The Political Economy of Eighteenth-Century Insects: Natural History and Political Economy in France 1700-1789

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Table of Contents

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Abstract

This dissertation argues that insects provided a crucial lens through which Enlightenment thinkers could reimagine and represent their societies. It demomstrates that the understanding of the functioning of their individual bodies, the close observation of their collective behaviour, and its manipulation and management, helped eighteenth-century scholars to conceptualise, and root in nature, their social orders and the changes that they wished to see in them. While insect collectives such as bee swarms or ant colonies that had long been used to metaphorically model human societies, in the eighteenth century, these metaphors were reformulated and given an empirical basis.

Investigating writings on insects on the part of natural historians, agronomists, *philosophes* and physicians, the thesis contributes to the growing literature on the role of animals in human history in general and in the Enlightenment in particular. It builds on two scholarly traditions: French studies and the cultural history of scientific, economic and political knowledge (mainly written after the 1980s). I take from French studies methods for the close reading of texts and more recent ideas on how 'to bridge' different fields of knowledge; the latter discipline will be useful in providing ideas about the history of observation and experimentation, theories of the animal and human body as well as eighteenth-century understanding of political econonmy.

As this dissertation demonstrates, insects helped conceptualise new ideas of the human individual and his or her passions (chapters 1 and 2), of how human collectives are formed (chapter 3) and how governments can manipulate and regulate them in the most profitable ways possible (chapters 4 and 5). By investigating Enlightenment writings on insects, this thesis shows, we can recover part of the rich history of our modern understanding of our own ways of living together.

Introduction

1. Introduction

In his assessment of the recent transformations of the modern city, media theorist Eric Kluitenberg borrowed an analogy from the animal world to describe human social urban life. He argues that human urban life is best represented as a swarm: 'Today, we are witnessing the rise of swarm publics, highly unstable constellations of temporary alliances that resemble a public sphere in constant flux; globally mediated flash mobs that never meet, fuelled by sentiment and affect, escaping fixed capture.'[1] The modern city is here figured as a swarm, a collection of billions of individuals who form no real or lasting relationships. Kluitenberg is by no means the only contemporary thinker to conceptualise modern collectivities by using reference to insect life such as 'swarms' or 'hives'; philosophers, social scientists and geographers have all sought to conceptualise modern human life through metaphors of insect societies. Swarms too have been shown to capture, and shape, the problems of modern human life. According to a recent report by the United Nations Environment Programme, declining honeybee populations and 'colony collapse disorder' present a significant threat to food security for humans around the globe, as bees pollinate one third of global crops.[2] The problems facing honeybee colonies are directly attributable to human interventions such as industrialised agriculture, engineering projects or urban development, which affect, as biologists have shown, the very genetic code of the bee.[3]

This dissertation investigates a central period in European history in which the understanding of the relationships between insects and human collective lives underwent fundamental changes: the Enlightenment. Taking its cue from a growing concern among humanities scholars with human-animal relationships, this thesis shows how observations of individual and collective insect bodies contributed to

[1] Eric Kluitenberg, *Delusive Spaces: Essays on Culture, Media and Technology* (NAi, 2008), p. 287.
[2] Stéphanie Kluser, Marie-Pierre Chauzat, and Jeffrey S. Pettis, *UNEP Emerging Issues: Global Honey Bee Colony Disorder and Other Threats to Insect Pollinators* (United Nations Environment Programme, 2010) <http://www.unep.org/dewa/Portals/67/pdf/Global_Cee_Colony_Disorder_and_Threats_insect_pollinators.pdf.> [accessed 28 July 2017].
[3] Jake Kosek, 'Ecologies of Empire: On the New Uses of the Honeybee', *Cultural Anthropology*, 25.4 (2010), 650–78.

debates about how to conceptualise – and govern – large numbers of individuals living, moving and working in a given space. What we now call 'social' insects were particularly useful for this endeavour, as they appeared in large groups that, as in the case of harmful pests or useful bees, often proved challenging to control. Like contemporary media theorists, eighteenth-century savants frequently had recourse to metaphors or observations of insect collectivities to make sense of their own societies, and to construct new conceptualisations of their social order. Insects, and in particular social insects, have of course long been used as figures for humanity; in the fast-changing world of Enlightenment France, however, they did so with particular frequency and intensity.

While insect collectives such as bee swarms or ant colonies that had long been used to metaphorically model human societies, in the eighteenth century these metaphors were reformulated and given an empirical basis. The Enlightenment was a period of intense discussions around the nature of animals, and their differences from and similarities to humans.[4] As Pierre Serna has recently argued in his history of animals during the French Revolution, 'dans cette mutation du monde que constituent les années 1750-1830, jamais peut être, dans l'histoire de la modernité et de l'ère contemporaine, l'histoire des hommes n'a été autant été mêlée à celle des animaux.'[5] This dissertation analyses texts from the middle decades of the eighteenth century, when, as the chapters that follow will demonstrate, insects such as bees, ants, and polyps (considered to be insects at the time) were at the heart of some of the most important debates of the Enlightenment. The eighteenth century was, famously, a period of intense debates around what it means to be human, both in the singular and

[4] Anita Guerrini, *The Courtiers' Anatomists: Animals and Humans in Louis XIV's Paris* (Chicago: University of Chicago Press, 2015); 'L'animal des lumières', ed. by Jacques Berchtold and Jean-Luc Guichet, *Dix-huitième siècle*, 42.1 (2010); Laura Brown, *Homeless Dogs & Melancholy Apes: Humans and Other Animals in the Modern Literary Imagination* (Ithaca: Cornell University Press, 2010); Tobias Cheung, 'Transitions and Borders between Animals, Humans and Machines 1600-1800: Introduction', *Early Science & Medicine*, 15.1/2 (2010), 1–2; 'Special Issue: Animals in the Eighteenth Century', ed. by Glynis Ridley, *Journal for Eighteenth-Century Studies*, 33.4 (2010), iv; 427-683; Matthew Senior, 'The Souls of Men and Beasts, 1630-1764', in *A Cultural History of Animals in the Age of Enlightenment* (Oxford: Berg, 2007), IV, 23–45.

[5] Pierre Serna, *Comme des bêtes: Histoire politique de l'animal en révolution (1750-1840)* (Paris: Fayard, 2017), p. 12.

in the collective.[6] As this dissertation demonstrates, insects helped conceptualise new ideas of the human individual and his or her passions (chapters 1 and 2), of how human collectives are formed (chapter 3) and how governments can manipulate and regulate them in the most profitable ways possible (chapters 4 and 5). Discussions of insect bodies, that is, were also discussion of human individual and political bodies.

By looking at literary, natural historical, and agronomic discourses of insects, this thesis shows, we can recover part of the rich history of our modern understanding of our own ways of living together. In the introduction, I first set out the literatures on which this dissertation builds: French studies and the cultural history of scientific, economic and political knowledge (mainly written after the 1980s). As the thesis located in the discipline of French studies, I take from French studies methods for the close reading of texts and more recent ideas on how 'to bridge' different fields of knowledge; the latter disciplines will be useful in providing ideas about the history of observation and experimentation, theories of the animal and human body as well as eighteenth-century understanding of political economy. Building on the insights from these literatures, it becomes apparent that the study of eighteenth-century insects is firmly situated within an interdisciplinarity context of eighteenth-century forms of knowledge. Using 'bridging concepts' such as that of population which came into increasing use in all of these different fields of knowledge I show how insect were central to the understanding of new forms of human social order in the Age of Enlightenment.

Investigating writings on insects on the part of natural historians (in the eighteenth-century sense as outlined by historians of science discussed above), agronomists, *philosophes* and physicians, the thesis thus contributes to the growing literature on the role of animals in human history in general and in the Enlightenment in particular. As this is a dissertation contributing to the field of French studies, it analyses texts, and focuses on textual, rather than experimental or observational practices. Nevertheless, because insects crossed so many modern disciplinary

[6] For a recent overview, see Yves Citton and Laurent Loty, 'Penser ensemble les rapports entre individus et communautés à l'époque des lumières', *Dix-huitième siècle*, 2009, 4–26.

boundaries, the work by historians of science, medicine and political economy who have shown that all these different fields shared methods, concerns and languages has been particularly useful. This dissertation thus expands the argument that histories of nature in the age of Enlightenment were, at the same time, histories of human societies. The chapters that follow show, in short, that investigations of human and animal bodies were used to make, and think through, claims about political economy and the functioning of individual and collective behaviours. It shows that authors and observers always understood insects through the lens of their own concerns and assumptions.

2. French Studies: The Literary History of Humans and Animals in the Enlightenment

This thesis originates from a fascination with the role of animals in French literature: animals have long been a subject of study for scholars of the seventeenth and eighteenth centuries. The following section briefly sketches out important methodological changes in literary studies over roughly the last four decades, important to this thesis because they moved animals (amongst other non-human actors) to the forefront of interest in French literary studies and fundamentally changed the ways scholars understood the role and function of animals in literary texts. This thesis' focus on insects as a window onto political and conceptual changes in the period builds on this literature and its argument that animals have been fundamental in the development of human cultural and political life.

The study of animals in literature is not, of course, an invention of the 1980s. Important works by George Boas and Leonora Cohen Rosenfield, written in the 1930s and 1960s, for example, offered extensive accounts of human attitudes *towards* animals.[7] They thus investigated what authors in the seventeenth and eighteenth

[7] Leonora Cohen Rosenfield, *From Beast-Machine to Man-Machine: Animal Soul in French Letters from Descartes to La Mettrie* (New York: Octagon Books, 1968); George Boas, *The Happy Beast: In French Thought of the Seventeenth Century* (Baltimore: Johns Hopkins Press, 1933); Henri Busson, 'La Fontaine et l'âme des bêtes', *Revue d'Histoire littéraire de la France*, 43.2 (1936), 257–86; Hester

centuries had to say about animals and related themes such the animal soul or animal mechanism, and the way in which writers of all literary genres represented these themes. Others explored the use of animals as symbols. Georges May, for instance, in an article on Denis Diderot's *Jacques le fataliste,* in 1961 analyses the dog as an image for human liberty and loyalty, assuming that the dog's status as 'symbole universel' makes the animal instantly recognisable to its readers as a reminder of man's unique and inalienable liberty.[8]

More recent literary scholarship has approached 'the animal' in eighteenth-century French literature from a new perspective, owing much to theoretical discussions over 'structuralism' and 'poststructuralism' that were first formulated in France during the 1960s and 70s and took a hold on the Anglo-American academic world during the 1980s.[9] The claims of poststructuralist scholars as to the overriding importance of the underlying structures of language fundamentally subverted the traditional approach adopted by scholars in the humanities, centred around the human subject as the sole agent of meaning and as actively shaping the world around him or her. With (post)structuralism, meaning was no longer considered the product of a

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Hastings, *Man and Animals in French Literature of the Eighteenth Century* (Baltimore: Johns Hopkins University, 1934).

