

## Numbers and Fractals: Neuroaesthetics and the Scientific Subject

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*Scientific knowledge of the brain has evolved, and carried out a general arrangement. The situation is so complicated that we should not speak of a break, but rather of new orientations . . . It is obviously not through the influence of science that our relationship with the brain changed: perhaps it was the opposite, our relationship with the brain having changed first, obscurely guiding science. . . . The brain becomes our problem or our illness, our passion, rather than our mastery, our solution or decision. We are not copying Artaud, but Artaud lived and said something about the brain that concerns all of us: that "its antennae turned towards the invisible," that it has the capacity to "resume a resurrection from the death."*

—Gilles Deleuze, *Cinema 2: The Time-Image*

THE POPULARITY of mathematics and scientific reasoning in contemporary culture is evident from popular television series such as *Numb3rs* (CBS, since 2005) and Hollywood films about mathematicians such as *Good Will Hunting* (Gus van Sant, 1997), *A Beautiful Mind* (Ron Howard, 2000), and *Proof* (John Madden, 2005). Besides a general fascination for mathematics as principle underlying all kind of phenomena in our world, these films also indicate a particular interest in the brain, the mind of the scientist in particular. It is a classic trope to feature the scientist as a mad mind, but contemporary cinema shows that something else is at stake as well. The mathematician in contemporary popular culture may be socially not adapted, even paranoid and schizophrenic, but what is going on in this particular mind is no longer considered as completely

deranged and totally opposed to a normal functioning brain. Instead, the scientific and “mad” mind in popular culture seems to indicate deep metaphysical and ontological truths. In this essay I will propose the hypothesis that the popular obsession with mathematics and the mind of the scientist is related to a Deleuzian ontology of differences, repetitions, and folds that finds a full expression in films that not only deal with mathematics and madness in terms of their content (such as the Hollywood films indicated above) but also in terms of their particular “neuroaesthetic” style. The limitless beauty and power of numbers and geometric figures such as spirals and fractals that are at the basis of this style are related to the limitless powers of thought where madness and metaphysics fold and unfold in each other and point toward an “ungrounded ontology” of the virtual. Departing from the idea that “the brain is the screen,” I will start by looking at the changing relationships between cinema and the (neuroscientific) brain, from the movement-image and the time-image to a contemporary “neuro-image.” In the second part, I will develop this concept of the neuro-image further by looking at two films of Darren Aronofsky, *Pi* (1997) and *The Fountain* (2007), relating them to Deleuze’s ideas on thought in *Difference and Repetition* and on Leibniz’s Baroque mathematics in *The Fold*. I will argue that aesthetically both of these films give us, in two different ways, direct access to a scientific brain that reaches out to the universal questions of the genesis of the universe: life, death, and belief. In doing so, these films could be considered as the extreme poles of contemporary neuroaesthetics in cinema that reveal its profound relations to the forces of the virtual.

## Cinema and the Brain

### *The Movement-Image: Thought, Tropes, and the Mad Scientist*

Before entering the specific characteristics of contemporary cinema’s relation to neuroscientific discoveries about the brain and the mind (and the importance of mathematics), it is useful to recall how in the past cinema dealt with these issues. As Deleuze reminds us in *The Time-Image*, cinema has always had a profound relation with thinking, the connection to the brain even being cinema’s essence: “It is only when movement becomes automatic that the artistic essence of the image is realized: *producing a*

*shock to thought, communication vibrations to the cortex, touching the nervous and cerebral system directly.”* Cinema produces “nooshocks” to the brain; cinema and the brain enter into a circuit that produces new thoughts. The cinema of Eisenstein, which combines emotional images of attraction with intellectual montage, is for Deleuze the paradigmatic example of the organic way in which the movement-image connects to thought. In cinema of the movement-image, thinking proceeds by tropes, metonymies, metaphors, inversions, oppositions, attractions, and so forth. Deleuze calls this a form of action-thought,<sup>3</sup> where there is always a relation between man and the world. Hence its organic qualities, always relating to a synthetic Whole in which everything can be kept together. Where classic American cinema operates mainly through metonymical principles of continuity editing, Eisenstein’s films produce shocks to thinking through metaphorical montage. The prime example here is the intellectual montage in *October* (1927) where, for instance, images of the commander-in-chief Kerensky entering a room in the Winter Palace are dialectically intercut with a peacock, producing the synthetic thought of his vanity (and eventual downfall).

Another way in which classical cinema or the movement-image is related to the brain and to mental processes is its relation to memory and to the imagination (dreams and fantasies). Here again the organic composition of the Whole is determining the place of memory and imagination. Memories are always presented out of the necessity of a clearly defined point in the present to which we always return. The flashbacks in *Daybreak* (Marcel Carné, 1939), for instance, are motivated by the character’s fate in the present. Moving back and forth in time is always related to the organic Whole of the tragic conditions of the present, and it explains how this present has come about. Hitchcock’s *Spellbound* (1945) most famously shows how dreams figure in our unconscious minds. Here the main character suffers from amnesia and anxiety attacks whenever he sees black stripes on a white surface (a fork scratching on a white table cloth, stripes on pajamas, ski marks in the snow). The famous dream sequence designed by Dalí is shown as an oneiric flashback that can be decoded by the psychoanalysts in the film to discover its significance and, again, the composition of a Whole that makes sense.

