Do emotions shape the World? Biennial Yearbook of the European Society for the Study of Science and Theology 2015-2016, "Studies in Science and Theology" Vol. 15, D. Evers, M. Fuller, A. Runehov, and K.-W. Sæther (Eds.) (Halle-Wittemberg, Martin-Luther-Universität, 2015), pp. 225-24. ISBN 978-3-00-051976-5

Cartesianism, the Embodied Mind, and the Future of Cognitive Research

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Abstract

In his oft-cited book *Descartes' Error*, Antonio Damasio claims that Descartes is responsible for having stifled the development of modern neurobiological science, in particular as regards the objective study of the physical and physiological bases for emotive and socially-conditioned cognition. Most of Damasio's book would stand without reference to Descartes, so it is intriguing to ask why he launched this attack. What seems to fuel such claims is a desire for a more holistic understanding of the mind, the brain and the self. For Descartes however, here allowed to answer back, the question of accounting for the whole diversity of human potential experiences was what could not be left out of sight. Concerning the question of his neglect of the mind said to be "abysmally" detached from the body, it is claimed here that, in the light of Descartes' move which was to break with the scholastic practice of putting more and more things under the control of the soul, the program of using the reality of embodiment to understand the mind was one he actually started. An answer is also suggested to counter the charge that Descartes failed to account for the interaction of the two substances, the mind and the material body, by showing why and how Descartes actually believed in the substantial union of mind and body. Yet, he kept in the picture an *ingenium*, a faculty of pure understanding (*entendement*), overarching a cybernetic model of the body-mind, of which we also here seek to appreciate the significance. This project of accounting for the interaction of mind and body ended up in a study of the "passions," as emotions were then called.

Keywords

Descartes, Damasio, embodied cognition, neuroscience, mind, soul, somatic marker, dualism, cybernetics, emotions, conservation, information

…my continuing to have a conscious life after a brain operation is a different phenomenon from someone-or-other having a conscious life connected to my body after the operation. So science needs a word for what is essential to me, the survival of which entails my survival—and the word "soul" serves that function. — Richard Swinburne (1997)

…dreaded "Cartesianism" has been given such widespread publicity in books and journals that there is a worrisome avoidance of just what Descartes actually had to say, why he thought he had to say it, what his critics said in rebuttal, how he handled the criticism, and how original he was in his treatment. In that rich colloquy, much of what now passes for leading-edge thought proves to be reheated and often stale by comparison. — Daniel Robinson (2000)

1. Introduction – Thought and the body

Antonio Damasio (b. 1944) is a Portuguese-American neuroscientist who established fame with his hypothesis of an emotional basis to consciousness and his defence of a need for more study of the somatically-based mechanisms of social regulation that determine more than was previously assumed in the operations of the rational part of the self. His 1994 book *Descartes' Error* made him famous. Damasio, at least in crafting the title of that monograph, joined a bandwagon that seems to guarantee popular press success. He ends his book with a severe blow aimed at Descartes, accusing him of having been the worst obstacle to the development of an objective and scientific study of the mind. Damasio's precise references to Descartes' works are for the most part wanting: they are notable by their absence and, what is more, we would expect from someone voicing such charges that he has reviewed at least Descartes' most important texts in their bearing on this subject. To take only the *Meditations on First Philosophy*, routinely assigned as reading for undergraduate students, upon reading them one would inevitably stumble upon Descartes' expression about the mind being "*mélangé avec le corps*" (Descartes 1970: 123) [AT VII, 81]. There is something profoundly intriguing metaphysically in what Descartes does that seems to systematically elude the "rough and ready" commentaries that recycle him as the standard "dualist." Something in Descartes seems to invite slander and mischaracterisation (Harrison 2009: 107).

The main contribution of Damasio's famous book, which comes after a fascinating review of the case of Phineas Gage and of another patient who underwent major brain surgery, is the development of the "somatic marker hypothesis." This refers to changes in the peripheral nervous system and the automatic arousal that is stimulated by those changes in the pre-frontal cortices, which create a feeling that helps us make correct choices prior to thinking about them. It helps us decide which course of action to take. Emotional processes thus bias behaviour, in particular decision making, in the sense that a defect in emotion causes an impaired decision-making process.

