Descartes *agonistes*—The 'Real' Descartes Stands Up: How the agendas, identities, rebellions, successes, failures and delusions of 'youth' (1618-33) generated the historians' mature Descartes

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ABSTRACT

The symposium, 'Nacht van Descartes', of the Descartes Centre for the History and Philosophy of the Sciences and Humanities will feature four erudite delineations of key dualities and tensions in Descartes' thought and action, and of how those dualities and tensions were seen by contemporaries, successors and later historians. I do not propose to judge amongst these images or to offer a balancing act. A synthesis is possible, but a dialectical and historical one, not an additive or merely comparative one. I suggest the key resides in reconsidering the younger Descartes. This is not because he offers some simple, Whiggish, 'just so' story of how all the later tensions and complexities came to pass. Rather, his younger self displayed the same dynamics of tense, combative creativity, but did this before his complex and daring public endeavours had eventuated.

Before Descartes constructed a metaphysics; before he pondered the articulations of theology and systematic natural philosophy; before he traced the physiology of the emotions and their ethical entanglements; before he had a continent wide network of correspondents, uncontrollable followers and deadly enemies—before any of that, he had already been deeply, ambitiously, rebelliously, sometimes deludedly, committed to deep work in the two knowledge games that most interested him and which were interacting in new ways in that generation—thus helping foment the process we call the Scientific Revolution. Those domains were, of course, natural philosophy and mathematics. The young Descartes struggled, succeeded, failed, embraced fantasies—and saw their downfall—within those realms, and, most importantly, in the creative space opening between those realms, which he called physico-mathematics. In so doing over the years 1618 to 1633, he unintentionally matured, becoming the Descartes who was about to produce the writings behind the dualistic and tense images presented today.

Thus, I shall try to square these circles, to 'synthesise by transcending', or by 'transposing to a different key'; that is, by going earlier and deeper into the dynamics of the younger Descartes in the knowledge games that were to be—over a longer stretch of the Seventeenth century—main topics of the Scientific Revolution. This approach, I modestly hope, may help trigger off our larger debate.

Synthesising by Changing Key: Back to the 'Young' Descartes

We've been treated to four very scholarly depictions of dualities and tensions in Descartes' career, and of how those dualities and tensions were seen by later generations. They all have great merit, and I don't propose to balance or resolve them. But a sort of synthesis is possible, in an historical sense—if we reconsider the younger Descartes. Descartes' younger self worked on topics, and in ways, that set down the foundations, the tense, fluid, conflicted foundations, for his later tense, fluid carryings on. He did this in two of the

most significant knowledge games of his age: natural philosophy and mathematics, and it on parts of those I'll concentrate.

Before we begin, let me stress that I am not denying the tensions and dualities of his later career displayed this afternoon. They are real, not figments of the historians here gathered. Two illustrations: Descartes and the Enlightenment and Descartes and facts—

Of course Descartes didn't participate in the Enlightenment, but there's no doubt that some of his thought already had recognisable, if not fully expressed, DNA of that movement. In some grand ways he **is** the first modern. The same may be said of other, quite different contemporaries…that great poet, and Puritan, John Milton for instance—just as much displayed enlightenment genes to come, yet he was also, in different ways, personally unfitted to have actually lived in the 18th century.

Facts…Descartes knew their value and he respected their role in the architecture of natural philosophical systematics. However, Descartes was explicitly in favour of systematics in ways later natural philosophers would not be, or would purport not to be. So, Descartes' respect for facts in itself might have gotten him into the Royal Society, but his much more central commitment to systematics and holism of knowledge would have made him unclubbable there.

So, my aim is to 'synthesise by transposing to a different key'; that is, by going earlier and deeper into the dynamics of the younger Descartes. Before Descartes constructed a metaphysics; before he pondered the articulations of theology and systematic natural philosophy; before he traced the physiology of the emotions and their ethical entanglements; before he had a continent wide network of correspondents, uncontrollable followers and deadly enemies—before any of that, he had already been deeply, ambitiously, rebelliously, sometimes deludedly, committed to deep work in natural philosophy and mathematics––two knowledge games which were interacting in new ways in that generation—thus helping foment the process we call the Scientific Revolution. The young Descartes struggled within those realms, and, importantly, in the space opening between those realms, which he called "physico-mathematics". Thus over the years 1618 to 1633, he unintentionally matured, becoming the Descartes who was about to produce the writings behind the dualistic and tense images presented earlier today.