If we look at more literal images in which the brain and the mind of the scientist feature in the movement-image, we find that classical cinema presents us quite frequently with the trope of the mad scientist,

together with that of the brain, as metaphors for all kind of fears. In the fifties, a whole range of horror movies produced the B-genre of so-called "brain movies." A telling example is *Fiend without a Face* (Arthur Crabtree, 1958), in which a mad scientist secretly experiments in thought materializations to detach consciousness and give it an entity of its own. The experiments he performs on his own brain literally get a boost when his instruments are hit by lightening (another trope of mad science since Dr. Frankenstein), and he discovers that the atomic plant near his laboratory provides an even more powerful aid. Of course, the experiments soon become uncontrollable, and the scientist realizes that he has created an invisible fiend of expanded intelligence, a mental vampire that feeds on atomic power and the brains plus spinal cords of human beings. While the representation of materialized thought as literal disembodied brains is quite over the top, the metaphoric relations between the unleashed brain and the dangers of nuclear power during the Cold War are still striking. And again we see here how in the movement-image thought, tropes and the brain are connected in an organic way. The mad scientist soon regrets the effects of his thoughts and experiments when they disturb the Whole.

#### *The Time-Image: Belief, Theorem/Problem, and Schizophrenia*

With the arrival of the time-image, cinema's relationship to the brain takes on a different form. Deleuze now refers to Artaud, who argued that cinema can be brought together with the innermost reality of the brain. "But this innermost reality is not the Whole, but on the contrary a fissure, a crack," Deleuze adds.<sup>4</sup> This crack is quite literally related to a break with the organic sensory-motor link of man with the world, so that the time-image produces seers who find themselves struck by something intolerable in the world and confronted with something unthinkable in thought. So the "task" of cinema is now no longer to produce thought in showing the connections to the Whole, but to produce "the psychic situation of the seer, who sees better and further than he can react, that is, think."<sup>5</sup> When the sensory-motor link of man with the world is broken and we can no longer be sure of the exact relationships between man and world, of the great organic links between what he sees and hears and the world, it is *belief* that becomes the ontological basis of the image. Belief becomes a power of thought that replaces the model of knowledge. And, Deleuze

adds, this also changes the nature of belief: "Whether we are Christians or atheists, in our universal schizophrenia, *we need reasons to believe in this world.*"<sup>6</sup>

I will return to the schizophrenic nature of this belief in cinema, but first it is important to recall Deleuze's observation that thought in the time-image no longer operates through figures and tropes but becomes theorematic and problematic. The cinematographic image no longer only gives us an association of images, but "it also has the mental effect of a theorem, it makes the unrolling of the film a theorem . . . it makes thought immanent to the images."<sup>7</sup> In this description of the image as theorematic thought, Deleuze refers to mathematics:

In fact there are two mathematical instances which constantly refer to each other, one enveloping the second, the second sliding into the first, but both very different in spite of their union: these are the theorem and the problem. A problem lives in the theorem, and gives it life, even when removing its power. The problematic is distinguished from the theorematic (or constructivism from the axiomatic) in that the theorem develops internal relationships from principle to consequences, while the problem introduces an event from the outside—removal, addition, cutting—which constitutes its own conditions and determines the "case" or cases: hence the ellipse, hyperbola, parabola, straight lines and the point are cases of projection of the circle on its secant planes, in relation to the apex of a cone. This outside of the problem is not reducible to the exteriority of the physical world any more than to the psychological interiority of a thinking ego. . . . There is a decision on which everything depends, deeper than all the explanations that can be given for it. . . . As Kierkegaard says, "the profound movements of the soul disarm psychology," precisely because they do not come from within.<sup>8</sup>

In my discussion of *Pi* and *The Fountain* I will return to the theorem and the problem. For now, it is important to see how thought in the time-image is related to the exteriority of a belief, a choice that has to be made outside any mode of knowledge.

Another important characteristic of the time-image is that it no longer refers to a Whole defined as an organic open totality as in the movement-

image, defined by montage of associations or attractions between parts, the set, and the changing Whole. In the time-image, the Whole is the outside, which means that what is important now is what happens in between images, a spacing that according to Deleuze means that "each image is plucked from the void and falls back to it. . . . Given one image, another image has to be chosen which will induce an interstice *between* the two. This is not an operation of association, but of differentiation, as mathematicians say, or of disappearance, as physicists say: given one potential, another one has to be chosen, not any whatever, but in such a way that a difference of potential is established between the two, which will be productive of a third or something new."<sup>9</sup> Thought becomes irrational and not necessarily organic. It is known that for the time-image Deleuze has demonstrated how this inorganic power of thought and belief is related to the unsummonable of Welles, the inexplicable of Robbe-Grillet, the undecidable of Resnais, the impossible of Duras, and the incommensurable of Godard. In all these types of time-images, the power of thought is related to a confusing and confused experience of time and the reality of the virtual of the past and future.<sup>10</sup>

A final aspect of the time-image that has to be addressed is its schizophrenic nature. Deleuze never explicitly related the cinema book to his work on schizoanalysis that he developed with Guattari; however a schizoanalysis of cinema seems to be called for when reading the cinema books together with the two volumes on capitalism and schizophrenia, *Anti-Oedipus* and *A Thousand Plateaus*. In "Is a schizoanalysis of cinema possible?" Ian Buchanan refers to crucial passages in *A Thousand Plateaus* where Deleuze and Guattari turn to cinema to explain the schizoanalytical implications of the delirium and the delirious nature of cinema. He furthermore argues that the cinematographic apparatus is, in essence, schizoanalytic: the frame, the shot, and montage corresponding to the Body without Organs, the assemblage, and the abstract machine. Buchanan thus suggests that "if cinema is delirium we need a theory of delirium to form the basis of a schizoanalysis of cinema."<sup>11</sup> In "Delirium Cinema or Machines of the Invisible?" I have elaborated this suggestion by looking at the relationship between clinical and critical forms of schizophrenia, and its implications for cinema.<sup>12</sup> I here argue that a schizoanalysis of cinema entails a shift in the conception of the cinema as a "machine of the visible" (the images rendering the visible world) to cinema as a "machine of the invisible" (images making the invisible—thought, the virtual—visible).

Although from its beginnings cinema has had the potentiality to render thought visible, the time-image fully developed this possibility of giving the image the delirious and psychotic potentiality to giving us direct access to the mind, to consciousness, to the invisible: a camera-consciousness.

