

**Images of Generation: Animal oeconomy and prosperity
in Doctors Mandeville and Quesnay**

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Approaching sterility and generation

The Physiocratic idea that good governance must be rooted in an understanding of nature and nature's economy does not strike the environmentally aware observer of the late twentieth century as in any way odd. On the other hand, it is difficult to find even language which can span the eighteenth and twentieth centuries when it comes to a theme starting to be stressed in recent Quesnay scholarship, that nature's economy for Quesnay involves in an essential way the activity of a "fire" or "ether" which "explains all transformations in nature including the animation of living things" (Christensen 1993). Apparently more straightforward, but in fact scarcely less puzzling, is what Quesnay seemed to take as a direct implication, that manufactures and trade generate nothing and do not constitute "wealth." This last, of course, is an old puzzle.

We propose to approach both nature's economy and the supposed sterility of manufacturing and trade obliquely, yet in a way that we think is fresh and hope will be clarifying, namely, by contraposing Quesnay's maxims on good governance and opulence and the very different views of a fellow medic and near contemporary, Bernard Mandeville. Contrasting Quesnay's notion of wealth and his "rules" for prosperity with their opposite extremes gives us a clearer sense of the boundaries within which Quesnay's own discourse takes place. This in turn helps to re-contextualize Quesnay, after years of seeing him simply borrowed to undergird projects originating elsewhere: Quesnay as the progenitor of input-output thinking; Quesnay as the father of the surplus approach; Quesnay as an early under-consumptionist; Quesnay as proto-Marxian articulator of the materialist hypothesis.

The doctors Mandeville and Quesnay

Using Mandeville as a foil for Quesnay is perhaps new but is not strange. There are some striking common elements between them. (1) Both were trained in medicine and spent many years as practicing physicians, though Quesnay of course began as a surgeon and Mandeville throughout was particularly interested in hypochondria, which he viewed roughly speaking as a psycho-somatic disorder. (2) Both wrote treatises on animal oeconomy and illness. Among other works, Quesnay published Observations sur les effets de la saignée in 1730 and his L'art de guérir par la saignée in 1736 (both reissued, in one volume, in 1750 under the title Traité des effets et de l'usage de la saignée). He also published the Essai phisque sur l'oeconomie animale in 1736 (expanded edition, 1747). Mandeville wrote much less on medicine: a single volume, A Treatise of the Hypochondriack and Hysterick Passions, published in 1711, and a graduation disputation at Leiden, on the chyle, Disputatio Medica Inauguralis de Chylosi Vitiata ["Depraved chylication"] (1691). An enlarged edition of the Treatise, with the word Passions changed to Disease appeared in 1730. (3) Medicine aside, both men also developed theories of good government which seemed to them more compelling even than what they could adduce about "physiology" and illness. (4) And, finally, there is an interesting Leiden connection, though it serves more to define their differences than to unite them.

Mandeville (1670-1733), as was common, studied philosophy prior to taking his medical degree. He entered the University of Leiden in 1687 and graduated in 1691. There he came under the influence of Burchard de Volder, who taught a somewhat selective Cartesianism (at a time when it was officially not allowed to dispute Cartesian notions in University orations), but who also visited the Royal Society, set up what may have been the first physical laboratory on the Continent, and introduced teaching based

on Newton's ideas (Sassen 1970; Lindeboom 1968, 1970). De Volder may also have been instrumental in getting Archibald Pitcairne, an ardent mathematical mechanist, to teach at Leiden in the academic year 1692-93, just too late for Mandeville to have heard him, though not for another of De Volder's students, Herman Boerhaave.^(D&L)

Boerhaave's own student years at Leiden (1684-93) encompassed Mandeville's. He at first intended to enter the ministry, but after several years studying philosophy opted to complete a medical training instead. Like Mandeville, he was unimpressed by the instruction available at Leiden, to the point where it seems likely that he attended too few lectures to be able to take his degree there, even though he resided in the city throughout his student days. We know of no encounter between Mandeville and Boerhaave, and Mandeville's medical writings took a different direction from Boerhaave's. Whereas Boerhaave espoused a medical education heavily based on what we would now call the basic sciences (mathematical physics, chemistry, and botany, at the time), Mandeville was sceptical about how much these subjects, particularly mechanics, had to offer in curing disorders, and he expected much more from the method of "experience" (or a posteriori reasoning). In this he felt he was following Thomas Sydenham, who also served as a model for Boerhaave, though only for his bedside concern.