Damasio implicitly equates rational consideration of response options with their conscious consideration, since his aim is to rule out the necessary presence of conscious deliberations in most circumstances of decision. Yet, non-conscious information processing (which is still a form of cognition, as the mediaevals had seen) was never considered by Damasio (Sepper 1996: 23; Peghaire 1943).[1] There is no room in what he presents us for a non-fully-reflective rationality that would not be immediately equated with a thought entirely shaped by conditionings emanating from the body. Ruling this out means that most of what "thought" is for Descartes is outlawed.

One of the empirical supports for the somatic marker hypothesis is the Iowa gambling task, a psychological test where players are being asked to answer questions about the game while their galvanic skin responses are measured and timed, with recording of body reactions preceding the answer they give. This same experimental protocol was re-opened a decade after the inquiries of Damasio's team by neuropsychology graduate student Tiago Maia and his then-advisor James McLelland (Maia and McLelland 2004). They realised that Damasio's team questions were open-ended, and that when one asks the players more specific questions that are not predetermined to arouse general feelings but rather thoughts such as "what about this move, getting this amount? or loosing this much?" it is found out that the strategy to go with is, as common sense would have it, to think first, not to emote. This raises concern, both in the light of the accusation aimed at Descartes, that he delayed and stifled the development of a science of the mind, and also in light of the observation made by Roger Scruton concerning the application of neuroscience to every field, including the humanities, and in most cases sharing in a trait of the scientistic stance: using impressive scientific terminology without making any controllable predictions, yet still creating the appearance of a scientific question and scientific data (Scruton 2013: 36, also 45–6 on "memes").

[1] The *cogitative* is in human beings an extension of something animals have, the *æstimativa*, and it informs about concrete decisions. It allows one to know things particular but, with the rest of the capacities of human beings, also allows them to know of these particulars as falling under a universal nature.

2. Descartes' initial program

Whereas in the second Meditation Descartes posited a mind that seems by moments autarkic and independent of the body, the sixth Meditation strives to determine what is responsible for this most intimate union between them (see Brown 2006: 4–5). In the *Regulæ ad directionem ingenii* (commenced around 1628), an unfinished work, Descartes had sought first to enunciate the criterion he is famous for, about thinking things in isolation (Descartes 2002: 82) [AT X, 366]. He will posit later levels of functioning between mind and body, to which we will allude in a moment, which would flesh out their connectedness in terms of the mind being informed of the states of the body.

The model developed by Descartes is that of a brain as effector and switchboard, that can respond fairly automatically to many of the body's perturbations, but which also communicates with the soul, through the capacity of the will to rule over the mix of data flow from the body and instructions from the brain. Descartes indeed posited an *ingenium*, the mind as it conceives images in its capacity to see them and through them, to think in images and derive "facts from figures," borrowing the title of Moroney's famous book on statistics. One was to see through these figures, in a progression led by the *entendement*, so as to discover in a pure act of intuition, and hence be able to deduce in an orderly fashion, what one has discovered alongside the disorderly meshing of notions and things in reality (see Descartes 2002: 114–5) [AT X, 393–4]. Descartes' project, at which he ended up failing, was to try to understand how algebraic reasoning can happen in the mind relying on the dispositions of the body. He actually denied that when we think of anything other than God or, reflectively, the mind itself, we involve at all times something other than the body and the brain as a representational means. The supreme criterion enunciated in the *Regulæ*, that of inspection and grasp in immediacy by intuition, is not conceived alongside the optic metaphor of the secular idealist tradition, but as shown by Michel Serres, it is built around the sense of touch with intervening distance (Serres 1984: 122–6). In all this – and even though Descartes the "dualist" is a characterisation we have heard just about everywhere he is mentioned – in point of fact, his model should more faithfully be dubbed trialist (see Cottingham 2008: 173–87).