These schizoanalytic implications of the time-image become increasingly evident and important. Besides their fascination for mathematics and the (mad) mind of the scientist, contemporary cinema and popular culture at large are also populated with schizos, delirious and delusional characters, characters that suffer from amnesia and other brain disorders. Contemporary cinema has quite literally entered the mind of its characters, playing all kind of tricks with the mind of the spectators as well. Mind-game movies such as *The Game* (David Fincher, 1997) and *Minority Report* (Steven Spielberg, 2002) present complex narratives that play with the spectators' expectations.<sup>13</sup> In *Tierra* (Julio Medem, 1996), the main character is schizophrenic or perhaps even dead; *The Butterfly Effect* (Eric Bress, 2004) deals with blackouts and schizophrenic hallucinations; in *Eternal Sunshine of the Spotless Mind* (Michel Gondry, 2004), the classic screwball theme of remarriage is literally played out in the mind of the two main characters, who have their memories of one another erased by a company called Lacuna; *The Machinist* (Brad Anderson, 2004) presents events from the traumatized mind of its protagonist; in *Fight Club* we enter the movie quite literally on a ride through the brain's neural network, only to find out at the end that the two protagonists are actually one, a "crystal character," so to speak, whose virtual and actual sides are both real. Many more examples can be given of contemporary film characters who seem to have lost their minds or are, as Anna Powell indicates, in "altered states."<sup>14</sup> In any case, the wondering and wandering character of the time-image described by Deleuze seems to be replaced by a "delusional" character of what could be called the neuro-image (or schizo-image). The wondering characters of the time-image after World War II are paralyzed by something intolerable they see in the world. Such "schizophrenic" characters, whose brains we literally enter in the neuro-image, are not so much traumatized by something intolerable, but lost in the vortex of screens, data, and information of contemporary globalized media culture.

#### *The Neuro-Image: Brains, Chaos, Interdisciplinarity*

If we consider contemporary cinema as belonging to a new type of image, this always has to be seen in a continuum with the other types of image.

Just as a number of different relationships between the movement-image and the time-image can be distinguished,<sup>15</sup> neuro-images are distinct from the other two types of images, but they are also profoundly related to them. As Gregg Lambert and Gregory Flaxman argue in "Ten Propositions on the Brain," the future of the cinematic brain lies particularly in the development of the crystalline image.<sup>16</sup> The neuro-image is, in any case, a development of the time-image. In the conclusion of *The Time-Image*, Deleuze has already suggested several characteristics of video and digital images that came into being at the time of the publication of the cinema books. Here, Deleuze argues that cinema will change, but by no means is it meant to die, as long as it is produced from a will to art. So, on the one hand, the contemporary neuro-images are not at all dependent on new technologies of the digital age. On the other hand, contemporary digital and media culture seem to form an intrinsic part of the new image because it makes the chaos into which all images plunge very palpable and sensible. Neuro-images relate to chaos and complexity theory and to all kinds of neuroscientific findings on the workings of the brain. Increasingly, neuroscience demonstrates that aberrations of the brain tell us something about the normal functioning of the brain, and that the differences between madness and metaphysics can be very subtle, perhaps only a matter of differentiation: "cerebral creation or deficiency of the cerebellum."<sup>17</sup> Furthermore, Deleuze has indicated that already in the time-image a specific "brain-cinema" emerged (for instance the cinema of Kubrick and Resnais) that connects the inside and outside: "Between the two sides of the absolute, between the two deaths—death from the inside or past, death from the outside or future—the internal sheets of memory and the external sheets of reality will be mixed up, extended, short-circuited, and form a whole moving life, which is at once that of the cosmos and the brain, which sends out flashes from one pole to the other."<sup>18</sup>

It is worth recalling the three characteristics of the new image mentioned by Deleuze because they point toward this paradoxical nondependency and dependency to new (visualization) technologies. First, the organization of space is different. Instead of privileged directions, space has become omnidirectional, and there no longer seems to be an outside or out-of-field: "they have a right side and a reverse, reversible and non-superimposable, like a power to turn back on themselves."<sup>19</sup> Second, the screen itself can no longer be considered as a window or a painting,

but rather it constitutes a table of information, a surface inscribed with "data," where information replaces nature, the brain-city replaces the eye of nature: "the image is constantly being cut to another image, being printed through a visible mesh, sliding over other images in an 'incessant stream of messages,' and the shot itself is less like an eye than an overloaded brain endlessly absorbing information: it is the brain-information, brain-city couple that replaces that of eye-Nature."<sup>20</sup> Finally, the new image gives way to a new psychological automaton, already present in the time-image, where characters are no longer psychologically (and psychoanalytically) motivated but become the performance of a speech-act: Bresson's "models," Rohmer's puppets, Robbe-Grillet's hypnotized ones, and Resnais's zombies. In Resnais, "there are no more flashbacks, but feedbacks and failed feedbacks, which, however, need no special machinery."<sup>21</sup>

The neuro-image is related to chaos and complexity theory. Translated into mathematical terms, it is related to the fractal organization of many elements in nature, where self-same structures constitute infinite variations of "difference and repetition." In *What Is Philosophy?* Deleuze and Guattari refer to the fractal nature of the plane of immanence.<sup>22</sup> Aesthetically, fractals have mesmerizing power, rhythm, and beauty.<sup>23</sup> I will return to the mathematics of fractals and numbers in the second part. For now it is important to note the relation between chaos and complexity theory and the neuro-image trying to create some temporary order. This temporary order is fractal, reproducing self-same relations of macro and micro parts of Chaos or reproducing other basic but infinitely variable geometric patterns. These complex patterns are related to a profound connection between microcosmic and macrocosmic perspectives that are held together "mid-way" in our brains. Some neuroscientists even argue that the brain itself is fractally structured.<sup>24</sup> Finally, chaos theory and schizophrenia seem to be connected in their nonlinear dynamic, as is suggested in recent neuroscientific studies.<sup>25</sup>

Clearly, all these connections and fractal enfoldings, variations and patterns of different levels of existence, the relation to mathematics and neuroscience and the clinical and metaphysical implications of the neuro-image, asks for an interdisciplinary approach that remains to be developed more profoundly. For now I will further analyze some characteristics of the neuro-image from a film-philosophical perspective, taking the films of Darren Aronofsky as a central focus.