Quesnay, for his part, and as is well known, drew heavily on Boerhaave, especially in the first edition of his Essai phisique sur l'oeconomie animale, which was published by Cavelier, also Boerhaave's French publisher. Substance aside, he may have learned something of the Newtonian style from Boerhaave, perhaps reinforced by Malebranche and Voltaire (see Fox-Genovese 1976). Newton's style has been defined by I. Bernard Cohen as involving the use of mathematical constructs -- simpler analogues of more complex physical situations -- which could be explored as mathematical exercises before physical problems were readdressed (Cohen 1990). The style was thus a form of idealization. It is useful to keep this notion of idealization in mind when reading the

phrases that pepper Quesnay's long introduction to the first edition of the Essai, to the effect that reason is a suspect guide, and one must rely always on the instruction of experience. Quesnay's *experience* was always *l'observation exacte* (e.g., Essai 1736: ix, xxxviii, emphasis added). According to Quesnay, in other words, experience has to be mediated. Whether this is via pure Cartesian reasoning or by Newton's exact mathematical description is immaterial. Either way, Quesnay was a very long way from Mandeville, who declared himself happy to be identified with the disdained "empyricks."

Linking animal economy to generation and sterility

We wish to focus attention on some interconnections between method (style), animal economy and riches -- an unlikely set, we acknowledge. We start with analytical style, though this spills over quickly to the other things.

Demonstration and social order

Quesnay's language is that of law and system rather than that of an observer of particulars. This has to do with the problem of demonstration. If we do not know the structure of something we wish to explain, but have to infer it from observations of "effects" -- Mandeville uses the example of a watch whose hands we see moving but whose mechanism is hidden -- then at best we are able to adduce sufficient possible causes. Demonstration eludes us. Mandeville saw this as inevitable in the case of "physiology" or animal economy, both because we lack instruments to catch the "animal spirits" -- the minute and exceedingly quick humors that travel through the nerves -- and, more importantly perhaps (since the spirits were merely hypothesized anyway), because we cannot see into the living body without severely disturbing its functioning. He held our speculations about "society" to be similarly constrained.

That was because Mandeville didn't view societies as natural entities. What we can observe, instead, is individual human beings. Close attention to behavior suggests that we are not naturally social. What we call societies therefore can be nothing more than contingent arrangements we humans devise on the basis of experience and trial and error (see Bianchi 1993). And the arrangements must take into account the ever-present potential for conflict arising from the fact that individual interests may pull in different directions. If we are to understand "society", then, we need to grasp what it is that energizes people, on the one hand, and what keeps them from being constantly at odds, on the other. Passions or desires are the names Mandeville gave to the one element, laws the other. Passions and laws; can we be certain that these are the key elements? No; but they suffice for understanding. And the test of what is sufficient is supplied by whether this view of society enables us to generate plausible accounts of how nations have come to riches or have experienced impoverishment. Quesnay thought he was able to provide such accounts, but he did so by linking nature to society in the language of demonstrative certainty.

Idealization

How did Quesnay manage this? If we cannot demonstrate about observed nature, we surely can about idealized nature -- and do so with mathematical precision ("Despotism", Maverick 1946: 260, 279). The same, of course, holds for society. Idealization, as we have stated already; was Newton's style. As already noted, whether Quesnay's version derives from Descartes or Newton, or was his own particular invention, is not material; our point is simply that what he discusses is society perfected. Nature perfected was not just Newtonian; it was also the received view of what, or how, artists should paint. Mandeville, who had a particular interest in painting, knew the doctrine and rejected it out of hand (De Marchi and Van Miegroet 1994). Whether

Quesnay viewed the doctrine more positively we do not know;¹ if he did, it would simply confirm that the differences between Mandeville and Quesnay play themselves out over a wide terrain.

