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11. Deleuze, Guattari, and Neuroscience

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The celebration of the brain forms a surprising conclusion to Deleuze and Guattari's writing together at the end of *What Is Philosophy?* Published at the beginning of the so-called "decade of the brain" of the 1990s, *What Is Philosophy?* is prescient concerning a series of contemporary questions regarding neuroscience in culture. In *What Is Philosophy*, the role of the brain sciences is clear. "It is up to science to make evident the chaos into which the brain itself, as subject of knowledge, plunges."¹ For Deleuze and Guattari, this plunging into chaos is the brain's strength. It allows the brain an intense engagement with the virtual.

In opening up the brain to us, the brain sciences make us rethink our relation to chaos, to the virtual. More generally, developments in the brain sciences increasingly allow for a culture that targets the nervous system more directly and precisely than before. In response, there is a critical literature emerging concerning the brain sciences and culture (by authors such as Jonathan Moreno, Joseph Dumit, Brian Massumi, Elizabeth Wilson, and Steven Rose).² At the same time, contemporary artists such as VJ

Mark Amerika have begun to draw on neuroscience to develop a more positive, “postcognitivist”³ concept of the aesthetic. Amerika’s advice is to “Think of . . . locating the breakout potential of your neuroaesthetic self.”⁴

This chapter draws on the history of Deleuze and Guattari’s discussion of the brain to explain why they think science should make evident the chaos into which the brain plunges, why the brain itself is a “subject,” what this might mean for increasingly “neural” cultures, and why much of this might involve aesthetics.

Mouth, Brain, and Images of Thought

There are many points of convergence between Deleuze and Guattari and those working within the brain sciences.⁵ Deleuze’s interest in questions regarding the brain was long-standing. Much of his philosophy is an attempt to work out the relations between the event, the brain (and thinking processes), and perhaps more directly and politically, subjectivity. Eventually, Deleuze concluded that “subjectification, events and brains are more or less the same thing.”⁶ So the brain was fundamental to Deleuze’s materialist philosophy. Nevertheless, he wanted to allow for a metaphysics within this materialism,⁷ and here the brain was to become crucial.

The problems involved are outlined in *The Logic of Sense*, precisely when discussing the relations between the corporeal (bodies, actions) and the incorporeal

(events, sense, meaning “as an encounter of force fields”⁸). Deleuze writes of the confusion (in the mouth) of speech, language, and eating, or: “The struggle between the mouth and brain . . . eating, on the one hand, and thinking, on the other, where the second always risks disappearing into the first, and the first, on the contrary, risks being projected onto the second.”⁹

Understanding the materiality of the brain eventually arises as a possible explanation for such confusion. In 1985, while discussing the *Cinema* books, Deleuze commented,

It’s not to psychoanalysis or linguistics but to the biology of the brain that we should look for principles, because it doesn’t have the drawback, like the other two disciplines, of drawing on ready-made concepts. We can consider the brain as a relatively undifferentiated mass and ask what circuits . . . the movement-image or the time-image trace out, or invent, because the circuits aren’t there to begin with.¹⁰

The themes of the importance of the brain, an emphasis on microbiology, and the brain’s openness as a form of organization are repeated many times. In an interview in 1988, Deleuze commented

our current inspiration doesn’t come from computers but from the microbiology of the brain . . . It’s not that our thinking starts with what we

know about the brain but that any new thought traces uncharted channels directly through its matter, twisting, folding, fissuring it.¹¹

Here we find a crucial difference between Deleuze's approach to the brain and at least some of both the cognitive and neurosciences. For Deleuze, that which is referred to throughout *What Is Philosophy?* as "opinion" or "doxa"—a mode of thinking via what we might call pre-given "charted channels"—is not really thinking. Real thought, for Deleuze, involves "uncharted channels." More than this, in *Difference and Repetition*, it involves the destruction of the received images we have of *what it is to think*:

generalised thought process . . . can no longer be covered by the reassuring dogmatic image [of a neat assemblage of thought processes, of "common sense"] . . . henceforth, thought is also forced to think its central collapse, its fracture . . . Artaud pursues in this the terrible revelation of a thought without image.¹²

Even the attempt to define the faculties—since Kant, arguably the philosophical basis for much of the cognitive and neurosciences to come—is suspect, at least in its finality.¹³ Deleuze sees the possibility of new faculties, or of older faculties surprising us, or dissolving. Again it will come down to the crucial question of "new cerebral pathways," with science's responsibility to "discover what might have happened in the brain for one to start thinking this way or that."¹⁴

The fixed images of thought to which Deleuze objects should not necessarily be confused with the new images of thinking processes—if that is what they are—produced by PET [positron emission tomography] and fMRI [functional magnetic resonance imaging]. Such images can indeed bolster older images of thought. They can appear, as Joseph Dumit puts it, to “picture personhood”¹⁵; however, the very fact of seeing these images disrupts many previous images of thought, calls for new forms of adaptation both by and to the brain, ruptures opinion and doxa, indeed multiplies some images of thought as it dissolves others. In comments on “pop videos” in 1988, which we can see as applicable to brain imaging, Deleuze said

What was interesting about pop videos at the outset was the sense you got that some were using connections and breaks that didn't belong to the waking world, but not to dream either, or even nightmare. For a moment they bordered on something connected with thought. This is all I'm saying; *there's a hidden image of thought that, as it unfolds, branches out, and mutates, inspires a need to keep on creating new concepts, not through any external determinism but through a becoming that carries the problems themselves along with it.*¹⁶

This hidden, mutating “image of thought,” is both stimulated and never quite captured in new forms of image production. This suggests that the real activity of the brain might not be totally amenable to overdetermined “models” or “pictures” of thinking

processes, or to many cultural actions and politics modeled on these. The problem is the brain's creativity. "The problem is that [creative] activity isn't very compatible with circuits of information and communication, ready-made circuits that are compromised from the outset . . . the brain's the hidden side of all circuits, and these can allow the most basic conditioned reflexes to prevail, as well as leaving room for more creative tracings, less 'probable' links."¹⁷

Sean Watson rightly points to the challenge posed to common cognitive/communicational models by Deleuze's thinking: "communication in this context cannot mean information exchange or systems of representation. Instead, *communication is a matter of structural modulation of the body and nervous system. Communication is a mutual adjustment of bodies.*"¹⁸ This adjustment can be banal. Deleuze notes that things can too quickly become a kind of "organized mindlessness . . . what happened with pop videos is pathetic" and "most cinematic production, with its arbitrary violence and feeble eroticism, reflects mental deficiency rather than any invention of new cerebral circuits."¹⁹ Deleuze's fascination with neuroscience dwells on the possibility of something more than this banal deficiency. In *L'Abécédaire de Gilles Deleuze* (and here I am relying, gratefully, on Charles Stivale's summary):

Deleuze says that neurology is very difficult for him, but has always fascinated him. [Ideas] don't proceed along pre-formed paths and by ready-made associations, so something happens, if only we knew. That

interests Deleuze greatly since he feels that *if we understood this, we might understand everything, and the solutions must be extremely varied*. He clarifies this: *two extremities in the brain can well establish contact, i.e. through electric processes of the synapses. And then there are other cases that are much more complex perhaps, through discontinuity in which there is a gap that must be jumped. Deleuze says that the brain is full of fissures, that jumping happens constantly in a probabilistic regime. He believes there are relations of probability between two linkages, and that these communications inside a brain are fundamentally uncertain, relying on laws of probability.*²⁰