## Neurocinema and the Forces of the Virtual

### *Pi: Visceral Qualities of the Brain of a Mathematician*

$\pi$  ( $\pi$ ) is the Greek symbol for 3.1415926535 . . . (on to infinity), the ratio of a circle's circumference to its diameter. *Pi*'s main character is a mathematician, Max Cohen (Sean Gullette), who is obsessed by finding a universal pattern in the numbers that  $\pi$  represents. He searches for a way of predicting the fluctuations in the stock market and is chased by both a Wall Street company and a group of Hasidic Jews. The mathematical theories and numerological references to the Kabbalah (the Gematria) that Aronofsky makes to are true, but the film is not about mathematics. Rather, it is about cool math theories and the belief that mathematics is related to the divine.<sup>26</sup> When asked if *Pi* is a science fiction film, the director emphasizes that it is sci-fi in the tradition of Philip K. Dick, a tradition of inner exploration. "It's pushing science forward within the fiction realm, so I think ultimately it is a science fiction film."<sup>27</sup> So, the film gives us a kind of pop-mathematics that nevertheless relates to bigger underlying questions about the origin of the world and cosmic or divine spirituality that are typical for the neuro-image.

*Pi* is a subjective movie. The images are completely shot from the perceptions of Max Cohen; they render his mental space.<sup>28</sup> I will return to the ways in which this is done stylistically. For now, it is important to see that Max suffers from paranoid schizophrenia, the initial idea for the film being about paranoiac schizophrenia.<sup>29</sup> The expression of a subjective mental space and the references to schizophrenia are again typical for the neuro-image. *Pi* refers to the brain on three different levels. First, as already indicated, the image itself is completely mental (the brain is the screen). At the same time, there are metaphorical references to the brain. The brain no longer stands for dangers of nuclear power and mad scientists. The brain is now seen as a complex computer network that can go wrong. In one scene Max literally discovers a bug in Euclid (Max's homemade computer), which can be read in relation to the "bugs" in his mind. Finally, inside Max's delirious hallucinations, which always happen after heavy headache attacks, he also sees an actual brain on the floor in the underground and in the washbasin ("that was Rudolph Guiliani's brain that we borrowed," Aronofsky jokes in the 1998 Artisan Entertainment DVD edition commentary about this brain).

What is very striking about *Pi*'s different relations to the brain is its visceral qualities. First of all, the choice of the film stock is remarkable. *Pi* is



Figure 9.1 Max sees an actual brain on the floor in the underground and in the washbasin. From the film *Pi* (1998), by Darren Aronofsky.

shot in black and white reversal film, which is difficult to develop and has no gray tones, only sharply contrasted black and white. Furthermore, the camera angles and movements bring the camera into Max's head space by always staying close to him, or showing his (hallucinating) point of view. Sometimes, a little camera on his body (a Snorri-cam) gives the sense of agitated movement (for example, when he is chased in the underground). "We wanted the audience to experience how it was to be a renegade genius mathematician standing on the verge of insanity," Aronofsky said.<sup>30</sup> The soundtrack is another important element that affects the senses directly. Max's headaches are announced by an uncontrollable shaking of his thumb, followed by what Aronofsky calls a hip-hop montage of Max taking pills, where the images and music get into a fast rhythm. Then, as the pain kicks in, we (with Max) physically experience it through a sharp and penetrating sound that sharply penetrates our brain. When Max opens his computer and gets the bug (an ant) out, his fingers are sticky with a sort of slimy substance that Max first looks at, listens to, smells, and then tastes. The actual three pounds of brains in the hallucinations are touched with a pen (which causes the sharp sound again) and are finally literally attacked and smashed. Contrary to many of the brain-films in the time-image, where the mental landscape is more often expressed in a more distant way

(even if that could be very violent or passionate), the mental space and brain in the neuro-image are very physical and sensuous.

### *Pi's Theorematic Nature and Geometric Style*

If we take Deleuze's definition that a theorem develops internal relationships from principle to consequences, we can consider *Pi* as a theorematic film. At several points in the movie Max's voiceover states his assumptions: "(1) Mathematics is the language of nature. (2) Everything around us can be translated and understood through numbers. (3) If you graph the numbers of any system, patterns emerge. Therefore everywhere in nature there are patterns." Clearly this is the theorem the film proposes; the principle of mathematics, as underlying principles of everything, should then also make it possible to decode and predict the patterns of the stock market, which, according to Max is "a living organism, screaming with life." This is the theorem Max explores.

So what about the numbers and geometric figures in the film? In the 1998 Artisan Entertainment DVD extras (the director's commentary track, actor's commentary track, notes on  $\pi$ , music video, and behind-the-scenes montage), the attraction of the number  $\pi$  is indicated as the attraction for the circle: It is perhaps the fact that a circle is probably the most perfect and simple form known to man. And lying at the heart of it is a specific, unchanging number that also manages to appear everywhere in functions of geometry, statistics, and biology. It keeps popping its head up, reminding us that it is there and defying us to understand why.  $\pi$  is a nonrepeating decimal that reaches out into infinity, and the biggest challenge now is to compute the number farther than before, farther than the many billions it has reached now. Besides the circle and the number  $\pi$ , the Fibonacci sequence and the spiral are other mathematical figures that return in the film. The Fibonacci sequence is a sequence of numbers in which each succeeding number in the sequence is the sum of the two preceding ones (1, 1, 2, 3, 5, 8, 13, . . .). It appears that many phenomena in the world reproduce Fibonacci sequences (flowerhead arrangements, the human body, DNA, voting patterns). In *Pi*, Max also looks at the Fibonacci patterns of the stock market. Spiral logarithms are other frequent patterns in nature (seashells, whirlpools, hurricanes, an embryo, the galaxy). Many have argued that these patterns must have a meaning, perhaps a divine meaning.<sup>31</sup>