Scientist or Natural Philosopher: The contested field of natural philosophising

If we are going to understand the young or the old Descartes, and any of his contemporaries, we have to start with some conceptual housecleaning: The best recent early modern historiography has largely discarded the word 'Science' as some emerging modern essence, and focused instead on the actual constellation of traditions and disciplines devoted to seeking knowledge of nature in early modern Europe. Chief amongst those fields was natural philosophy.

Early modern natural philosophy was a elite sub-culture and field of contestation. When one 'natural philosophised' one tried systematically to explain the nature of matter, the cosmological structuring of that matter, the principles of causation and the methodology for acquiring or justifying such

natural knowledge. The dominant genus of natural philosophy was, of course, Aristotelianism in various neo-Scholastic species, but the term applied to alternatives of similar scope and aim; that is, to any particular species of the various competing genera: neo-Platonic, Chemical, mechanistic or, later, Newtonian. Natural philosophers learnt what I call the 'grammar of natural philosophising' at university whilst studying hegemonic Scholastic Aristotelianism. Even alternative systems followed the rules of this game. All natural philosophers and natural philosophies constituted one sub-culture in dynamic process over time. At its climax in the early and mid seventeenth century the 'Scientific Revolution' was a set of transformations, a virtual civil war, inside the seething, contested culture of natural philosophising.

Along with the study of the continuities and changes in early modern natural philosophy has come attention to those disciplines then thought to be superior to it, such as theology, cognate with it, such as mathematics, or subordinate to it, as in the traditional mixed mathematical sciences of hydrostatics, statics, geometrical optics, positional astronomy and harmonics.

The term belonged to Aristotelianism, referring to a group of disciplines intermediate between natural philosophy and mathematics and subordinate to them. A natural philosophical account of something was an explanation in terms of matter and cause…for Aristotle, mathematics couldn't do that. The mixed mathematical sciences, such as optics, mechanics, astronomy or music theory, used mathematics not in an explanatory way, but instrumentally to represent physical things and processes mathematically. So in geometrical optics, one used geometry, representing light as light rays—this might be useful but didn't get at the underlying natural philosophical questions: "the physical nature of light" and "the causes of optical phenomena". Similarly, geometrical astronomy is an instrumental discipline used to predict positions; cosmology is a part of natural philosophy, explaining reality in terms of matter and cause.

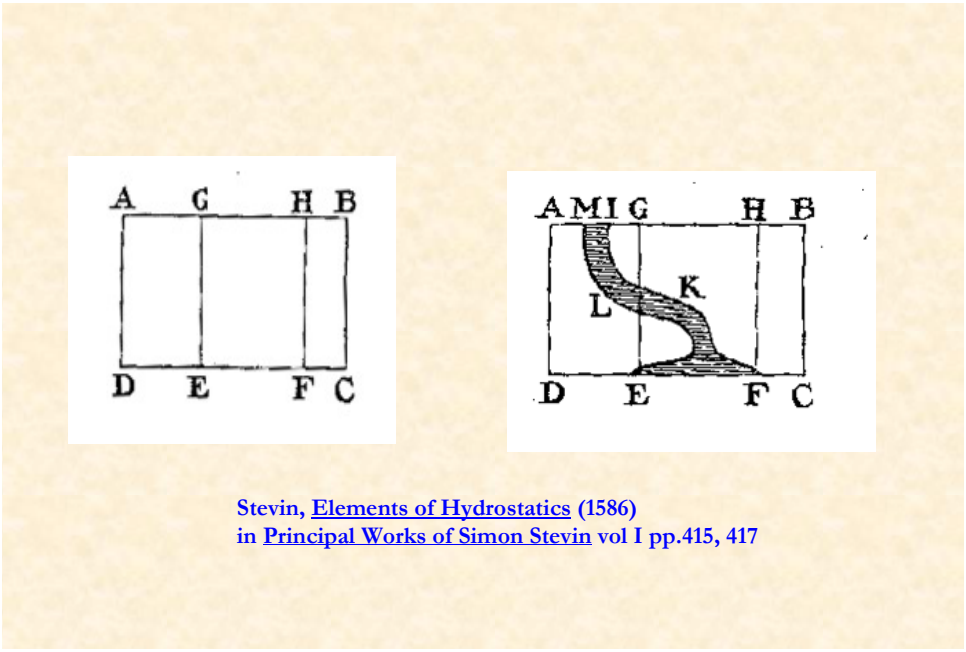
<u>Descartes and Beeckman: physico-mathematics within and for mechanist natural philosophy</u>

