Neuroscience and the Soul: What We Can Learn from Metaphors for Mind[1]

Joshua P. Hochschild[2]

Introction: Learning From Metaphors

Aristotle says that one of the acts of intellect that cannot be taught, a sign of genius, is the ability to notice likenesses between disparate things (*Poetics* 1459a6-8). Ascertaining analogies, seeing similies, making metaphors: these are often moments of insight and surprise, of discovering meaningful connections, of distilling intelligibility and sense out of what was previously confusing and difficult to grasp. With metaphors we variously imbue things with meaning, solve previously stubborn problems, and gain traction for further dialectical inquiry.

Metaphors are as at home in biology and history as in poetry: we make sense of current events in light of past precedents, we learn about a new species by comparing it's unfamiliar functions with those of which we are more familiar. Metaphors are even valuable in mathematics—the word "analogy" comes from Greek mathematical proportion—and we intuitively see that, say, a sphere is to a circle as a cube is to a square. Even when mathematical concepts can be given formal definitions, they often begin as analogies: imaginary "numbers" that are not on the number line, or geometric "dimensions" beyond, or even between, the familiar three.

And, of course, metaphor or analogy is important at the highest level of philosophy: Aristotle also says that we cannot define perhaps his most important philosophical concepts, actuality and potency, but we learn about them by grasping and abstracting from similarities between different concrete instances of material and formal causes (*Metaphysics* VIII.6, 1048a35-1048b8). In this and other cases, often the most basic principles or most fundamental concepts must be acquired only indirectly and approached by analogy, because they cannot otherwise be deduced or delineated.

So we should not be surprised that metaphors have played a crucial role in understanding human nature and human function. Man, we say, is the rational animal, but "rationality" itself proves difficult to define. Since it appears in the definition, we can know *that* rationality is whatever sets human beings apart from other animals, but we still may not understand *what* rationality is—we could be like someone who has learned to refer to water as "H_2O" while knowing nothing about the periodic table of elements and the concept of molecular structure, and so having no concept of what the formula "H_2O" represents besides "the nature of water," whatever that is.

---

[1] This essay is edited from a lecture delivered for campus chapters of the Thomistic Institute at the University of Pittsburgh and Carnegie Mellon University (December 4, 2023), University of Miami (September 29, 2023), and Cornell University (October 25, 2022).

[2] B.A. in Philosophy, Yale University (1994), Ph.D. in Philosophy, University of Notre Dame (2001), Professor of Philosophy at Mount St. Mary's University (Emmitsburg, USA) and Director of its Philosophy, Politics and Economics program.

Thinking is like sensing, and like imagining—but crucially different. And human beings are like other animals, and even like plants, but crucially different. In fact, another part of the definition of human being, as a kind of *living* body, itself lacks clear definition. What is life? Modern biology still struggles to answer. Is it homeostasis, or a certain kind of thermodynamic system? We can identify certain life-functions—characteristics that seem to manifest life: reproduction, metabolism, stimulus response. But a *sign* of life is not its *definition*. And the metaphor can work in the other direction: the architect Christopher Alexander has defined life as a certain kind of ordering and structure, giving something balance and harmony – in such a way that, by his definition, "life" is even present in non-biological things, like well-designed buildings and humanely-furnished rooms (see Christopher Alexander, *The Nature of Order*, Book 1, "The Phenomenon of Life"). In art and design, and even in philosophy, this is a powerful concept—but I imagine the biologist could find it helpful only as a reminder of how difficult it is to define life.

Alexander wants to better understand non-living things by comparing them to living things, but historically, one of the most tempting metaphors for understanding living things has been to compare them to non-living things: organisms as complicated machines. We can learn from the comparison, so long as we also remember, along with the similarities, the differences. Likewise one of the most common metaphors for understanding thinking is to compare it to the activities of other animals, or of machines: it is a certain kind of output given a certain kind of input. Tool-building, language using, social coordination – things we take to be signs of intelligence are also manifested by other animal species, and in principle (and increasingly in practice), these can be replicated in the behavior of sufficiently sophisticated fabricated devices.