[8] Georges May, 'Le maître, la chaîne et le chien dans "Jacques le Fataliste", *Cahiers de l'Association internationale des études francaises*, 13.1 (1961), 269–82; See also Leon Schwartz, '"Jacques Le Fataliste" and Diderot's Equine Symbolism', *Diderot Studies*, 16 (1973), 241–51.

[9] The distinction between structuralism and poststructuralism is a difficult one to make and cannot be reduced to temporality ('post' because it comes after), especially since thinkers such as Roland Barthes or Jacques Lacan are sometimes considered to belong to both; Jonathan Culler has thus argued that these distinctions are unhelpful; see Jonathan D. Culler, *On Deconstruction: Theory and Criticism after Structuralism*, Twenty-fifth anniversary edition (Ithaca: Cornell University Press, 2007). For overviews of poststructuralist thought, see James Williams, *Understanding Poststructuralism* (Chesham: Acumen, 2005); Colin Davis, *After Poststructuralism: Reading, Stories and Theory* (London: Routledge, 2004); Stefan Münker and Alexander Roesler, *Poststrukturalismus.* (Stuttgart: Metzler, 2000); *The Cambridge History of Literary Criticism. Volume 8: From Formalism to Poststructuralism*, ed. by Raman Selden (Cambridge: Cambridge University Press, 1995). A short definition is of course hard to give for such a diverse body of theories; Catherine Belsey provides a useful definition: 'Poststructuralism names a theory, or a group of theories, concerning the relationship between human beings, the world, and the practice of making and reproducing meanings. On the one hand, poststructuralists affirm, consciousness is not the origin of the language we speak and the images we recognize, so much as the product of the meanings we learn to reproduce. On the other hand, communication changes all the time, with or without intervention from us, and we can choose to intervene with a view to altering the meanings – that is to say the norms and values – our culture takes for granted.' Catherine Belsey, *Poststructuralism: A Very Short Introduction* (Oxford: Oxford University Press, 2002), p. 5.

rational and creative thinker, but of underlying linguistic structures. As an important consequence, structuralists and poststructuralists thus cast doubt on, or 'decentred', the notion of the rational human subject, capable of discovering the 'truth', both about him- or herself and about the external world.[10] The idea of the human self as increasingly 'rationalising', self-reflected and in confident possession of his or her own thoughts came to be decried as an illusion originating in the belief of the Enlightenment.[11] The notions of 'rational man', but also of the genius author, celebrated by previous generations of literary scholars, for many now became a 'myth'[12].

Given that the supposedly rational subject of the Enlightenment had been unmasked as a myth, scholars also began to question the traditional distinction between between rational man and animals, the latter supposedly lacking rationality. A key text for the emerging new field of animal studies from the 1990s onwards was Jacques Derrida's *L'animal que donc je suis (à suivre)* (published posthumously in 2006), an essay in which the poststructuralist philosopher prompted by his cat's gaze, interrogates the relationship and boundaries between man and animal.[13] In *L'animal*, Derrida throws into radical doubt the idea of a fixed boundary between the human subject and the 'animal world', which he decries as a foundational error of Western philosophy. Derrida argues that the contrast between the categories of rational man

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[11] Dror Wahrman, *The Making of the Modern Self: Identity and Culture in Eighteenth-Century England* (New Haven: Yale University Press, 2006); Charly J. Coleman, 'The Value of Dispossession: Rethinking Discourses of Selfhood in Eighteenth-Century France', *Modern Intellectual History*, 2.3 (2005), 299–326; Jan Goldstein, *The Post-Revolutionary Self : Politics and Psyche in France, 1750-1850* (Cambridge, MA: Harvard University Press, 2008); Jonathan Lamb, *Preserving the Self in the South Seas, 1680-1840* (Chicago: University of Chicago Press, 2001); Andrew Curran, 'Monsters and the Self in the Rêve de d'Alembert', *Eighteenth-Century Life*, 21.2 (1997), 48–69.

[12] In the same breath that Barthes declared the 'death of the author', he also announced the 'birth of the reader'. Overviews and critiques of postmodern literary criticism with further bibliographies, include *The Routledge Companion to Postmodernism*, ed. by Sim Stuart, 3rd edn (London: Routledge, 2011); Nicola Bran, *The Cambridge Introduction to Postmodern Fiction* (Cambridge: Cambridge University Press, 2009); Michael Greaney, *Contemporary Fiction and the Uses of Theory: The Novel from Structuralism to Postmodernism* (Basingstoke: Palgrave Macmillan, 2006); Terry Eagleton, *The Illusions of Postmodernism* (Oxford: Blackwell, 1997); Stephen Connor, 'Postmodernism and Literature', in *The Cambridge Companion to Postmodernism*, ed. by Stephen Connor (Cambridge: Cambridge University Press, 2004), pp. 62–81.

[13] Derrida, *L'animal.*

and irrational 'animal' made possible the long tradition of Western metaphysics, reaching from the philosophies of Plato, to those of Descartes and Heidegger. Derrida instead aligns himself with what he deems 'pre- or anti-Caretesian' philosphers, chiefly Montagine, who, in his 'Apologie de Raymond Sebond', used the description of a cat to denounce man's arrogant assumption of being able to know 'les branles internes et secrets des animaux'.[14] According to Derrida, Cartesian philosophers defined the rational human subject on the back of the falsely homogenous category of 'the animal' that does not distinguish oysters from apes, let alone Derrida's cat from any other cat. Derrida, by contrast, wishes to emphasise the multiplicity of animals as well as of humans: 'Au-delà du bord *soi-disant* humain, au-delà de lui mais nullement sur un seul bord oppose, au lieu de 'L'Animal' ou de 'La-Vie-Animale', il y a, déjà là, une multiplicité hétérogène de vivants'.[15] It should also be noted that Derrida and his followers reject the rights-based notion of animal ethics developed mainly by American thinkers such as Peter Singer.[16] The idea of an animal endowed with rights, Derrida argued, is no more but the continuation of the very liberal subject of the Enlightenment that his work denounces.

Inspirational for scholars in animal studies looking for how we came to think of animals as 'different' from humans were the many literary and historical studies which have emerged since the 1990s on the question of the 'socio-cultural' construction of the Enlightenment understandings of the human 'self', human sociability and of society. Enlightenment protagonists themselves considered their age as one in which the understanding of the individual and of society underwent significant changes and attributed this to the rise of reason and rationality over human

[14] Michel de Montaigne, *Apologie de Raimond Sebond*, ed. by Robert Aulotte (Paris: Société d'enseignement supérieur, 1979), p. 331. For a critical comparison of Derrida's and Montaigne's cats, and the argument that the two projects are in fact diametrically opposed, see Thierry Gontier, 'Montaigne on Animals', in *The Oxford Handbook on Montaigne*, ed. by Philippe Desan (Oxford: Oxford University Press, 2016), pp. 732–49.
[15] Derrida, *L'animal*, p. 53.
[16] Paola Cavalieri, *The Death of the Animal: A Dialogue* (New York: Columbia University Press, 2009); *In Defense of Animals: The Second Wave*, ed. by Peter Singer (Oxford: Blackwell, 2006); *Animal Rights and Human Obligations*, ed. by Tom Regan and Peter Singer (Englewood Cliffs, New Jersey: Prentice Hall, 1989); Tom Regan, *The Case for Animal Rights* (London: Routledge, 1988); Peter Singer, *Animal Liberation: A New Ethics for Our Treatment of Animals* (London: Cape, 1976).

passions in their time. Postmodern scholarship, in an attempt to expand the canon of eighteenth-century literature, constructed on the basis of 'cold reason', began to investigate more carefully the understandings of human passions, of 'sensibility' and 'sentiment' which had been central to discourse of the 'rational' self in the Enlightenment. Crucial studies such as George Barker-Benfield's *The Culture of Sensibility* (1992) and Janet Todd's *Sensibility: An Introduction* (1986); or, for the French context, Anne Vila's *Enlightenment and Pathology* (1998), David Denby's, *Sentimental Narrative and the Social Order in France, 1760-1820* (1994), for instance, fundamentally revised the picture of the Enlightenment as based on reason and mathematical and empirical approaches to nature.[17] These scholars have emphasised that sentiment and sensibility were considered crucial to a number of scholarly fields; sentiment, they argue, dominated medical discourses, political economy and even experimental physics. They also demonstrated that sensibility was a crucial component in attempts to redefine the social order, and the relationship between individuals and their societies in a more secular age.[18] At a moment in scholarship that is, when the rational, liberal subject was increasingly thought of as a socio-cultural construction, scholars showed that alongside rationality, Enlightenment savants also insisted on the importance of feeling and sensations in the formation of the modern 'self'. This aspect of the Enlightenment discourse has been taken up by those interested in revising the idea of a purely instrumental relationship between men and animals, emphasising instead its affective dimension.