As for many today in the brain sciences, for Deleuze the brain is not a series of smooth, mechanical circuits. As announced in *L'Abécédaire*, and also as influenced by Steven Rose's popular book on the brain, *The Conscious Brain* (1976), Deleuze's "brain" performs two kinds of actions, one "basic conditioned reflexes," the other "creative tracings."²¹ However, *both* of these are uncertain and probabilistic. Both of these are situated in a shifting topology of relations. Both involve the specificity of actual connections and breakdown within synaptic activity, and the importance of global *probabilities* of connection. This is the beginning of a "thread which rises towards the virtual."²²

These two kinds of action also have their differences, however. The conditioned reflex does not maintain, strictly speaking, a smooth connection with a circuit, but there

is still a *habit of probable* contact between elements over time in a *shifting* patterned response. Creative tracings, however, are more radical. They face up to discontinuities and making something new of them (entirely new syntheses)—“in which there is a gap that must be jumped.” Of course, both of these will always be found in combination, contributing to the complexity of the probabilistic nature of synaptic activity. I will deal with habit in more detail.

Habit

It is true that, for Deleuze, activities in the brain “don’t proceed along pre-formed paths and by ready-made associations.” There is, however, a kind of continuity, *only* found in habit, as he explains in *Difference and Repetition* (75). Habit is a crucial concept for Deleuze. As *continuity*, however, habit is the dynamic and shifting *contraction* or *synthesis* of experience over time, in fact *as* time. It “contracts,” synthesizes, “contemplates,” or to put it simply, *unifies*, the duration *between*, and extending *through*, repetitions. It is not simple repetition. This is partly because there is no simple repetition. There is always an intensive differentiation—a change—within a duration (71ff). Simply put, “difference inhabits repetition” (76). Indeed, in that it is never simple or exact, even repetition is *part of the continuity* “contracted” in synthesis (if a kink or fold in it). In sum, habit is an ongoing adaptation to changing circumstances, even itself

a force within those circumstances. It is not a way of doing things exactly the same every time.

Deleuze's discussion of habit and synthesis in *Difference and Repetition* suggests that *we are a complex mix of habits, passive syntheses, at a number of levels*. These habits include both "sensory-motor habits that we have (psychologically)" and, more basic "primary habits that we are: the thousands of passive syntheses of which we are organically composed" (74). The latter involve the ongoing composition and functioning of the body. Even before this, "we are made of contracted water, earth, light and air" (73). Something like a series of microcontemplations is necessary to contract this tumult of passive synthesis: "A soul must be attributed to the heart, to the muscles, nerves [we assume brain] and cells, but a contemplative soul whose entire function is to contract a habit" (74).

Our entire "primary vital sensibility" (73) is based on this arrangement of habits of contemplation/contraction/synthesis in the organic and the sensory-motor (perception/action). It is within this vital sensibility that "the lived present constitutes a past and future in time." Contractions of previous events into a habit are directed toward the future in an expectancy. Often this is not conscious (passive synthesis). Sometimes, building on the passive, it is conscious ("active syntheses of a psycho-organic memory and intelligence [intuition and learning]") (73). In that all of this is always at least somewhat probabilistic—and at that a shifting mix of many probabilistic

events—it is hardly a clockwork model of ecological events involving brain, body, and world.

It is in these complex relations between organic and perceptual, passive and active syntheses that we find Deleuze's "rich domain of signs." Just as there is no simple repetition, here the sign is not a matter of the simple recognition or representation (which often rely on a simple notion of repetition) necessary to cognitivism. The sign is a dynamic envelope (synthesis) of events, as in some connectionist or dynamicist theories of cognition, or the theory of neural networks, both in its neurological and sensory-cultural form.²³ The material domain and action of signs is not that of the symbolic processing of representations. It is an ongoing synthesis of syntheses, of complex durations and mixtures. It is, again, "probabilistic" and uncertain. More than this, it involves both active and passive synthesis, a work on habit. It is therefore often "discontinuous" and calls for "jumping in a probabilistic regime." Signs, considered as syntheses, "always envelop heterogeneous elements and animate behaviour." This is because

Each contraction, each passive synthesis, constitutes a sign which is interpreted or deployed in active syntheses. The sign by which an animal "senses" the presence of water do not resemble the elements which its thirsty organism lacks.²⁴

Rather, there is a contraction of a complex series of primary series involving the water, the animal, and thirst, contracted as a probabilistic field of microevents that are drawn together by this field.

In short, habit, *including habit at the level of synaptic activity*, is an ongoing and changing adaptation of brain to world, and vice versa. It must, in the process, negotiate a complex set of real continuities and discontinuities, fissures and jumps through time, that are also part of thinking processes—what Deleuze calls “creative tracings.” As he writes in *Difference and Repetition*, “We do not contemplate ourselves, but we exist only in contemplating—that is to say, *in contracting that from which we come*” (74, my emphasis). Indeed, and here we find an early version of what will, in *What Is Philosophy?* become “micro-brains.” For Deleuze, “everything is contemplation, even rocks and woods, animals and men . . . even our actions and needs” (75).

We need to emphasize the crucial complication to this. Synthesis, or “contraction . . . takes place not in the action itself, but in a contemplative self which doubles the agent.” Here perhaps the difference is between the direct physical action, such as the electro-chemical actions involved in the firing of the synapse for example, and the shift in probabilistic pattern of connection—a contemplative self—or overall field of connections involved in the brain. This contemplation contracts within, across and yet, in a sense, separate from actions. It thus, like thought, *as thought*, “never appears at any moment during the action” (and cannot be seen in brain imaging). It

thus not only unifies a field of probability, but can be seen *to create a virtual structure to actions that is subjectivity*. This virtual structure does not belong to us. “Subjectivity is never ours, it is time, the soul, or the spirit, the virtual” (82–83).

In the light of this, consider V. S. Ramachandran’s famous use of mirrors to break the habits of phantom limb pain, in which the mirror allowed the sufferer to “see” a limb, a reflection of the remaining limb, where it is in fact missing.²⁵ This is not so much a re-recognition, as a synthesis of continuity and discontinuity.²⁶ We can also consider, in this light, the famous “mirror neurons”—neurons that fire either when an animal acts or when it observes another performing a similar act.²⁷ These neurons should not be seen, first, as operators of resemblance—a recognition of a picture—between pre-given agents. They are first dynamic points of synthesis of an interrelation, of a movement in an abstract field including both animals.²⁸ This movement reworks the probabilistic “diagrams” of future affectivity and movement (thus a stimulation to/like action). Mirror neurons involve a “contemplation” doubling and synthesizing action. This does not occur in a simple reflection of the action in the “observer,” but in the new synthesis formed between the action and its observation. In other words, the mirror neuron’s key element is not resemblance but the *arousal* of circuits of action and, differently, *virtual restructuration of futurity*. Two sensibilities become contiguous via a perceptual synthesis, so that “two extremities” *between* different bodies/brains “can well establish contact” in the contraction of a duration. After this, perhaps, something like

“recognition” occurs, although this might be better thought of as an integrative meeting of something like that which Brian Massumi calls “biograms.”²⁹ These “retain a privileged connection” (186) to the strangest but most fundamental set of synthetic habits we know. These are found in proprioception. Biograms are “less cartographic,” more “lived diagrams based on already lived experience [though as a kind of abstract diagram of experience], revived to orient further lived experience. Lived and relived.”

