

Brains Situated, Active, and Strange: Neurosurgical magnification and physicalism's aesthetic consequences

Abstract Trimble

The uncanny most often involves the sense that an object oscillates between two states: living and dead and, by extension, human/non-human, conscious/unconscious, volitional/non-volitional. Yet recent literature often ignores that the uncanny is also conditioned by its setting. We shall examine an instance of the uncanny from the memoirs of a neurosurgeon that may provide a new approach to the materiality of intelligent systems and their location in medical imaging. Oscillations between being/function, form/activity take us back to Aristotle's *Metaphysics* which, along with environmental, enactive, and embodied strains of cognitive science, serves to show that a materialistic philosophy of mind may require greater commitments from its adherents than they are willing to consciously admit.

Das Unheimliche beinhaltet am häufigsten das Gefühl, dass ein Objekt zwischen zwei Zuständen oszilliert: lebendig und tot und damit menschlich/nicht menschlich, bewusst/unbewusst, willensmäßig/nicht willensmäßig. Doch die jüngste Literatur ignoriert oft, dass das Unheimliche auch durch seine Situiertheit bedingt ist. Wir werden ein Beispiel für das Unheimliche aus den Memoiren eines Neurochirurgen untersuchen, die einen neuen Ansatz für die Materialität intelligenter Systeme und ihre Stellung in der medizinischen Bildgebung bieten können. Schwankungen zwischen Sein/Funktion, Form/Aktivität führen uns zurück zu Aristoteles' *Metaphysik*, die zusammen mit ökologischen, enaktiven und körperbezogenen Strömungen der Kognitionswissenschaften zeigt, dass eine materialistische Philosophie des Geistes von ihren Anhängern mehr abverlangen kann, als sie willens wären einzuräumen.

As the Chorus in Sophocles' *Antigone* has it, in Anne Carson's version, »many terribly quiet customers exist but none more / terribly quiet than Man [...] down he grinds the unastonishable earth / with horse and shatter.«¹ Sophocles' word for the coolness of this cool customer is >τὰ δεινὰ,< »δεινότερον< – »dreadful,< »able,< »wonderful,< and is often translated »uncanny.< This ableness makes Man dreadful and canny and many of his creations more dreadful to himself. Though precise words for it may be lacking, the sensation seems to be universal and often associated with hu-

1 Anne Carson: *Antigonick (Sophokles)*, New York: New Directions 2015, p. 15; and Sophocles: *Oedipus the king. Oedipus at Colonus. Antigone*. Vol. 1 (The Loeb Classical Library, vol. 20), trans. Francis Storr, New York: William Heinemann 1912, lines (l.) 334, 340. References to Classical Greek works employ the Perseus database: Gregory R. Crane, ed., *Perseus Digital Library*, <http://www.perseus.tufts.edu> (accessed 09.01.19).

man, or human-like *technē*. From ancient times, the elaborate imitation of human nature has brought wonder and disquiet about both the imitation and the original.²

This study looks at the uncanny and theories of mind. While the uncanny is fundamentally a sensation, we will not examine cases where pluralities of anonymized subjects report their reactions in controlled settings, nor will we arrive at new theoretical definitions. Rather, we will take instances of the phenomenon reported in a single individual and use them to tell us about what this individual's experience means in his environment. Since this is a neurosurgeon and his experience is triggered by contemplating the nature of human consciousness during an operation on a human brain, his experiences are important for those who merely contemplate at their desks. The surgeon is gifted in his craft and in his depiction of it, a careful analysis of his experience will attempt to express what a deeply-committed physicalist, materialist monism implies for a consciousness composed of matter. It is up to the reader to infer what such a reading means, beyond aesthetics, to those who do not cut into brains. While contemplating the nature of consciousness is a practice as old as making mechanical dolls, we shall show that technologies of magnification and procedures specialized for neurosurgery trigger sensations of what it means to have or be a human brain and thus prompt new questions.

After Freud's 1919 essay,³ arguably the most influential work on the uncanny has been that of Masahiro Mori from 1970. In researching human interactions to robot ›faces,‹ Mori found that when the humanlike features of the robot reached a certain point of verisimilitude humans suddenly began to experience a sense of eeriness. His graphic representation of subjects' responses showed a steep inverse curve which was then translated as »the uncanny valley.«⁴ He found movement to be an important intensifier of the phenomenon, and movement and activity is a central feature of the uncanny in all sources. Recent work has argued that uncertainty in the object's category (›inanimate‹ or ›animate,‹ for example) does not trigger the sensation while discordant levels of verisimilitude (some features are lifelike and some not) do.⁵ It is also the case that subjects with more morbid fears are more sensitive to stimuli of

