, to put them at risk in the setting and provide occasions of manipulation for the entities to show their mettle. It is not passion, nor theories, nor preconceptions that are in themselves bad, they only become so when they do not provide occasions for the phenomena to differ.

This is where Stengers and Despret make sense of most science studies in offering a positive philosophy for the mass of mediations revealed by inquiries into scientific practice: *the more mediations the better*. This has nothing to do with the old Duhem–Quine thesis of so-called 'underdetermination' – as if the task was still to distinguish between what the scientists say and what the world says, according to the zero-sum game metaphor criticized in the first section. On the contrary, the more scientists work, the more artificial set-ups they devise, the more they intervene, the more passionate they are, the more chance they offer for phenomena to become articulated through their 'logos' and 'graphos'. This has nothing to do with an empathic version of science either, because when phenomena differ they also take their distance with the dramatically poor repertoire of sympathies and antipathies that the scientists possessed beforehand. The misunderstanding comes from the meaning of 'distance'. The distance to be researched is not that between the observer and the observed – this would be cheap exoticism – but that between the contents of the world *before and after* the inquiry. So neither distance nor empathy is a sure guide that a good science has been concocted, but only this criterion: is there now a distance between the new repertoire of actions and the repertoire with which we started? If yes, then time has not been wasted; if no, then money has been spent in vain, no matter how 'scientific', in the traditional sense, the results look.

Good and Bad Generalizations

Scientific, in the hands of Stengers and Despret, is an adjective that defines an articulation among propositions that allows them to be more articulate, that is, to generate less redundant 'logies' and 'graphies', thus modifying more and more the ingredients that make up the multiverse, their repertoire of actions, their competencies and performances and, thus, the questions that they raise among those, scientists and non-scientists, who are put in touch with them. In this new definition, very little remains of the former 'science is what provides an accurate picture of the world'. Yet it retains most of the features recognized by the pioneering efforts of Popper and Lakatos to break away from the limits of the pictorial – and thus redundant – version of science: science is creative and imaginative activity in which former versions of the multiverse are systematically jeopardized. For political reasons that do not need to be outlined here, Popper and Lakatos underestimated the extent to which scientific protocols had themselves to be recast. But one query needs to be answered: why is it better to go from *less* articulated to *more* articulated propositions? Is not the most traditional definition of science precisely the opposite: provide synthetic and coherent laws that sum up in the most economic ways widely dispersed phenomena in one single theory? Should not science travel from articulated propositions to fewer ones?

This is the most interesting feature, the seventh in our list, of Stengers and Despret's principle because it introduces a new wedge between two different versions of generalizations that were indistinguishable before. Provide as general an explanation as possible is one thing; *eliminate alternative versions* is another. The emphasis on going from less articulate to more articulate propositions allows Stengers and Despret to sort out good ways of generalizing from bad ones. The good ones are those that allow for the connection of widely different phenomena and thus generate even more recognition of unexpected differences by engaging a few entities in the life and fate of many others. The bad ones are those which, because they had had such a local success try to produce generality, not through connection of new differences, *but by the discounting of all remaining differences as irrelevant*.

Genes, for instance, may be engaged in so many aspects of behaviour and development that they become obligatory ingredients that come to enrich any description of half a dozen sciences; or, in the hands of those who call themselves 'eliminationists', they can be used to bulldoze their way through the same disciplines, which are treated as archaic and obsolete because they raise non-genetically framed questions. Instead of allowing the gene to modify many situations, and thus to be modified in its definition of what it does by those many encounters, eliminationists lose any chance of learning through experimentation what a