[17] G. J. Barker-Benfield, *The Culture of Sensibility: Sex and Society in Eighteenth-Century Britain* (Chicago: University of Chicago Press, 1992); Anne C. Vila, *Enlightenment and Pathology: Sensibility in the Literature and Medicine of Eighteenth-Century France* (Baltimore: Johns Hopkins University Press, 1998); David J. Denby, *Sentimental Narrative and the Social Order in France, 1760-1820* (Cambridge: Cambridge University Press, 1994); David Marshall, *The Surprising Effects of Sympathy: Marivaux, Diderot, Rousseau, and Mary Shelley* (Chicago: University of Chicago Press, 1988); Janet M. Todd, *Sensibility: An Introduction* (London: Methuen, 1986); On history of science, see, among others: Sean M. Quinlan, 'Sensibility and Human Science in the Enlightenment', ed. by David J. Denby and others, *Eighteenth-Century Studies*, 37.2 (2004), 296–301; Jessica Riskin, *Science in the Age of Sensibility: The Sentimental Empiricists of the French Enlightenment* (Chicago: University of Chicago Press, 2002); E. C. Spary, *Utopia's Garden: French Natural History from Old Regime to Revolution* (Chicago: University of Chicago Press, 2000), ch. 5.

[18] See the introduction to *Animals and Humans: Sensibility and Representation, 1650-1820*, ed. by Katherine M. Quinsey (Oxford: Voltaire Foundation, 2017).

Based predominantly in English literature departments, these scholars have focused on the role of animals in discourses around rationality and, just as importantly, sensibility. One of the most recent contributions to the field, a collection of essays on animals and humans in the period between 1650 and 1820, characteristically sets out 'to recontextualise the key eighteenth-century concepts of "sentiment" and "sensibility" in regard to animal-human relations'.[19] Contributors explore a range of genres and themes, ranging from descriptive nature poetry as a genre which allows natural phenomena an 'independent voice' or the way which the writings of Alexander Pope propose notions of 'animal subjectivity' and 'animal welfare'. This edited volume follows a range of studies that have, similarly, dealt with 'affective' relations between animals and humans.[20] Thomas Menely's study of eighteenth-century animals and sensibility argues that poetry provided a space where animals were given a voice, and eighteenth-century ideas about sympathy and its virtues put into practice.[21] Ingrid Tague has discussed the significant rise in petkeeping in eighteenth-century Britain, basing her analysis also on literary sources such as children's stories or elegies and epitaphs for lapdogs or house cats.[22] Pet-keeping, she argues, 'offered a unique opportunity for eighteenth-century Britons to articulate their view of what it meant to be human and what their society ought to look like'; pets thus allow Tague to discuss the ways in which the new intimacy between human and non-human animals destabilised categories of race, gender and social status.

Tague's study also intersects with a third concern of studies on eighteenth-century animals in recent years, namely their role as commodities in the expanding consumer societies of the time.[23] The theme of sensibility, was, as scholars such as

[19] Quinsey, *Animals and Humans.*

[20] For perspectives on the so-called 'affective turn' from a range of disciplines, se *The Affective Turn: Theorizing the Social*, ed. by Patricia Ticineto Clough and Jean O'Malley Halley (Durham, N.C.: Duke University Press, 2007).

[21] Tobias Menely, *The Animal Claim: Sensibility and the Creaturely Voice* (Chicago: University of Chicago Press, 2015).

[22] Ingrid H. Tague, *Animal Companions: Pets and Social Change in Eighteenth-Century Britain* (University Park, Pennsylvania: Penn State Press, 2015).

[23] Significant studies on the rise of consumerism include Michael Kwass, 'Ordering the World of Goods: Consumer Revolution and the Classification of Objects in Eighteenth-Century France', *Representations*, 82.1 (2003), 87–116; *Luxury in the Eighteenth Century: Debates, Desires and Delectable Goods*, ed. by Maxine Berg and Elizabeth Eger (Basingstoke: Palgrave Macmillan, 2002);

Barker-Benfield have pointed out, intimately connected to the rise of consumerism in the eighteenth-century, which required individuals to 'indulge' in 'the luxury of feeling' just as they 'indulged' their appetites for the newest consumer goods.[24] Pets were consumer goods too, and the affections felt for them by their owners expressed a new consumerist sensibility, as well as anxieties regarding its dangers for the old social order. Eighteenth-century Europeans purchased not only pets, but also a growing number of exotic animals and animal products. As Louise Robbins has demonstrated for eighteenth-century Parisian culture, animals such as elephants, parrots or exotic birds became items for the luxury trade, and thus implicated in the eighteenth-century 'consumer revolution'.[25]

Not all literary scholars interested in animals, of course, abandoned the traditional venues of literary scholarship. However, even studies dealing with individual French authors were now reread in the light of the new interest in topics such as sensibility. For scholars in French studies, the most obvious candidate for an examination of animals, sensibility and compassion is the work of Jean-Jacques Rousseau. Jean-Luc Guichet, for example, has extensively discussed the centrality of the animal for Rousseau's thought.[26] Guichet argues that the important presence of animals in Rousseau's oeuvre needs to be explained in the context of Enlightenment anthropology and its redefinition of the human subject. Guichet presents those aspects in Rousseau that emphasise the new closeness between human and animal; the Rousseauist concept of pity, for example, which has long been known to lie heart of Rousseau's conception of society, is now shown to be rooted in natural man's

The Consumption of Culture, 1600-1800: Image, Object, Text, ed. by Ann Bermingham and John Brewer (London: Routledge, 1995); *Consumption and the World of Goods*, ed. by John Brewer (London: Routledge, 1993); Lorna Weatherill, *Consumer Behaviour and Material Culture in Britain, 1660-1760* (London: Routledge, 1988).

[24] Barker-Benfield, *Culture of Sensibility*.

[25] Louise E. Robbins, *Elephant Slaves and Pampered Parrots: Exotic Animals in Eighteenth-Century Paris*, Animals, History, Culture (Baltimore, Md. ; London: Johns Hopkins University Press, 2002). For the British context, see 'Guns, Ivory and Elephant Graveyards: The Biopolitics of Elephants' Teeth', in *Animals and Humans: Sensibility and Representation, 1650-1820*, ed. by Katherine M. Quinsey (Oxford: Voltaire Foundation, 2017), pp. 35–55; Christopher Plumb, *The Georgian Menagerie: Exotic Animals in Eighteenth-Century London* (London: I.B.Tauris, 2015).

[26] Jean-Luc Guichet, *Rousseau, l'animal et l'homme: L'animalité dans l'horizon anthropologique des Lumières* (Paris: Cerf, 2006).

connection to, and civilised man's difference from, animals.[27] Women writers, as Jeanne Bloch and Stéphanie Miech have shown, used animal fables or animal characters in novels to figure the relations between not only rational man and his animal other, but also between man and (less rational) woman, another crucial aspect of Enlightenment thought.[28] Eighteenth-century women writers, Bloch and Miech argue, employed animal figures both to represent the human individual and his or her capacity to feel sympathy for others, and to illustrate models of patriarchal domination.

The works of other famous *philosophes,* in addition to Rousseau, have been reexamined from the specific angle of the animal question. This is true especially of Diderot, who frequently employed animal images in his speculative texts. Kate Tunstall has recently shown how Diderot (and Laurence Sterne) used the image of the bee swarm to figure the theory that the mind is material and embodied.[29] She thus closely analyses literary figures for what they can tell us about Enlightenment materialists, and their attempt to understand human thought as the product of the sensitive body. Caroline Jacot-Grapa has explored how the author mobilises different animal (including many insects) figures in order to represent the 'animality' within man which, for Diderot, determines so much of his or her volition.[30] Unlike May's description of Diderot's figure of the dog, that is, these animal figures are not reminders of human uniqueness, but rather of the unstable boundaries between man and animal. Animals have also been shown to be central to the thought of Voltaire,

[27] Guichet, *Rousseau*, p. 432. The argument on Rousseauist pity elaborates an argument made by Lévi-Strauss; see Claude Lévi-Strauss, *Le totémisme aujourd'hui* (Presses Universitaires de France, 1969), pp. 143–45.

[28] Stéphanie Miech, 'Romans féminins et œuvres picturales : analyse du bestiaire et approche de la société des Lumières', *Sociétés & Représentations*, 29 (2009), 67–90; Stéphanie Miech, 'Nature et fonctions du bestiaire dans les romans de femmes auteurs au siècle des lumières', *Dix-huitième siècle*, 42 (2010), 139–59; Jeanne Bloch, 'Le héros animal dans les contes de fées de Mme d'Aulnoy', *Dix-huitième siècle*, 42 (2010), 119–38.

[29] Kate E. Tunstall, 'The Early Modern Embodied Mind and the Entomological Imaginary', in *Mind, Body, Motion, Matter: Eighteenth-Century British and French Literary Perspectives*, ed. by Mary Helen McMurran and Alison Conway (Toronto: University of Toronto Press, 2016), pp. 202–29.

[30] Caroline Jacot Grapa, 'Des huîtres aux grands animaux', *Dix-huitième siècle*, 2010, 99–118; Caroline Jacot Grapa, *Dans le vif du sujet - Diderot, corps et âme*, L'Europe des Lumières (Paris: Classiques Garnier, 2009); Caroline Jacot Grapa, 'Le Moi-Araignée du "Rêve de d'Alembert" de Diderot', in *Littérature et médecine: approches et perspectives (XVIe-XIXe siècle)*, ed. by Andrea Carlino and Alexandre Wenger (Geneva: Droz, 2007), pp. 177–98. See also Annie Ibrahim, 'Diderot et les métaphores de l'animal : pour un antispécisme ?', *Dix-huitième siècle*, 2010, 83–98.

who used animals to argue against both materialism (he defended the immaterial animal soul) and the overly devout or tyrannical (he advocated vegetarianism, at least in theory).[31]

These studies of literary uses of animal and insect figures in the works of particular authors or in various genres offer fascinating insights into the way in which animals were used metaphorically to discuss assumptions about what it means to be human, to live in a human body, or how men and women changed the way they related to one another. The animal figures used by Diderot, Rousseau or Voltaire, that is, were used to interrogate knowledge about what it means to be animal and, by implication, human. This thesis, similarly, pays attention to the ways in which conceptions of 'reason' and 'sensiblity' are constructed on the basis of engagement with animals. Unlike the studies mentioned above, however, I do not trace sentimental relationships. Instead, the chapters that make up this thesis show how animals – both real and imagined – served as tools for the construction of political communities.