On his post school travels in the Netherlands in 1618, Descartes began to learn a radical and marginal species of natural philosophy from his new 'mate', Isaac Beeckman: an early version of corpuscular-mechanism. Even more important, I would argue, was a commitment, similarly inherited from Beeckman, to a program of what they called "physico-mathematics". What was this and how did it relate to natural philosophy?

The term physico-mathematics denoted a commitment to radically revising the conventional Scholastic Aristotelian view of the mixed mathematical sciences as subordinate to natural philosophy, non explanatory and merely descriptive. The mixed mathematical disciplines were somehow to become more intimately related to natural philosophical issues of matter and cause—they were to become, as I have recently taken to saying, more 'physicalised', more closely intertwined with or integrated into natural philosophising, regardless of which specific genre of natural philosophy the budding physico-mathematician endorsed.

Three early exercises by Descartes in physico-mathematics survive. Here is the first and most important:

[FIG 1] Back in 1586 Simon Stevin, the ultimate maestro of practical and mixed mathematics, had proven a special case of the hydrostatic paradox. Stevin demonstrated that a fluid filling two vessels of equal base area and height exerts the same total pressure on the base, irrespective of the shape of the vessel and hence, paradoxically, independently of the amount of fluid it contains. Stevin's proof proceeds with Archimedean rigour on the macroscopic level of gross weights and volumes and depends upon the maintenance of a condition of static equilibrium.

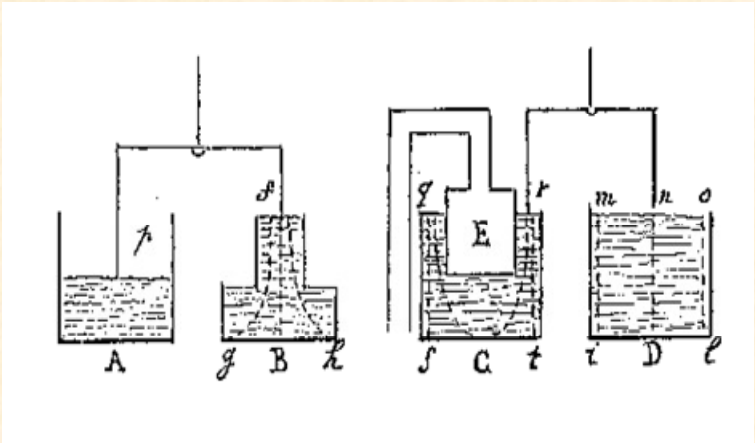


Stevin, Elements of Hydrostatics (1586)
in Principal Works of Simon Stevin vol I pp.415, 417

[FIG 2] In early 1619 Descartes tried to turn Stevin's result into physico-mathematics for the benefit and approval of Beeckman.

Descartes takes two containers B and D, which have equal areas at their bases, equal height and equal weight when empty, and are filled to their tops. He proposes to show that, "the water in vessel B will weigh equally upon its base as the water in D upon its base"—Stevin's paradoxical result.