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- 2 In early Buddhist literature, stories of mechanical dolls (*vantraputrikā*) that disintegrate when exposed to amorous advances served to enforce the argument that it is the human which has no independent, integral existence. See one example in Carolina A. Foley Rhys Davis: *Psalms of the Early Buddhists*, vol. 1: *Psalms of the Sisters*, ed. Henry Frowde, London: Oxford University Press 1909, pp. 153–154. These stories' modern equivalents can be found in Heinrich Kleist, Charles Baudelaire, Rainer M. Rilke: *Essays on Dolls*, trans. Idris Pary and Paul Keegan, London: Syrens 1994.
 - 3 Sigmund Freud: »The Uncanny,« in: *The Standard Edition of the Complete Psychological Works of Sigmund Freud*, vol. xvii (1917–1919): *An Infantile Neurosis and Other Works*, trans. Alix Strachey, London: Vintage 2001, pp. 217–256.
 - 4 Masahiro Mori: »The Uncanny Valley,« *IEEE Robotics & Automation* 19.2 (1970/2012), trans. K. F. MacDorman and Nori Kageki, pp. 98–100.
 - 5 See Karl F. MacDorman and Debaleena Chattopadhyay: »Reducing consistency in human realism increases the uncanny valley effect; increasing category uncertainty does not,«

reality/unreality.⁶ This supports observations that the uncanny is a conditioned and graduated response.

The uncanny is the sensation of the unfamiliar (*uncanny*) paired with the excessively familiar (*canny*, δεινός = clever). The phenomenology of the uncanny is a liminal critique of identity. It takes two contradictory predications and predicates them – alive/not alive, real/unreal. The uncanny feeling one gets looking at a shopfront mannequin is not there because one thinks it might be alive. The verisimilitude of objects in both states is enough that the stimuli afforded to both living and non-living things are evoked at once at deep levels of affectivity. We can thus describe the uncanny as the sensation (not the doubt) that the object is oscillating between two disjunct, or sometimes contraposing, identities. As the uncanny is a conditioned set of predications, we must determine the conditions and arrive at an inventory of predications, apply them to our case, and try to determine their broader significance.

1.2 »Das Unheimliche«

All descriptions of the uncanny are oriented around a subject/object relation. This is because, as Freud mentions at the onset of his essay, the uncanny is an aesthetic problem. Be it a doll, mannequin, twitching corpse, or robot, theory centers on identifying what it is about that object which invokes this feeling in that subject. »Das Unheimliche« makes several important discoveries. Starting with Schiller's remark that *unheimlich* is the exposure of that which must be hidden, Freud shows that »heimlich« (»homey«) and »unheimlich« (»uncanny«) lie on a continuum where excess of the first leads to the second.⁷ The uncanny is found more often in literature than in daily life. While life's accidents rarely arrange themselves in such a way as to evoke it; writers can conjure fictive ones that do.⁸ Thus decisive to the uncanny is its *setting*. Finally, Freud concludes that there are two, perhaps related, root causes of

Cognition 146 (2016), pp. 190–205. We should note that these authors' arguments do not imply that categories are not important factors. As the following shows, those who experience the uncanny are often not uncertain about the category of the object, rather they sense an uncertainty despite their knowledge. This is a point the authors (along with Jentsch, see Freud: »The Uncanny,« p. 219) have missed in their rejection of the literature they apply to »category uncertainty« because of their perception that such positions regard »uncertainty« as being only at the conscious level (see MacDorman and Chattopadhyay: »Reducing consistency,« pp. 191–192). Affective states have many different triggers, knowledge being merely one of them. Furthermore, the authors do show that being »humanlike,« »animal,« an »inanimate object« are important (see MacDorman and Chattopadhyay: »Reducing consistency,« p. 201.). Are these not categories?

6 See MacDorman and Chattopadhyay: »Reducing Consistency,« p. 202.

7 Freud: »The Uncanny,« »among its different shades of meaning the word *heimlich* exhibits one which is identical with its opposite, *unheimlich*. What is *heimlich* thus comes to be *unheimlich*,« p. 225.

8 See *ibid.*, p. 245.

the phenomenon: suppressed superstitions and repressed infantile complexes. The first stems from the fact that primitive forms of thought have been surmounted (*überwunden*) by the civilized subject, yet it happens that events in life correspond to them. Numbers reappear in unrelated circumstances, a person you thought ill of suddenly fell ill, the portent reappearance of a familiar object, uneasy silences, the sense of being watched. Freud relates his own experience of taking a walk in an Italian town and continually finding himself at the same, seedy, crossing. The unexpected repetition of his surroundings, he thinks, triggers a latent superstition of occult correspondences. Civilization has not fully overcome the world of magical thinking and so this disturbance arises.⁹ The second is less common and, in the examples Freud gives, tends to have the body as its object while the first involves thoughts, signs, places, and events.