In these analyses, it becomes clear that the category of the animal can include many different beings. Following Derrida's complaint that philosophers tend to use 'the animal' as a homogenous category of which all members can be opposed to man, scholars have drawn attention to the fact that the category of 'animal', as well its many subcategories, is a historical construction. This can be illustrated with definitions of the kinds of animals that this thesis discusses: insects. Eighteenth-century writers did not yet understand insects to mean small invertebrates. As this thesis shows, they agreed, however, that insects were 'animals', that is living, sentient beings that were neither plants (because they could move) nor humans (because they could, supposedly, not think),[32] and that they could be used just as well, or even better, than animals that

[31] Renan Larue, 'Voltaire, laboureur et naturaliste. Ferney et la genèse des Singularités de la nature', *Dix-huitième siècle*, 2013, 167–80; Christiane Mervaud, 'Bestiaires de Voltaire', in *Bestiaires de Voltaire*, Studies in Voltaire and the Eighteenth Century (Oxford: Voltaire Foundation, 2006), pp. 5–200.

[32] See the definition of the *Dictionnaire de l'Académie* (1787) : 'ANIMAL, s. m. Être, composé d' un corps organisé et d' une âme sensitive. *Acad.* Tout ce qui a vie, sentiment et mouvement. *Trév.* Être qui a du sentiment, et qui est capable d' exercer les fonctions de la vie. *Rich. Port.* De ces trois définitions, celle de l' *Acad.* est sans contredit la meilleûre. *Animal* terrestre, *animal* aquatique, *animal* amphibie, etc. "L' homme est un *animal* raisonable.'

we might now consider much closer to us on the evolutionary ladder for thinking about the differences between man and animal, or between the rational soul and the passionate body. The animals included under this category in the eighteenth century do not necessarily correspond to modern entomological classifications; arthropods and even reptiles were thus unproblematically classed as insects.[33] Contemporary dictionaries were, accordingly, not overly concerned with classificatory precision. For instance, the *Dictionnaire de l'Académie* of 1768 used the following definition of insects to distinguish different varieties according to their movements (a definition which only changed in 1835 to reflect new divisions based on the lack of vertebrae):

> INSECTE. s.m. Petit animal dont le corps est coupé comme par anneaux. Il y en a de plusieurs sortes; les uns rampent comme les vers, les autres marchent comme les fourmis, & les autres volent comme les mouches, les hannetons, les papillons.

The *Encyclopédie* article 'Insectes' defines them as animals that don't fit the categories of fish, bird or quadruped and follows the Aristotelian notion that insects are bloodless:[34]

> INSECTE, (*Hist. nat*.) petit animal qui n'a point de sang. On a distingué les animaux de cette nature en grands & en petits*;* les grands sont les animaux mous, les crustacés & les testacés; les petits sont les *insectes*. Il y a plus d'especes d'*insectes* que d'especes de poissons, d'oiseaux, ou de quadrupedes. Il y a aussi plus de différences de conformation parmi les *insectes*, que dans tout autre genre d'animaux.

[33] As noted by Tunstall in a footnote; see Tunstall, 'Embodied Mind', p. 220, fn.8. Denis Diderot and Louis Jean-Marie Daubenton, 'Animal, *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*, ed. by Denis Diderot and Jean le Rond d'Alembert, (University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), ed. by Robert Morrissey and Glenn Roe) <http://encyclopedie.uchicago.edu>

[34] Even though, as Liliane Bodson points out, Aristotle had qualified that insects lack *red* blood, the idea of insects as bloodless animals was widespread until the nineteenth century: Liliane Bodson, 'The Beginnings of Entomology in Anient Greece', *The Classical Outlook*, 61.1 (1983), 3–6.

This definition of insects was echoed that of Antoine Ferchault de Réaumur (1683-1757), whose *Mémoires pour server à l'histoire des insectes* made him undoubtedly the leading authority on insects, both in France and beyond. Réaumur was generous in placing creatures into the category of insect. He argued that any animal that could not be classified as either mammal, fish or bird should be an insect, regardless of size or the number of incisions (previously, for Aristotle, an insect or 'entoma' was an animal with a body divided into segments).[35] Réaumur admitted that he had no problem with that and this meant that he had no problem with classifying crocodiles as insects, though of course they did not meet his criterion of being easily encountered by a Frenchman. Unlike the Swedish naturalist and classifier Carl Linnaeus (1707-1778), the French naturalist was not particularly interested in offering a comprehensive system that would enable naturalists to identify all classes of insects.[36] These naturalists were not, as we will see, concerned merely with the subtleties of insect anatomy; instead, they used their histories of insects to write about human society. It is well-known, of course, that Parisian literary authors, naturalists, and political economists moved in many of the same spaces, where they could share and debate ideas. Famous naturalists such as Réaumur and his rival Georges-Louis Leclerc de Buffon (1707–1788) attended the weekly meetings of the Academy of Sciences, where they would have heard (and given) papers about a whole range of subjects that we would now classify as, say, chemistry, biology or engineering.[37] Outside the Academy, Réaumur attended the salon of Mme de Tencin, whose other regular attendees included the academician Bernard le Bovier de Fontenelle, the famous theorist and novelist Charles de Secondat, Baron de Montesquieu (1698-1755), the political writer Charles-

[35] Harry B. Weiss, 'The Entomology of Aristotle', *Journal of the New York Entomological Society*, 37.2 (1929), 101–9.
[36] Brian W. Ogilvie, 'Order of Insects', in *The Life Sciences in Early Modern Philosophy*, ed. by Ohad Nachtomy and Justin E. H. Smith (Oxford: Oxford University Press, 2014), pp. 222–45.
[37] Mary Terrall, 'Salon, Academy, and Boudoir: Generation and Desire in Maupertuis's Science of Life', *Isis*, 87.2 (1996), 217–29; Alice Stroup, *A Company of Scientists: Botany, Patronage, and Community at the Seventeenth-Century Parisian Royal Academy of Sciences* (Berkeley: University of California Press, 1990); Roger Hahn, 'Scientific Research as an Occupation in Eighteenth-Century Paris', *Minerva*, 13.4 (1975), 501–13; Roger Hahn, *The Anatomy of a Scientific Institution: The Paris Academy of Sciences, 1666-1803* (Berkeley: University of California Press, 1971).

Irénée Castel de Saint-Pierre (1658-1743), and the novelist and dramatist Pierre de Marivaux (1688-1763); Buffon, on the other hand, was a regular guest at the famous salons of Mlle de L'Espinasse and Mme Geoffrin, frequented by famous freethinkers such as Diderot, Jean le Rond D'Alembert or Maupertuis.[38]

While literary scholars acknowledge the importance of empirical observations of animals alongside their use as metaphors, and underline the closeness of naturalists and *philosophes*,[39] they rarely engage directly with how the new knowledge of animals emerging in the Enlightenment was produced, nor how it was used to mediate between different areas of knowledge such as natural history and political economic pursuits which in the eighteenth century were inextricably linked. They are less interested, that is, in understanding how the overlap between different writings on animals and writings on humans in the Enlightenment was possible in the first place. In order to understand the connections between the natural and the social, we need to study texts from different genres and identify the common themes and objects of knowledge.

The work of Joseph Vogl, an influential German scholar of European literature, provides such an attempt at analysing texts in the light of the realisation that eighteenth-century knowledge was produced across what we now see as different genres and modes of writing. In his monograph *Kalkül und Leidenschaft,* Vogl analyses the history of 'homo economicus' in European writings as it emerges in the period from the baroque to the nineteenth century with the help of a method he terms 'poetology of knowledge'.[40] Following poststructuralist theorists such as Michel

[38] Virginia Parker Dawson, *Nature's Enigma: The Problem of the Polyp in the Letters of Bonnet, Trembley and Réaumur* (Philadelphia: American Philosophical Society, 1987), p. 19; Gilles Bresson, *Réaumur: le savant qui osa croiser une poule avec un lapin* (Saint-Sébastien-sur-Loire: D'Orbestier, 2001), p. 198; Pierre-Maurice Masson, *Une Vie de femme au XVIIIe siècle: Mme de Tencin (1862-1749)* (Paris: Hachette, 1909). On salon culture more generally, see Dena Goodman, *The Republic of Letters: A Cultural History of the French Enlightenment* (Ithaca: Cornell University Press, 1994); Jolanta T. Pekacz, *Conservative Tradition in Pre-Revolutionary France: Parisian Salon Women* (Peter Lang, 1999); Antoine Lilti, *The World of the Salons: Sociability and Worldliness in Eighteenth-Century Paris* (Oxford: Oxford University Press, 2015).

[39] On Diderot and the natural history of Buffon, see Jacot-Grapa, 'Des huîtres'. On Rousseau and botany, see Alexandra Cook, *Jean-Jacques Rousseau and Botany: The Salutary Science*, SVEC, 2012:12 (Oxford: Voltaire Foundation, 2012).

[40] Joseph Vogl, *Kalkül und Leidenschaft: Poetik des ökonomischen Menschen* (Zurich: Diaphanes, 2004).