All these processes are a constitutive, material part of the work of the brain in the world, and *of the work of the world in the brain*.

Self-Organization

To the previous we must add the influence of Raymond Ruyer on Deleuze. Paul Bains gives an important account of the way that Deleuze and Guattari take up Ruyer’s concept of an immanent auto-formation, in a kind of self-organizing *self survey* of an entire set of relations at *infinite speed*, the speed of thought perhaps.³⁰ It is via this self-formation without an external point of reference that the brain becomes subject, although this is, in a sense, a “subjectless subjectivity,”³¹ one that diminishes the role of what is normally taken to be the subject in favor of the material brain itself. This is synthesis writ large. Here, there is the emergence, at infinite speed, of a “kind of global

transconsistency or existential grasping whereby a fragmentary whole emerges . . . a unity in multiplicity, an absolute survey that involves no supplementary dimension.”³²

This could be seen as a more cybernetic or informational model of thinking processes (here the influence of Gregory Bateson); however it would be more correct, perhaps, to see cybernetics as a *restricted* attempt at modeling and deploying the dynamics of topological folds and syntheses that Deleuze will see as fundamental to the brain-world relations. Cybernetics does seem closer to the reality of feedback or dynamic folding in the networks between nervous system and world than the cognitivism that was to overwhelm it.³³ Yet cybernetics was also more restricted by its desire to enhance forms of control, and that in a largely military context, if not that of duck shooting.³⁴ These restrictions have proved to be highly effective in the application to performance culture (increasingly including cognitive performance³⁵), including the use of brain sciences in performance cultures, and to what Samuel Weber has discussed as the reduction of cognitive processes to “targeting.”³⁶

Superfolds

Perhaps surprisingly, for Deleuze, science is sometimes the solution here as much as the problem. For example, in response to the, for Deleuze, reductive categorization of forms of life in the nineteenth and early twentieth centuries, “biology had to take a leap into

molecular biology, or dispersed life regroup in the genetic code.”³⁷ Genetic code, of course, opens everything up to variation again, rejuvenates the power of life itself. This changes both the nature and power of the “forces in play.” Biological forces are liberated from their schematization (and from opinion and doxa) and subsequently from the forms of control involved, although this, of course, also raises questions of the manner in which these new relations of forces allow for new forms of control.

For Deleuze, that which has come into play is a force allowing the possibility of an ongoing series of auto-formations across an entire field. The potential is for what he calls an “unlimited finity.” John Marks explains this: “Quite simply, an infinity of beings can apparently be constituted from the finite number of four bases from which DNA is constructed.”³⁸ The unlimited finity evokes “every situation of force in which a finite number of components yields a practically unlimited diversity of combinations. It would be neither the fold nor the unfold but the *Superfold*, as borne out by the foldings proper to the chains of the genetic code, and the potential of silicon in third-generation machines.”³⁹

Transported to the brain sciences, this explains what Deleuze means when he says that in understanding the molecular biology of the brain, “we might understand everything” *and* that “the solutions must be extremely varied.”⁴⁰ Neuroscience gives increased access to a new series of potentials for an ongoing, “unlimited finity,” the product of a Superfold, in the brain and the nervous system, considered as onto-genetic,

generative of worlds. The ethical and political issues involved in “neural cultures” will be located, for Deleuze, in the potentials of the neuroscientific superfold(s): the probabilistic nature of the synapse, the topology of a brain that can self-survey at what is, to all intents and purposes, infinite speed, along with the “unlimited finity” that neuroscience can provide access to in relation to the brain. In all these respects, the brain sciences’ opening up of the processes of thinking could be a more radical event than that of the discovery of the “superfold” of the genome.

Let us consider the nature of the folds and probabilistic activity of the brain more carefully.

Dark Precursors and Graspings

We recall that the syntheses and related “contemplations,” actual and virtual, micro and macro, as processes of auto-formation, occur at all levels, throughout a dynamic ecology. *They are all there is in a world considered as ongoing dynamic becoming, a world in which relations and contractions form dynamic “objects” and not vice versa.* These contractions, or syntheses, lie behind many of Deleuze’s concepts of the obscure from which events arise—the “dark precursor,”⁴¹ for example, or the depths of the fissures of the brain, the depths of the monad, and so on.

Let us take the “dark precursor.” This is what precedes a bolt of lightning. We could say it is what precedes, or is even the first stage of, a *notable* contraction of synthesis. The dark precursor is “invisible, imperceptible,” but it determines the thunderbolts’ “path in advance but in reverse, as though intagliated,” that is, in relief—in effect momentarily creating a *channel* in the chaos for the thunderbolt.⁴² Of course, lightning bolts and electrical firings in the synapses can be thought of in similar ways.

For Deleuze, every “system contains its dark precursor which ensures *the communication of peripheral series*”—in synthesis as self-survey. It is this that might allow, for example, “two extremities in the brain [to] well establish contact,” as Stivale writes.⁴³ The dark precursor is not an opening up of a “communication” in the sense of a message. It is rather, as Watson puts it “a matter of structural modulation of the body and nervous system.”⁴⁴ The dark precursor modulates body and nervous system down to the level of the ongoing genesis of channels between synapses—in dark precursors of the elements of microperception.

Here we might combine the dark precursor with the subsequent firing of the synapses, in what we could also see as a *grasping* toward the coming together of an event. This is what Whitehead called an “actual occasion” or “concrecence.”⁴⁵ “Grasping” is, via Whitehead, the term adopted by Guattari, precisely in the context of what he calls the “*synaptic*.”⁴⁶ For Guattari, a kind of “grasping,” like the dark precursor, establishes some coherence in chaos. It finds unity or connection within it, in Deleuze’s

terms in “contemplation,” without actually taming the chaos per se.⁴⁷ Guattari here quotes Whitehead directly: “Each new phase in the conspescence means the . . . growing grasp of real unity of feeling.”⁴⁸ Whitehead called the “dark precursor” the “lure to the creation of feelings.” The final result is the *literal* creation of feeling, the sudden adjustment of the nervous system, a *unity of feeling*, not a “logical outcome.” For Deleuze, like lightning, this unity of feeling is spectacular. It is partly spectacular because it undoes the temporary constraints of the channels formed temporarily by the dark precursor or the lure to feeling.⁴⁹ “Once communication between heterogeneous series is established, all sorts of consequences follow within the system. Something ‘passes’ between borders, events explode, phenomena flash, like thunder and lightning.”⁵⁰ Synapses firing, but more than that. A new auto-formation, self-survey at infinite speed, contacts between extremities. Thought.

Of course, very little of this in conscious. Here, Deleuze’s description of the “depths” of the Leibnizian monad is strikingly resonant with a Deleuzian concept of the depths of the brain. We see that syntheses are a kind of fold, contemplations perhaps a kind of inflection in this fold (the fold in self-survey).

It is as if the depths of every monad were made from an infinity of tiny folds (inflections) endlessly furling and unfurling in every direction, so that the monad’s spontaneity resembles that of agitated sleepers who twist and turn on their mattresses.⁵¹

This agitation involves much more than the “organic connections and integrations” assumed sometimes of the brain as “a constituted object of science . . . an organ only of the formation and communication of opinion.”⁵² Things are perhaps somewhat more chaotic. The thunder and lighting of the brain is “nonobjectifiable” in any entirely systematic way. Even thinking science is a form of creation.