3. Mind, World, and Causality

In the *Regulæ*, Descartes assumes, against the immediate realism of the Scholastic tradition in its doctrines of our knowledge of sensible species, that the intellect does not have access to the external world. In the *Dioptrique*, a short treatise that was intended with *Les météores* to be included in *Le Monde*, Descartes denies that we can have a picture of the retina, since this would presuppose other eyes and lead to a regress-based demonstration, and to some hidden homonculus (Descartes 1992: 133, 155–6) [AT VI, 114, 141]. Doing this, he transgresses his own position in the *Regulæ*, in which he had initially maintained the Aristotelian solution that there is a perceptual relation between the intellect and what it perceives (Kirkebøen 2001: 177). Descartes abandons this project and progressively moves to one where such an assumption is replaced with another one according to which the relation between brains and activities of the intellect is a causal one. If we consider the three grades pertaining to the certainty of sensations presented in the sixth set of replies to the objections on the *Meditationes de prima philosophia* (Descartes 1970: 282–5) [AT VII, 436–9], we see that the first degree anticipates the reflex model of behaviour and that Descartes expresses it in purely mechanical terms, without reference to an immaterial soul. That is Damasio's whole point, and it is granted right there from the start, in the first degree. For instance, in the *Passions of the Soul* (Descartes 1969: §72) [AT XI, 382), in order to make a point about the brain, Descartes reasons by analogy with the foot!

Descartes further sees that the motor act requires an inhibitory process along with an excitatory one and, as Kirkebøen notes, at the heyday of contemporary experiments on the brain Charles Sherrington found it mind-boggling that with so little scientific experimentation on nervous conduction one could have intuited it so well (Kirkebøen 2001: 179). When we open the *Traité de l'Homme*, we are struck by this working of a dual and oppositely polarised system that Descartes seems to have understood, distinguishing between afferent and motor modes of nervous conduction (Descartes 1664: 26–8) [AT XI, 141–2]. W. McCulloch, reflecting on the origins of cybernetics, said that it should have taken as its patron saint not so much Leibniz, as Wiener suggested in his 1948 foundational work *Cybernetics, or Control and*

Communication in the Animal and the Machine, but rather Descartes, since he first saw that there was need of a negative feed-back to achieve homeostasis in the body (McCulloch 1989: 21–49; Vallée 1996: 43–5). (Malebranche, in the continuation of Descartes, goes further and gets an amazingly accurate grasp of the *present-day* notion of nervous influx transmission in *De la recherche de la vérité*, chapter VI; see Brunod 2006: 36.) Pavlov also said he drew inspiration from Descartes' theory of the reflex. This is where the perceptual relation is replaced by a causal one and it is supposed that the pineal gland, which unlike all our other bodily organs does not have a symmetrical correlate, can serve as a bridge between the two halves of the brain and of the whole man. Where Damasio will declare that our unity of consciousness is a by-product of simultaneously operating disseminated information (Damasio 1994: 84, 94–5), Descartes will use the pineal gland research program to start an attempt to make sense of our capacity to err. If we remember that the will is in us the image of God, as developed in the fourth of the Meditations, it will also be the faculty that is capable of preventing the inundation of our circuits by sadness-inducing passions, and which alone can master the body (see Descartes 1969: §76) [AT XI, 385]. This gland is said to be moved, to vibrate in as many cycles as there are perceptible differences in the object. For Descartes, when the brain receives sensory information and stimuli, this gland acts as a gateway, and further encodes this information so as to adjust it to a system of divided channels working with feedback; in other words, the hand approaching the fire too closely moves but not without a brain response inevitably being delayed. Thus we have a potentially reinforcing and a potentially diminishing channel. There is nothing in the reaction we have to things that is not derived entirely from their coming into us and creating an internal representation of their magnitude.