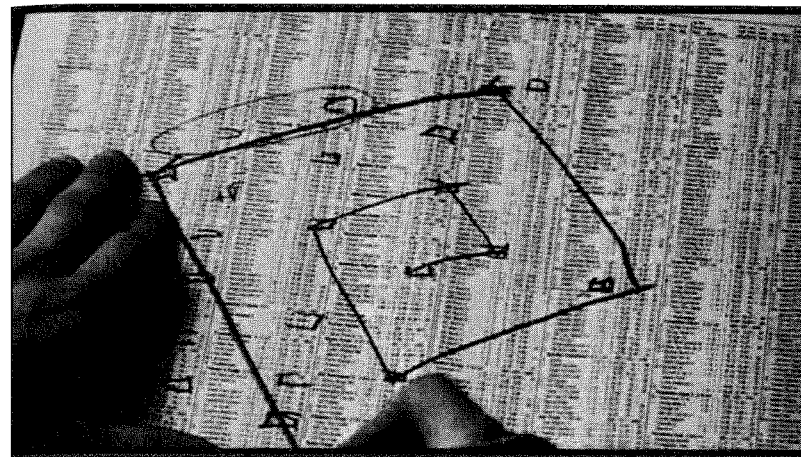


Figure 9.2 Max looks at the Fibonacci patterns of the stock market. From the film *Pi* (1998) by Darren Aronofsky.

In *Pi*, these mathematical figures are not just the theme of the film. They are also repeated in the style of the film: circles, spirals, and Fibonacci sequences are frequently expressed in the mise-en-scène and in the camera movements. The title sequence is a graphic design of circles, spirals, and other figures such as neurons displayed on a sequence of the number  $\pi$ . Elements of these graphic figures reappear later in the film. Spirals appear in the mise-en-scène, for example, in the milk in a cup of coffee, in the smoke of a cigarette, and in the arrangement of a game of Go that Max's friend Saul leaves behind when he has committed suicide. Fibonacci sequences are drawn on the financial paper and by the Jewish numerologists, and circles are featured, for example, in zeros on the computer screen, while at the same time the camera encircles Max in a 360-degree pan. In a consistent style, form and content repeat each other or are enfolded in one another.

*Pi* has several endings; at least there is an ambiguity about what actually happens, which is again a characteristic of the neuro-image that it shares with the time-image. We don't know whether Max actually sees the divine light, whether he actually drills his own brain, whether from a hyperactive state of positive symptoms of schizophrenia he falls into a catatonic state, or whether he actually has freed himself from his "brain power" and can accept life on a phenomenological scale of enjoying

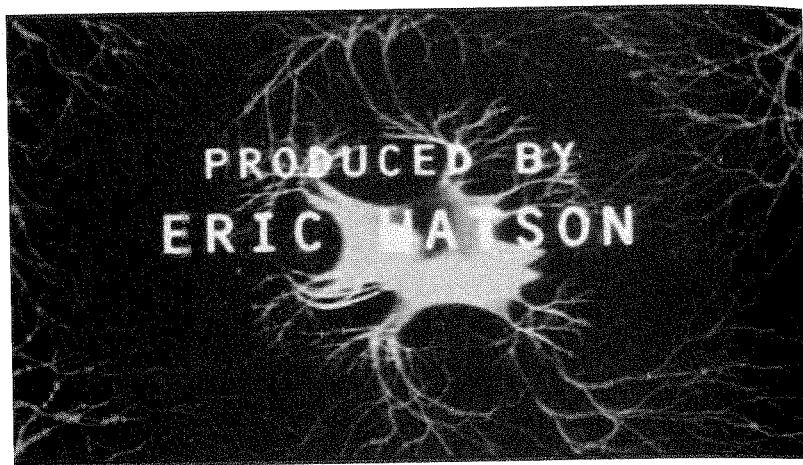


Figure 9.3 The title sequence includes images of neurons displayed on a sequence of the number pi.

From the film *Pi* (1998) by Darren Aronofsky.

nature as it appears and the company of the neighbor girl. A final observation to make about *Pi* is the presence of ants. As already indicated Max finds an ant in his computer, and in fact his apartment is swarming with ants—even the brain he attacks at the end is crawling with them. In the DVD commentary, Aronofsky tells his motivation for including this theme: when on a holiday in Mexico he visited a small unknown Mayan temple and discovered that it was literally covered with ants. He suddenly saw that humans (the important civilization of the Mayans) and ants were all the same; he saw the groundlessness of the “I,” which is also a groundlessness Max discovers the closer he comes to the mysteries of the universe. Aronofsky’s story and the way the ants are present in *Pi* also resonates with Deleuze’s conclusions of *Difference and Repetition*, where he develops a nonrepresentative, preindividual way of thinking about difference: “The ultimate, external illusion of representation is this illusion that results from its internal illusions—namely, that groundlessness should lack differences, when in fact it swarms with them. What, after all, are Ideas, with their constitutive multiplicity, if not these ants which enter and leave through the fractured I.”<sup>32</sup> I will return to *Difference and Repetition* in the last part. For now, it is important to mark a connection between *Pi*’s way of dissolving Max’s identity by introducing ants in the



Figure 9.4 Max finds an ant in his computer.

From the film *Pi* (1998) by Darren Aronofsky.

image. Now, the ant is no longer a metaphor for a “bug” in the system but a rhizomatic connection between different forms of life without a determined “I” (subjectivity).