If the mental objects of philosophy, art, and science (that is to say, vital ideas) have a place, *it will be in the deepest of the synaptic fissures, in the hiatuses, intervals, and meantimes of a nonobjectifiable brain, in a place where to go in search of them will be to create . . .*⁵³

Here again the brain as a kind of “superfold” (and not necessarily only in consciousness), dynamized by a rolling and chaotic series of “microperceptions.”⁵⁴ These are “little folds [or, we might say, syntheses] that unravel in every direction, folds in folds, following folds, like one of Hantai’s paintings or Clérambault’s toxic hallucinations.” As Deleuze puts it, “the task of perception entails pulverizing the world, but also spiritualizing its dust” (87). These “tiny perceptions are as much *the passage from one perception to another* as they are components of each perception” (87, my emphasis). In addition, this ongoing chaos of microperceptions is not contained within what we take for the present moment (what William James called the “specious present”⁵⁵). Nor is this chaos necessarily smoothly integrated into a linear sequence of

macroperceptions to which it can be reduced, although the macroperceptions are “nourished” by the chaos of microperceptions.

If the brain has any ongoing unity then, even as self-survey, it is not as a clear organic series of connections and integrations functioning seamlessly. It is rather as a *chaosmos*, a chaos that also nourishes auto-formation and de-formation. This is a chaosmos—which we could also call *the virtual*—in which what counts are the *notable* or *remarkable* events of difference that emerge (some of which becomes unities of feeling). This should be something scientists should like. As Deleuze puts it, “We have to understand literally—that is, mathematically—that a conscious perception is produced when at least two heterogeneous parts enter into a differential relation that determines a singularity.”⁵⁶

If microperceptions give rise to conscious perception, this is not in the manner of mechanical parts in an overarching machine. Microperceptions arise from difference creatively, and are “requisites or genetic elements” for further creation.⁵⁷ Again, like a synthesis or contraction, or a fold or inflection, a perception is a *produced differential intensity*. This is why every macroperception is not a recognition, but is something startling (or, we could say, even recognition is startling). If not startling, a macroperception would not arise. Startling differentials, then, make up “the object as a perception, and the determinability of space-time as a condition” and “differential calculus is the psychic mechanism of perception.”⁵⁸

The key notion here is that “clear perception as such is never distinct,”⁵⁹ as in a very clear and accurate picture of an object. It is rather a “distinguished . . . remarkable or notable” result of a genesis of differential series. *What is noted, in fact produced, is difference differing.* What is more, these remarkable differential events of perception can occur at different levels depending on the “perspective” involved. Deleuze suggests they occur within a protein.⁶⁰ In this context the same applies to a neuron, a mirror neuron most obviously (if indeed mirror neurons act as speculated), but in fact any neuron, considered as a sensing cell in its own right. “We” are built from this, with larger animals possessing the ability to assemble “increasingly numerous differential relations of a deepening order . . . determining a zone of clear expression that is both more extensive and increasingly hermetic.”⁶¹ This is suggestive of a brain not just larger than other animals, but allowing, at “infinite speed,” a more extensive differential survey of its “unlimited finity,” or ongoing “Superfold.”

In sum, Deleuze presents a shifting topological model of the relations within the brain—and between brain, body, and world—of variable and shifting relations of “continuous and discontinuous communications.” This is also a concept of thinking in which physical mechanisms are mutually immersed in, but not entirely equal to, shifting differential patterns or intensities. Deleuze here articulates a complex theory of perception, and indeed of the generation of “ideas.” It allows for both the mutual independence and dependence of the psychic and the more obviously material

(although in another sense, this qualifies the nature of matter, to which we have to add a virtual aspect).

The Brain and Electronic Images

It is with this in mind that we can briefly examine Deleuze's comments on the brain in *Cinema 2*. John Mullarkey notes that much of the cinema books is "inspired by the microbiology of the brain" and that "Deleuze sees cinema as operating at the molar level to shock the brain into forming new synapses, connections, and pathways,"⁶² which, as we have just seen, will also allow for new differential series, new "dark precursors" and new forms of "thunderbolts," in short new forms of thought, new ideas. For Deleuze, real thought is impossible without this shock. The cinema is remarkable in the way it approaches the conditions of thought as shock—technically. For example, Deleuze thinks that "Montage is in thought "the intellectual process" itself, or that which, under the shock, thinks the shock."⁶³ The shock is a "totally physiological sensation," with a "set of harmonics acting on the cortex which gives rise to thought."

At the same time, there "is as much thought in the body as there is shock and violence in the brain. There is an equal amount of feeling in both of them."⁶⁴ Although the brain has its own specificity, for Deleuze, "brain-ness"—and thought—are not

restricted to brains per se. On the other hand, sensation is not restricted to the body (the neurons are full of sensation). More than this, shock and violence, “thunderbolts” and “lightning” are found everywhere. Or, thought/sensation is extended throughout the entire ecology of events.

This means shock, violence, and thought/sensation are configured differently within different relations to different biological, social, or technical forms.⁶⁵ Deleuze is particularly concerned here with the new electronic imaging. It poses a challenge to the brain to adapt, and seems, on the other hand, to come closer to the brain’s own forms of dynamic organization. The new imaging therefore, like many aspects of neuroscience (remembering that neuroscientific images themselves are exactly these new electronic images), poses the possibility of new, extended forms of control and possible freedoms in a more complex engagement with the brain—in what I have begun to call “neural cultures.” In this context, the brain is both accelerated and possibly exceeded by the technics that are to some extent based on concepts, in the development of “thinking machines,” of the brain. These technics augment the brain, analyse it, work it differently. The question becomes: “cerebral creation or deficiency of the cerebellum,”⁶⁶ or both at the same time?

For Deleuze, “neural cultures” are not, and will never be, those cultures that finally know how thinking processes work in an absolute sense. They will be rather those that work the powers of the ongoing, and differential, genesis of experience and

action, of thought-sensation, in which experience and action, inside and outside, begin to fold over each other at dizzying speeds. They are accelerating cultures, in a “perpetual reorganization.” As he writes in *Cinema 2*,

The new images no longer have any outside (out-of field), any more than they are internalized in a whole . . . They are the object of a perpetual reorganization, in which a new image can arise from any point whatever of the preceding image.⁶⁷

Deleuze seems attracted to this perpetual reorganization, for reasons that should by now be obvious. At the same time he has doubts about a rationalist, informational co-opting of this, in which “the shot itself is less like an eye than an overloaded brain endlessly absorbing information” (267). He wonders if the brain is adequate to the new image cultures *in their extreme informational, rationalist modes*.

As we have seen, Deleuze’s concept of the brain is very different to that of a rationalist, cognitivist informatics. Yet if not an “informationalist” organ, it can be very much at odds with informational demands. Writing earlier in *Cinema 2* about Hal the computer’s famous breakdown in Kubrick’s *2001: A Space Odyssey*, Deleuze comments, “if the calculation fails, if the computer breaks down, it is because the brain is no more reasonable a system than the world is a rational one. The identity of world and brain, the automaton, does not form a whole but rather a limit, a membrane which puts an outside and an inside in contact, makes them present to each other, confronts them or

makes them clash . . ." (206). John Rajchman points out that this leaves us not with a (hyper)rational brain, but a "neuroaesthetic brain,"⁶⁸ a flexible, sensate brain working with "unities of feeling," but one always with a set of limits, if flexible limits.