A couple of interesting things must be acknowledged. Firstly, when we open *L' Homme*, we are struck to see that this stance on mechanism concerning the functionings of the body, which has been so often levelled against Descartes as a grave impediment to the development of science because it exceeds what would have been necessary in terms of a program of mechanisation of the body (see Lachelier's observations on "Spiritualism" in Lalande 1993: 1020), is in fact nothing other than the normal mode of scientific functioning, its unavoidable mechanical reductionist first step. We can't study

everything about anything, or track as many variables as we wish. Descartes, who says his method resembles that of the mechanical arts (Descartes 2002: 117) [AT X, 397], puts as a principle that he will describe everything he can about the body in entirely mechanical terms, relying on what he sees around him: fountains, clocks, pipes, timers and valves (Werrett 2001). He will first, methodically, describe the body in this fashion, and see if anything resists this approach. Secondly, when we open *Les passions de l'âme* (1649), written in French, what we read in §3 is that anything which, in us, we can't conceive in any way as belonging to a body, we will have to attribute to our soul. So we have in Descartes, when it comes to the passions, a form of physiological-psychological blending that provokes discomfort in people like Damasio, probably because, interestingly enough, *they* are the ones who are trained to think of a mind as detached from the body and thus consider that, in their endeavour to affirm a form of neutral monism, they have to debunk what is in the end a straw man. Damasio insists on saying: "Emotion, feeling and biological regulation all play a role in human reason: the lowly orders from our organism are also in the loop of high reason" (Damasio 1994: XIII).

Interestingly enough, Descartes himself anticipates this stance against the "Cartesian" vision of man, a vision which incidentally has little to do with him. Certainly, he on occasion abused abstraction and used too stringently the principle of the excluded middle, as Leibniz was quick to point out (Leibniz 1989: 383–412). He writes in the fifth part of the *Discourse on Method* that, concerning the soul, "it is not enough for it to be lodged in the human body like a pilot in his ship" (Descartes 1998: 33, see 98) [AT VI, 59; VII, 81]. He considers that anyone will feel this union as something immediately given (Descartes 1989: 75, letter 28–6–1643) [AT III, 693–4]. When Damasio says that he is worried when there is an acceptance of the importance of feeling without an effort to understand the biological machinery, this is something to which Descartes had already responded when he said, in the prefatory letter to the *Passions of the Soul*, that his intention was to explain them as a *physicien*, not as a moral philosopher (Descartes 1728: 34) [AT XI, 326].

Damasio furthers a research program started by Descartes. What Damasio ends up calling for, an account of the passions that would study them through a systematic analysis of human physiology, started to be imple-

mented by Descartes. Damasio's somatic-marker hypothesis, which furthers the reversal of sequence between detached judgment and rational thought and fear-inducing sudden emotion that had been effected in the James-Lange hypothesis, is present in the *Passions* (see Descartes 1969: §38) [AT XI, 358], when Descartes treats of the summation of reactions bearing on incoming vibration/excitation. The soul will have nothing to get from a contribution originating entirely in the soul.

4. Fighting the shadow of Descartes: the soul in all this

One could draw a parallel between Damasio's attacks, directed at a Descartes which he does not seem to have encountered in his letters to Elisabeth or in the *Passions of the Soul*, and the charges of Ernst Mayr against typological Platonism (Mayr 1959: 166–8, 171–6; 1978: 49, 52). When one sees Mayr repeating relentlessly that Darwin has destroyed typological thinking and replaced it with population thinking, one comes to appreciate that the Platonism referred to is centred around vague ideas in the mind of some divinity (see Powers 2013), whereas for Plato the forms were not that. They were not someone thinking something, they would impose themselves even upon God, in their quality of objective realities, or "real" reality (Gluck 2007: 17; De Santillana 1970: 70). The presence of regimes of spontaneous turbulence and then attraction, what we term strange attractors, of mechanical responses in the building up of biological species, is a field that is still very much unexplored and undeveloped (see Goodwin and Solé 2002). When one looks at this, one realises that the same thing is going on: Damasio's thought is based on a mainstream academic approach that would say that somehow, during evolution, the nervous system appeared, and then a neurological complication took place, and eventually a mind came from this (Damasio 2010: 284–90). Damasio makes a clear case in *Descartes' Error* and *Self Comes to Mind* for the modularity of the mind, and talks about simultaneous processes of information that create this impression of wholesome consciousness (for another recent defence, see Gazzaniga 2011: 43–74).