Closer to economics, however, we see this in their treatment of markets. Quesnay's markets are generic and formal. All that is important in his markets is that the prices which obtain are appropriate to return the necessary advances to the farmer and start the circle of wealth on a new revolution. Mandeville, by contrast, spells out the rough and tumble of actual market practices. He writes about the strategic interaction between a mercer and his lady client (Fable, Kaye 1924, I: 350-1). We recognize the situation he describes as an instance of a common method used in pricing at the retail level up to the early nineteenth century (Alexander 1970). He also discusses the tactics of two merchants, each of whom seeks an advantage by proffering false information (Fable I: 61-3), a common occurrence on the Amsterdam exchange when Mandeville was studying at Leiden. For him these examples show the passions playing themselves out in social settings; the observation and interpretation of such particulars constitutes Mandeville's style.

While Mandeville used observed particulars as the materials for an induction, Quesnay saw them as possible obstacles to clear thinking. For the formal -- the idealized -- requires seeing beyond mere forms, or particulars. Mr. H., Quesnay's interlocutor in the "Dialogue on the Work of Artisans", has to be read this lesson. "I must tell you", says Mr. H, "that I always see true production in the goods made by artisans." To which Mr. N, Quesnay's spokesman, replies: "...it is not a question of production of this sort, i.e. a simple production of forms which the artisans give to the materials used... -- but of a real production of wealth" (Meek 1962: 205; first emphasis added).

This sort of dialogue is purely didactic and Quesnay's characters are not very

¹We do know that, prior to becoming a surgeon, he learned to do engraving (Hecht 1958: 215); and if one looks at the illustrations in medical textbooks early in the eighteenth century, it is clear that they represent selected and clarified reality, as befits their instructional purpose.

believable. In Mandeville's hands, the dialogue -- his favorite genre² -- is intended to entertain as well as persuade. He was aware of the objection that the form lends itself to demolishing merely straw men; but he guards against this by making his characters "real...faithfully copied from Nature" (preface to Fable, Part II). Even that route was fraught with danger, as Quesnay saw things. Ideas such as "production" and "regeneration", he insisted, cannot be conveyed properly through ordinary language. And if we are forced to choose, it is language that must yield. "But it is not for the natural order to conform to a language which expresses only confused and ambiguous ideas; it is for the expressions to conform to the exact understanding of the natural order, in distinctions which are rigorously regulated by reality" ("Artisans", Meek 1962: 204). The regulation here is not really by reality; it is reality that is being regulated. Facts must be reasoned with, arranged and matched up according to a system (Essai 1736: xxxvii). This is not nature faithfully copied, but nature perfected.

But nature is always perfected with some end in view. In the Italian Renaissance tradition of History painting the perfection involved selection: choosing the right subject, the most dramatic moment, the appropriate disposition of the figures, etc. For Newton perfecting nature meant, in the first instance, demonstrating the law of force as the locus of a mass point under the influence of inertia modified by the pull of a centripetal force, but without taking account of real mass (bodies) or mutual attraction (Mathematical Principles 1960 [1729]: 40-43 (Bk. I, sect. II, prop's I and II)). For Quesnay it meant demonstrating how wealth is generated and regenerated, where both the dimensions of the circle and the point at which it is broken into, are important. The "circumstances" supposed are ideal: classes smoothly performing the roles that are essential to a healthy economy (the productive class employing state-of-the art farming techniques; proprietors