gene is really doing (Kupiec and Sonigo, 2000). Wherever they go, the gene will do the same thing, that is, literally, reproduce itself tautologically (see the critique of the discourse of gene action in Fox-Keller, 1999; Lewontin, 2000)! Generalization should be a vehicle for travelling through as many differences as possible – thus maximizing articulations – and not a way of *decreasing* the number of alternative versions of the same phenomena. This feature is tied up with the first one listed above: the only reason epistemologists imagined an all-purpose methodology for producing scientific knowledge was because of their eliminativism. Only by *withdrawing* most phenomena from the multiverse can one imagine a general theory that succeeds every time it repeats the same argument and is never vehemently contradicted. The opposite of that position is not to abstain from any generalization at all, but, according to Stengers and Despret, a generalization that runs the following *additional* risk: *I accept being at once general and compatible with alternative versions of the multiverse* (Stengers, 1997a, 1998). In the hands of Prigogine and Stengers this has been a powerful way of sorting out branches and results of physics because of the problem of time: what can we make of a discipline, physics, which can only handle the 'little detail' of time by pretending it doesn't exist (Prigogine and Stengers, 1988)?[3] Popper would have let most of physics pass; not Prigogine and Stengers, because this kind of atemporal physics had paid for its success by the obliteration of an obstinate feature: the irreversibility of time. For Stengers, the price was too heavy (Stengers, 2000).

Allowing for a Common World

At this point, a reader might be worried that Stengers and Despret's touchstone is no longer specific to science and objectivity. If it makes such a plea for more articulation, more risky descriptions, more compatibility, it could be applied to the political order as well, especially because of this insistence on rendering talkative as many entities as possible and avoiding eliminativism. That is precisely the crucial point of any political epistemology and the reason why the fourth feature ('Look for Recalcitrance in Humans and Non-humans') – being applicable to the natural and social sciences – now becomes so essential.

Let us not forget that any epistemology is a political epistemology: it is never a question of elaborating a theory of knowledge only, but always also a principle for mapping a divide between science and politics (Latour, 2004; Shapin and Schaffer, 1985). Popper invented his whole machinery for no other purpose than to be able to remove Marxism and psychoanalysis from the list of *bona fide* sciences and thus fight the enemies of the Open Society. Stengers and Despret are no exceptions to this venerable tradition except that their principle (and theirs

alone, so far) allows *not* to prejudge the right way of cutting through science and politics, good and bad sciences and good and bad politics (not to say bad science allied to bad politics, good science added to good politics, bad science allied to good politics and good science allied to bad politics . . .). The great efficiency of Stengers and Despret's principle is to reopen this whole pandemonium that their colleagues tried to order prematurely into one set of indisputable sciences and another set of disputable false sciences mingled with disreputable politics. This eighth feature of their theory is the most radical and the most immediately usable: (westernized and scientificized) humans have a tendency to obey scientific authority in a way that they never would in any other more clearly political situation. This is what has led astray most scientists when they tried to apply the natural sciences to the social ones. What they saw as a miraculous extension of scientific objectivity was in effect the mere consequence of the aura of utter indisputability with which they had prematurely endowed the sciences.

Only in the name of science is Stanley Milgram's experiment possible, to take one of Stengers and Despret's topoi. In any other situation, the students would have punched Milgram in the face . . . thus displaying a very sturdy and widely understood *dis*obedience to authority.[4] That students went along with Milgram's torture does not prove they harboured some built-in tendency to violence, but demonstrates only the capacity of scientists to produce artifacts no other authority can manage to obtain, because they are undetectable. The proof of this is that Milgram died not realizing that his experiment had proven nothing about average American inner tendency to obey – except that they could give the appearance of obeying white coats! Yes, artifacts can be obtained in the name of science, but this is not itself a scientific result, it is a consequence of the way science is handled (see the remarkable case of Glickman, 2000). Stengers and Despret's principle, if taken seriously, means that the right cut is not the one that will distinguish science from politics but the one that will distinguish inarticulation (redundant science or redundant politics) from well-articulated propositions. Whether you treat humans or non-humans, you should use the set-ups *that allow the maximization of disputability.*

The problem with Popper and Lakatos's shibboleth is that they were completely unable to do this, since they tried to insulate indisputable science from the vagaries of politics. They could render some sciences indisputable but they were stuck whenever, to their great surprise and sometimes horror, discussions continued. . . . Whereas for Stengers and Despret the continuation of the discussions – that is the proliferation of other enduring versions of what the multiverse is made of, even after some sciences have spoken – simply means, to use my own terms at this point, that the task of composing the common world

has not been prematurely simplified. We no longer wish to have scientists coming from hard sciences to define *primary qualities* – the essential ingredients that really make up the world, ingredients that are invisible to common eyes and visible only to the scientists' disembodied and disinterested gaze – while the common men and women are limited to *secondary qualities* that do not refer to what the world is like but only to their cultural and personal imaginations.