A moment of consideration should alert us to the fact that, if one were to "make" a mind, whatever that might mean, deciding that it really is one

would not be so easy. To decide that something is a mind entirely without the phenomenal reality of our own experience of consciousness would be not only unsatisfying but, many would say, self-defeating. A purely functionalist approach certainly thinks it can live up to the challenge, but inevitably it will have recourse to behavioural and extraneous criteria of "intelligent" action, according to which anything that does not function entirely according to mechanical pre-programming will be deemed intelligent. The look for modules that "really" do what is too easily attributable to higher orders, however connected and disseminated, is also bound to be misleading (see Changeux 1985: 134–40, 264–8, 273–8). It does not advance our understanding of anything to claim that universal and abstract objects of thought are effected by a smaller module somewhere, and that it is really this neurone rather than the whole person that has the capacity to think numbers, or use adverbs insofar as they differ from nouns (Robinson 1980: 143). Descartes was not doing that: he thought he could find how we reason in algebra by studying the images that are bound to happen in us, because of our physiological-structural conformation as a body. They would be a power of our body. (It is too easy to forget that Cartesianism was accused not of transcendentalism, but of materialism!) For that purpose, Descartes invented a sort of mathematicized vision of the world, but, interestingly enough, at the same time he had a distrust of ontological claims derived from mathematical statements (see Davis and Hersch 2005).

4.1 A detour by the realism of the forms

For Damasio, the *paramecium* already possesses the essence of the emotional process (Damasio 2010: 257–8; 2003: 69). One would find in Raymond Ruyer (1902–87), one of the rare serious students of the natural sciences (particularly the biological ones) in contemporary French philosophy, a refutation of the "seeing eye" that is entirely akin to what we saw was Descartes' own argument against Kepler's homunculus in the *Dioptrique*. Ruyer posited the truth of a variant of panpsychism as a condition for the potential knowledge of organic pre-human (and embryonic human) organisms which are not to be conceived as mere abstractions floating in thin air, but that should be deemed to possess a *pour soi*. Would crediting them with a *pour soi*, a capacity for self-inspection, entail transparency to oneself and a capacity to

choose that would go all the way to the particular? Even more, can we speak of the machine of the body knowing, seeing, and inspecting itself directly in any other way than through the use of an analogy which remains entirely dependent upon that quality of intelligence transferred from ours, in the direction of a consciousness in "internal circuit," with which we would still be able to communicate? Ruyer posits two consciousnesses, one in internal circuit and the other one in external circuit, without their being capable of communicating. He often repeated that the embryo would surely be very surprised to be declared less "knowledgeable" than the author of a treatise on embryology, while the first "knows" how to make legs while the second does not (Ruyer 1966: 141). F. Kaplan, reflecting on the "missing link" in all our theorizing about finality, objected to Ruyer that if one posits that the organism, in the pre-cognitive infra-human state of living organisation, already possesses what matters most in consciousess, then it would hardly be helpful to give it the surveillance of the body as an object, since this consciousness alone was deemed capable of making the said organism exist. Also, if we give more intelligence to this primary consciousness than to its counterpart (the cognizant, abstract and reflective consciousness – *conscience seconde*), then it becomes difficult to explain why we cannot teach it much else than what it does strictly in "internal" circuits, as it watches over the body's operations. How would such a consciousness be informed of the conditions of its environment, of the properties of foodstuffs, or of the characteristics of light? (Kaplan 2009: 54–5)

We have already alluded to the mediaeval understanding that rational thought is more than reflectively conscious thought aiming at an object and knowing its own act, that automatic and pre-programmed responses such as languages, do not preclude a Cartesian model. Descartes seeks to clarify consciousness from its reflective presence to itself. He says that we are a thing which thinks, and even posits our pre-existence as a thinking substance in a way that would remind one of the *Phaedo* (§ 70) where Plato says that the living can come from the dead (Rodis-Lewis 1970: 53). So he thinks – and this again was at the heart of McCulloch's insight – along the lines of two extremes in opposition with an indefinite number of gradations of their correspondence always situated in that "middle." With two limiting cases, he is

thinking about a completely mechanical body, and then about a completely self-transparent soul, but never claims that he has isolated one or the other.