Descartes, Aquae comprimentis in vase ratio reddita à D. Des Cartes, AT X 69



In contrast to Stevin's rigorous Archimedean argument, Descartes attempts to reduce the phenomenon to corpuscular–mechanics by showing that the force on each 'point' or part of the bottoms of the basins B and D is equal, so that the total force is equal over the two equal areas. He claims each 'point' on the bottom of B is, as it were, serviced by a unique line of 'tendency to motion' propagated by contact pressure from a point (particle) on the surface of the water through the intervening particles. He takes points g, B, h; in the base of B, and points i, D, l, in the base of D. He claims that all these points are pressed by an equal force, because they are each pressed by "imaginable lines of water of the same length"; that is, the same vertical component of descent—an idea gleaned from Stevin. Concerned with the instantaneous tendency to descend, we may compare the lines of tendency in respect to their vertical 'components'.

Descartes' mappings of lines of tendency are quite tendentious. Without justifying the three-fold mapping from f, he smuggles it into the discussion as an 'example'—I call his move here, following Dennis Sepper the "figuring up" of the problem. He then argues (syllogistically!) that *given the mapping*, f can indeed provide a three-fold force to g, B and h.

Young René was quite pleased. He continued to use descendants of these concepts the rest of his career. We have the key concept of instantaneous tendency to motion, and an example of its analysis into components. Descartes' later mechanistic optics and natural philosophy depend on the analysis of instantaneous tendencies to motion, rather than finite translations. These ideas, further developed, become central to what Stephen Gaukroger and I call the dynamics of Descartes, the concepts that govern the behaviour of micro-corpuscles in *Le Monde* and the *Principles*.

Stevin's derivation of the hydrostatic paradox fell within the domain of mixed mathematics rather than natural philosophy. It did not provide an *explanation* of the phenomenon.

The account Descartes substitutes for it falls within the domain of natural philosophy: the concern is to identify the material bodies and causes in play. Fluids are made up, on Descartes' account, of microscopic corpuscles whose movements or tendencies to movement are understood in terms of an emergent theory of forces and tendencies, a causal discourse about "dynamics" as I just said. He wants to explain—by his matter theory and new dynamics—what causes the pressure exerted by a fluid on the floor of its containing vessel. These moves imply a radically non-Aristotelian vision of the relation of the mixed mathematical sciences to his particular brand of corpuscular-mechanical natural philosophising. Descartes is saying hydrostatics is no longer merely an instrumental and descriptive discipline of mixed mathematics in the Aristotelian sense. He wants to shift hydrostatics from the realm of mixed mathematics into the realm of natural philosophy, provided that natural philosophy is the one he holds.

This is the key case. The others are, first, a curious, widely overlooked physico-mathematical fragment on refraction of light adapted and explicated from bits of the work of Kepler, and secondly his well known work with Beeckman on the nature of accelerated fall. Not everything was so promising with these latter cases. The optical work is short and apparently aborted, no law of refraction was found, nor its natural philosophical causes. And the work on accelerated fall, viewed as an exercise in physico-mathematics takes on a different appearance than it has in the traditional literature, where it is seen as Beeckman and Descartes failing to become Galileo. I argue it was a failed attempt at physico-mathematisation, and one recognised as such by Descartes, with reverberations in his later work.

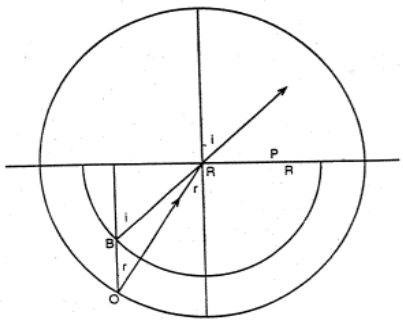
So, in sum early on he was paying more attention to being an aspiring physico-mathematician within the field of natural philosophy (wherein he was leaning toward a corpuscularian agenda), than he was to articulating and enunciating details of corpuscular structures and behaviours. And his physico-mathematics was both a vast agenda and possible intellectual identity, and yet in practical terms a scene of very mixed results. There was already a tension between program and identity on the one hand and results on the other.

This kind of tension was to escalate for the young Descartes in these very early years, but before I tell you about that I need to jump forward a few years to mention his eventual great breakthrough in physico-mathematics.