#### *The Fountain: The Belief of a Brain Surgeon*

Just like *Pi*, Aronofsky’s more recent film is a particular kind of science fiction film. Moving between three layers of time (sixteenth-century Spain, twenty-first-century North America, twenty-fifth century somewhere in space), it is basically the story of the same couple, played by Hugh Jackman and Rachel Weisz. (Information for the film refers to *The Fountain* [dir. Darren Aronofsky, 2005], DVD edition, Warner Bros. Home Video [2006]; Special Features: “Inside *The Fountain*: Death and Rebirth” [production story].) In the twenty-first century, Tommy is a brain surgeon who tries to find a cure for his wife, Izzy, who has a brain tumor. This story unfolds into the past where conquistador Thomas wants to save Spain and her Queen Isabelle by finding a holy tree in the New Spain, and into the future, where the astronaut Tom travels through space in a biospheric “bubble-ship” (he forms an organic unity with the tree in his spaceship) and tries to deal with the previous stories. *The Fountain* is inspired by many elements, such as the myth of the fountain of youth, Spanish conquistador stories, and ancient





Figure 9.5 Tom travels through space in a biospheric “bubble-ship.”  
From the film *The Fountain* (2006), by Darren Aronofsky.

Mayan culture, as well as David Bowie’s “Space Oddity’s Major Tom” and cowriter Ari Handel’s PhD in neurosciences. “I’ll take different threads from different ideas and weave a carpet of cool ideas together,” Aronofsky says.<sup>33</sup> This rhizomatic way of thinking and creating has led to the story of Tommy and Izzy, but the film exceeds its narrative on all sides and levels.

*The Fountain* is a neuro-image not simply because of its references to neurosciences and the biology of the brain. Even though the film is partly science fiction, partly happening in outer space, it is actually taking place in inner space. As with *Pi*, the film gives us a mental landscape of its main male character, only this time we are not in a mad brain, but in a metaphysical brain that reaches out into the past and the future. As a new type of image, the film shows how the organization of space has become very different as an omnidirectional space, most obviously in the futuristic parts where bulbs, spheres, and lights float in and out the frame from all directions, which are repeated in the mise-en-scène of the lights in the other parts as well. As I will show in the next section, many elements in the composition of the image return. The elements that create spatial omnidirectionality, therefore, are part of the other layers of time as well. *The Fountain* no longer gives us a window to the world, but it has become a “brain-information” table. And again, as in *Pi*, this brain has to be seen as a very sensuous one:

the senses of touch, smell, and taste are frequently emphasized in close-up shots. But all these combined elements do not give us a window onto the world or reality, but they form a new tapestry of thoughts and affects. That this is not so much dependent on the numerical possibilities of contemporary cinema will soon become clear. Finally, it can be argued that *The Fountain*’s characters are like Resnais’s zombies (only more sensuous). This is especially the case with the character of Izzy, who in fact is actually dead most of the time we see her and who returns in feedback loops. I will return to this point as well.

Perhaps the most important general characteristic of the film that makes it a new type of film is that, despite its dealing with dead and seemingly outer space issues, it makes us believe in the world, in love, and in life. This is the true quest of the brain surgeon, who wants to find a cure to the “disease of death” but will discover beauty in *believing* love and life will continue.

### *The Problem and Fractal Style*

Whereas *Pi* is a theorematic film, *The Fountain* is “problematic.” Its central problems are the Big questions of life and death. What does it mean to live? What would it mean to live forever? What does it mean to die? Obviously the film cannot give any answers, but these universal questions are enfolded in the singular love story of the two main characters. The film proceeds to unpack the thoughts and affects connected to the problem of life, love, and death by repeating the same story in different layers of time. In *Difference and Repetition*, Deleuze has argued that there are several forms of repetition:

Beyond the grounded and grounding repetitions, a repetition of *ungrounding* on which depend both that which enchains and that which liberates, that which dies and that which lives within repetition. Beyond physical repetition and psychic or metaphysical repetition, an *ontological* repetition? . . . Perhaps the highest object of art is to bring into play simultaneously all these repetitions, with their differences in kind and rhythm, their respective displacements and disguises, their divergences and decenterings; to embed them in one another and to envelop one or the other in illusions the “effect” of which varies in each case. Art does not imitate, above

all it repeats; it repeats all the repetitions, by virtue of an internal power.<sup>34</sup>

Deleuze develops these points by arguing that all repetitions are ordered in the pure form of time (that create different forms of differences in the repetition). He argues that the "Before" and "During" depend on the third time, the Future, which is the proper place of decision ("a decision on which everything depends, deeper than all the explanations that can be given for it," quoted earlier in connection to the Outside of the problem). This takes time "out of joint" as a repetition within the eternal return:

There is only eternal return in the third time: it is here that the freeze-frame begins to move once more, or that the straight line of time, as though drawn by its own length, re-forms a strange loop which in no ways resembles the earlier cycle, but leads into the formless, and operates only for the third time and for that which belongs to it.<sup>35</sup>

Deleuze has already developed these ideas in *Difference and Repetition* as the "three syntheses of time": habitual time of the During or Present, time of recollection of the Before or Past, pure time of the eternal return of the Future.<sup>36</sup> They can also be recognized in the movement-image (first and second synthesis of time) and the time-image (third synthesis of time).<sup>37</sup> The time-image is already concerned with the third time, but it seems that the neuro-image, as third image type ("Cinema 3") brings together the other synthesis of time as well.

The neuro-image involves a form of time in which the three syntheses are playing in "strange loops," repeating and differentiating them in a sort of culminating or vortical movement of all times. In any case, Deleuze's ontological ideas on repetition, art, and time shed a light on the ontological questions and problems that *The Fountain* poses. The film clearly brings into play the different kinds of repetitions, physical, metaphysical, and ontological. Here, too, it is only in the third time, the literally ungrounded future (where everything is floating), that "all times" come together, as Deleuze suggests. Only in the future do we see the "Historical Isabelle" from the Before and "Present Izzy" from the During appear in Tom's hallucinations and feedback loops that are repeated several times, leading up to Tom's final decision to end the other two times by choosing the eternal

return. Paradoxically, the eternal return happens by accepting death and returning to the Unicity of being.