Here I want to explore the nature of thinking, and by extension, the nature of the thinking being, human nature. I want to see what we can learn from the metaphor of man as machine, and the project of conceptualizing human thought as a mechanistic process. My argument is that, while these are powerful metaphors from which we can learn, we also learn from recognizing where the metaphor falls short, from the disanalogies, the ways in which the similarities break down. Sometimes I think we lose track of whether we are analogizing intelligence to the functioning of a computer, or analogizing computer functions to intelligence: does the computer have "memory"? Does our mind "process information"? But whether we are mechanizing the mind, or anthropomorphizing the machine, we should be as attuned to the limit of the metaphor—what it does *not*, as much as what it *does*, illuminate.

Thus in the first section I will describe the modern attempt to understand human nature and the nature of intelligence in the mechanistic mode, through the complementary endeavors of neuroscience and artificial intelligence. In the second section I will summarize Aquinas's attempt to understand human nature and the nature of intelligence, which works without the mechanistic metaphor and even implicitly criticizes it. Aquinas, we will see, reaches elsewhere for a metaphor of the mind and so, in the final section. I suggest a strategy for negotiating the differences between the modern mechanistic and the Thomistic modes of explanation.

Mind as Machine: Neuroscience and Artificial Intelligence

Today, the metaphor of mind-as-machine seems to have special support in two "scientific" efforts to understand human nature, approached from different directions: neuroscience tries to dissect it, and Artificial Intelligence tries to replicate it. Let us consider each of these projects.

Granted that the field of artificial intelligence develops quickly, as of today its key components include neural networks, parallel processing, machine learning and deep learning. In short: A.I. is enabled by increased computational power, and, just as important, increasingly layered and sophisticated architectures for channeling that computational power.

The result is the ability, at least in limited domains, for a machine to exhibit "intelligent" behavior—which is to say, more carefully: to simulate the kind of behaviorial output or "product" that, when produced by a human being, we take as a manifestation of human intelligence.

Described this way, the question immediately arises: Is that behavior, when exhibited by machines, *actually* intelligent? Granted that we use verbs like "learning," "planning," "solving," "recognizing," "deciding"—even "writing" and "composing"; but by describing computer functions in this way, are we being literal, or are we using a kind of shorthand for—are we conveniently anthropomorphizing—what we always knew to be practically feasible machine functions that are not themselves signs of "intelligence" (except as signs of the intelligence of the machine's designers and programmers)?

When a computer algorithm spits out a string of words in response to a prompt, is it only a metaphor to say that it "composed paragraphs" and exhibited the capacity to "write"? Even as a question about our language use, it may be more difficult to answer than appears, complicated by the fact that we are in the habit of using terms derived from computers as metaphors for human activity: We sometimes describe thinking as "processing," memory as "storage," attention capacity as "bandwidth," etc. But this is why we must still pose the question: Is a computer that "decides" or "writes" doing the same thing as a human being who decides or writes? And what about the activities that we are not so likely to use in speaking about computers, but which we associate with genuinely human rational nature: intuiting, contemplating, meditating, praying, or wondering what is true?

The AI project may not even intend to *understand* and *reveal the nature* of intelligence, such as we find it in human beings. Is enough, as far as that project is concerned, only to *mimic* or *simulate* (some or all of) the *behavior* that intelligence issues in, with intelligence itself, whatever it is, remaining something of a mystery—to use another machine-metaphor, a "black box"?

AI has been remarkably successful, at least when developed for tightly circumscribed tasks: playing chess, interpreting handwriting, steering cars, nudging you to increased social media engagement, and in recent years generating images and composing coherent prose across various genres (when given a large bank of models and well-adequate prompts). But is the "intelligence" of ChatGPT, statistically calculating a string of words that reads to us like a poem, however impressive that feat may be, anything like the intelligence of a poet drawing on imagination, experience, insight and inspiration to craft a poem? Is the chess computer, brute-force calculating a

probabilistically winning move based on analysis of a database of games and millions of iterations of possible moves, anything like the intuitive vision and creative reflection of a chess master surveying the board?