<u>A Physico-mathematical triumph of historic proportions: Discovering and explaining the law of refraction</u>

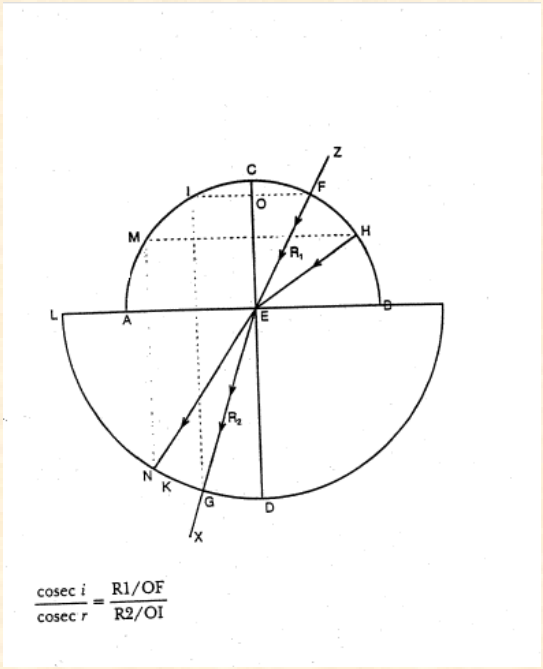
In Paris in 1626/27 Descartes, collaborating with Claude Mydorge, pulled off a colossal physico-mathematical triumph. First, they discovered the long sought law of refraction. This was accomplished using only traditional mixed mathematical optics: **[FIG 3]** In my reconstruction, Descartes and Mydorge used the traditional image locating rule in order to map the image locations of point sources taken on the lower circumference of a half submerged disk refractometer. Even using the cooked data in Witelo's widely read 14th century textbook, one gets a smaller semi-circle as the locus of image points. This yields a law of cosecants.

Harriot's Key Diagram: Half Submerged Disk Refractometer. Source Points On Lower Circumference. Image Points On Smaller Semi-Circular Locus. A Law Of Cosecants Results For Refraction of Light. J.Lohne, 'Zur Geschichte des Brechungsgesetzes', Sudhoffs Archiv 47 (1963), 152-72, p.160



[FIG4] In order to create a refraction predictor, they flipped the inner semi circle up above the interface as the locus of point sources for the incident light.

Mydorge's Refraction Prediction Device Mydorge to Mersenne in Correspondence de Marin Mersenne (ed. C. deWaard) (Paris 1945ff). I. 405.



Then came Descartes' physico-mathematical magic: Taking this representation of the new law, again as what I call the 'figuring up', the preparation of a macro-geometrical result for physico-mathematical analysis,

Descartes then adduced a natural philosophical take on light to explain the law. He transcribed into "dynamical" terms the geometrical parameters embodied in his diagrammatic representation. The resulting dynamical principles concerning the mechanical nature of light were: [1] that the parallel component of the force of a light ray was unaffected by refraction, whilst [2] the absolute quantity of the force of the ray was increased or decreased in a fixed proportion. Here he was articulating and extending the kind of ideas about the dynamics of corpuscles he had begun in hydrostatics back in 1619.

So, by 1627 the young Descartes, *physico-mathematicus*, had a great result, a solution to a classical mixed mathematical problem and a radical physico-mathematical move to adduce the causes of the new law. But notice, he still displayed no vocation toward systematic natural philosophising. The future author of *Le Monde* and the *Principia* was nowhere in sight. Yet within two years system building would be his chief concern. Obviously we have missed some things in the years 1619-29 that must now be added to the brew.

Grand Identities and Illusions 1619-28: mathesis universalis and universal method

The story of Descartes' struggles in the years 1618-1628 involves both solid mathematical work, and increasingly unrealistic methodological aspirations. Descartes envisioned two more projects, which entailed the modification of agenda and identity. These other projects of the years 1618-1629 were meant to encapsulate and transcend 'mere' physico-mathematics. The failure of these visions drove Descartes toward his explicit vocation in systematic natural philosophy, a program he had never before embraced.