This gives art—and media—a special role in the reorganization of the nervous system in response to new technical and social demands. "Creating new circuits in art means creating them in the brain too."⁶⁹ As Rajchman puts it, and against some of the more naturalist accounts of art in neuroscience,

art is less the incarnation of a lifeworld than a strange construct we inhabit only through transmutation or self-experimentation, or from which we emerge as if refreshed with a new optic or nervous system.⁷⁰

This makes all art and media a kind of (proto-cognitive) architecture even, we might say especially, with regard to the folding of contacts in the brain, "if askew or non-Euclidean." With its digital imaging, mappings of brain dynamics, and restructuring of brain, body, world relations, neuroscience could also be seen as necessarily aesthetic, or, more appropriately, a kind of ongoing architectonics of the nervous system in tune with this nervous system, not imposing a cognitivist pseudo scientific paradigm upon it.

Ethical questions become highly complex questions of the design of the new as much as a loss of old certainties. If the brain's sciences were to focus only on "consequence of discovery" issues, without addressing architectonic issues, they would

face the obvious problems of being unprepared for what they make available bioculturally.

All this this does not mean, as in many misunderstandings of Deleuze and Guattari's concept of schizoanalysis, an ongoing complete reassembling of the brain in some wacky, impossible way. Rather, it is a question of using the plasticity and specificity that is there, alongside the foundations, so to speak. This should not mistake these foundations for a structure more rigid than it actually is, but neither should it overdetermine the capacities of the brain to "perform" complex rationalist systems that often exclude the experimental, the flexible, that are the peculiar talent of the brain as subject. For Deleuze, "Neuroaesthetics becomes possible . . . just when sensation is freed from representation and even from phenomenological conditions to become experimental and diagnostic."⁷¹ Thus, as Rajchman points out, the perils of neuroscience reintroducing "cognitivist" schemes for recognizing objects, or else phenomenological ones for "embodying" life-worlds. It is here that Guattari's formulation of a "machinic unconscious" is crucial.

Guattari and the Synaptic

Of Deleuze's three major direct discussions of the brain (in *Cinema 2, A Thousand Plateaus*, and *What Is Philosophy?*), two were written with Guattari. Even the *Cinema*

books emerged in part from Deleuze's work with Guattari. Here I shall very briefly give an account of four concepts that seem to feed into both Deleuze's view of the brain, and Deleuze and Guattari's final statement on the brain in *What Is Philosophy?* These concepts are "metamodelization," the "machinic unconscious," the "synaptic," and the "fractalizing." All of these contain a desire to take into account the immanence of self- or auto-modeling of biological/ cultural events. At the same time, they contain a deep (political and ontological) suspicion of imposed models, at the least of the less-than-dynamic limits of these models. On the contrary, there is a valorization of the opening to virtuality of the gap, or "synaptic." In addition, as with Deleuze's notion that "even rocks and woods" are a contemplation, concepts such as the machinic unconscious and the synaptic are broadly applied beyond the brain.

Let us start with metamodelization. This also involves what is essentially an adaptive metamethodology.⁷² Metamodelization is

something which does not establish itself as an overcoding of existing models [as is so often the case with cognitivist models of thinking processes], but as a procedure of "autodelization" which takes over all or parts of the existing models in order to construct its own cartographies, its own references and therefore its own analytical approach and methodology.⁷³

It is therefore not only an immanent automodelization, but one that intervenes and reorganizations the operations of models imposed upon/within a given event.⁷⁴ If we take metamodelization seriously, to paraphrase Guattari, we have the brain we deserve⁷⁵ (for Guattari, the unconscious we deserve). With regard to thinking processes, this implies that Deleuze and Guattari were not seeking a fixed alternative model of the brain or nervous system, although they were willing to take up parts of existing models from elsewhere (new media as well as the history of philosophy and the molecular biology of the brain).

This brings us to the machinic unconscious. This is not limited to the brain, or even to the subject. It is rather the unconscious taken “transversally”—that is, as operating across fields, bringing them together in new ways. It is directed toward the future rather than the past. It is

an unconscious whose screen would be none other than the possible itself, the possible as a flower of language, but also the possible as a flower of skin, as a flower of socius, as a flower of cosmos.⁷⁶

This radically undefined unconscious is also open to all to understand and work with, without “distress” or “preparation.”⁷⁷ This is, if you like, a very democratic view of work with the unconscious. It is unrestricted by disciplinary models. It lives in the world at large. It is informed as much by media manipulation and “cohorts of technicians” as by any kind of interior life. It is “machinic” not because it is mechanical,

but because it is productive, and also because it is not necessarily centred around human subjectivity, but involves the most diverse material fluxes and social systems." It is not "the exclusive seat of representative contents"⁷⁸ (there goes symbolic processing again), but rather "the site of interaction between semiotic components and extremely diverse systems of intensity" (a kind of "extended mind"⁷⁹ at warp drive). It does not "depend on a universal syntax" or "universal structures" but rather "processes of singularization," so that it "evolves with history."⁸⁰ It can be individual or collective, and tends to underwrite the ongoing creation of territories of existence.

Guattari complicated this creation of territories with a concept he calls the "synaptic." This arises *between* existential territories and other dynamic structures. The synaptic does not open, initially at least, onto individuation and structure, connection or temporal systematization (of territories, of forms of existence, of things that are "placed" in a system or syntax of signs). The synaptic opens instead onto the "nondifferentiable."⁸¹ It involves a potential for movement from formed systems to chaosmos, the virtual. The synapse is "*dis*-positional."⁸² Synapses are *fields* of potential, that, via these openings away from structures, are able to break off aspects of events or previous territories and set them free. An example Guattari gives from perception is when an aspect of an "organized" face, say a moustache or a "grimace," breaks free in perception, and is able to connect with everything, everywhere, as in "dreams" or "phantasms," "delirium," or "religion." Technically,

the synapses integrate, to a deterritorialized level, the existential breaks resulting from the refrains . . . *the synaptic gap . . . marks . . . an explicit break . . . rich in content*, even if in a content that is mutilated, made “arbitrary,” rendered a-signifying⁸³, that is to say cut off from its syntagmatic bases, and from its paradigmatic bonds.⁸⁴

In a sense, the synapse is the open shifting field of potential that comes before Deleuze’s “dark precursor” creates a channel in the space between territories for a flash of lightning (or a firing of a synapse—a micro-individuation—to occur).

If Guattari’s machinic unconscious has a foundational syntax or order of events it might look like this: *synaptic—dark precursor—the flash of individuation—unity of feeling*. However, the elements of events in Guattari’s terms would not have a regular syntax. In fact, the synaptic for him is precisely the possibility of “points of reversal” away from determination. (This again discounts a cognitivism or computationalism of the brain.) It is true, as with the machinic unconscious, that Guattari uses the term “synaptic” in a very broad context, far beyond its usual reference to the brain. It does eventually inform Deleuze and Guattari’s view of the brain, but this is a two-way street. On the one hand, as previously mentioned, Deleuze and Guattari generalize “brain-function,” beyond the brain as normally conceived, to a world full of micro-brains. “[N]ot every organism has a brain, and not all life is organic, but everywhere there are forces that constitute

microbrains, or an inorganic life of things.”⁸⁵ On the other hand, Guattari’s synaptic does seem very resonant with their discussion of actual synapses.