Foucault, Vogl assumes that 'the economic' is not a timeless category that was gradually 'discovered' by economists, but that it was actively produced in the seventeenth and eighteenth centuries across different fields of knowledge; literature, he argues, mediated these new economic ideas and practices. The representatives of Enlightenment political economy thus created not only a field of knowledge but also the very objects they purported to know, as well as the subjects who could know them. Based on this argument, Vogl's poetology of knowledge sets out to study these new objects as and how they were constituted, whether in fictional or non-fictional texts. The term 'poetology' thereby emphasises that fields such as political economy or the natural sciences rely on literary techniques, while literary genres are capable of producing knowledge equivalent to that developed in other disciplines. Because objects of knowledge (such as 'the economy') have not always already existed, awaiting modern empiricists to discover them, Vogl argues that we need to pay attention not only to the objects themselves, but also to the themes, genres and figures of speech that subtend their descriptions. Knowledge becomes less about what is explicitly said than about themes and forms, which express the values and codes of a given time and place, or what Vogl calls a 'substrate' or 'milieu' of knowledge. Because knowledge is less about the 'scientific truth-value' of a proposition, fictional and scientific or political economic texts equally produce and represent knowledge, although this does not mean, of course, that they produce it in identical ways or that literary text always confirm or agree with the knowledge produced by other genres. As a consequence, this approach allows the crossing of modern disciplinary boundaries; Vogl himself studies a wide range of genres, from baroque plays to cameralist treatises from different European countries. While most studies in what has been called 'literary economic anthropology' using an approach similar to Vogl's have focused on different episodes of German nineteenth-century history, they share the common assumption that all genres can contribute to the production of economic

knowledge.[41] These works, by showing how (economic) knowledge can be produced in different fields, provide an inspiration also to think about knowledge of the 'animal'.

First, however, to make sense of the way in which animals connected different spheres of knowledge in the eighteenth century, we need to turn to the histories of disciplines which were directly concerned with the production of knowledge and categories to represent society

3. The Cultural History of Knowledge: Eighteenth-Century Intersections Between Natural History, Medicine and Political Economy

The second half of the twentieth century saw fundamental methodological changes not only in literary scholarship, but also in the way that historians of science, medicine and political economy thought about the production of knowledge. Most importantly, a number of historians have convincingly demonstrated that eighteenth-century naturalists were not 'merely' studying nature, for at the time the study of nature was always simultaneously a study of human society. The inverse logic applied to eighteenth-century political economists, who understood the 'oeconomy' of nature and the 'oeconomy' of society to be inseparable from one another. The extensive literature historicising the eighteenth-century intersections between natural history, medicine and political economy is another important pillar of this thesis.

Partly as a result of the influence of poststructuralist theories traced above, partly as a result of new methodological and theoretical approaches on knowledge

[41] Poetology of knowledge has heavily influenced the study of German literature; works sharing Vogl's approach have focused above all on the nineteenth and twentieth centuries; see, for example, Manuel Bauer, *Ökonomische Menschen: Literarische Wirtschaftsanthropologie des 19. Jahrhunderts*, 1st edn (Göttingen: V&R unipress, 2016); Alexander Košenina, *Literarische Anthropologie: Die Neuentdeckung des Menschen* (Berlin: de Gruyter, 2016); *Ökonomie des Glücks. Muße, Müßiggang und Faulheit in der Literatur*, ed. by Mirko Gemmel and Claudia Löschner (Berlin: Ripperger & Kremers, 2014); Rüdiger Campe, *The Game of Probability: Literature and Calculation from Pascal to Kleist*, trans. by Ellwood H. Wiggins Jr. (Stanford, California: Stanford University Press, 2013); Burkhard Meyer-Sickendiek, 'Vom Grübeln: Ein Beitrag Zur »Poetologie Des Wissens«', *KulturPoetik*, 10.2 (2010), 264–75; Petra Renneke, *Poesie Und Wissen: Poetologie Des Wissens Der Moderne*, Beiträge Zur Neueren Literaturgeschichte ;Bd. 261 (Heidelberg: Winter, 2008); Fritz Breithaupt, 'Urszenen Der Ökonomie', in *Singularitäten*, ed. by Marianne Schuller and Elisabeth Strowick (Freiburg: Rombach, 2001), pp. 185–205; Joseph Vogl, *Poetologien des Wissens um 1800* (Fink, 1999).

production from within the history of science and medicine and partly as a result of new developments in scientific research itself, historians of science and medicine began to abandon the view of the sciences of the past as the work of 'great men'. With the so-called 'cultural turn' of the 1980s, historians of science and medicine set out to rewrite the history of Enlightenment. One of the most important results of the cultural turn for this thesis was the shift of focus away from the 'hard' sciences (such as physics or mathematics), the traditional subjects of historians of science, to the 'soft sciences' such as chemistry and, crucially, the life sciences. The essays published in the collection *Cultures of Natural History* (1996) marked a turning point in this regard, as they not only made visible the latest works in this new area but also underlined the crucial importance of a field which had become, from the 1960s onwards, one of the most successful scientific disciplines: the life sciences.[42]

In restoring natural history from the sixteenth to the twentieth century to the historical and geographical contexts in which it was practised, *Cultures of Natural History* brought to fruition a number of developments and influences. These incldued the work on the production of scientific knowledge by the philosopher, physicist and historian of science Thomas Kuhn (1922-1996); of French philosopher Michel Foucault the overall ordering grids of knowledge (theories, rules and principles, values and morals, for example) in *Les mots et les choses* (1966); and of anthropologists such as Clifford Geertz (1926-2006).

Because of the influence of these different methodological traditions, scientific and medical knowledge was no longer seen as neutral or universal but as a reflection of the wider concerns of a given society; science and society were no longer seen as autonomous spheres, but as inextricably entangled with one another. The focus of *Cultures of Natural History*, accordingly, was less on the merits or achievements of past naturalists, than on their material, social, literary, bodily and even sartorial practices, with the aim of showing, in the editors' words, 'how various are the frameworks that have structured and informed natural historians' dealings with nature,

[42] N. Jardine, J. A. Secord, and E. C. Spary, *Cultures of Natural History* (Cambridge: Cambridge University Press, 1996).

how the boundaries between the natural and the conventional, artificial and social have been continually contested and relocated'.[43]

Scientific and medical thinking and practices as a contested, changing space has been also underlined by the medical historian Roy Porter and literary and literary historian George S. Rousseau.[44] They have remarked on the subject of eighteenth-century science and medicine in general, the overlap between different fields of knowledge before the nineteenth century makes it almost impossible to translate them into our modern scientific disciplines.[45] Self-proclaimed naturalists thus studied subjects as diverse as shells, insects, antique artefacts or even, in the case of David Hume, religions.[46] Some focused their energies on developing systems of classification that could encompass the entire world (most famous among them was, of course the Swedish naturalist Carl Linnaeus (1707-1778));[47] others, like Réaumur, understood their task to be attentive observation and detailed descriptions;[48] others again, like Dezallier d'Argenville, collected naturalia according to mainly aesthetic and commercial criteria.[49] The diverse concerns uniting those we now classify as naturalists, medical writers or political economists have recently been subsumed under the heading of 'useful knowledge'.[50] Historians of economics as well historians of

[43] Jardine et al, *Cultures*, p. 12.
[44] G. S. Rousseau and Roy Porter, eds. *The Ferment of Knowledge: Studies in the Historiography of Eighteenth-Century Science* (Cambridge: Cambridge University Press, 1980).
[45] G.S. Rousseau and Roy Porter, 'Introduction', in *The Ferment of Knowledge* (Cambridge: Cambridge University Press, 1980), pp. 6–7.
[46] Rhoda Rappaport, 'The Earth Sciences', in *The Cambridge History of Science Volume 4: Eighteenth-Century Science*, ed. by Roy Porter (Cambridge: Cambridge University Press, 2003), pp. 417–35 (pp. 417–18).
[47] Lisbet Koerner, *Linnaeus: Nature and Nation* (Cambridge MA: Harvard University Press, 1995).
[48] Lorraine Daston, 'Attention and the Values of Nature in the Enlightenment', in *The Moral Authority of Nature* (Chicago: University Of Chicago Press, 2004), pp. 100–126.
[49] Bettina Dietz, 'Mobile Objects: The Space of Shells in Eighteenth-Century France', *The British Journal for the History of Science*, 39.3 (2006), 363–82.
[50] Joel Mokyr, *The Gifts of Athena: Historical Origins of the Knowledge Economy* (Princeton: Princeton University Press, 2002); See also the responses to Mokyr collected in Maxine Berg, 'The Genesis of "Useful Knowledge"', *History of Science*, 45 (2007), 123–133; Liliane Hilaire-Pérez, 'Technology as a Public Culture in the Eighteenth Century: The Artisans' Legacy', *History of Science*, 45.2 (2007), 135–53; Larry Stewart, 'Experimental Spaces and the Knowledge Economy', *History of Science*, 45.2 (2007), 155–77; Kristine Bruland, 'Technology Selection and Useful Knowledge: A Comment', *History of Science*, 45.2 (2007), 179–83; Joel Mokyr, 'Knowledge, Enlightenment, and the Industrial Revolution: Reflections on The Gifts of Athena', *History of Science*, 45.2 (2007), 185–96; Margaret C.

science or technology have thus argued that savants and other agents such as artisans were engaged in the production not just of knowledge, but of 'useful knowledge', that is in the production of knowledge of manipulable and useable natural objects as well as in the invention and application of new technologies. While the economic historian Joel Mokyr defines 'useful knowledge' as knowledge that has the potential to create new technologies, historians of natural history have taken a broader view, linking it to global commerce. Medicine, unlike natural history, was a long-established university subject leading to one the three traditional professions (with law and theology) and with its own university faculties, textbooks and curricula.[51] Nevertheless, as historians have shown, there were many overlaps with natural history and medical experts were similarly engaged in the production of 'useful knowledge'. Many naturalists had originally trained as doctors; Linnaeus, for instance, had written his dissertation on malaria, and Bernard de Jussieu was a physician before he became an influential botanist.[52] Botany, in particular, was part of the medical curriculum, as well as serving increase the kingdom's riches through, for example, the introduction of new specimens. As Emma Spary has shown, medicine and natural history (as well as agriculture) shared a concern with improving, or critiquing, France's political economy, and their practitioners were involved in various national projects of improvement both before and after the Revolution.[53] The overlaps between different fields of knowledge is evident also, as Spary has argued in her study on the *Jardin du roi*, at the level of institutions. The concern with improvement, and the relationship between medicine and natural history is exemplified, as Spary shows, in the history of the *Jardin*, transformed by Buffon from a medical garden used to train physicians and apothecaries into a fully-fledged natural historical institution.[54]

Jacob, 'Mechanical Science on the Factory Floor: The Early Industrial Revolution in Leeds', *History of Science*, 45.2 (2007), 197–221.