Damasio does not distinguish between mind and soul. He also, in some respects, interchanges the common significance of emotion and feeling (Damasio 1994: 249–50; 2003: 69). Whenever Descartes did something similar, he would carefully warn his reader (Descartes 2002: 86) [AT X, 369]. Damasio's response, when this difficulty is pointed out, is to say that he uses the vocabulary he needs for his research. But there is, for Descartes and the *philosophia perennis*, an unbridgeable distance between the mind and the soul. Animals can have a mind, but will not have a soul in the sense that Descartes intended. The soul thus understood makes us who we are, whereas the mind connects us with the phylogenetic history of a species. This soul requires a machinery of the brain, that is not too severely damaged or hampered, for it to manifest itself in our experience. That the integrity of the machine of the body is a condition for the soul to be able to find expression in our experience of embodied subjects, does not entail that we are nothing but a body, and that our mind is an epiphenomenon whose sole function is to "think the body."

The irony is that Descartes is acting all along as a physiologist much more than as a purely speculative armchair metaphysician. For him, contrary to the pious notion he had heard about, that we die when the soul departs the body, it is the body not presenting to the soul an instrument sufficiently malleable that occasions the collapse of the whole psychosomatic machinery (see Descartes 1969: §6) [AT XI 330–1].

4.2 Descartes' restatement of formal reality

What is a form in traditional philosophy? It seems that it has not been well understood, since, already in Descartes' and Mersenne's day, what was understood by it was the only aspect that is amenable to mechanical integration in a system. Mental unification provided by a cognisant subject was the correlate, beyond the few geometrical examples that could be adduced (geometric truths which, we need to remember, were created for Descartes who did not fully accept the Pythagorean ascendency). In the third Meditation, Descartes wrote that, when one is confronted with an object containing a greater degree of "formal" reality, taking form as in the scholastic sense of

the form of a body and not as in the formal sciences of today, then one needs, in order to sufficiently account for its presence, a mind that is not some psychic or living capacity of that form, nor an abstractly thinking mind such as ours. From this, he concludes that only God as form-imparter, could as it were be "seen" operating there. Whereas I can have, for example, the idea of a stone, that of an animal with such and such body, muscles, nerves, flesh (as in Ezekiel's chapter 38), of this all together I would not have the idea since it is more difficult (Descartes 1970: 57, 61–2) [AT VII, 37–8, 40–1]. The point is entirely cogent and was beautifully developed by Chesterton in "The Ethics of Elfland" (1986: 249–68). Why has God made something so utterly incomprehensible? Which ushers in the temptation to reduce to mechanical motions that which our minds will apprehend alongside what Bergson dubbed its inveterate habits. What, then, is a true form? A form objectively present, of which the schema, contrary to mechanical inventions, would not be only in the mind of the conceiver/ engineer. The third Meditation establishes clearly that Descartes had another understanding of form, beyond the reduction of causation to formal-mechanical causation typical of the birth of modern science.

Seeing that Ruyer credits with consciousness of a "primary" type any organism, a point on which Damasio would follow him, if we want to attribute something to it, our only way of doing so will have to be through the experience of reflective, or "secondary", consciousness. What happens is that, at that point, one takes another posture and starts denigrating (albeit subtly) that secondary consciousness which would "know" less than the primary one. But to say that the embryo "knows" how to secrete arms, legs, etc., may be striking and powerful, but it is also fraudulent in terms of a warranted conclusion, if what we mean is that a series of stabilised and recursive instructions could never achieve the same result. This is because to reach this conclusion, one has to rely on what it would be for us, reflectively conscious beings, to conceive such a program, and, in another moment, mark the operating range for optimal functioning according to which it could be found wanting.

5. Descartes' conserving God and the physics of information

What theological implications can we derive from this? It is a question that Descartes would not have been too hasty to ask. In part because he thought that the true philosopher has to resolve for himself the greatest of all mysteries: why is this physical order so intimately conjoined to simple substantial spirits? Looking at the cosmology he devised, one could pause in front of the seeming absence of room for divine interventions. Descartes, particularly in his unpublished *Le Monde*, seems to be doing for the world at large what he has done for the human body, which is to start by making it an entirely mechanical contraption.