In *What Is Philosophy?* Deleuze and Guattari are discussing the structure of the brain, the task of science in relation to the brain, and the relation of the functions of science to the brain. They focus particularly on the chaos, or virtuality, into which the “brain itself, as subject of knowledge plunges.” They write:

It is up to science to make evident the chaos into which the brain itself, as subject of knowledge, plunges. The brain does not cease to constitute limits that determine functions of variables in particularly extended areas; relations between these variables (connections) manifest all the more an uncertain and hazardous characteristic, not only in electrical synapses, which show a statistical chaos, but in chemical synapses, which refer to a deterministic chaos . . . Even in a linear model like that of the conditioned reflex, Erwin Strauss has shown that it was essential to understand the intermediaries, the hiatuses and gaps.⁸⁵

We have seen that, for Deleuze and Guattari, the structure of the brain is not so much “syntactic” as topological, a probabilistic series of chaoses in interaction, which are folded by ongoing connections between “extreme elements.” There is also a range of synaptic “dis-positional” aspects to the brain—gaps and hiatuses, electrical and chemical synapses themselves.

This is made more complex by what Guattari refers to as a “fractalisation”⁸⁶ related to the synaptic. Massumi writes of a “fracture at the base of meaning,”⁸⁷ based on Guattari’s use of the term in *Cartographies Schizoanalytiques*. As well as indicating a fracturing of meaning, however, Guattari uses the term “fractalisation” to describe the “texture” of “intermediate temporalities,” the fractal effect of mixed temporalities—durations and syntheses—in “becoming.”⁸⁸ Related to the synaptic, fractalization indicates a further conception of the potentialization that occurs within the brain, not only in space, but in terms of the recursive creation of time(s), within the gaps and hiatuses in the nervous system of which Deleuze and Guattari are so fond.

Man Absent from, but Completely within the Brain

We can now understand why, in *A Thousand Plateaus*, Deleuze and Guattari consider the “dendrites” (the parts of the neuron receptive to stimulus) badly labeled. The term “dendrites” is derived from the Greek for “tree,” and they are committed to a less hierarchically structured (rhizomatic or “grass-like”) brain. In this brain, the “discontinuity of the cells, the role of the axons, the functioning of the synapses, the existence of synaptic microfissures, the leap each message makes across these fissures, make the brain a multiplicity.”⁸⁹ We understand why they favor the dynamism and fragmented nature of short-term memory over long-term memory, and radicalize this

further by suggesting that short-term memory “is in no way subject to a law of contiguity or immediacy to its object; it can act at a distance, come or return a long time after, but always under conditions of discontinuity, rupture and multiplicity.”⁹⁰ Short-term memory is, simply put, more dynamic, more subject to folds, strange continuities over distances as well as gaps and discontinuities, more open to the “fractalisation” of meaning and temporalities. We also understand Deleuze and Guattari’s concept of the brain as involving embodiment in a very direct manner—“Sensation is no less brain than the concept.”⁹¹ However, they also add an extended materialism to the mix, one that takes the incorporeal into account. In this, they give a *qualified* materialist account of metaphysics, as literally arising within the brain.

An extended note in Deleuze’s *The Logic of Sense* is crucial for understanding Deleuze’s concept of the brain in relation to metaphysics. Here, he accounts for the “conversion of the physical surface of the brain into a metaphysical surface.”

Modern studies insist on the relations between areas of cortical projection and topological space. “The projection in fact converts a Euclidean space into a topological space, so that the cortex cannot be adequately represented in a Euclidean manner” . . . It is in this sense that we speak of the conversion of the physical surface into a metaphysical surface, or of an induction of the latter by the former. We can thus identify the cerebral and metaphysical surfaces: it is less a question of bringing about the

materialization of the metaphysical surface than of following out the projection, conversion, and induction of the brain itself.⁹²

This interaction between physical surfaces and inducted metaphysical surfaces,⁹³ or between Euclidean and topological spaces, is the foundation of a much fuller account of thinking processes that seeks to account for thinking processes via physical structures alone. For Alliez, it allows an account of consciousness as *“nothing other than form or, rather, active formation in its absolute existence: consciousness and morphogenesis are one and the same thing.”*⁹⁴ Sometimes, “seeing the brain in action” in brain scans seems to distract from this less visible process of active formation. It does so in favor of the identification of physical locations and visible structures, often as the location of aspects of subjectivity, in which we find “our” subjective states such as “happiness” or “meditative peace.”

Of course, these may not be “our” states. That which neuroscience discovers but which is hard to reconcile with humanism (the key and as yet unresolved problem of neuroethics), is that “It is the brain that thinks and not man, the latter being only a cerebral crystallization.”⁹⁵ It is in the brain that new worlds—new, singular, universes of reference—form, including those universes of reference that become, often briefly, if again and again, “man” or “woman.” Indeed, it may surprise many how central the brain is to Deleuze and Guattari’s thought, and how much it is the brain that proves to

be the key substitute for “man.” Deleuze and Guattari’s “posthumanism” is molecular biological.

We will speak of the brain as Cézanne spoke of the landscape: man absent from, but completely within the brain. Philosophy, art, and science are not the mental objects of an objectified brain but the three aspects under which the brain becomes subject. Thought-brain.⁹⁶

Or rather, for all the above, not *in* the brain, or not *only* in the brain, because “The brain is the junction—not the unity—of the three planes” (the three active planes of the functions of science, the percepts and affects of art, the concepts of philosophy).⁹⁷ For Deleuze and Guattari, the brain as junction is *a folded exteriority* (echoing the history of the development of the nervous system⁹⁸). It is a folded exteriority still profoundly subject to forces from the outside, in part because, as with mirror neurons, or perception in general, which can occur at a distance, the brain is such a powerful organ of synthesis across ecologies. At the same time, while radically open to the exterior, the brain possesses *a very deep interiority* (as “synaptic” and “fractal”) in which the coming together in the brain is reworked profoundly—literally metaphysically (topologically)—as syntheses encounter the forces of the virtual. The folding of exterior and interior together (Superfold) is what enables Deleuze and Guattari to claim, in *A Thousand Plateaus*, that “there is indeed one exterior milieu for the entire stratum.” The “stratum” they refer to here is not quite that of the human, but of “the prehuman soup immersing

us,” and this exterior milieu, “permeating the entire stratum,” is “the cerebral-nervous milieu.”⁹⁹

Deleuze and Guattari’s concepts of radical exteriority and radical interiority allow for a brain that “naturally” metamodels, mutilates, or “*dis-positions*” rigid schematic ontologies, including those concerning thinking processes, toward a pragmatic open to ontogenesis. In this respect, Alliez gives perhaps the most accurate definition of the brain according to Deleuze and Guattari. The brain is

that operation of being that composes the meta-stable system of phases belonging to a pre-individual world in formation—in the midst of individuation—qua ontogenesis of itself. Following the principle of a conversion of the cerebral surface into a metaphysical surface, we could almost say that the brain is ontology delivered over to the pragmatics of being.¹⁰⁰

In many ways, such a definition of the brain lies precisely at the intersection of the rigors of a neuroscience concerned with the constitutive elements of the pre (and post) personal on the one hand, and social/ political diagnosis of the way thinking is materially constituted within biological and social practices or modes of living.