What Stengers and Despret's principle invites us to do away with entirely is the notion of *unknown factors that would make us act without us being aware of them*. Not that Stengers and Despret are against any explanation of a behaviour that is not conscious, but those explanations of invisible forces should be *politely* entered into the composition of the common world, that is, some chance should be left to those who are thus 'explained' to discount them as irrelevant for reasons that have to do *not only* with their inner feelings or cultural imaginations – this is what Stengers called 'intolerant tolerance' (Stengers, 1997a) – but also with *what the multiverse is really made up of*. No common world may be achieved if what is common has already been decided, by the scientists, out of sight of those whose 'commonalties' are thus made up (Latour, 2004). Here again, the common sense of Stengers and Despret's criterion cuts the pie differently from the Popper-Lakatos falsification principle, which could accept politics dealing with values only on condition that matters of fact were first safely removed from any political dabbling. Political epistemology always deals with the composition of the common world, and thus should be able to distinguish between good and bad articulations of science and politics, not only between good and bad sciences.

This eighth and last feature makes Stengers and Despret's principle of sorting out bad and good science an extraordinarily difficult, exacting and painful requirement, because it forces scientists to take very seriously the *outside* of their science as well as the conditions in which their results can be made compatible or incompatible with those of the rest of the collective. Contrary to what the science warriors sometimes imagine, the new attention to scientific practice has not loosened the constraints on scientific production – as if the slogan 'anything goes' had taken over Academia – but, at least in the hands of those two innovative philosophers, *immensely increased the price at which good science can be purchased*. The results of applying their shibboleth is something that every scientist and supporter of science suspected all along: good science is rare and when it occurs it is an event that should be cherished like a miracle, commented on and disseminated like a work of art.

Conclusion: How Many Bodies Should We Have?

In what way does this passage through a new political epistemology help theorize the body differently? Like most questions raised under the modernist predicament, that of the body depends on the definition of what science is. This is especially salient in this case, since any 'body talk' seems to necessarily lead to physiology and later to medicine. If science is left to its own devices to define by itself – without further scrutiny or court of appeal – what the body is made up of, as if it pertained to the realm of primary qualities, it will be impossible for other versions of what a body is to be sustained. Thus it will be impossible for something like a democracy to be sustained when bio-power has taken over, according to the dire prediction of Michel Foucault and his followers. One will be forced either into spirituality – the body is what is abandoned to 'matter' while the essential aspects of the person are freed from its shackles – or into phenomenology – there is something in lived-in embodiment that no cold and objective scientist will ever comprehend, and that should be saved from the arrogant pretensions of science. These two positions, however, abandon the fight prematurely since they too quickly connect bodies, physiologies, materialities, medicine and primary qualities in one single package. If we modify the conception of science and take seriously the articulating role of disciplines, it becomes impossible to believe in the dualism of a physiological body pitted against a phenomenological one. The great lesson of Stengers and Despret, however, is that they do something science studies have carefully avoided doing: they provide once more a *normative* touchstone to distinguish good from bad science.

One example will make this point clear. My former colleague in San Diego, the neurophilosopher Paul Churchland (Churchland, 1986), carries in his wallet a colour picture of his wife. Nothing surprising in it, except it is the colour scan of his wife's brain! Not only that, but Paul insists adamantly that in a few years we will all be recognizing the inner shapes of the brain structure with a more loving gaze than noses, skins and eyes! Unquestionably, Paul sides with the eliminativists: once we have a way of grasping the primary qualities (in his case the brain macro structure, but it could be, for other even more advanced scientists, the micro structures of individual neurons, or the DNA sequences of the brain itself, or even further, the atomic structure of the biophysics of the DNA, or, as Hans Moravckek would have it, the information content of the whole body measured in gigabytes!) we can eliminate as irrelevant all the other versions of what it is to be a body, that is, to be somebody. This example of Pat Churchland's colour scan indicates why it would be silly to say that 'in addition' to the objective brain structure, there is also an old, maybe archaic, soon obsolete, subjective way of looking at faces – the ordinary ones captured, for instance, on