Some might suggest that they are alike, but that that the chess master surveying the board, or the poet striving for the right combination of sense and sound, *doesn't actually know what he is doing*: that what they are conscious of thinking is really only a sliver of the activity of the brain, the tip of the iceberg where all the work is actually going on subconsciously, under the surface, and that some deep background calculations, which do not have to be conscious—and maybe even need to be unconscious—are in fact going on in the human mind exactly as in the chess computer or text generator. This is an interesting suggestion. Partly it is a simple empirical hypothesis: someday neuroscience should reveal whether or not the chess master's brain really does contain a subconscious neurological chess computer feeding answers to his conscious homunculus. But the suggestion raises more than that empirical question: it raises the question of what even deserves to be called "intelligence": the submerged, quiet computational activity, or the self-aware homunculus that receives its output?

The AI project learns from the actual functioning of the human brain—essentially treating the living organ as a machine that might, in principle, be reverse-engineered, so that we could produce in some other medium its architecture and programming. If AI approaches "intelligence" from the bottom up—trying to construct it out of non-intelligent parts—neuroscience seeks to explain "intelligence" from the top down—trying to deconstruct it into non-intelligent parts, anatomizing and dissecting it, into something more mechanistic and elemental, that biological organ we take to be the already-existing source of intelligence.

By "neuroscience" here I mean broadly the empirical study of brain activity, which includes the (not purely empirical) interpretation of the findings of that study: modeling brain activity, theorizing about the relationship between different kinds of brain activity, and doing all of this to attempt a kind of mapping of brain activity to cognitive functions. While medical practitioners and philosophers have long expected and theorized about physiological-cognitive connections, modern neuroscience has revealed these connections in stunning ways. The most important tool here has been functional magnetic resonance imaging (fMRI), which detects neuronal activity indirectly by its correlated blood flow. This technique is only as old as the 1990's, but it was immediately recognized as revolutionary, not only for anatomy and physiology but for theoretical physics, psychology, and philosophy of mind and action.

From brain imaging we have learned much about neurons, how they are behave, how they are organized, and how they develop. Among the findings of neuroscience are several that actually make the prospect of artificial intelligence—especially AGI, artificial general intelligence—seem more challenging than previously imagined. Not only is the brain a living organ with a capacity for growth and healing unavailable to silicon and wires, but we have learned about neuroplasticity—the way that patterns of neuronal activity change and adapt. And we have learned that, while neuronal activity does indeed have a digital or binary dimension—a synapse fires, or it doesn't—it also has analogue qualities: synapses can be primed to fire, and to different degrees; they coordinate their activity; and they fire in dynamic patterns. Neurons even seem "chaotic," in the technical sense of modern mathematics, that collectively they depend for their behavior less on simple input-output determinations than on patterns of apparently

random, but actually highly complex and computationally sensitive, variations. In a 2022 book, *The Primacy of Doubt*, exploring connections between quantum physics, chaos theory, and the science of uncertainty, Tim Palmer attempts to describe key intellectual activity—inductive inferences and the eureka moment of discovery—in terms of the "chaotic" activity of neurons: the brain, he thinks, is a computer, just not a deterministic, algorithmic, and mechanistic one, but rather a noisy, fractal, and stochastic one.

Other scientists have explored how even other parts of the body beside the brain, including our heart and lungs and gut, contribute to our cognitive functions. The more we learn about the brain the less it seems appropriate to model it as a mechanical piece of hardware. This organ seems more like a complex, living organism, something less like a calculator or thermostat than a city or an ecosystem.

Discoveries like this inform the AI project: in order to replicate "intelligent" functions, will we need to design machines that are more like bustling cities and layered ecological systems, more chaotic and fractal, less mechanical and clean; more, somehow, *organic*? Can we retain the metaphor of mind as machine, the assumption that intelligence just is, or at least "emerges from," a certain kind of complex physical activity?