²The few glimpses we have of his life suggest that he was a committed conversationalist (see Fable I: xxix). This is reflected in his writing. In 1728 he published a Part II to the Fable of the Bees, comprising a long preface -- mostly about the dialogue form -- followed by six dialogues (this is vol. II of the Kaye edition); and the Treatise is wholly dialogue. Carrive (1980) notes that Mandeville's Treatise is the first medical work in which the author adopts the informal approach of talking with a patient.

spending their revenue in the ways required to maintain the circuit); tax policy likewise attending to this condition; markets being unfettered; external trade balancing the burden of imports against the domestic (agricultural) surplus; and so on. The aim is to isolate the conditions comprising "the order of good government", "the form of government which is self-evidently the most perfect" ("General Maxims", Meek 1962: 231). Quesnay's "society" is of course based squarely on the France of his day. It is nonetheless a construct, and only because it is so is it useful for demonstration.

Animal economy: circulation versus digestion

The circulation of the blood, in Quesnay's writings on animal economy and on the blood especially, is the model for the well-governed society. That is not controversial (Foley 1973), but perhaps it has not been stressed sufficiently that Quesnay's view of the circulation itself was somewhat idealized.³ The purpose of the circulatory system was "to distribute to all parts the fluids [*sucs*] that they need" (*Essai* 1736: 231); it is a system of proportions and fine balances, of *un equilibre parfait* (230). It must deliver the humors to the correct parts of the body, each according to its needs, and, in addition, it must distribute the proper mix of humors -- Quesnay's discussion of the temperaments is based on different *derangements* of the mix of humors. While imbalances do occur, and it is sometimes desirable to intervene and assist nature to restore its natural balance, there is nonetheless a lot that is generic and self-correcting; and everything is law-governed. For example: the droplets of blood are equally composed and have nearly the same size in all sorts of people (*Essai* 1736: 171); fever can become a remedy against itself and against its cause (*Traité* 1750: 74-6); bloodletting, though sometime useful, must be practiced subject to a correct understanding of the laws of circulation (*ibid.*: 7,8, 322-3); and its role

³Meek, though he viewed it as analytical abstraction rather than mathematical idealization, saw quite clearly what the method involved (1962: 375 and note 2).

always is to restore the quantity of fluids and the proportions of the humors – a process which ironically he calls "spoliation" (ibid.: 39, 77-8). The whole system, meanwhile, is ceaselessly maintained by the "air" (Essai 1736: 231; see further Conclusions section, below).

As these brief indications suggest, Quesnay's approach to medicine was largely mechanistic, or of the "iatro-mechanical" sort, a synthesis made by Boerhaave and others of the Galenic qualities, chemistry, and new discoveries in anatomy all organized in terms of modern mechanics (see King 1958, 1972, 1978; Risse 1992). The 1736 edition of Essai phisique sur l'oeconomie animale heavily emphasizes a view of the body as machine, explains chemistry in terms of the motion of particles in mixtures, and views health and illness in terms of the balance of humors, which in turn is determined by the actions of the solid parts of the body. Although Christensen (1993) has revealed that the 1747 edition of this work shows an acceptance of a vegetative soul, a kind of life force that regulates the unconscious activities of the body, this is identified with an ether, giving it a decidedly materialistic cast. Quesnay continued to speak in terms of particles in motion, and his new edition in 1750 of his works on blood letting, Traité des effets et de l'usage de la saignée, continued to be largely mechanistic as well.

The iatro-mechanical school propounded one of the great systems of the period, and Quesnay was nothing if not systematic. As we have seen, in the introduction to the Essai he suggests that it is necessary to "reason with the facts, investigate and reassemble the pieces that do not fit, arrange and match up (if I dare say) that which is confused – in a word: to build a system" (1736: xxxvii). As his simplified, bifurcated system of pipes and buckets of water illustrates (Foley 1973), one must observe, then idealize – Quesnay says "abstract" – nature and erect a system which is describable in mechanical and mathematical terms. The same holds in the social sphere (compare "Artisans", in Meek 1962: 204). For, as Quesnay says of the moral law (alongside physical law, one of the two kinds of natural law), it is "the rule of all human action in the moral order

conforming to the physical order" ("Natural Right", Meek 1962: 530). The *Tableau Economique* displays this conformity. Real live individuals do not conform exactly to the roles assigned them in the *Tableau*, but by idealizing we gain clarity and insight, without losing any truth about the way nature works.