[51] Good overviews are Thomas Broman, 'The Medical Sciences', in *The Cambridge History of Science*, ed. by Roy Porter, Cambridge Histories Online (Cambridge: Cambridge University Press, 2008), pp. 463–84; L. W. B. Brockliss and Colin Jones, *The Medical World of Early Modern France* (Oxford: Clarendon Press, 1997).

[52] Spary, *Utopia'*s *Garden*, p. 20.

[53] Spary, *Utopia'*s *Garden*, p. 8. See also Gillispie, *Science and Polity.*

[54] Spary, *Utopia'*s *Garden*.

These studies of natural history and medicine, emphasising the fluidity and flexibility of scientific/medical identities in the seventeenth and eighteenth century not only demonstrated that their practitioners should not be compared with the laboratory-based and specialised 'scientists' of later ages. They have also shown that they were contributing to another, then emerging field of knowledge: political economy. In the seventeenth and eighteenth centuries, this field aimed to contribute to the wealth and order of their societies and what political economists, then called 'the happiness' of their people. The concern of Enlightenment savants with increasing the prosperity of their state thus clearly united writings on political economic and on natural historic matters.[55] As the academician and most famous observer of insects Antoine Ferchault de Réaumur (1683-1757) put it in an unpublished memoir written in order to convince the monarch to increase the funds given to the Academy of Sciences: '[l'Académie] pourroit contribuer à augmenter la gloire et les richesses du royaume, si le royaume en revanche donnoit une subsistence honneste à ceux qui travaillent utillement'.[56] Knowledge, Réaumur claimed, or at least the knowledge produced by well-paid academicians, would increase the wealth and prosperity of the state.[57] The spheres of knowledge of nature and knowledge of government were not, in other words, distinct in eighteenth-century France. Hence, in order to fully understand the enlightened pursuit of knowledge, we also need to understand how it intersected, or overlapped with, political and economic concerns.

Historians of economics have long been interested in this area of eighteenth century knowledge, often interpreting some of the developments as the beginning of modern individual-based economic thinking. The Austrian-born American economist Joseph Schumpeter (1883-1950), for instance, in his influential and exhaustive *History*

[55] The key account is Robert Mauzi, *L'Idée du bonheur dans la littérature et la pensée françaises au XVIIIe siècle* (Paris: Colin, 1960).
[56] René Antoine Ferchault de Réaumur, 'Réflexions sur l'utilité dont l'Académie des sciences pourroit être au Royaume si le Royaume luy donnoit les secours dont elle a besoin (dated 1716-1727)', in *L'Académie des sciences : histoire de l'Académie, fondation de l'Institut National Bonaparte membre de l'Institut national*, ed. by Ernest Maindron (Paris: Félix Alcan, 1888), p. 110. For the ways in which eighteenth-century botany in particular was employed in the service of the state, see E. C. Spary, *Utopia's Garden*.
[57] Réaumur, 'Réflexions'.

of Economic Analysis (1954), attempts to track 'the filiation of ideas' from the past to the present, thus judging the writings of Adam Smith or François Quesnay according to their contributions to the development of modern liberal economic theory.[58] Most studies in the history of political economy of the first half of the twentieth century sought to understand the contribution – or failure to contribute – of 'mercantilist' and 'cameralist' state economic thinking to the rise of the modern administrative and fiscal state during the seventeenth and eighteenth centuries.[59] While they disagreed as to whether these two groups of writers, mainly in Germany and France, were merely mouthpieces or puppets for economic formulating theories in support of their absolutist governments, or whether they followed an independent and more entrepreneurial agenda as independent advisors on how to achieve happiness for the people, these scholars agreed that the central question in regard to these economic theories revolves around their contribution to the rise of the modern state and its administrative and bureaucratic apparatus.[60]

Influenced by the culture turn of the 1980s, however, historians of economics too increasingly abandoned the study of 'great economists' and their contributions to the 'progress' of economics and of the nation-state. Keith Tribe, in his influential history of the works German Cameralists, for example, argued that these were not, as previous historians had claimed, straightforward instructors for the administrations of rising states. Tribe, instead, pays close attention to the discursive strategies and concepts used by the Cameralists in order to construct the idea economic order.

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[58] Joseph A. Schumpeter, *History of Economic Analysis* (Abingdon, Oxfordshire: Routledge [1954], 2006).

[59] Most famously: Eli Heckscher, *Mercantilism*, 2 vols (London: Allen & Unwin, 1935); Gustav Schmoller, *The Mercantile System and Its Historical Significance (1884)* (New York: A.M. Kelley, 1967); Jacob Viner, 'Power versus Plenty as Objectives of Foreign Policy in the Seventeenth and Eighteenth Centuries', *World Politics*, 1, (1948), 1-29; Albion W. Small, *The Cameralists: The Pioneers of German Social Polity (1909)* (New York: B. Franklin, 1969); Kurt Zielenziger, *Die alten deutschen Kameralisten* (Jena: Fischer, 1914).

[60] For overviews of historiography, see Philip J. Stern and Carl Wennerlind, 'Introduction', in *Mercantilism Reimagined: Political Economy in Early Modern Britain and Its Empire*, ed. by Philip J. Stern and Carl Wennerlind (Oxford: Oxford University Press, 2013), pp. 3–22; Andrea Lynne Finkelstein, *Harmony and the Balance : An Intellectual History of Seventeenth-Century English Economic Thought* (Ann Arbor: University of Michigan Press, 2000),'Conclusion'; Andre Wakefield, *The Disordered Police State: German Cameralism as Science and Practice* (Chicago: University of Chicago Press, 2009),'Introduction'.

Expanding his analysis to other European countries, Tribe has thus begun to seriously historicise the notion of the 'economy'. He demonstrates that the concept as we understand it now would have made little sense to seventeenth- or eighteenth-century political economists, who did not separate 'politics', or theories of good government, and 'economics' as the production and distribution of wealth.[61] As Tribe has shown, the notion of 'oeconomy' was in a period of transition during the course of the eighteenth century.[62] It no longer merely referred to the Aristotelian notion of *oikonomia,* understood as the art of managing the people and objects of a household and sometimes also used as a model for the regulation of the royal household. At the same time, however, the term did not yet refer to the 'economy' as we understand it now, that is, as an autonomous system based on exchange of goods and capital. While political economists thus treated subjects that we now categorise as belonging to 'economics', they did so without having the notion of an overarching system existing separately from the natural world. In eighteenth-century France, of course, the most famous formulation of a system of political economy was that of the physiocrats. Earlier historians of economics, such as the already mentioned Schumpeter or the Marxist Ronald Meek,[63] considered them as early theorists of liberal industrial capitalism, writing at a time when the modern nation-state was in the process of being born.[64] More recently, scholars have attempted to place the physiocrats in their cultural context, rather than view them as precursors to the capitalist ideology or classical

[61] Keith Tribe, *The Economy of the Word: Language, History, and Economics* (New York: Oxford University Press, 2015); Keith Tribe, 'Continental Political Economy From the Physiocrats to the Marginal Revolution', in *The Cambridge History of Science Volume 7: The Modern Social Sciences*, ed. by Theodore M. Porter and Dorothy Ross (Cambridge: Cambridge University Press, 2003), pp. 154–70; Keith Tribe, *Land, Labour and Economic Discourse* (London: Routledge & Kegan Paul, 1978). Other important studies historicising the concept of 'the economy' or 'mercantilism' include Finkelstein, *Harmony* and Joyce Appleby, *Economic Thought and Ideology in Seventeenth-Century England* (Princeton: Princeton University Press, 1978).

[62] For a concise overview of the history of the term, see Tribe, *Economy of the Word,* chapter 2: 'The Word: Economy', pp. 21-88.

[63] Ronald L. Meek, *The Economics of Physiocracy: Essays and Translations*, 2 vols (Cambridge MA: Harvard University Press, 1963).

[64] In addition to Schumpeter, *History*; and Meek, *Economics* see also Elizabeth Fox-Genovese, *The Origins of Physiocracy: Economic Revolution and Social Order in Eighteenth-Century France* (Cornell University Press, 1976).

economics.[65] Historians have thus underlined that they had no conception of the 'economy' as a product of human labour or institutions, stressing instead the roles of 'nature', God, and the feudal order in their theories.[66] For the physiocrats, wealth was the 'natural' product of the land, recurring every year as long as human agents heeded to the natural order created by God. This explains their claim – puzzling to those who seek to understand physiocracy from the vantage point of modern economic science – that agriculture is the only productive sector. Despite his critique of the physiocrats' emphasis on agriculture, as historians have recently shown, Adam Smith's view of political economy was also closely tied to notions of natural bodies and their moral economies. Catherine Packham has thus argued, for example, that Smith owed a great deal to new physiological theories of the human body.[67] Combining the argument that pre-nineteenth-century political economy encompassed not distinct spheres, but all aspects of 'economic life' with the new attention paid by cultural historians to sentiment and sensibility, Emma Rothschild has argued for the importance of moral sentiments in all of Smith's works, not just his moral philosophy.[68] Most importantly for the purposes of this dissertation, Margaret Schabas has investigated the particularity of 'classical political economy' by studying its close connection to nature and her laws.[69] Building on Foucault's claim in *Les mots et les choses* that political economy 'invented' new categories in the early nineteenth century,[70] she thus demonstrates that 'until the mid-nineteenth century, economic theorists regarded the

[65] The most recent study is Liana Vardi, *The Physiocrats and the World of the Enlightenment* (Cambridge: Cambridge University Press, 2012).
[66] Michael Sonenscher, 'Physiocracy as a Theodicy', *History of Political Thought*, 23.2 (2002), 326–339; Peter Groenwegen, 'From Prominent Physician to Major Economist. Some Reflections on Quesnay's Switch to Economics in the 1750s', in *Physicians and Political Economy*, ed. by Peter Groenewegen (London: Routledge, 2001), pp. 93–115; H. Spencer Banzhaf, 'Productive Nature and the Net Product: Quesnay's Economies Animal and Political', *History of Political Economy*, 32.3 (2000), 517–51.
[67] Catherine Packham, *Eighteenth-Century Vitalism: Bodies, Culture, Politics* (Basingstoke: Palgrave Macmillan, 2012).
[68] Emma Rothschild, *Economic Sentiments: Adam Smith, Condorcet, and the Enlightenment* (Cambridge MA: Harvard University Press, 2002).
[69] Schabas, *Natural Origins.*
[70] Schabas, *Natural Origins*, pp. 17-18.

phenomena of their discourse as part of the same natural world studied by natural philosophers.'[71]

An important attempt to overcome modern disciplinary boundaries and study eighteenth-century savants in the light of their own concerns is the publication in 2003 of a collected volume in the journal *History of Political Economy* on the intersections between natural history and political economy in the seventeenth and eighteenth centuries. This volume brought together some of the scholars of early-modern science who had studied the contribution of natural history to European and colonial commerce, as well as historians of political economy.[72] The essays collected in the volume argue for a 'double seepage' between 'political economy and physiology, or botanical oeconomy, public *benessere,* or mineral riches'.[73] Building on Foucault and Tribe's work on eighteenth-century political economy and its reliance on natural resources,[74] the essays are linked by the idea that natural history came to be seen as useful for generating 'wealth' – increasingly understood also as including natural resources – for the state, while political economic considerations came to define the study of nature.