Since the early Beeckman days in 1618-19, Descartes had pursued an analytical, problem-solving agenda in mathematics, which in these respects seemed to him to resemble his physico-mathematics. He worked in a piecemeal way, convincing himself that general protocols could be found for solving problems in both algebra and geometry. Physico-mathematics also involved geometrically 'figuring up' problems so that they could be resolved (leading to corpuscular-mechanical explanation stories). So, he thought that physico-mathematics, too, could be brought into this unified orbit. This hope triggered in 1619-20 his dream of a unified analytical approach to all mathematically based disciplines—practical, pure and physico-mathematical—to which he appropriated the already circulating name 'universal mathematics'. All this is recorded in an early fragment, which later was embedded in the text of the *Rules for the direction of the mind*.

Moreover, even that overheated conception quickly gave way, within a matter of months in 1619, to the even more encompassing mirage of a universal method, which remained with him from 1619 right through to the late 1620s

Descartes *agonistes*, it therefore turns out, was not just struggling to work out a physico-mathematics with possible corpuscular-mechanical bearings. He was also a master analytical mathematician and dreamer of gigantic and seductive methodological fancies, all of which arguably affected his shifting and evolving self-understandings and agendas.

We can imagine him in 1619-20 becoming more self-absorbed in his evolving versions of the intellectual and identity categories *physico-mathematicus*,

universal mathematicus; *methodologist*. At each stage of these early adventures Descartes was well pleased. To fancy himself a physico-mathematician, then a universal mathematician, provided a sense of who he was intellectually (and particularly as some special specimen of mathematician).

In 1627-28, after his optical breakthrough, and working partly in the shadow of Marin Mersenne's cultural battle against both radical scepticism and religiously heterodox natural philosophies, he picked up universal mathematics and method again in detail, and tried to write a unified treatise about his earlier dream of a methodologically sound universal mathematics, the unfinished *Rules for the direction of the mind*. I argue that this project didn't blossom into the intended magisterial work of method and universal mathematics, but collapsed under its own weight of self-generating problems and contradictions.

Note first that systematic natural philosophy had no part in this vision. This project intended that natural philosophising be pushed from center stage for good: Explanatory talk about matter and cause would become a marginal pursuit in one corner of the total range of application of this universal mathematics run by a master method.

Now, none of this should surprise us, or rather it doesn't surprise me, because of my view of *method discourse as mythic discourse*, adumbrated in earlier publications of mine. Method doctrines, I argue, have specific structures which simultaneously cripple their abilities to deliver the cognitive goods they promise, yet create for audiences illusions that they can so deliver: What I've termed the illusions of *application of rules*, of *adequate grasp of target fields*, of *unity*, and of *methodological progress*. Hence WE know that Descartes cannot have succeeded, and that he very likely succumbed to the textual persuasion of his own method discourse. That allows us to appreciate the obvious, surface level problems in the text of the *Regulae*, leaving us unsurprised to find that it fails, and breaks off exactly where a key crippling problem appeared to Descartes himself. Descartes realised this method was not going to work.

Descartes' fantasy projects peaked at two moments: First in 1619-20 when he hit on universal mathematics, leading quickly to the first gleams of the method; and then late in the 1620s, after the optical work, with the composition of most of the *Rules*. But the projects of method and universal mathematics failed. And guess what? Descartes had to return to the two real but largely separate cultural games in town—he retreated to a more isolated and independent, high faulting analytical mathematics; and he [re-]turned, separately, to the field of natural philosophising. Leaving forever his fantasy agendas in universal mathematics and method, he realised that he was actually meant to be a radical version of his own Jesuit scholastic mentors in systematic natural philosophy

Hence, much of the story of Descartes' *agonistes* revolves around the intended and unintended entanglements of two these trajectories—in physico-mathematical natural philosophy, and in analytical mathematics, promoted to fantasy programs in universal mathematics and method—a process marked by determined planning, unintended shifts and some

spectacular insights, some fruitful, some disastrous, all in turn conditioned by the varied environments in which Descartes moved. And it is these struggles that finally bring us, fully prepared, to become readers of *Le Monde.*

Le Monde as Early, but Consummate System

Le Monde was a system of natural philosophy, cannily designed to compete in the field. I particularly stress Descartes' famous vortex celestial mechanics as an exquisitely constructed object and as a strategic, natural philosophical gambit. The vortex celestial mechanics are the 'engine room' of the argument of *Le Monde*, Descartes' technical way of addressing the natural philosophical challenge posed by realist Copernicanism, particularly Kepler.