Boerhaave, from whom Quesnay seems to have borrowed significantly, albeit selectively, for his own animal economy, noted that because the chain of causes and effects "seem to make a continual circle without Beginning or End" it is difficult to know where to begin a discussion of animal economy. He nonetheless chose to start with the digestion, since the body is composed of aliment (Institutes 1751 [1707] I: 47-8). Quesnay adduced a similar-sounding reason, yet opted for circulation. "The life of the body", he said, "seems to consist only in the circulation" (Traité: 11). Quesnay considered digestion as well, but gave it nothing like the space devoted to circulation.

Nothing comparable, either, to the attention it is given by Mandeville. From student days, we know, Mandeville had been especially interested in the digestion, and he (independently of Boerhaave) focused almost exclusively on digestion in his Treatise. The digestion is treated, not only as complementary to good health, but as varying essentially with choices: choices about diet, and of lifestyle (for details see De Marchi 1991). Mandeville analyzed the complex of diet, lifestyle, digestive processes and health in terms suggestive of Work and Waste (compare Wise 1989-90). And he arrived at sequences that could complement and undergird flourishing health or dissipated strength. These are models of generation, or its opposite, whose symptoms of lethargy and depression are known as hypochondria ("the hypo").

What is most striking about Mandeville's analysis of digestion is that the metaphors he applies to this aspect of animal economy are primarily economic. Recall that digestion for him is not strictly physical, but involves choices and thought. Soul and body are said to work reciprocally upon one another in this part of the animal economy, and the process of thinking is regarded as "labour" (Treatise 1730: 231, 236). Great

quantities of the animal spirits (the finest of particles, produced through chyfication and transported to the brain via the blood) are "consumed" in this labor (231); while the brain itself is likened to a "capacious Exchequer of human Knowledge", a "vast Treasure of Images" (Fable II: 165). Moreover, in speaking of the danger of dissipation for males through sexual activity, the imagery is of a stock (again "vast Treasures" is invoked) that can be emptied ("insensibly consumed by a continual Expence") but cannot be restored (Treatise 1730: 208, 211).

Not surprisingly, there is a parallel between digestive models of generation and dissipation and the prosperous society, though there is also a Mandevillian twist. The flourishing hive of the Fable of the Bees corresponds to the generative model of digestion, only prosperity doesn't come from restraint, frugality, aversion to luxury, from conserving one's "treasure"; it comes from its very opposites. The dissipative model of digestion, in turn, corresponds to the hive that is honest, content, and must therefore enjoy just a minimal existence.

Quesnay, we have seen, considered the laws of circulation to be none other than the laws of motion (Essai: 7, 8, 217, 219, 227, 229-31; Traité 1750: 2-3, 11, Ch. VII *passim*).⁴ Since, moreover, the laws of society in its ideal form are derivative, he does not employ economic images to characterize aspects of the animal economy, but instead fits his description to the prior system of idealized circulation.

The roles of Nature and of Art in generating prosperity

The contrast in the source of images shows itself, as we would expect, in the discussions by the two Doctors of what makes for prosperity. And if we focus more narrowly on the role of the artisan, it shows up there with startling clarity. Quesnay's

⁴This not be read as implying complete inexorability. The vegetative soul acts along with and can interfere with the laws of motion.

formula is straightforward: "Abundance plus dearness equals opulence" ("Corn", Meek 1962: 84). Notice the language here; not generate or conduce to, but "equals." This is the language of demonstration. Abundance stands in direct relation to the surplus generated by nature, dearness refers to prices for agricultural products high enough to cover costs and at the margin even induce extra output -- the proper price for maintaining nascent wealth (ibid.: 77, 79). There is more hidden in the formula about the requirements of good governance; the "General Maxims" (Meek 1962: 231-62) provide the necessary elaboration. But in this idealized schema, the work of artisans cannot be considered productive. They produce no value that is not reducible to wages and materials costs, hence no surplus upon alienation such as nature yields in agriculture and fisheries.