In our more phenomenologically-oriented terms Freud's examples are predications set into the following oscillating pairs: inside/outside, I/not-I, alive/not-alive, autonomous/non-autonomous, volitional/non-volitional, real/unreal. While leaving aside most of his conclusions about deeper repressed or suppressed causes, we will concentrate on his argument that the uncanny is a situated and conditioned phenomenon – an often neglected observation. In a literary environment, the sensation is *set up* by the author, in life by a particular positioning and attitude of the subject.

1.3 Medical imaging & the uncanny

When it comes to the uncanny of the body, few positions are better suited to it than the medical, and none so inured to it as its practitioners. The uncanny effect of electricity had been noted from Luigi Galvani's sensational demonstrations at the end of the 18th century, inspiring the Shelleys and *Frankenstein*.¹⁰ The cold corpses of an executed criminal wired to Giovanni Aldini's battery jerked and twitched to the horror of the public and local law-enforcement. Electric current applied to the living can also be a source of the sensation, perhaps because of the resulting unnatural, mechanical, muscle contractions, just as Freud (and Jentsch before him) included epileptic seizures in his inventory of stimuli.¹¹

Medical imaging has been a notable source for the sensation. Rarely today is one unnerved by an X-ray or MRI reading. But patients also have become inured. Wil-

9 See *ibid.*, p. 246–248.

10 See Richard Holmes: *The Age of Wonder*, New York: Vintage Books 2010, p. 317.

11 See Freud: »The Uncanny,« p. 225.

helm Conrad Röntgen's first X-ray image of his wife Berthe's hand in 1895 invoked »a vague premonition of death« in his still en fleshed subject.¹²

The first electrochemical readings of galvanic currents in humans had comparable effects, though they were merely understood as *representations* of mental activity. A telling example came from the Berlin Brain-Computer interface. The project's aim was to have electroencephalograms (EEGs) read activity in the motor cortex of paralytics which could then be translated into commands. By attempting to move a finger, the subject would stimulate that part of their motor cortex and train themselves to move a cursor over a computer screen. As activity in the cortex preceded the subject's sense of agency by a few milliseconds, the cursor mapped to the EEG readings seemed to move *before* the subject believed that they had *decided* to move. This prompted one journalist to exclaim in amazement: »My God, I am a cursor!«¹³

We customarily make a decision and only then observe its effect, especially with respect to the directed movements of our own bodies. To an observer the readings show neural processes presumed to govern a movement, which is imprecisely associated with »volition.« However, when the subject is also observing the reading, it appears as though the movement corresponds not with the result but with the cause because it moves not at the moment when they move, but *before* the moment they *decide* to move. Thus there appears to be two agents in one body: the experimental subject and the reading. I would venture that an EEG reading by itself would not bring about such a sensation were the subject shown the graph and how to read it as a continuum of signals. Mapping motor cortex activity to a cursor, an object perceived as single facilitates the sensation of a double (I/not-I). As the uncanny is a situated phenomenon, the manner in which technology mediates the setting determines whether, and how, the uncanny appears. Here oscillation between inside/outside, I/not-I, volitional/non-volitional are all stimuli of the uncanny facilitated by certain techniques of imaging technology.

2.1 Wonder & disquiet

Though the uncanny is an occasional byproduct, wonder is the dominant aesthetic of brain science posed in figures that, as is often noted, are astronomical: 100 billion neurons, the »trillion cognitive handshakes« accounting for the estimate of neural

12 Akira Mizuta Lippit: »Phenomenologies of the Surface: Radiation-Body-Image,« *Qui Parle* 9.2 (1996), pp. 31–50, here p. 35. Some 17 years later Thomas Mann's *Magic Mountain* would eroticize the X-ray as it brought *das Unheimliche* to the experience of the body itself.

13 Cornelius Borck: »Media, Technology, and the Electric Unconsciousness in the 20th Century,« in: *L'ère électrique – the electric age*, ed. Olivier Asselin, et al., Ottawa: University of Ottawa Press 2011, pp. 33–60, pp. 53–54.

connections.¹⁴ Such a vastness is typically an all-encompassing but undifferentiated mass. It is a metaphysics that takes the quantity of complexity and transforms it into the quality of consciousness.¹⁵

Unusual examples of both wonder and the uncanny can be found in the recent memoirs of the neurologist Henry Marsh (born 1950). *Do No Harm*¹⁶ is a careful examination of conscience and regret wrought in deeply-considered humanity. Fully admitting to the psychological pressure to dehumanize the patient,¹⁷ he is also well attuned to the larger moral and philosophical questions of his profession and his art. Chapters focused on individual medical conditions unfold the life of a renowned British surgeon, a teacher, a student, a patient, a reformer, a son, a humane curmudgeon. But this does not make him a Cartesian dualist endowing himself or anyone with the immaterial hidden in the material. We have no souls, »all we think and feel is no more or no less than the electrochemical chatter of our nerve cells. Our sense of self, our feelings and our thoughts, our love for others, our hopes and ambitions, our hates and fears all die when our brains die [...]«. ¹⁸ Yet, these facts do not debase humanity to automata, but »[...] upgrade matter into something infinitely mysterious that we do not understand.« ¹⁹