I argue the celestial mechanics are a hybrid entity. Their genealogy derives partly from Descartes' physico-mathematics, because they are based on Descartes' principles of dynamics, his rules of motion, which I can show arose by extension and generalisation of the ideas about the mechanics of light that he got, physico-mathematically from his newly discovered law of refraction back in 1627. But, the vortex mechanics are clearly a piece of generic natural philosophical ***discourse***, playing the central role in this new corpuscular-mechanical system.

I show that a charitable reading of the vortex mechanics propels us into the details of the *Le Monde* as a system—from the explanations of stars and stellar vortices, through planetary orbits, the behaviour of satellites and comets, as well as local fall and tidal phenomena on planets, not to mention the behaviour of light in its cosmological setting. [but *Le Monde*, clever system that is was, was but a first try a prentice work…]

Tracking Hurricanes: Further Paths of Developing Tensions and Dualities

● What, for example, of Descartes' in later life maintaining, in public, that his natural philosophy was mathematical, or geometrical? —an image that lives on in intellectual history, history of philosophy and sloppy history of science. You now know that it makes little sense for him to have later claimed that his natural philosophy was mathematical: It ***might*** be said is that although his natural philosophy is discursive like all others, it tries to delimit speech to in-principle quantitative properties. But, that really won't do, because that's not what any mathematician of the time would have seriously called mathematical. Part of the answer, I can suggest, resides in Descartes' reflection upon his own prior trajectory in physico-mathematics *cum* natural philosophy. Descartes' physico-mathematics, with all its complexity and ambiguity at any point between 1618 and 1633, was still more mathematical than any natural philosophical discourse could be. And Descartes' corpuscular-mechanical natural philosophy, especially its dynamics of corpuscles or causal register, had deep roots in his physico-mathematical trajectory. So, when he later called his natural philosophy mathematical, he was, in my view, disappointedly alluding to this hidden dimension of his own experience. 'Mathematical' was his short hand sign in public for all he had hoped for and tried to do, first in physico-mathematics with a corpuscular-mechanical flavour, and later in a corpuscular mechanical system of physico-mathematical source and 'type'.

● Similar points relate to his remarks in later life about method. He did not have our post-Bachelard, Kuhn and Feyerabend theoretical basis for denying the efficacy of a universal, transferable method; but, he had experienced the collapse of his own actual method program, and he knew the actual trajectory of each of his successes and failure. Again, reflecting on his hopes, and still wishing perhaps that it was not so, he happily used method-talk, as I call it, to package and sell his work, but ducked, weaved and equivocated at every turn about his own history with method, its nature, and its efficacy.

Coda

So to sum up: we have had in the other papers a drawing out and comparing of tensions and dualities in Descartes later career which lead on to wider domains of subsequent intellectual history. I wanted to go back further to look for embryonic agendas, images, awarenesses of possibilities and of failures that were woven in early (and hence deeply) into the life of the Descartes who later and gradually expressed and unfolded the dualities and tensions others have so eruditely exposed, and resolved here this afternoon.

By going for the young Descartes in this way, I hoped––post facto admittedly––to set up the considerations of the other participants, because the tension ridden mature Descartes is the product of, on my telling, a tension ridden less mature Descartes. And if the mature Descartes is full of hints and symptoms of cultural dynamics coming into play and debouching in the enlightenment, the younger Descartes is full of hints and symptoms of his own later self, and of the cultural dynamics in the generation leading to his, and amongst his contemporaries, arguably...just arguably...the critical generations in the forging of modern science via that process we partially misname as the scientific revolution.

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