What Is Philosophy? concludes that the brain even poses a challenge to preconstituted areas such as science, art, and philosophy. If the brain is the “junction,” then this is a junction in which neither science in general, nor neuroscience in particular,

should expect to remain themselves. As Arkady Plotnisky puts it, Deleuze and Guattari see the “possibility of a different future of thought, in which the boundary between philosophy, art and science and even all three themselves disappears back into the chaotic field of thought.”¹⁰¹ The most important questions to consider (especially at the junction of the biological/social, neuroscience, and what we have called here “neuroaesthetics”), are “the problems of interference between the planes that join up in the brain.”¹⁰² This interference seems particularly acute in neuroscience’s case.

Beaks Against the Window

We like to play with models of mind. Yet sometimes it seems that we return too often to different models of recognition as the objects of our play. We might even multiply these models of recognition as we play. Yet, as Deleuze writes of Kant, this does not go far enough. “Far from overturning the form of common sense, Kant merely multiplied it.”¹⁰³ At the heart of this problem is the changing of a politics of being with regard to models of thought. At the heart of this is perhaps the creativity with which we create transversal movements between fields, disciplines, and practices, when this is necessary. And we can take the following, in which Deleuze quotes Guattari, as perhaps a basis for an alternative future politics of being to that of neuro-cognitive controls.

Here,

symptoms are like birds that strike their beaks against the window. It is not a question of interpreting them. It is a question instead of identifying their trajectory to see if they can serve as indicators of new universes of reference capable of acquiring a consistency sufficient for turning a situation upside down.¹⁰⁴

Such symptoms as these birds indicate the general social and biological urgency of the call of the virtual, no matter how faint that call might be. This is a call which is always as close to home as it is far away.

Notes to Chapter 11

1 Gilles Deleuze and Félix Guattari, *What Is Philosophy?* trans. Hugh Tomlinson and Graham Burchell (New York: Columbia University Press, 1994), 216.

2 Jonathan Moreno, *Mind Wars: Brain Research and National Defense* (Washington, D.C.: Dana Press, 2006); Joseph Dumit, *Picturing Personhood: Brain Scans and Biomedical Identity* (Princeton, N.J.: Princeton University Press, 2003); Brian Massumi, "Fear (The Spectrum Said)" *Positions* 13, no. 1 (2005): 31–48; Elizabeth A. Wilson, "The Work of Antidepressants: Preliminary Notes on How to Build an Alliance between Feminism and Psychopharmacology," *Biosocieties* 1 (2006): 125–31; Steven Rose, *The Future of the Brain* (Oxford: Oxford University Press 2006).

3 Mark Amerika, *Meta/Data* (Cambridge, Mass.: The MIT Press, 2007), 53.

4 *Ibid.*, 32–33.

5 For two examples, see Watson discussing Edelman (Sean Watson, "The Neurobiology of Sorcery: Deleuze and Guattari's Brain," *Body & Society* 4 [1998]: 23–45; Gerald Edelman, *Bright Air, Brilliant Fire* [New York: Basic Books, 1993]); or Guattari on his taking up of Varela's work (Félix Guattari, "On Machines," *Journal of Philosophy and the Visual Arts* VI [1995]: 8–12).

6 Gilles Deleuze, *Negotiations*, trans. Martin Joughin (New York: Columbia University Press, 1995), 176.

7 Brian Massumi notes that this materialism might be found in "the quantum waves crossing the brains synaptic fissures" in *A User's Guide to Capitalism and Schizophrenia* (Cambridge, Mass.: The MIT Press, 1992), 157.

- 8 Brian Massumi, *A User's Guide to Capitalism and Schizophrenia*, 33.
- 9 Gilles Deleuze, *The Logic of Sense*, trans. Mark Lester and Charles Stivale (New York: Columbia University Press, 1990), 240.
- 10 Deleuze, *Negotiations*, 60.
- 11 Ibid., 149.
- 12 Gilles Deleuze, *Difference and Repetition*, trans. Paul Patton (New York: Columbia University Press, 1994), 147.
- 13 Ibid., 143.
- 14 Deleuze, *Negotiations*, 176.
- 15 As in the title of Dumit's book, *Picturing Personhood*.
- 16 Deleuze, *Negotiations*, 149, my emphasis.
- 17 Ibid., 61.
- 18 Watson, "The Neurobiology of Sorcery," 38, my emphasis.
- 19 Deleuze, *Negotiations*, 61.
- 20 Charles Stivale, "N-Z Summary of *L'Abécédaire de Gilles Deleuze*," 2000, <http://www.langlab.wayne.edu/CStivale/D-G/ABC3.html>, accessed October 2, 2004, my emphases.
- 21 Steven Rose, *The Conscious Brain* (New York: Vintage Books, 1976).
- 22 Deleuze and Guattari, *What Is Philosophy?* 122.
- 23 For a neurological account of neural networks, see Donald Hebb, *The Organization of Behavior* (New York: Wiley, 1949); for an account of their sensory-cultural form, see Friedrich Hayek, *The Sensory Order* (Chicago: University Of Chicago Press, 1952).
- 24 Deleuze, *Difference and Repetition*, 73.

25 V. S. Ramachandran and Sandra Blakeslee, *Phantoms in the Brain: Probing the Mysteries of the Human Mind* (New York: Harper Perennial, 1999).

26 Charles T. Wolfe, "De-ontologizing the Brain: From Fictional Self to the Social Brain," *Ctheory* 30, 2007, <http://www.ctheory.net/articles.aspx?id=572>, accessed October 30, 2007.

27 V. S. Ramachandran, "Mirror Neurons and Imitation Learning as the Driving Force Behind 'the Great Leap Forward' in Human Evolution," *Edge*, 2000, http://www.edge.org/3rd_culture/ramachandran/ramachandran_index.html, accessed September 14, 2007.

28 Paolo Virno, *Multitude between Innovation and Negation* (New York: Semiotext(e), 2008).

29 Brian Massumi, *Parables for the Virtual* (Durham, N.C.: Duke University Press, 2002), 187.

30 Paul Bains, "Subjectless Subjectivities" in *A Shock to Thought*, ed. Brian Massumi (New York: Routledge, 2002), 101–16; also see Eric Alliez, *The Signature of the World* (London: Continuum, 2005), 62–63. The immanence of formation as individuation is also taken from Gilbert Simondon. Guattari also takes the concept of autopoiesis from Francisco Varela ("On Machines"), although he qualifies it with an "allopoiesis" that respects a simultaneous, if still immanent, relation to exteriority in the process of "active formation."

31 Bains, "Subjectless Subjectivities," 101–16.

32 *Ibid.*, 103.

33 Cf. Jean-Pierre Dupuy, *The Mechanization of the Mind: On the Origins of Cognitive Science* (Princeton, N.J.: Princeton University Press, 2000).

34 Cf. Norbert Wiener, *Cybernetics or Control and Communication in the Animal and the Machine* (Cambridge, Mass./New York: MIT/Wiley, 1949); and Norbert Wiener, "The History and Prehistory of Cybernetics," *Kybernetes* 27 (1998): 29–37. Gary Genosko has pointed this out, in personal conversation.