When he conceives of God, Descartes sees his action as sustaining creation anew at every infinitesimal instant (Descartes 1970: 74, 143; 1728: 285) [AT VII, 48–9, 109; XI, 44).[2] It looks like he reintroduces for substantial realities, in particular in the lengthy argument of the third Meditation we just covered, that which is denied for physical motion of bodies by his own work and that of Galileo: the need for a sustaining force pushing through a point of application (Frankfurt 1998: 57–8).[3] So, while we said that he first asserted an Aristotelian-like theory of perceptual reality, a correspondence theory of truth, and subsequently abandoned it for a causal account of what is in the mind, the implication is not only that our perceptual cognitive faculties would not spontaneously grasp the whole of reality and that, as a consequence, a part of it would be constructed. More importantly, Descartes' God proceeds in himself, so to speak, to a similar internalization.

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[2] This does not mean that Descartes believed in an atomism of time. On his theory of conservation, and its possible ground in Thomas Aquinas, see Garber 2001: 195.

[3] When saying that God's conservation of impulse rules out the possibility of motion being merely a natural and independent phenomenon, Schmaltz (1998: 97 note) interestingly points out that the contrast set out by Frankfurt between a motion in need of no sustainer for the physical world and a presence of formal reality directly testifying to an act of sustentation, although correct in its appreciation of Descartes' own words, might be reconceptualised adequately by observing that motion is conditioned by something internal to moving bodies, originally impressed in them and conserved there by God.

The easiest way to approach the problem of a God mediating his relationship to the world through the temporally infinitesimal re-emission of forms is through Leibniz's critique. Reflecting on Descartes' natural philosophy, Leibniz highlights what he finds to be an error, in part already flagged by Huygens (Leibniz 1989: 296–302). He asserts that we must distinguish between motive force and quantity of motion, and that we can't simply calculate one from the other. Force is to be appreciated by the quantity of effect produced, as for instance in the case of the height to which we can raise a body, not in starting from the velocity which we can impart to it. Thus, it is the conservation of the quantity of motion that is central. Leibniz argued that velocity does not measure it adequately. He will finally affirm that mass, multiplied by this height from which a body falls, or to which it has been raised, must be used instead of the product of mass and velocity. For Leibniz, Descartes made the mistake of confounding quantity of motion and motive force (see Westfall 1983: 134–6).

One takes the idea of quantity of motion from statics, from the consideration of simple machines. Situations where force equals quantity of motion have something artificial about them, and this is why Leibniz considers that those static forces are dead, that they are either the beginning- or the end-part of a tendency to motion, a *conatus*. *Vis viva*, on the other hand, is what moves with a thorough impulse. It is thus *vis viva* that will be called upon to account for what happens in the example where Descartes has erred in introducing a body of superior mass altering the motion of a body of inferior (in point of fact tiny) mass, but not inversely. For Leibniz, the active force is converted into elastic force when the body is brought to rest, and regenerated from this elastic force in a new motion in the opposite direction.

In a context where we expect a physically operable concept of simultaneity and clock synchronisation, the physics of Descartes stands out firstly as a theory of local interactions. It might be judged energetically as a physics wherein God has to intervene to readjust the quantity of motion over the whole system, since it would otherwise quickly run down. One can leave it at that, and treat it as an occasionalist theory that any contemporary physical theorising would depart from in the light of a greater respect than it shows for the autonomy of nature.

With Andrew Gluck, let us emphasise a few points. Do we know anything about nature in the final analysis? For Descartes, mathematics does not tell us about the true nature of reality. It may be the best we can achieve, but in the end it leaves us ignorant. We don't know how one billiard ball communicates motion to another, such that the result will be the same when it hits once again with the same force and direction. In the end, there is only one adequate explanation, and it is not a version of the Leibnitian calculating God, rather one is to find it in the immutable thoughts of God. There is an element of Neoplatonism in Descartes, and as such when he accounts for the world as though there were no God, it is for him an "as if." The fact that there is a God renders our knowledge suspect (Gluck 2007: 76). Because Descartes rests the trustworthiness of his faculties in God, to a larger extent than any other Western philosopher, he can all the more freely practice "world-making," to use Goodman's expression.