It should be at the moment when the matter of the brain meets the conscious activity of the subject that Marsh himself experiences wonder. This is something he observes on a regular basis when he operates – by way of a little known but apparently common practice – on those in a conscious state under local anesthetic.²⁰ The surgeon administers a device to suck away the diseased area from the brain whose »consistency is like jelly«²¹. All the while his anesthetist is posing questions, showing pictures, both listening to the patient's responses and determining whether the sucker has begun to evidently damage »eloquent brain.« It is also common for neurosurgeons to use patients' responses to map matter to function before operating, as individual brains differ. But Marsh does not mention wonder in any of these situations, but appears in the memoirs only when Marsh stands in contemplation before the mystery and does not wield his instruments.

Essential to Marsh's experience is his surgical apparatus and its binocular magnification. The universe in the skull is tightly packed with clearances less than a milli-

14 See Raymond Tallis: *Aping Mankind*, London: Taylor and Francis 2016.

15 Rather like Lenin's version of the »theory of reflection.« See Alexander Spirkin: »Consciousness.« in: *Themes in Soviet Marxist Philosophy. Selected Articles from the »Filosofskaja Enciklopedija.« Sovietica*, vol 37, ed. T.J. Blakeley, Dordrecht: Springer 1975.

16 Henry Marsh: *Do No Harm. Stories of Life, Death, and Brain Surgery*, New York: Picador 2016.

17 See *ibid.*, p. 39.

18 *Ibid.*, p. 200.

19 *Ibid.*

20 See *ibid.*, p. 187.

21 *Ibid.*, p. 1.

meter and the surgeon must have very elaborate tools to miniaturize his movements. Early in his book Marsh accounts for this intimate relationship:

»Modern binocular operating microscopes are wonderful things and I am deeply in love with the one I use, just as any good craftsman is with his tools. It cost over one hundred thousand pounds and although it weighs more than a quarter of a ton, it is perfectly counter-balanced. Once in place, it leans over the patient's head like an inquisitive, thoughtful crane. The binocular head, through which I look down into the patient's brain, floats as light as a feather on its counter-balanced arm in front of me, and the merest flick of my finger on the controls will move it.«²²

He later writes:

»After so many years of operating with the microscope it has become an extension of my own body. When I use it it feels as though I am actually climbing down the microscope into the patient's head, and the tips of my microscopic instruments feel like the tips of my own fingers [...]«²³

It would be hard to find a finer example of the Heideggerian *Zeug* which, ready-to-hand and in smooth operation, melds into the consciousness of its user. But this is not just the carpenter with the hammer fusing to the hand. Essential to his manipulation is the binocular magnification that not only unites him with his other instruments but unfolds the interior of the brain into an extension of the surgeon's surroundings.

Nicholas Rasmussen described a similar process in his history of electron magnification. With its novelty, the popular War-time imagination regarded the electron microscope »as an extension of the organs of perception: as an augmentation of the eyes for seeing a tiny thing, or even more powerfully, as a vehicle to transport the entire person to a bizarre world of the minuscule, a place whose landscapes were laden with a variety of sensed meanings«.²⁴ The need to arrive at common standards of reading electron micrographs led to these landscapes being marked and read like maps giving a ›you are here‹ indication at scales of magnification in the tens of thousands. Rasmussen concludes »The perceived is the physically lived in the course of active work [...]«²⁵ Embodied in his landscape Marsh's experience is yet more physical. He writes: »I feel like a mediaeval knight mounting his horse and setting off in pursuit of a mythical beast.«²⁶ Unlike the electron microscopists, he is an

22 Ibid., p. 24.

23 Ibid., p. 26.

24 Nicolas Rasmussen: *Picture Control. The Electron Microscope and the Transformation of Biology in America, 1940–1960*, Stanford: Stanford University Press 1999, p. 223.

25 Ibid., p. 247, for the discussion of mapping see Ibid., p. 238.

26 Henry Marsh: *Do No Harm*, p. 24.

agent acting within and upon the environment and not just an observer whose static position within a scaling magnification needs to be marked.