Neuroscience and AI can't properly answer that question, although they operate on the assumption of an answer: they proceed by taking seriously the metaphor of mind as machine, which is to say they are methodologically materialist and mechanistic. That is why the technical projects of AI and neuroscience seem to converge, one from the bottom up, the other from the top down, on the question of whether human cognition is ultimately a complex physical function. But they converge on this question because they both start with and reinforce an answer to it: they assume that whatever thinking is, it must be a physical process.

Let us assume that the AI/neuroscience project succeeds in its practical goal—that we can completely model the physical behavior of the human brain, and that we can reconstruct its behavior in other matter. Would that success determine an answer to the *philosophical*, more theoretical question of what intelligence *is*? And can we avoid that question? The famous "Turing test" says that we are justified in *treating* something *as* intelligent if its behavior can fool a human into *believing* it is intelligent. As for the question of *what intelligence is*, the test doesn't so much answer it as treat it as irrelevant: as far as the technical challenge of AI is concerned, the *objective status* of the model or simulacrum doesn't matter as much as its *functional performance*. If an android exhibits such behavior that it is *as if*, so far as we can *detect*, it is intelligent, what do we care whether *it really is intelligent or not*? How dare we suggest it isn't intelligent? Does the distinction—between *being intelligent* and *simulating effects of intelligence*—even matter?

"What does it really mean to think?" The Turing test doesn't prevent the question from being raised, but it allows a certain kind of practical research to continue without needing or even desiring any answer to that question. It is not as neuroscientists or as AI engineers that we seek or need an answer to that question, but as something else—as rational human beings. To consider that question and how it could be addressed we now turn to a philosophical tradition which welcomes it more directly.

Aquinas on the nature of the rational animal

To ask about the nature of intelligence is not only to ask about a human power but to ask about *human nature*. Since we take thinking to be characteristic of the human animal, the question, *What does it mean to think?* cannot be separated from the question, *What does it mean to be human?*

Aquinas says that our intellectual nature is in one way one of the easiest, and yet in another way one of the hardest, things to know (*Summa Theologiae* Ia, q. 87, a. 1). The intellect "has in itself the power to *understand*, but not to *be understood*, *except as it is made actual*," that is, we don't understand the nature of the intellect without some help to actualize that understanding in us. So Aquinas distinguishes two ways that the intellect may know itself: first, "the mind's very presence, which is the principle of the act by which the mind perceives itself, is sufficient for the first type of cognition that is had of the mind." This is the case when, for instance, "Socrates or Plato perceives himself to have an intellective soul in virtue of the fact that he perceives himself to have intellective understanding." The knowledge here is simple self-awareness: one realizes that one understands something, and so realizes also that one is such as to have the capacity to understand. So in this sense "the mind is said to have a cognition of itself through its own presence." This is the kind of inescapable certainty that even Descartes could not avoid, as when, all else having been called into doubt, he discovered that he knew that he was *thinking*, and so knew also that he was *a thinking thing*.

But "the mind's presence is not itself sufficient" for the more general or universal, which is to say scientific or theoretical, knowledge of intellect, by which "we consider the nature of the human mind on the basis of the intellect's act." For this, empirical observation or introspection is not enough; instead, to gain "a cognition of [the soul's] 'what-ness' and nature," "what is required is diligent and subtle inquiry." Aquinas continues: "Hence, many are ignorant of the nature of the soul, and many have fallen into error about the nature of the soul" (trans. Freddoso).

Notice that Aquinas has introduced to our discussion of intellectual power the word "soul." His doing so needs no special defense. For in the classical meaning of the term, it is uncontroversial that every living thing has a soul; the soul is simply what gives a living thing its life—it is the necessary something that makes the difference between a living body and a corpse, whatever this something turns out to be. On this conception, whether there are souls is uncontroversial; and whether an individual thing has a soul is an empirical matter, settled by determining whether it is alive. Hence Aquinas's first level of knowledge of the soul we have when we are aware of ourselves as alive. The interesting theoretical question—and properly a philosophical one, not a "religious" one—is *what sort of thing is the soul:* is it a part of the body, an effect of bodily arrangements, a separate substance? Raising and addressing this question requires what Aquinas calls the more subtle kind of philosophical inquiry that is not settled by merely empirical observation.