35 Cf. Maurizio Lazzarato, "The Machine," transversal, 2006, <http://eicpcp.net/transversal/1106/lazzarato/en>, accessed October 10, 2007; and Paolo Virno, *A Grammar of the Multitude: For an Analysis of Contemporary Forms of Life* (New York: Semiotext(e), 2004).

36 Samuel Weber, *Targets of Opportunity: On the Militarization of Thinking: On the Militarization of Thinking* (New York: Fordham University Press, 2005).

37 Gilles Deleuze, *Foucault* (London: Athlone Press, 2001), 131.

38 John Marks, "Molecular Biology in the Work of Deleuze and Guattari," *Paragraph* 29 (2006): 95.

39 Deleuze, *Foucault*, 131.

40 Stivale, "N–Z Summary of *L'Abécédaire de Gilles Deleuze*."

41 Deleuze, *Difference and Repetition*, 119.

42 *Ibid.*, 119.

43 Stivale, "N–Z Summary of *L'Abécédaire de Gilles Deleuze*."

44 Watson, "The Neurobiology of Sorcery," 38.

45 See Alliez on Guattari and Whitehead, in *The Signature of the World* (London: Continuum, 2005), 55.

- 46 Félix Guattari, *Cartographies Schizoanalytiques* (Paris: Editions Galilee, 1989), 82ff.
- 47 Félix Guattari, *Chaosmosis: An Ethico-Aesthetic Paradigm* (Sydney: Power, 1995), 113.
- 48 Guattari, *Cartographies Schizoanalytiques*, 82, quoting Alfred North Whitehead, *Process and Reality* (New York: Free Press, 1979), 224.
- 49 For example, it is speculated that the mirror neuron creates a “unity of feeling” across bodies and brains, and this might create new potentials for future action. This does not, however, mean that this action will resemble that which has been “mirrored.”
- 50 Deleuze, *Difference and Repetition*, 118.
- 51 Gilles Deleuze, *The Fold: Leibniz and the Baroque* (Minneapolis: University of Minnesota Press, 1992), 86.
- 52 Deleuze and Guattari, *What Is Philosophy?* 209.
- 53 *Ibid.*, 209.
- 54 Deleuze, *The Fold*, 86.
- 55 William James, *The Principles of Psychology* (New York: H. Holt and Company, 1893), 609.

56 Deleuze, *The Fold*, 88. A simple example might be all the movements—and microperceptions—involved in a moving car. We will tend to notice a *shift* in velocity, which is the differential of distance covered over time, precisely because it changes, when we accelerate, and for a moment the new speed is “notable or remarkable.” An example that Deleuze gives here is that of the “sound of the sea: at least two waves must be minutely perceived as nascent and *heterogeneous* enough to become part of a relation that can allow the perception of a third, one that “excels” over the others and comes to consciousness” (88).

57 *Ibid.*, 89.

58 *Ibid.*, 90. See also Tim Van Gelder, 1999, for a cognitive philosopher’s view of these differential conditions, and Varela, 1999, for a neurologist’s perspective.

59 *Ibid.*, 91.

60 Deleuze, *Difference and Repetition*, 92.

61 Deleuze, *The Fold*, 92.

62 John Mullarkey, “Deleuze and Materialism,” *South Atlantic Quarterly* 96 (1997): 446.

63 Gilles Deleuze, *Cinema 2: The Time-Image* (Minneapolis: University of Minnesota Press, 1989), 158.

64 *Ibid.*, 204.

65 John Sutton, “Porous Memory and the Cognitive Life of Things,” in *Prefiguring Cyberculture: An Intellectual History*, ed. Darren Tofts, Annemarie Jonson, and Alessio Cavallaro (Cambridge, Mass.: MIT Press, 2002), 130–41.

66 Deleuze, *Cinema 2: The Time-Image*, 266.

67 Ibid., 265.

68 John Rajchman, *The Deleuze Connections* (Cambridge, Mass.: MIT Press, 2000), 136.

69 Deleuze, *Negotiations*, 60.

70 Rajchman, *The Deleuze Connections*, 135. Here we might include Ramachandran's "10 universal laws of art," for example, as useful as they might be. See V. S. Ramachandran, "The Artful Brain," *Reith Lectures 2003* BBC, 2003, <http://www.bbc.co.uk/radio4/reith2003/lecture3.shtml> (accessed August 31, 2007).

71 Rajchman, *The Deleuze Connections*, 136.

72 Gary Genosko, "Félix Guattari: Towards a Transdisciplinary Metamethodology," *Angelaki* 8 (2003): 129–40.

73 Félix Guattari, *Soft Subversions*, trans. Sylvère Lotringer (New York: Semiotext(e), 1996), 268–69.

74 All "models" are metamodels in a sense, as there is no outside to immanence.

75 Félix Guattari, *L'inconscient Machinique* (Paris: Recherches, 1979), 7.

76 Ibid., 8. Translated by Taylor Atkins at <http://fractalontology.wordpress.com/2007/10/01/introduction-to-felix-guattaris-machinic-unconscious>.

77 Guattari, *Soft Subversions*, 194.

78 Ibid., 196.

79 Cf. Sutton, "Porous Memory and the Cognitive Life of Things."

80 Guattari, *Soft Subversions*, 196–97.

81 Guattari in Charles Stivale, *The Two-Fold Thought of Deleuze and Guattari: Intersections and Animations* (New York: Guilford Press, 1998), 224.

82 Guattari, *Cartographies Schizoanalytiques*, 200.

83 Simply put, not fitting into systems of signification yet still operating as a kind of intensity. It does not follow a logic of representation, but rather creates new territories—it “opens fields of the possible that aren’t at all in bi-univocal relationship with the description presented” (Guattari in Stivale, 1998: 221).

84 Ibid., 199, my emphasis.

85 Deleuze and Guattari, *What Is Philosophy?* 213.

86 Ibid., 216.

87 Guattari, *Cartographies Schizoanalytiques*, 218. A fractal could be seen as a infinitely complex breakdown of dimension across levels (most famously represented in a snowflake but also commonly seen in fractal diagrams).

88 Massumi, *A User’s Guide to Capitalism and Schizophrenia*, 150.

89 Guattari, *Cartographies Schizoanalytiques*, 218–19.

90 Gilles Deleuze and Félix Guattari, *A Thousand Plateaus*, trans. Brian Massumi (Minneapolis: University of Minnesota Press, 1987), 15.

91 Ibid., 16.

92 Deleuze and Guattari, *What Is Philosophy?* 216.

93 Deleuze, *The Logic of Sense*, 355.

94 Of field in self-survey at infinite speed, of the shifts in the relations between probabilistic series of microevents.

95 Alliez, *The Signature of the World*, 63.

96 Deleuze and Guattari, *What Is Philosophy?* 210.

97 Ibid., 210.

98 Ibid., 208.

99 Cf. Rose, Rose, *The Future of the Brain*, 11ff.

100 Deleuze and Guattari, *A Thousand Plateaus*, 64.

101 Alliez, *The Signature of the World*, 62.

102 Arkady Plotnisky, "Chaosmologies: Quantum Field Theory, Chaos and Thought in Deleuze and Guattari's *What is Philosophy?*" *Paragraph* 29 (2006): 53.

103 Ibid., 54.

104 Deleuze, *Difference and Repetition*, 137.

105 Deleuze, "What Children Say," in *Essays Critical and Clinical*, trans. Daniel W. Smith and Michael A. Greco (Minneapolis: University of Minnesota Press, 1997), 63–64.