An apt comparison may come from the science fiction film *Fantastic Voyage* (1966) where a submarine with a crew including Donald Pleasence and Raquel Welch is shrunk to microscopic size in order to treat an aneurysm in the brain of a famous scientist. In 1966, miniaturizing the whole surgeon was perhaps the only conceit imaginable to treat such an ailment. Yet nautilists sailing through the blood stream, or the ventricles of the heart, cannot sustain the conceit that the film's characters have been shrunk. The effect is rather that the patient's body, as the film's setting, expands to the limits of the frame. Marsh evinces the same sensation as he searches for and removes a tumor:

»I am looking directly into the centre of the brain, a secret and mysterious area where all the most vital functions that keep us conscious and alive are to be found. Above me, like the great arches of a cathedral roof, are the deep veins of the brain – the Internal Cerebral Veins and beyond them the basal veins of Rosenthal and then in the midline the Great Vein of Galen, dark blue and glittering in the light of the microscope. This is anatomy that inspires awe in neurosurgeons. These veins carry huge volumes of venous blood away from the brain. Injury to them will result in the patient's death. In front of me is the granular red tumor and beneath it the tectal plate of the brainstem, where damage can produce permanent coma. On either side are the posterior cerebral arteries which supply the parts of the brain responsible for vision. Ahead, beyond the tumor, like a door opening into a distant white-walled corridor once the tumor has been removed, is the third ventricle.«²⁷

Miniaturization expands the brain into a landscape and anatomy into a perilous topography. The sense of wonder is brilliantly effected on the reader. In the case of *Fantastic Voyage* much silliness comes of the period special effects; yet we also watch the protagonists as third persons floating inside another third person in the story. While Raquel Welch gets her wetsuit tangled in interstitial tissue, Marsh is a first person whose point of view dissolves into the reader's through the course of his narration. Near the start of his memoir he reflects:

»The idea that my sucker is moving through thought itself, through emotion and reason, that memories, dreams and reflections should consist of jelly, is simply too strange to understand. All I can see in front of me is matter. Yet I know that if I stray into the wrong area, into what neurosurgeons call eloquent brain, I will be faced by a damaged and disabled patient when I go round to the Recovery Ward after the operation to see what I have achieved [...]«²⁸

²⁷ Ibid., p. 7.

²⁸ Ibid., p. 1.

Later, in discussing very taxing operations on unconscious patients he writes:

»Sometimes, if the dissection is particularly difficult and intense, or dangerous, I will pause for a while, rest my hands on the arm-rests, and look into the brain I am operating on. Are the thoughts that I am thinking as I look at this solid lump of fatty protein covered in blood vessels really made out of the same stuff? And the answer always comes back – they are – and the thought itself is too crazy, too incomprehensible, and I get on with the operation.«²⁹

While a sensitive and persuasive stylist, he never uses the word ›uncanny‹ in this book, but this is indubitably the sensation he describes here. The thought is too strange, ›too crazy‹, ›too incomprehensible.‹ To be able to work he must return to his functional anatomy and banish the thought that he is sucking up thought. It stupefies him.

A cardiologist working on a heart is not stupefied by the source of circulation, a surgeon cutting into the kidneys is not immobilized by a confrontation with diuresis. Why has Marsh been struck?

Making use of our previous examples we find several explanations. The second passage has Marsh stunned by the thought that his brain is made of the same stuff as that which he is working on. His matter is guiding the manipulation of analogous matter on the table before him. This is an oscillation of the inside/outside and a doubling, I/not-I; but that duality is not part of the first passage.

Another explanation might be that he suffers from a Cartesian superstition. Like Freud's Viennese gentleman, the twinge that thoughts are immaterial lets an immaterial soul roil itself before him like a witch on a broom. This may be so. A passage describing his mother's death leads Marsh to a discussion of ›the binding problem‹ in cognitive science – how consciousness is connected to the brain. And he writes: »I had such a strong sensation, as she lay dying, that some deeper, ›real‹ person was still there behind the death mask.«³⁰ Perhaps his unconscious is averring that his mother has a soul. But contemplating the binding problem and his dead mother's side is not uncanny, it is mysterious and provokes wonder. Marsh could be suffering from ›primitive‹ influences, but that is a facile reading.

Better to distinguish how these scenes have been set up by Marsh as author and Marsh as subject of the sensation. Marsh the author seeks primarily to evoke wonder with himself as the subject in a state of its contemplation. With wonder comes the sacred. The vesicles ascending above him narrow and the veins, their branching stonework, are glittering, encrusted vaulted arches: he is in a cathedral moving toward the altar, ›a white corridor‹ and the third ventricle. This discovery in the contempla-

29 Ibid., p. 27.

30 Ibid., p. 198.

tive silence of the space should then be one of communion between matter and thought, but the result is disquiet.