Many scenes are repeated several times throughout the film. Most striking, perhaps, is the scene where Izzy suddenly appears, dressed in a white winter coat and a white knitted cap, and says, "Take a walk with me." This exact scene is repeated three times. The first time Tom replies from the future (Tom looks different in every layer of time), saying "Please, Izzy," it is as if he wants her to leave him alone. The second time we see this scene, it is Tommy (in the present) who replies "Please, Izzy" and explains that his colleagues are waiting for him for an operation. We move more deeply into that layer of time, discovering "the problem" and how Tommy is obsessed with changing that fate. The third time we see this scene, Tommy changes his mind and does follow Izzy into the snow. This will lead to Tom(my)'s final decision to finish the story of the conquistador in the past (a story that Izzy was writing and that she repeatedly asks him to finish), to finally die in the future (the climax of the film, where Tom dies in the nebula of a dying star and becomes a celestial particle), and to accept her death by planting a seed on her grave in the present. The final image of the film is another repeated scene from the present, an extreme close-up where Tommy whispers in Izzy's neck "Everything is fine": the eternal return has selected the affirmative powers of love, life, and belief.

As in *Pi*, a mathematical order seems to underlie all these scenes. In *The Fountain*, the formal mathematical principle that gives the film its particular style is another recurrent geometrical figure of the neuro-image, the fractal. Deleuze refers to Mandelbrot's fractals in *The Fold* in relation to Leibniz's philosophy and his Baroque mathematics.<sup>38</sup> As is well known, fractal formulas produce complex geometric shapes (very different from the Euclidian geometric lines and points of Renaissance perspective). Fractals can be subdivided into parts, each of which is a differentiated reduced-size copy of the whole. Again, we see here a logic of "difference and repetition" translated into mathematical language. We can also understand how the screen as a window projecting onto a plane (following the Renaissance perspective) of the movement-image and the time-image now, in the neuro-image, has turned into a table of data, when Deleuze explains the Baroque mathematics: "Transformation of inflection can no longer allow for either symmetry or the favored plane of projection. It becomes vortical and is produced later; deferred, rather than prolonged or proliferating: the line effectively folds into a spiral in order to defer

inflection in a movement suspended between sky and earth.”<sup>39</sup> This is one of the many occasions that show that Deleuze’s own philosophy is in a sense fractal, where similar patterns and principles are repeated in endlessly complex variations throughout his entire work.

*The Fountain’s* style is fractal on several levels. I’ve already mentioned the striking repetition of entire scenes. Also cinematographically and in the composition of the image, patterns recur throughout the whole film. The different layers of time are connected through formal shapes and figures by stylistic enfoldings. And each layer of time also has its own particular predominant figure. Throughout the whole film, low and high camera angles (characters looking up into the celestial starfield, the camera looking down on the scene below) are repeated frequently, emphasizing the infinity of the cosmos, the abstract beauty of the composition of the scenes on earth, and the connection between the two. Microcosmos and macrocosmos are also repeatedly connected purely visually, for instance in the image of a brain cell under a microscope that is very similar to the movements and lights in the sky. I already mentioned the particular arrangements of lightning in the first and second layers of time that match the omnidirectional cosmic light bulbs in the third. Other elements in the *mise-en-scène* are also very subtly repeated, such as the pattern on Isabelle’s royal dress that is like the roots of a tree, which connect her to the tree in the space bubble and to the tree of life. And the whole design of the film is the shape of a crucifix (or “cruciform,” also including up and down movements) that returns in all layers.<sup>40</sup> But, as indicated by Aronofsky, each layer for itself also has a different predominant figure. In sixteenth-century Spain and the Mayan civilizations, the triangle (the three-point star in Mayan cosmology, arches in the Queen’s palace) is recurrent and sometimes enfolded in a picture on the wall in Tommy and Izzy’s apartment in the twenty-first century. In this layer of time, the most repeated forms are the rectangle and square (computer screens, windows, pictures, doorways, etc.), emphasizing our screen culture. And in the third layer of the future it is the circle, the bulb, and the sphere that are presented in many variations.

Finally the film stock itself is used in a fractal way. Although the idea of fractal logics goes back to Leibniz, fractals can only actually be produced by means of computer technology with huge calculating powers. So, in a sense, it seems logical that the neuro-image, which has access to the endless possibilities of CGI, would be fractal. And yet, the power of *The Fountain* is certainly also due to the fact that Aronofsky has made only very limited

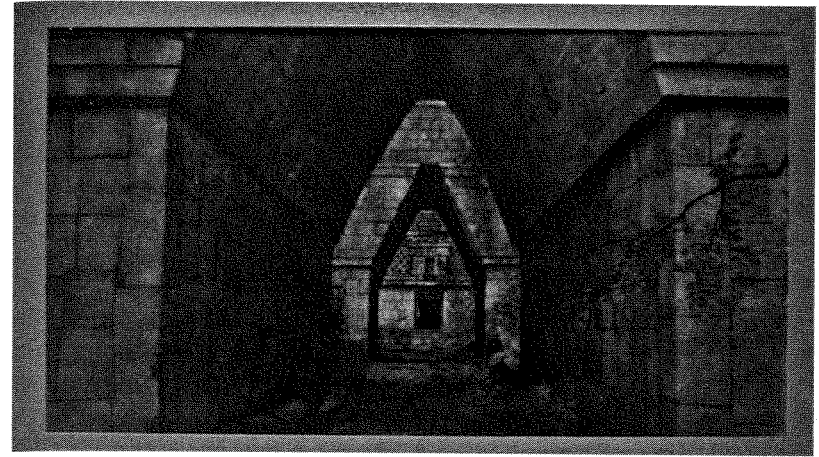


Figure 9.6 *The triangle, a recurrent figure in sixteenth-century Spain and the Mayan civilizations, is here seen in a picture on the wall in Tommy and Izzy’s apartment. From the film *The Fountain* (2006), by Darren Aronofsky.*