Against this characterization, consider the following image by Mandeville of the soul as artificer. The "tools" of this artificer are the organs of the body, and the finer spirits are the soul's "skill." The spirits indeed "act under the Soul, as so many Labourers under some great Architect" (Treatise 1730: 159-60). Not only is this a further reminder that the animal economy is describable -- and frequently is described -- in economic terms, but there is in it an allusion to the works of human invention that are in some sense more than materials and skill. That is indeed Mandeville's view.

Mandeville, shockingly from a Quesnaysian perspective, deliberately diminishes the role of nature in Works of Art. Of course, he says, we cannot subsist without nature; but neither can societies exist without "the Concurrence of human Wisdom" (Fable II: 186). And if we look at and compare the works of nature and the works of art, "The Difference...is...immense" (ibid.). Nature supplies "only" raw materials, plus the constitution of the workers -- "the Make of [the] Frame, the Accuracy of the Machine." But nature's part in "the Skill and Patience" embodied in human creations, including society, is "very inconsiderable" (187-8). Learning, and the experience of the ages, contributes by far the greater part.

Value, surplus and trade

The word "value" rarely appears in Mandeville's writings; he usually speaks of price.⁵ And for him, as for Quesnay, the price of any reproducible tends to the cost of production. At the same time, "riches", the term Mandeville employs when he is discussing prosperity, is not reducible to nature-generated wealth. Riches are not so much physical as a matter of enlarged desires, refined appetites, improved understanding, and an acquired taste for novelty -- all the result of exposure to "Strangers [and] Superfluities" (Fable I: 185). Indeed, Mandeville draws an analogy between wine and (human) commerce. Single grapes cannot be said to contain wine; for that they must be heaped together and crushed, and the fermentation which results must be skillfully managed. Just so in mutual interactions between individuals. Sociality stems from the experience of being social: *fabricando fabri finus* -- by making we make the maker. Similarly, when it comes to trade in goods, whereas Quesnay maintains that trade is always an exchange of equivalents, there is for Mandeville also something more, something equivalent to the "fermentation" that transforms the grape, without vinosity on its own, into wine. This something more is not measurable in the same units as the original inputs, hence does not yield a surplus identifiable in "own" terms (the grape rate of net return); but it is none the less real for that.

This translates directly into maxims of governance to produce prosperity. Quesnay, confining himself to the wise management of an agricultural nation, spells out the conditions for allocative balance and renascent wealth. Dearness of price will obtain if there is competition between nations; and natural constraints will be attended to if the nation exchanges its agricultural surplus for luxuries.⁶ Not only is this safer for the

⁵In the same way, perhaps, in his Treatise, he rejects the baggage-laden term "temperament" preferring instead "constitution" (Carrive 1980).

⁶Of course, Quesnay also stresses the need to complement freedom of external exchange with an unfettered internal trade. One great advantage that he expected of this was a more stable price of agricultural produce ("Men", Meek 1962: 94-5).

nation -- the demand for necessities is more dependable -- but in this way too, balance is maintained: "the burden of its purchases is borne only by its opulence [surplus]" ("Corn", Meek 1962: 77, 79). Mandeville, as we would expect, goes beyond natural surplus to the larger conception of trade as a sort of ferment.