In the first passage the surrounding architecture is distinguished by coursing veins and arteries thrumming with life and dangerously fragile. The object of his procedure is not diseased brain tissue which would prompt the doctor to think of the thoughts he would be removing, but an aneurysm, a vessel itself. Disquiet comes unprompted in a still space, not when he is engaged with ›thinking matter‹ – the knight in search of his beast – but when he is in contemplation or at rest. Thus, while the physician as author guides the reader towards wonderment, the uncanny is what he relates of his own experience.

This sensation that is ›too strange to understand‹ and ›too crazy, too incomprehensible‹ comes upon him when he considers the relation between the matter he beholds and the thoughts that are that matter. Yet where he must identify matter and function while operating on a conscious patient, he does not report the sensation. In fact, the act of manipulation itself wards off the uncanny when he »get[s] on with the operation.«³¹ Since it is neither the procedure nor the direct interaction of thought and matter that prompts the uncanny, we are led to conclude that the setting and the surgeon's contemplative attitude within it are determinative.

Though routine, miniaturization turns discrete objects into a landscape where the subject disappears. One should be sensing astronomical *billions and billions*, a wholeness rising out of an unreckonable multiplicity. However, with landscape comes topography. The knight-errant with his sucker cannot experience this land he has entered as an *unum* once he is inside it. There are lofty peaks, rills and hills. And because he is a monist and not a dualist, he does not tolerate equivocations that these features *are associated with* or *play host to* a function: they *are* that function, these thickets and cairns are thoughts. Conflicting predications, as in all the above cases, are sources of the oscillation. Preserving form and function in the conditions of his work, wholeness held in contemplation, taking in the whole mass, he can stand in wonder. When all that surrounds him is differentiated, disquiet looms. This *Unheimlichkeit* is that which inheres in strange places, Freud in his Italian jaunt, a seediness that all around you is aware,³² a species of that disquiet which comes from believing you are being watched. It is one thing to say that this brain on the table is aware, or that the patient performing a task is aware, another to say that walls are aware. Even more so to say: *that cliff hears, that mountain sees, that hillock remembers*. Though the aesthetic of wonder hardly excludes *Unheimliches*, for Marsh it becomes a totali-

31 Ibid., p. 27.

32 In Timothy Morton's ethics of materialist enchantment this uncanniness is what we should try to achieve in all our relations with the world (Timothy Morton: *Dark Ecology. For a Logic of Future Coexistence*, New York: Columbia University Press 2018). This could provide the positive side to the experience of mental materiality.

ty undermined by differentiation into discrete forms. The environment must be de-animated to get back to the cutting and the clamping.

2.2 The uncanniness of mental organs

With the setting conditioning the uncanny and its inventory, we must determine its contents. We are immediately struck by the duality of the object in the two passages: matter as one and thoughts, feelings and sensations as the other. As this is the uncanny, they confront the subject in a state of oscillation. A way to give terms to the oscillation in Marsh's landscape would be to say its topography is made up of discrete *mental organs*, an admittedly unorthodox phrase. If Marsh is a suppressed Cartesian dualist, then the tension between material/immaterial, flesh/thought is easy to explain, and such may be the case. But it is more relevant to explain what it is that triggers the sensation and the more broadly held concepts behind that stimulus.

As we have seen above, the I/not-I and inside/outside distinctions are not essential to the sensation here. This leaves us with distinctions more characteristic of cognitive science than psychoanalysis or medicine: volitional/non-volitional, conscious/unconscious, animate/inanimate. Magnification expands the brain into the environment and sets Marsh in the midst of it. Basking, contemplating, not relating to surroundings as objects for manipulation or sites of risk, the doctor begins to look around him at the landscape. In this setting the subject is put in a different relationship with the outcroppings of this environment. In most of the examples of the phenomenon presented aesthetically, the object's movement is a critical element. A mechanical doll is much closer to the edge of the uncanny valley than a stationary one. As we know from classical epistemology – the eye does not see itself – brain structures are incapable of feeling and incapable of kinesis. Nothing is actually surging or eyeing Marsh in his peregrinations. Yet if this expanded setting and his attitude toward it destabilizes this boundary, if sight, feelings, a thought, memory, are each an object that is an activity, then each oscillates in an identification between a form and an action. Speak of the materiality of activity and in comes the strangeness.

While association of thought and activity has a long philosophical history,³³ the kind of brain science Marsh ascribes to regards the association of form and function as axiomatic. His description of the landscape presumes it. From the phrenology of the 19th century to the current fashion for research based on Functional Magnetic

33 In fact, it is a broadly held position in Western philosophy at least since Fichte. A perceptive survey at the cusp of American pragmatism can be found in George P. Adams: »Mind as Form and as Activity,« *The Philosophical Review* 22.3 (1913), pp. 265–283. »Form« for Adams seems to be his reading of »Gestalt«.