use of digital effects. This is an indication that technology is not the cause of aesthetic change, even though it can be profoundly related to it. Most strikingly the third layer of time, the cosmic images, are not computer generated, even though that would be the current way of showing outer space. Instead, Aronofsky and his team hired Peter Parks, a specialist in macro photography, who brewed chemicals and bacteria to create a fluid dynamics on the film stock, which affected the substances photographed. Parks explains: “When these images are projected on a big screen, you feel like you are looking at infinity. That’s because the same forces at work in the water—gravitational effects, settlement, and refractive indices—are happening in outer space.”<sup>41</sup> Without any computer image, even the ontological status of the film material of *The Fountain* itself is in this way deeply fractal.

#### *The Baroque House and the Monad*

The Leibnizian Baroque enfoldments are characteristic for the neuro-image and also can be analyzed in the way matter and soul fold into one another. In *The Fold*, Deleuze describes an allegory of the Baroque house. The lower floor has windows, several small openings that stand for the five

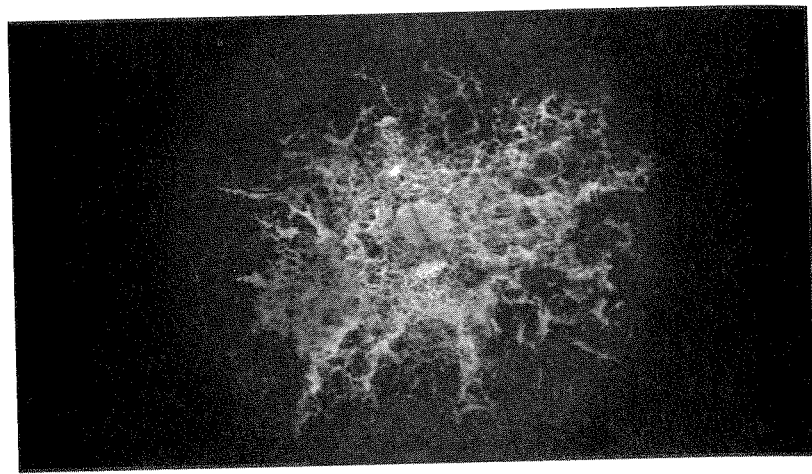


Figure 9.7 Peter Parks, a specialist in macro photography, brewed chemicals and bacteria to create a fluid dynamics on the film stock.  
From the film *The Fountain* (2006), by Darren Aronofsky.

senses and are connected to the “pleats of matter.” The upper floor has no windows, is decorated with a “drapery diversified by folds”: “Placed on the opaque canvas, these folds, cords or springs represent an innate form of knowledge, but when solicited by matter they move into action.”<sup>42</sup> Again, the repetition with the cinema books is striking, especially when Deleuze continues that Leibniz constructs “a great Baroque montage” that “moves between the lower floor, pierced with windows, and the upper floor, blind and closed, but on the other hand resonating as if it were a musical salon translating the visible movements below into sounds up above.”<sup>43</sup> In this sense *The Fountain* can be seen as a “Baroque house” where the different layers of time are like the floors in a Baroque house. The images of the Future literally also are “monadic,” including all series and states of the world, but whose organizing principle lies outside the monad itself and outside the world.

Deleuze suggests that the virtual resides in the soul, but it also needs matter in order to be actualized and incarnated in the subject, repeating the folds of the soul in matter. One could now argue that the subject is formed in the folds of matter and soul, physically and metaphysically, but that its formative principle lies outside both these points, in the mathematical

principle. If the movement-image gives us material aspects of subjectivity (physical) and the time-image gives us immaterial aspects of subjectivity (metaphysical), the neuro-image goes beyond subjectivity, opening up to the infinite possibilities of universal series (mathematical).<sup>44</sup> As indicated earlier, the arrival of the neuro-image does not imply the extinction of the other two images. They remain possible variations of the image, but they will also increasingly be implicated in the third image, the image of the Third time, the future.

In the final analysis, the search for the principles of infinite possibilities is the fundamental theorem and problem of *Pi* and *The Fountain*. As Claire Colebrook argues, Deleuze has a double commitment: everything begins from the sensible but the task of thinking is to go beyond the sensible into the potentials that make the sensible possible, into the extension of any possible series outside actual experience.<sup>45</sup> This search for the “beginning of the universe” is also the reason both *Pi* and *The Fountain* refer to the book of Genesis. In *Pi*, the first page of Genesis in Hebrew and numerical translations appear on Max's computer screen when he is close to breaking through. *The Fountain* refers to the tree of life (as opposed to the tree of knowledge) that is described in the book of Genesis. In both cases the implication of a universal mathematical pattern of infinite possibilities is the force of the virtual that is immanent within the power of the image. *Pi*'s theorematic nature brings the neuro-image to its most dangerous pole where a breakthrough turns into a breakdown of madness. *The Fountain*'s presentation of the problem of death resurrects life and love in a repetition of the eternal return and a truly becoming-imperceptible, becoming-world, or becoming-cosmos in a metaphysics that reaches into a cosmic ontology. As such these films can be considered as the two most extreme poles of the contemporary neuro-image, with infinite possible variations in between. Most strikingly the neuro-image seems to refer to an increasing consciousness in the three domains of thinking (art, science, and philosophy) that we are only temporary subjects, formed by the encounters and experiences we have in the world. But beyond the groundedness of our being we can experience in the first and second synthesis of time, we are connected in a universal and ungrounded eternal return of a fractured I, “swarming with difference,” into the infinite virtual potentialities of mathematical calculations that are at the basis of our madness and metaphysics.