Would you render a people "potent, renown'd and flourishing" he asks? Then "teach 'em Commerce with Foreign Countries, and if possible get into the Sea, which to compass spare no Labour nor Industry, and let no Difficulty deter you from it: Then promote Navigation, cherish the Merchant, and encourage Trade in every Branch of it" (Fable I: 184-5). Mandeville's Dutch background shows through in this advice, just as Quesnay's putative agricultural nation is France. What also comes through in Mandeville is his conviction that governing well is the art of drawing on and managing the human passions, since it is these which stir us to action. Encouraging trades and external commerce, he leaves no doubt, will bring out emulation and envy, stimulate avarice and luxury, and cause fraud to intrude (*ibid.*); but (a) there is no alternative; and (b) it is the role of legislators to "find out the true Use of the Passions...and by dextrous Management turn private Vices into publick Benefits" (*ibid.* II: 319).

Conclusions

We have explored the connections between prosperity and animal economy by putting special emphasis on Quesnay's method of idealizing nature, whether physical or social, and contrasting it with Mandeville's stress on particulars, human desires, learning and experience. The differences are summed up in images, and nowhere more clearly than in an image, which happens to have been employed by both, of the windmill.

Quesnay's story of the circulation begins with the movement of the humors in the lungs. There, inhaled air rarifies the blood and pushes it towards the heart, where it strikes the auricle, shaking down the animal spirits. These gather up the fibers of the

heart, causing contraction. Rushing out of the heart, the blood strikes the walls of the arteries, again shaking the spirits; this contracts the walls, squeezing the blood and causing it to move further (Essai 1736: 227-8). In his summarizing image of the process he says: "All the vital motion of our [body-]machine is continuously maintained by the air, just as a mill depends for its motion on the activating breezes" (ibid.: 231).

Mandeville's use of the same image occurs in the context, not of a description of the circulation, or even of the digestion, but in illustration of the point that if society is to be made strong and powerful, the passions must be aroused. Without the influence of the passions, he insists, human beings will not exert themselves, and all the invention and achievements of which they are capable will lie dormant, "and the lumpish Machine...may be justly compar'd to a huge Wind-mill without a breath of Air" (Fable I:184).

Both accept the heuristic of body as machine, but for Quesnay the motive force is material, while for Mandeville it is "spiritual." For Quesnay's circulation model to work, moreover, the activating breezes have to be more than intermittent; they must be utterly regular and reliable. The circle of nourishment for Quesnay is driven, in other words, in lawlike fashion, by natural forces; and the same sort of description exactly is transferred to the ideal society. There is nothing so abstractly perfect about Mandeville's machine. He starts with the passions; and it is only if the passions are wisely managed that prosperity will be caused. The models of generation and dissipation that we find in Mandeville's discussion of digestion are portrayed in the language derived from the story of riches generated through wisely managed passions, giving choice and will priority in both the animal and the material economy.

This bifurcation of methods and approaches presaged a double evolution of political economy. In the United Kingdom economics remained part of moral discourse until late in the nineteenth century, whereas in France it was co-opted to serve engineers in the form of cost-benefit applications. Mandeville's concern with particulars may be

seen as an extension of what Daston (1993) has called "the fuse and fodder of mid-seventeenth century inquiry", and his choice of Sydenham as the model physician marks him as a rudimentary nosologist rather than a medical systematist (see Risse 1992). But his prioritizing of choice, the passions, wise legislation and experience also point forward to Smith, John Stuart Mill and Marshall. Descartes, however, had warned against "unfettered curiosity", and Quesnay seems to have shared in a growing sense among mostly French writers that the novel, the particular, the unexplained, should give place to order, law-governedness and understanding. As Fontenelle put it, "Nature is...never so wondrous...as when she is known" (La Republique des philosophes 1768: 63; as cited in Daston 1993; emphasis added); or as Quesnay himself would have it: without a system, "experience always appears, in itself, to be discordant and incapable of leading to any truths" (Essai 1736: xxxvii). That was exactly what lead Newton to substitute mathematical analogues for complicated physical situations. One forward projection of that thinking is Walrasian general equilibrium analysis, but its intermediate stages can be traced in the French engineering tradition of useful calculation (Porter 1991, 1992; Etner 1987; Eckelund and Hébert 1978).

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