This more subtle inquiry, which can keep us out of error about the nature of the soul, is the kind of scientific investigation that starts with what is more accessible to us, as familiar effects, and leads us to what is more intelligible in itself, as their causes. In this case, we want to learn about the nature of the rational soul, the intellect, by learning about its distinctive rational powers; but we learn about its powers, by attending to their acts; and we become aware of its acts first in terms of their objects.

This is the general method for learning about other powers of the soul, and so let us consider some examples, starting with a familiar experience of sensation. I sense red. If I reflect on this, I realize that the visible redness (the seen *object*) reveals to me that I *am seeing* red (the *act* of seeing), which in turn reveals to me that I have a capacity for seeing red (and other colors; the *power* of sight). The inferences here might sound trivial but they make manifest to me that whether I am seeing red or not, I have within in me some capacity, which can be actualized across a range of qualities (literally a spectrum) which we call the capacity for sight.

Now obviously I can distinguish sensing red (and other colors) from sensing other kinds of sense objects through sense organs other than my eyes: my ears hear a range of sounds, my nose smells a range of odors. So I reflect further: what is it that is distinguishing these sense objects? What cognitive power tells me that colors are not sounds, and that neither are smells? The power of distinguishing cannot be in the power of sight or hearing or smelling. At the very least, the act of so distinguishing indicates the presence of another power, of receiving, ordering, collating, and distinguishing sense objects, which Aquinas calls the "common sense," to distinguish it from the "special" or "specialized" senses.

Continuing to reflect: perhaps it is the common sense that tells me that it is the same object that is red and tastes sweet. But what is it that helps me recognize that object—perhaps it is an apple?—as *something to be eaten*. What helps me to envision using it as *an ingredient in a pie*? And what is that helps me remain aware of it when it is in the other room, no longer present to my senses?

These questions lead us to name other "interior senses" (as in q. 78, a. 4)—not only the common sense, already mentioned, but the *estimative* sense (as it is called in animals, or the cogitative sense or "particular reason," as it is called in human beings). By this power we conceive of a unitary bundle of sense experience under some aspect or intention: the red object is for eating (an apple), or for throwing (a ball). There is also *imagination*, by which I can preserve within myself and fathom sense objects in situations that I have not directly experienced them. And there is *memory*, by which I can recall objects and make them present to my awareness even if they are not present to my senses.

From this example we can see that even such a simple human behavior as *identifying some apples and bringing them home to bake into a pie* involves a *fairly complicated interior life*—not just one, but several different kinds of related and layered cognitive acts or acts of awareness, of the exterior and interior senses. And this is even before we get to intellect or "thinking," for note that what I have described doing with the apples is not much different from what we witness in a bird, bringing a twig to furnish a nest, or a dog bringing you his leash in hopes of going for a walk. The complicated cognitive life of the inner senses is a life we share with other animals, at least with the higher ones, and does not set us apart as human beings. Perhaps we could call it a kind of "thinking"—nothing prevents us extending the word to include such things—and surely in us it is informed by our rational nature, but just as described so far it is not yet the kind of higher-order rational activity that Aristotle and Aquinas associate with the *intellect*, it is not yet the operation of *reason* which distinguishes human choice and understanding.

We start to see the need for reason, as a power that abstracts from the particular conditions of actual and possible sense objects, when we consider other things we might

want to attend to regarding the apples. Perhaps we want to use some geometry to calculate the volume of the apples. Perhaps I wonder what kind of apple they are, and how one variety of apple differs from another. Perhaps I wonder if I could define what makes an apple an apple, and not some other kind of fruit. Perhaps the apple doesn't remind me only of some past experience (my grandmother's apple pie, for instance) but of a coherent story (the Apple of Discord that provoked the Trojan War, or the forbidden fruit that led to the loss of Eden). Perhaps through such a story I become aware of an interesting question (What is the cause of disorder and unhappiness in human life?) or even aware of a thesis (such as Greek conception of hubris or the Christian doctrine of original sin). Perhaps I see in the apple a useful symbol to employ in my own creative act—a detail to add to a wood-carving, or an element to add to a poem or story or lecture—in hopes that others will not only notice the presence of "an apple" but discern and appreciate its significance, its connection to other stories and systems of ideas.