photographs. This would be granting the Churchlands the incredible privilege of defining brain scans as forming the indisputable primary qualities of the world – what the universe is made of – while letting humanists, lovers, archaic social scientists, add to this fabric of the universe the secondary subjective qualities, like little kids painting doodles on the washable walls of their kindergarten. Such a defeatist attitude would grant too much to the neurophilosophers and would miss all of the interesting features that will have been squeezed out by this body/soul dualism. It is at this point that I want science studies, supplemented by a hefty dose of normative epistemology, to add its grain of salt to the many disputes about primary qualities (see for instance, Varela and Shear, 1999).

To begin with, there is nothing especially subjective about carrying a photograph of one's 'significant other' in one's wallet. The whole history of photography documents how much our experiences have been shaped by the technical, commercial and aesthetic innovations of cameras (Jenkins, 1979), exactly as noses have been trained by the '*malettes à odeurs*' and other feats of the fragrance industry. We are thus not in a position to say that there are normal human beings who carry photographs of their lovers and mad scientists who try to reduce human subjectivity to mere neurons by carrying CAT-scans around. The very idea of a 'subjective side' is a myth obtained by discounting all the extrasomatic resources ever invented that allow us to be affected by others in different ways. The phenomenology of the lived-in body is every bit as dependent on material artifacts as the neuroscientists' laboratory at the Salk Institute. But second, and more importantly, why not view Churchland's enterprise as I treated the odour kits of the first section? I said above that, because of the training session, the trainee 'learnt to have a nose', to 'be a nose', by detecting small differences that were not affecting her before. Why don't we use this formulation to account for Paul's enterprise? He too is learning to become sensitive, through the mediation of instruments, to hitherto undetectable differences in the spin of the electrons of his cherished wife's brain. Paul may be perfectly right in saying that we should all become sensitive to electrical differences in each other's brains and that this sensitivity, this learning to be affected, will make us have a richer and more interesting understanding of others' personality than mere boring facial expressions. With the odour kit we inhabit a richly odiferous world; with colour scans we inhabit a richly atomical electric world.

Paul might be right, but *he might be wrong*, and this is where Stengers and Despret's touchstone cuts, and cuts sharply. There is an immense difference between treating Churchland as the reductionist and eliminativist he claims to be, and treating his attempt as adding one more contrast, one more articulation to what it is to have a body. The first corresponds to the traditional vision of

science: there are primary qualities; one can be reductionist; one level of a phenomenon is able to provide a bedrock for, or alternatively, to eliminate another. The second corresponds to what can be called a science studies or a Jamesian or a Whiteheadian outlook: there is no primary quality, no scientist can be reductionist, disciplines can only *add* to the world and almost never subtract phenomena. In the traditional vision, Churchland is either right or wrong, that is, the layer of phenomena he is sticking to is wholly independent of his equipment, laboratory, disciplinary affiliations, ideologies. Primary qualities are detectable only by invisible and disembodied scientists reduced not even to brains, not even to atoms, but to pure thought.

In a science studies version, however, what the neurophilosophers claim is up for grabs. They might articulate interesting contrasts, or they might repeat redundant results produced by other scientists that they don't really comprehend because they have forgotten the narrow instrumental constraints to which a few isolated facts owe their existence – this is for instance what Edelman (1994) uncharitably claims. Scientists might feel protected by Popper's falsification principle as long as they crank out data in a reasonably scientific manner but there is no refuge from the Stengers–Despret shibboleth. No amount of empirical falsification will render bad scientists immune to the accusation of having eliminated through their accounts most of the important contrasts they should have retained had they been 'polite' enough. If even hard physics can be castigated for having eliminated the 'little detail' of irreversible time, what treatment should be reserved for the much softer neurophilosophy, which has obliterated what it is to make sense of an individual face or to detect a colour?