Resonance Imaging (fMRI),³⁴ these models rely on ever narrower associations between brain regions and functions down to the ›grandmother neuron‹ hypothesis. Higher-level functioning relies on the computational models that have dominated cognitive science since the 1960s, and are again resurgent in a renewed fascination with neural networks.³⁵

Form as function is clearly delimited in the surgical setting with the conscious patient. Though the doctor knows the ›organ‹ *is* the ›thoughts,‹ the patient is still ›using‹ them. There is a hand grasping the hammer by the handle. The patient as an individual has cast themselves in the role of, however fictive, an agent. It is their turn to sense the uncanny. The physician's use of an instrument to do that for which it was made is quite *heimlich* in the sense of familiar for him or her. The weakness of form/function is that when a brain structure is *for* something it presumes this agent mediating for it. This medium can be a host-subject-patient, a ›ghost in the machine,‹ or an ›encoding‹ in a semiotic system. Computational and functional models have thus always been susceptible to criticism of the excluded middle or infinite regress.³⁶ Responsible proponents of this model, such as Jerry Fodor, argue that it may have its weaknesses, but that others are incoherent.³⁷

Rather than form and function, Marsh's landscape has become one of form and activity. Marsh in his cerebral landscape is not surrounded by features which are functions *for* doing something, he is surrounded by forms that *do*. In contrast to form/function, the pairing of form/activity applies rather to enactive approaches to cognitive science.³⁸ Enactive theories have two extended lineages. One is an outgrowth of phenomenology with Husserl and Merleau-Ponty as its founders, the other

34 A survey of the pitfalls of the fMRI mania is presented in Russell A. Poldrack: ›The future of fMRI in cognitive neuroscience,‹ *NeuroImage* 62.2 (2012), pp. 1216–1220. See also the critique in Michael Anderson: *After Phrenology: Neural Reuse and the Interactive Brain*, Cambridge: MIT University Press 2014.

35 See a critical summary of this history in *The Routledge Handbook of Embodied Cognition*, ed. Lawrence Shapiro, London: Routledge 2014, p. 363.

36 The homunculus argument: this organ is a tool for this subject to use who employs his faculties to use the organ, those faculties are tools which must have another subject to employ or manipulate them, *ad infinitum*. Raquel Welches inside of Raquel Welches.

37 Jerry Fodor and Ernest Lepore: *Holism. A Shopper's Guide*, Oxford: Blackwell 2004. Setting all the criticism from Husserl onward aside, anyone who considers the various forms of representing brain activity – EEG to fMRI to measurements of chemical, hormonal, and genetic change – might conclude that while behavioral, and computational theories work quite well as models, they are implausible as complete explanations.

38 The identification of form and activity recalls Ariel Kosman's recent interpretation of *eidōs* and *energeia* in Aristotle's *Metaphysics* as *form* and *activity* rather than *form* and *actuality*. See Aryeh Kosman: *The Activity of Being. An Essay on Aristotle's Ontology*, Cambridge: Harvard University Press 2013. See also Kosman: *Unity, Identity, and Explanation in Aristotle's Metaphysics*, ed. Theodore Scaltsas, David Charles and Marie Louise Gill, Oxford: Clarendon Press 2001, pp. 109–211, pp. 110–111. *Metaphysics* Θ (1050a–β), my translation: "So whenever the end result be something other than the use of a faculty, activity lies in the thing produced (the act of building in the built, the act of weaving in the woven, etc.). In general, motion lies in the moved. But where there is no other result besides that which is made active [as in the case of

stems from Gestalt Theory and J. J. Gibson's ecological theory of perception.³⁹ The last ten years has seen a reinvigoration of this field with results that rely on varying levels of positivism and plausibility.⁴⁰ Enactive, embodied and ecological (multi-E) approaches tend to resolve conundrums such as qualia and the ›soft‹ and ›hard‹ problems of consciousness through unmediated, non-computational models that view cognitive phenomena as continua between environment, organs of perception, and the brain.

There are weaknesses in the form/activity pairing as a model that does not incorporate the (functional) origins of the activity in question. Others note that enactive models do not permit for a proper account of *processing*, which should rely on structures performing component functions. Yet activities can be subsets of other activities just as computations can; and process itself is an activity. Philosophically, an enactive cognitive theory means that there is not a *seat* of a function, a host, a subject of activity in the possessor of the structure, or in the structure itself, but that the subject and activity are identical and the *mental organ* is no more than one component in that activity as the activity moves from stimulus to response. This model is especially effective with respect to representing physiological components of brain activity: action potentials, brain waves, energy and oxygen consumption are all themselves processes. Yet Marsh's experience suggests that, for some, this concept of mental materiality is still very strange.