There is no doubt that in such activity I am drawing on memory, imagination, and other interior senses that I share with animals. But the activity itself seems to go beyond such things. In formulating mathematical equations, or scientific questions, or theological theses, I am describing things that birds and dogs and other animals do not and can not do: wondering, apprehending conceptual connections, contemplating abstract truths. These—and not tool-using or problem solving or even uttering articulate sounds—are the things that are traditionally associated with intelligence, with conceptual thought, with rationality: the distinctive activities of human beings, the rational animal.

At this level of awareness, we are no longer really talking about particular physical sense objects at all—the apples I'm bringing home to bake into a pie—but about other kinds of objects, geometric shapes and mathematical formulae, natural kinds or "essences," universal concepts and theological claims—things which can be absolutely present to me *intellectually* only insofar as they are *abstracted* from, and transcend, any particular sensible conditions.

By ascending this way from the exterior senses through the interior senses to intellectual powers, we can easily see why traditionally, from Plato and Aristotle even through Descartes and Hume, the *objects of reason* were thought to be "universal," stable, and *certain*, somehow independent of or transcending particular physical experience—objects very different from the concrete objects observable by the senses as particular, contingent, and susceptible to change, because rooted in matter.

Again, the term "thinking" can be extended to include the activities of the inner senses which we share with animals, but if we restrict the term to properly intellectual activity, in which the non-human animals do not share, then *thinking involves the grasp of these objects of reason, intelligible forms abstracted from any individuating conditions*. The picture that emerges is that, in and through their intellectual power, human beings can somehow transcend or reach beyond the limitations of the physical world, that *the power to grasp the truth of things is in a way evidence that human being are in, but not totally of, the physical world*.

The non-physicality of the *objects* of reason is a fundamental element in classical arguments for the non-physicality of the *acts* of reason. I will not give any of the specific arguments here—and there are more than one—but suffice it to say that on the basis of reflections like these, about the "disembodied" character of the objects of intellect,

Aquinas, following Aristotle, concluded that not only intellectual objects, but the intellectual act itself, is not and cannot be physically embodied or limited by matter.

Other human life-functions are manifest in and through bodily organs, and have objects which are not fully separated from matter; this would include everything from digestion and respiration to sensation, memory, and imagination, and accordingly these powers cannot be separated from physical activity. But the activity of the intellect, insofar as its objects abstract from matter, is not itself a physical activity. This paves the way for Aquinas to argue, on the basis of premises he affirmed from Aristotle, that in principle the soul—what gives a human being its power to live—can survive apart from the body it normally enlivens, *insofar as it has a power which is immaterial and so whose activity could continue without the soul informing any bodily organ*.

Early on in Aquinas's questions on human nature, this very possibility leads him to ask whether the human soul is akin to an angel, a separate immaterial intellectual substance. The question arises because, in his order of presentation, before addressing human nature, Aquinas had dedicated a set of questions to the intellect of purely immaterial beings: angels (in questions 50-64, esp. qq. 54-58 on angelic knowledge), and before that he had also addressed the intellect of God (especially in q. 14 on God's knowledge). Having explored that background, within the "treatise on man," we find Aquinas often comparing human intellectual activity to angelic intellectual activity, and even comparing the human soul to angelic natures.

In contrast to the modern prevalence of mechanistic metaphors, it even seems that we could regard Aquinas's comparison of human souls to angels as a kind of metaphor for human nature, a way of understanding one thing by comparing it to another. If we do so, we immediately notice Aquinas's angel metaphor differs from the machine metaphor in two significant ways.

First, in seeking a point of reference by which to understand what is distinctive about human beings, Aquinas turns to something "higher" and more mysterious rather than something "lower" and more familiar. In a similar way, Plato, Aristotle and the Stoics all struggled to describe the status of human beings as oddly between the animal and divine. On the one hand, they all taught, we are indeed animals, and not divine beings. On the other hand, we seem to be set apart from other animals by having received some refracted share—some "element" or "spark"—of divine life. It is as if our rational power, while not itself a god, nonetheless imperfectly imitates and participates in the divine realm in such a way that sets us apart from everything else in the physical world.