Influenced by the rapid globalisation of markets and the economic expansion of the 1990s and 2000s, historians turned to studying the increasingly global networks of commerce in the eighteenth century, an age that saw both the creation and exchange of new commodities and efforts to form and expand European empire. Staffan Müller-Wille, for example, argues that Linnaeus' science of classification arose from the need to name plants so that they could then be exchanged in the global commodities trade.[75] The essays collected in *History of Political Economy* were thus at the forefront of a

[71] Schabas, *Natural Origins*, p. 2.
[72] *Oeconomies in the Age of Newton: Annual Supplement to Volume 35, History of Political Economy*, ed. by Margaret Schabas and Neil De Marchi (Durham, N.C.: Duke University Press, 2003).
[73] Neil De Marchi and Margaret Schabas, 'Introduction to Oeconomies in the Age of Newton', *History of Political Economy*, 35.5 (2003), 1–13 (pp. 4–5).
[74] Tribe, *Land, Labour and Economic Discourse*.
[75] Staffan Müller-Wille, 'Nature as a Marketplace: The Political Economy of Linnaean Botany', *History of Political Economy*, 35.Suppl 1 (2003), 154–72. A similar argument on natural history in the Dutch seventeenth-century as providing 'matters of fact' which could be exchanged in the global market much more easily than culturally defined products or knowledge in different languages can be found in Harold John Cook, *Matters of Exchange: Commerce, Medicine, and Science in the Dutch Golden Age* (New Haven: Yale University Press, 2007).

series of historiographical trends: a focus on commercial exchange, on the global connections spun by European naturalists, and on practices such as observation and collection; their emphases enabled contributors to see continuities on the level of practices that had remained invisible in more traditional histories focused purely on ideas. Harold Cook, in a monograph that also exemplifies these trends, has argued that the emergence of global trade was an important stimulant for the rise of natural history since it was able to produce what Cook calls 'matters of fact' – natural objects that could be not only known but also profitably exchanged and which could supposedly circulate around the globe without needing translation.[76]

Most recent studies on the links between natural history and political economy, including contributions to the 2003 issue of *History of Political Economy*, focus on botany. Partly, this is also justified by the interests of the eighteenth-century savants themselves. Foucault had already argued that the goal of eighteenth-century savants was to reduce the gap between words and things by naming them and thus making them visible.[77] More recently, this emphasis on the visible structure of 'things' – or 'matters of fact' – has been linked to the goal of commercial and imperial expansion and the values of the ever-more prosperous merchants and financiers.[78] This is particularly true of the man who, at least since Foucault made the case in *The Order of Things* for the connection between natural history and political economy as related by their tendency to classify, has been the most intensely studied eighteenth-century naturalist: the Swedish savant Carl Linnaeus (1707-1778). In her influential studies of Linnaeus' project of classifying the entire natural world, Lisbet Koerner (Rausing) has persuasively argued for a close interrelation between his natural history and his

[76] Cook, *Matters of Exchange*.
[77] Foucault, *Mots et choses*, pp. 137-176.
[78] See, in addition to *History of Political Economy* 35 Suppl 1 (2003), Cook, *Matters of Exchange*; Fredrik Albritton Jonsson, 'Natural History and Improvement: The Case of Tobacco', in *Mercantilism Reimagined: Political Economy in Early Modern Britain and Its Empire*, ed. by Philip J. Stern and Carl Wennerlind (Oxford: Oxford University Press, 2013), pp. 117–33; David Philip Miller and Peter Hanns Reill, eds., *Visions of Empire: Voyages, Botany, and Representations of Nature* (Cambridge: Cambridge University Press, 2010); Schiebinger, *Plants and Empire: Colonial Bioprospecting in the Atlantic World*; John Gascoigne, *Science in the Service of Empire: Joseph Banks, the British State and the Uses of Science in the Age of Revolution* (Cambridge: Cambridge University Press, 1998).

political-economic model of a cameralist society based on self-sufficiency.[79] Though Linnaeus did write on insects too, he did so mostly in relation to the plants they fed on; as he asserted, 'The knowledge of plants is the basis of all oeconomie.'[80] Botany, according to Koerner, was crucial to Linnaeus' vision of the political organisation of Sweden, as the knowledge it provided could help discover and acclimatise new plants or improve crop yields.[81] For Linnaeus, natural history and political economy were closely linked; both were, he wrote, the most essential of all the sciences 'since all people's well-being is based on it'.[82] Natural history, for Linnaeus, meant above all exploitation of resources for the benefit of the state.[83] For the French context, Emma Spary has shown how botanists, often directly sponsored by the Crown, promoted their science as a means to efficiently manage and increase the natural resources of their country.[84] They worked to acclimatise exotic plants if they had medicinal value or could be used as foodstuff, thus successfully establishing themselves as useful and necessary contributors to royal power from the early decades of the eighteenth century onwards.

Building on recent histories of political economy, this dissertation treats eighteenth-century political economy as the knowledge of how to govern the body politic conceived of as a whole that is more than the sum of its (interrelated) parts. This definition of the body politic applied to natural bodies too, of course; as we will see in more detail in chapter three, investigations of the natural bodies of insects also pursued the question of how the body's interrelated parts could form (new) wholes. As we will see in chapter four, one increasingly common conception of the body

[79] Lisbet Koerner, 'Underwriting the Oeconomy: Linnaeus on Nature and Mind', *History of Political Economy*, 35.5 (2003), 173–203; Lisbet Koerner, 'Carl Linnaeus in His Time and Place', in *Cultures of Natural History*, ed. by Nicholas Jardine, E. C. Spary, and James A. Secord (Cambridge: Cambridge University Press, 1996), pp. 145–62; Koerner, *Linnaeus*.
[80] Quoted in Koerner, 'Underwriting the Oeconomy', p. 185.
[81] See also Müller-Wille; Alix Cooper, '"The Possibilities of the Land": The Inventory of "Natural Riches" in the Early Modern German Territories', *History of Political Economy*, 35.Suppl 1 (2003), 129–53.
[82] Koerner, *Linnaeus*, p. 103.
[83] See also Müller-Wille, 'Nature', p. 155
[84] E. C. Spary, '"Peaches Which the Patriarchs Lacked": Natural History, Natural Resources, and the Natural Economy in France', *History of Political Economy*, 35.Suppl 1 (2003), 14–41; E. C. Spary, *Utopia's Garden*.

politic was that of the population, a body of people living on, and interacting, with a given territory, the natural laws which need to be respected and managed.

Due to this new conception of scientific knowledge and the inclusion of new actors in the production of knowledge, several historians of science and medicine have recently investigated seventeenth- and eighteenth-century research on animals, focusing on experimental and observational practices. Anita Guerrini, for instance, has argued for the importance of anatomical work in the early years of the Academy of Science in Paris to demonstrate the importance of (dead) animal bodies in the development of experimental science.[85] Insects, too, feature in recent works on Enlightenment natural history. Brian Ogilvie, in a series of essays, has shown how both artists and naturalists became interested in insects in the period between the Renaissance and the Enlightenment; through their observations and descriptions of insects, they developed, Ogilvie shows, new methods for knowledge production.[86] Attempts to make sense of and discover an order among the immense variety of 'little animals', as many of the early modern and Enlightenment naturalists discussed by Ogilvie called them, eventually led to the formation of entomology as a discipline in the early nineteenth century.[87] In her cultural biography of Réaumur, Mary Terrall reconstructs the practices of observation used and developed by eighteenth-century naturalists as they struggled to understand animal life.[88] Marc Ratcliff has reconstructed the history of eighteenth-century microscopy, much of which relied on insects (or at least on the tiny creatures that were then classified as such).[89]

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[85] Guerrini, *Courtiers' Anatomist.*

[86] Ogilvie, 'Order of Insects'; Brian W. Ogilvie, 'Insects in John Ray's Natural History and Natural Theology', in *Zoology in Early Modern Culture: Intersections of Science, Theology, Philology, and Political and Religious Education*, ed. by Karl A.E. Enenkel and Paul J. Smith (Leiden: Brill, 2014), pp. 234–60; Brian W. Ogilvie, 'The Pleasure of Describing: Art and Science in August Johann Rösel von Rosenhof's Monthly Insect Entertainment', in *Animals on Display: The Creaturely in Museums, Zoos, and Natural History*, ed. by Liv Emma Thorsen, Karen Ann Rader, and Adam Dodd (University Park, Pennsylvania: Penn State University Press, 2013), pp. 77–100; Brian W. Ogilvie, 'Attending to Insects: Francis Willughby and John Ray', *Notes and Records of the Royal Society*, 66.4 (2012), 357–72; Brian W. Ogilvie, 'Nature's Bible: Insects in Seventeenth-Century European Art and Science', *Tidsskrift for Kulturforskning*, 7.3 (2008), 5–21.