3 Conclusion

If Henry Marsh in *Do No Harm* is confronted with categories familiar from psychology and cognitive science, why then is he is struck with the uncanny? Marsh in the passages quoted above purports to have a physicalist and computationalist view of a form/function relationship. This accounts for his daily experiences and the nature of his work. And it is the dominant discourse of the brain science with which he is actively conversant. However something happens when, as a subject, he is taken into

the faculties], the activity resides in the subject (seeing in the seer, and speculation in the speculator, and life in the soul – and hence also happiness, since that is a particular kind of life). Evidently, therefore, substance or form is activity [ὥστε φανερόν ὅτι ἡ οὐσία καὶ τὸ εἶδος ἐνέργειά ἐστιν].” *Aristotle's Metaphysics*, ed. W.D. Ross, Oxford: Clarendon Press 1924. The attraction of this system is its characteristically pre-Modern unification of the material and the cognitive. See the survey by Joseph A. Novak, »Bretano's ›Über Aristoteles‹,« *Apeiron. A Journal for Ancient Philosophy and Science* 21.1 (1988), pp. 69–95. Aristotle himself, it should be noted, described mental activity as “ἄνευ ὕλης” – “without matter” (*De Anima* 2.12, 424a18). Kosman has an interesting reading of Aristotle's notion of perception and its objects as well: Kosman: *The Activity of Being*, pp. 225–228.

39 James J. Gibson: *The Ecological Approach to Visual Perception*, Hillsdale (New Jersey): Lawrence Erlbaum 1986.

40 See Shapiro: *Embodied Cognition*, p. 9ff.

an »embodiment relation«⁴¹ by the imaging technology needed for surgical intervention. Functions expand into a fraught, fantastic, enveloping landscape without the mask of agency. All that is needed is a pause, a contemplative silence, and the canyon walls begin to loom, to move, to ogle.

Marsh's materialist position »upgrades matter,« but the form/function duality presupposes an agent that has no material instantiation. In his daily thrownness, Marsh's views, like those of most cognitive scientists, are not challenged even (and perhaps especially) in manipulating the brains of conscious patients. Engagement in the operation permits him to reify his surroundings. Patient and doctor alike are »using their brains« to perform functions. Though no subject exists apart from the brain, functionality, along with contemplating cerebral functioning as a coordinated whole, continues to maintain the fiction of an integrated self. But the experience of miniaturization removes the hidden agent of computational theories of cognition and the oscillating identities of form/function collapse into form/activity. Agency disappears and awareness infuses what surrounds the doctor. The agent is suddenly nowhere and everywhere. What is more, the anatomical landscape surrounding Marsh is not a wondrous whole, not a plateau called *activity*. It is a rich topography made up of differentiated *acts*. Pausing in the midst of a landscape that watches, looms, remembers, feels, *teems*, is deeply strange and corresponds with examples of the uncanny such as being watched, or surroundings that are alive/not alive, volitional/non-volitional.

Marsh poses his own discourse as a question: »Are the thoughts that I am thinking as I look at this solid lump of fatty protein covered in blood vessels really made out of the same stuff?« His own belief in the affirmative sets him up for a disquiet when the fictive self is fragmented and the activities that comprise that self come into relief. The uncanny is a subtle and highly conditioned sensation; a different subject might have a different reaction. It is possible that, were the neurosurgeon a Cartesian dualist, he would hold that there were something residing elsewhere in the material he was manipulating and no disquiet would appear.

While we should not presume too much of ideological positions conditioning a sensation, like Freud and others we must consider the uncanny itself to have import in understanding what deeper concepts mean. Many of the pairings – the I/not-I associated with the doppelgänger especially – are fundamental to notions of the self. Defining the self as an autonomous agent is one of the most difficult issues in cognitive science, and »the binding problem« Marsh mentions the most difficult. An examination of one doctor's experience, or that of a thousand doctors ranked on some uncanniness curve, is not likely to lead to new answers, but a conflicted personal experience should problematize blithely-accepted ones. Like an atheist in the trenches,

41 Nicolas Rasmussen: *Picture Control*, p. 229 (adapting a term from Don Ihde: *Technology and the Lifeworld. From Garden to Earth*, Bloomington: Indiana University Press 1996).

the experience of contemplating thinking matter when it surrounds you seems to require a commitment that either goes beyond the profession of physicalist materialism or that requires much more of matter itself. Magnification alone is not the culprit, nor is the association of organs with activities. Rather the two provide the embodiment relation of a metaphysics that is easy to put on, but strange to walk around in.

As Marsh's experience reveals, the environments in which we encounter the mental as an object are theoretically productive. It would be incorrect to argue that the imaging and manipulative facility provided by technology create an environment that is artificial, or one that produces artificial sensations. In this case it is clear that the uncanny reveals what had erstwhile been hidden – in the stark, complete *reality* of having a position magnified to its aesthetic, and its logical, ends.