Second, Aquinas remains aware of this soul-angel metaphor as *only* a metaphor, conspicuously limited. Aquinas uses the comparison to clarify what keeps each side distinct. A human soul, even considered existing separately from a body, is *not* of the same species as an angel. As an intellectual substantial form that can subsist apart from the body, the human soul is *in a way* like an angel; but it is obviously not an *angelic nature*. A human soul is by its nature fit to actualize a body as a species of animal, while angels are not fit to so actualize a body (and are by nature each their own species!). We can even say that the angel *is* an intellect, that the angelic nature *is* that which thinks angelic thoughts, while the human soul *has* an intellectual *power*, and so is that by means of which the *human being* thinks (and thinks human thoughts).

Conclusion: On the relation of Thomistic and Mechanistic Science

Aquinas's treatment of human nature and intellect makes clear that he finds the nature of rational thought something to attend to carefully, as a distinctive mode of activity. To illuminate it, he finds it helpful to compare it to something even more lofty and pure—to the superior knowledge of the angels—but the comparisons are always followed by qualifications and distinctions. The understanding of human nature and human intellect is not to be clouded by being left in the confusion of misleading metaphors.

Consequently, Aquinas's "theological" perspective means that he never loses sight of the fact that the human being is an animal, a living physical organism. Paradoxically perhaps, Aquinas seems much more committed to the irreducibility of our biological nature than many of the methodological materialists engaged in A.I. and neuroscience. And in his biological realism, Aquinas would have no problem accommodating the specific findings and results of modern neuroscience and AI research. He would of course disagree with the way some people in neuroscience and AI often *theorize* what they are doing, and he would reject the materialist assumption that would reduce animals to machines. But his conception of the human animal, with an intellectual power that is joined to physical powers of the exterior and interior senses, is not only *consistent with*, it is even *predictive of*, all we have learned in empirical neuroscience about the correlation of physical events with cognitive activity. For instance, a recent fMRI study revealed that reading a novel has short term and long-term influence on someone's brain: given the role of imagination and emotion in the reading of literature, and the nature of cognitive habits, Aquinas would absolutely have expected that finding.

As for AI, Aquinas would no doubt marvel at, but he would still be able to accommodate philosophically, all the technical advances of that project. Intelligence being, for him, strictly the function of natural, living things, he would no doubt find the phrase "artificial intelligence" an oxymoron; but there is nothing contrary to the Thomistic account of thinking in establishing that physical computational power is able to mimic behavior that, in humans, indicates the presence of intellect. Aquinas's conception of the soul can even allow that a sophisticated machine might some day pass the Turing test. He would simply insist on asking the question that test tries to set aside: whether such a machine *is really thinking*.

Could some future discovery of neurological imaging or some future achievement of AI engineering disprove Aquinas's Aristotelian account of intellect as immaterial? The question seems ill-formed, mis-characterizing the relationship between philosophy and empirical research. The Thomistic theory of human nature is a theoretical account, falsifiable by intellectual argument, but not by the kind of empirical evidence that AI research and neuroscience aim to discover. In fact, as we have seen, the *empirical and technical* achievements of the modern mechanistic project do not answer, but rather sharpen, the questions about rationality and human nature which belong to a more properly *theoretical* mode of inquiry. As I have argued all along, AI and neuroscience themselves point to the need for *rational investigation* that is consistent with, but goes beyond *empirical findings*.

In short, the projects of AI and neuroscience, precisely in their success, raise questions they cannot answer, questions that belong properly to *philosophy*. Aquinas's account of the soul can only be considered on its own terms, that is, the actual arguments

and insights must be carefully articulated and evaluated, which means first that they must be made objects of thought and understanding. This is not a matter for any mechanical art or any laboratory experiment, but of speculation and rational reflection: the subtle intellectual activity—that spark of reason that seems to be a sharing in divine power—which human beings, but no other animal and certainly no lifeless machine, can conjure.