This is the very paradoxical result of much science studies that is concerned with the body. It is not a fight against reductionism nor a plea for the whole personal, subjective body that should be respected instead of being 'cut into pieces'. It is, on the contrary, as this issue indicates so tellingly, a demonstration of how impossible it is for a reductionist scientist to be reductionist! In the laboratory of the most outrageously eliminativist white coats, phenomena proliferate: concepts, instruments, novelties, theories, grants, prices, rats and other white coats . . . Reductionism is not a sin for which scientists should make amends, but a dream precisely as unreachable as being alive and having *no* body. Even the hospital is not able to reduce the patient to a 'mere object', as has been so beautifully documented by Annemarie Mol, Charis Thomson, Stefan Hirshauer, Marc Berg and many others (Berg and Mol, 1998; Cussins, 1998; Mol and Law, 1994). When you enter into contact with hospitals, your 'rich subjective personality' is not reduced to a mere package of objective meat: on the contrary, you are now learning to be affected by masses of agencies hitherto

unknown not only to you, but also to doctors, nurses, administration, biologists, researchers who add to your poor inarticulate body complete sets of new instruments – including maybe CAT-scans. To the puzzle of the multiverse, is now added the puzzle of the folded body: how can you contain so much diversity, so many cells, so many microbes, so many organs, all folded in such a way that 'the many act as one', as Whitehead said? No subjectivity, no introspection, no native feeling can be any match for the fabulous proliferation of affects and effects that a body learns when being processed by a hospital (Pignarre, 1995). Far from being less, you become more. No scientist on earth can reduce this proliferation to just a few basic, elementary, general phenomena under his or her control.

This is again where the Stengers–Despret normative argument is so important: to abandon the distinction between subjective and objective bodies, secondary and primary qualities, to deny to science the possibility of *subtracting* phenomena from the world, to revere hospital institutions that allow one to be affected, is not to abandon the difference between badly and well-articulated propositions. On the contrary, it is to push the frontlines of the struggle *inside* the sciences themselves, as Donna Haraway has always advocated. We should not forget that what puts the question of the body at the forefront of social science is, on the one hand, the meeting of feminism, science studies and a fair amount of Foucault's redescription of subjection, and on the other, the expansion of bio-industry into all the details of our daily existence. This Body Politic, the struggle around biopower – certainly, as Foucault foresaw, the great question of this century – cannot be sustained if one agrees to give science the imperial right of defining all by itself the entire realm of primary qualities, while militancy limits itself to the residual province of subjective feelings. Biopower should have a bio-counterpower. Without it, 'body talk' will never be any more effective than the songs of slaves longing for freedom. As this issue indicates so well, there is a *life* for the body after science studies and feminism, but it is not the same life as before.

Notes

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1. Gabriel Tarde was older than Durkheim and defined an alternative sociology which has barely survived (see Tarde, edited by Clark, 1969), but is now revived because it connects much more closely with biology than those of his more traditional counterparts. For an introduction, see Latour (2002).

2. Isabelle Stengers (1996, 1997a, 1998), who trained as a chemist, has become one of the most important philosophers of science in the French-speaking world. Currently a professor in Brussels, she has worked extensively with Ilya Prigogine and has developed a very original philosophy, first of

physics, then of biology and what she calls 'cosmopolitics'. She has recently written a masterpiece on A.N. Whitehead (2002). Vinciane Despret (1996, 1999, 2002) trained as a psychologist, she is a professor of philosophy in Liège, also in Belgium, and has put to good empirical use many of Stengers' insights, as well as developing a marvellous series of studies on psychology and ethology.

3. The whole work of Ilya Prigogine – with and without Stengers – has been devoted to understanding what changes physics should undergo when time – that is process – is reintroduced into it, instead of being considered as a completely reversible dimension as has been customary since at least Newton.

4. Milgram's experiment, conducted in the wake of the discovery of the horrors committed by the Nazis, consisted in finding out whether or not obedience to authority could make average Americans behave in the same way as their German counterparts (Milgram, 1974). Subjects were instructed to inflict electric shocks on a student, whom they were supposed to teach various things. To the great horror of Milgram, students did not stop inflicting extreme torture in the name of pedagogy, invoking the orders they had received to justify their action. Along with several others, Stengers and Despret have redone this experiment, showing that it is the design itself which is horrific.

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