If we are more suspicious of the overarching vantage point of Leibniz's God, able to prestabilise the course, trajectory, and interactions of all the monads for all times following, and if we would rather consider a God acting *hic et nunc* and revealing, besides his will in the holy books, his wisdom through the ubiquity of the laws of nature and the harmonious outcome of their effect, there is one dimension that remains to be explored. If the world is to contain freedom in action, if creatures are to become God's elect by answering his call, their interaction with the world will apprehend it as open and dynamic, as malleable to God's creative action. For the universe to mean something, for it to have a destiny, and for God to have created it so that he can delight in the fruits this universe will have produced, enough independence should have been allotted to it, so that information could be produced. When we read the universe's time arrow and go backwards in time, we can register units of significance, classes and sub-classes, and as such apprehend "frozen" information: it will be found as much in the structure of an atom as it will in a historical event. As Koichiro Matsuno has argued, to have fresh information, and not just frozen-Parmenidean information (which is no information, but patterned repetition of the same), a condition has to be met: "Information in the making is generatively active in keeping the capacity of lawful indeterminacy intact, while prescriptively specific at the same time in precipitating lawful determinacy in the form of information in the frozen

record" (Matsuno 1997: 245; see Rosen 2004: 15–6). If we are consistent in our rejection of an overarching, static version of the universe, we must allow laws and regulatory constants to be sustained and upheld by the action of a freedom capable of choosing, of discriminating.

6. Man as world and world as man

There is a metaphysical and theological continuity to be discovered throughout Descartes' stance when it comes to affirming freedom. It also has a bearing on our discussion of Damasio's anti-Cartesian neutral monist position. If all of what I think comes from the body, as we said, it ultimately comes from the reservoir of attempts made by the species to survive. If this is so, I would not be able to invent, and to cause information to appear in the universe. As Brunod aptly points out, specifically against Damasio, an illusory freedom resting on an equally illusory Self that is merely a reflection of a network of somatic automated responses, would not have led Socrates to drink the hemlock if all that mattered was the preservation of the body where the real Self resides (Brunod 2006: 37). That a greater universality always exists, that I am a body for others who look at me from outside, and for myself only when afflicted with ailment, signifies that the Self is not just a construction from disseminated frozen information, passively inscribed in some "engram" that would be a mechanical by-product of evolution's random walk. It is capable of seeing not only what there is outside, by progressively rectifying the sources of error – Descartes' grand project – but also of originating new information. It is capable of conjoining narration, hermeneutics, and functional mathematical explanation (see Salanskis 2013), in its aim of eradicating arbitrariness from our description of the universe. This is what one finds in a Descartes who is the originator of a mathematization and consequent mechanization of the world-picture (see Davis & Hersch 2005; Dijksterhuis 1986), and alternately the ancestor of present-day phenomenology that reanimates with one dimension what it seemingly deanimates with another. A comprehensive science of this kind would eradicate arbitrariness and, in keeping with Husserl's dictum of a most foundational science, reaffirm that the right action, what ought to be done, is as much a question of value as it is one of causal interaction to be left to chance (*causa seu ratio*). In this

sense, one should readily say, with François Le Lionnais who inquired about what was invariant in both Descartes and Einstein beyond the obvious differences in scientific outlook of their respective eras, that they believed in the primacy of reason (Le Lionnais 1952: 152). If we are to reduce the arbitrariness of our description of reality, we have to learn from Descartes that we will foster true science by inscribing it within an horizon of significance, and this in turn will require that we refuse fads that seek to make the mind a thing weighable and measurable, which amounts to transforming a necessary condition – a functionally efficient brain – into a sufficient one. It will also require that we start seeing with the soul, as this alone is seeing, for without the attainment of this vision, we would have no halt to a downward regress and nothing left to counter the absorption of the mind in the machine-like universe. That machine-world is not obtained out of world-making where God stands as guarantor of the truth of sensory certainty.

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