[87] See especially Ogilvie, 'Order of Insects'.

[88] Terrall, *Catching Nature.*

[89] Ratcliff, *Microscope.*

In sum, these works have made it very clear that eighteenth-century naturalists were not 'merely' studying nature; the study of nature was always, simultaneously, a study of human society. The same is true for political economists who, as Schabas has shown, understood the oeconomy of nature and the oeconomy of society to be inseparable from one another. As Spary demonstrates in her contribution to *Cultures of Natural History*, the concept of the 'oeconomy' linked investigations of animal, plant and human bodies, with the wider conceptualisation of 'nature' as well as of society.[90] The study of natural bodies was thus used to understand and illustrate different versions of the social body. While more conservative savants explored the intricate structures of living beings or Newtonian forces such as electricity or gravity, to prove God's handicraft and ordering of both the natural and social worlds, others produced provocative accounts of natural bodies based solely on physical laws. Natural historians were concerned, too, with change; they thus looked to animals to discover 'natural man' untainted by social mores. This, in turn, led to a concern with how human individual and social bodies could be changed and improved.

4. The Concept of Population: An Example of a Bridging Concept

Echoing the insights of historians of science and medicine on the shifting boundaries of disciplinary knowledge, historians as well as literary scholars have investigated practices, ideas or metaphors that touch on several fields. Literary historian Anne Vila, for instance, has argued that 'sensibility' functioned as a 'bridging concept' during the Enlightenment. Eighteenth-century bridging concepts, according to Vila, 'blended biological, psychological, and social interests', and, in the case of sensibility at least, 'created intriguing alignments between diverse discursive fields – for example, philosophical medicine and the philosophical novel'.[91] Joseph Vogl, in his reflection on the emergence of 'homo economicus', has identified 'population' as an object of

[90] Emma Spary, 'Political, Natural and Bodily Economies', in *Cultures of Natural History*, ed. by Nicholas Jardine, James A. Secord, and E. C. Spary (Cambridge: Cambridge University Press, 1996), pp. 178–96. See also Serna, *Comme les bêtes*, pp. 14-15.
[91] Vila, *Enlightenment and Pathology*, p. 258. The concept is borrowed from Jordanova, *Sexual Visions*, pp. 28–29.

knowledge – or, we might say, a bridging concept – that lies at the heart of several eighteenth-century fields of knowledge, from political economy, to the life sciences, to medicine.[92] The concept of 'population', of particular importance in the second half of this dissertation, constitutes a good example of the ways in which eighteenth century fields of knowledge traverse contemporary disciplinary boundaries and of the way in which scholars have dealt with this problem.

Vogl's insights into the concept of 'population' follow Foucault's important lectures only recently published in English as *Security, Territory, Population.*[93] Foucault argued that the concept of the 'population' as we understand now emerged in the late seventeenth century as both an object of knowledge and of political power. Foucault theorised this shift as a shift from 'sovereign power' to 'biopower'; he argued that older technologies of government based on sovereign power and thus the right of the ruler to determine the details of his subjects' lives (and, in extreme cases, to decide their death) was replaced by a theory and practice of government based on the 'natural' body of the population.[94] This natural body designated a specific kind of collective, defined not by, say, a social contract or a feudal hierarchy, but by its 'naturalness'; the population, Foucault argued, was no longer considered simply a collection of people who had to obey the sovereign, but a collection of bodies with their own desires and their own natural laws. The 'discovery' of the population in this period was essential to allow for a transition from older forms of governmental rule (based on the power of the sovereign) to modern liberal forms which target the biological life of subjects through individual disciplinary measures. At the same time, through various new regulatory technologies – the rise of statistics being the most obvious one – this disciplined individual is bound to a collective whole in need of constant observation, adjustment and regulations.[95] The seventeenth- and eighteenth-century 'discoverers'

[92] Vogl, *Poetologie.* Ted McCormick, 'Population', in *Mercantilism Reimagined: Political Economy in Early Modern Britain and Its Empire*, ed. by Philip J. Stern and Carl Wennerlind (Oxford: Oxford University Press, 2013), pp. 25–45., pp. 78-85.
[93] Michel Foucault, *Security, Territory, Population: Lectures at the Collège de France, 1977-78* (Basingstoke: Palgrave Macmillan, 2007).
[94] Foucault, *Security.*
[95] Foucault, *Security*, pp. 104-108.

of the population were aware, of course, that individuals differed from one another in significant ways; however, Foucault argues, they identified one constant that united all individual subjects: desire, understood as the individual's pursuit of self-interest rather than as the mark of spiritual corruption.[96] Desire – or what eighteenth-century writers called the passions – came to be seen as a 'natural', and inevitable, constituent factor of the human being; if the sovereign ensured that this desire could be played out, it would 'naturally' lead to the production of the collective interest. While desire itself was a natural given, the techniques governments adopted in order to allow for the productive, free play of desire were not. For Foucault, this notion of the naturalness of desire (and of the population) gave rise to a notion of government that was radically new. Whereas the sovereign according to the old 'ethico-juridical' conception was seen to have to supress the passions, now the task of government was to allow the passions to be channelled in productive ways.

Foucault's approach to population seen as concept contrasts with the works of scholars who seek to understand the reasons for the so-called 'demographic revolution;' of the eighteenth century. In contrast to Foucault and those who follow his understanding of 'population' (which is part of his theory of biopower) as a problem and technology of new form of government during the eighteenth century, much scholarship has taken the notion of 'population' as given. Demography – a discipline which only emerged through the acceptance of population as a 'natural' concept – is a case in point here. Thus, (mostly French) historical demographers apply the methods of modern demography to study populations of the past, calculating the size of the population in the eighteenth century.[97] Other scholars seeking the reasons for eighteenth-century population growth are more accurately described as historians of demography, such as James C. Riley who concludes his study on *Population Thought in the Age of the Demographic Revolution* (1985) by proposing that a new emphasis on the part of eighteenth-century 'demographers' and physicians on people's

[96] See especially, Foucault, *Security*, pp. 71-74.
[97] Jacques Dupâquier, *Histoire de la population française*, 4 vols (Paris: PUF, 1988); Marcel Reinhard, 'La population de la France et sa mesure, de l'Ancien Régime au Consulat', *Contributions à l'histoire démographique de la révolution française*, 2 (1965), 259–74.

environment led to reduced mortality and new attitudes towards nuptiality and fertility.[98]

Historians of eighteenth-century thought and literary scholars, influenced by the cultural turn, have begun to focus not on empirical reasons for population growth, but on what for eighteenth-century observers themselves was the central problem of their century: depopulation. As Sylvana Tomaselli remarked in an essay on the views of Hume and Montesquieu on population growth and decline, population 'impinges on nearly every important aspect of the Enlightenment's evaluation of the morality, manners, and mores of the Ancien Régime and of modern commercial society more generally speaking.'[99] Even though historical demographers have since demonstrated that France's populations number actually increased over the course of the century, *philosophes*, state administrators and other thinkers were convinced that the French population was in decline, which they associated with a decline in France's prosperity as a whole. As literary scholar Carol Blum has shown, these thinkers deplored, often in fictional form, what they considered France's fatally flawed policies in areas such as marriage and fertility, blaming, for instance, the Church's celibacy laws for the country's assumed depopulation.[100]

Both historical demographers and historians of ideas as well as literary scholars agree that one area where knowledge of populations was both developed and applied was medicine. Historians of medicine have thus investigated how doctors' care for the health and longevity of individual bodies developed into what we now know as public health: medicine turned from caring for (often privileged) individual bodies

[98] James C. Riley, *Population Thought in the Age of the Demographic Revolution* (Durham, NC: Carolina Academic Press, 1985). More recent studies using digital humanities methods to demonstrate the rise of demographic thinking come from scholars at the Institut national de démographie: Christine Théré and Jean-Marc Rohrbasser, 'L'entrée en usage du mot «population» au milieu du XVIIIe siècle', in *Le cercle de Vincent de Gournay*, ed. by Loïc Charles, Frédéric Lefebvre, and Christine Théré (Paris: INED, 2011), pp. 133–160; Christine Théré and Jean-Marc Rohrbasser, 'L'emploi du terme "population" dans l'Encyclopédie', *Recherches sur Diderot et sur l'Encyclopédie*, 31-32 (2002), 103–122. See also the older account of Joseph John Spengler, *French Predecessors of Malthus: A Study in Eighteenth-Century Wage and Population Theory* (Durham, N.C.: Duke University Press, 1942).

[99] Sylvana Tomaselli, 'Moral Philosophy and Population Questions in Eighteenth-Century Europe', *Population and Development Review*, 14 (1988), 7–29 (p. 8).

[100] Blum, *Strength* ; Tomaselli, 'Moral Philosophy'..

to a concern with the population and all its strata.[101] As Sean Quinlan has shown in particular, the issue of depopulation greatly concerned medical writers, as they became convinced that population growth would lead to increased national wealth and the well-being of its inhabitants.[102] Physicians viewed health and sickness no longer just as a matter of individual constitution, and began to turn to what we now call demography in order to understand the condition of the body politic.[103]

Historians of science have focused also on the development of statistical methods for counting populations.[104] Andrea Rusnock, for instance, has analysed the development of numerical methods for counting populations in seventeenth- and eighteenth-century France and England. On the basis of her discussion of the comparative development of medical and political statistics, developed in the seventeenth and eighteenth centuries as 'political arithmetic', she thus argues that 'the modern concept of the population and its measurement were mutually constitutive.'[105] Eric Brian, in a monograph focusing primarily on Condorcet, has shown how mathematicians working at the Academy of Sciences in the late eighteenth century

[101] Useful overviews of the historiography of population health can be found in Dorothy Porter, *Health, Civilization and the State: A History of Public Health from Ancient to Modern Times* (London: Routledge, 1999), especially 1-8; Olivier Faure, 'The Social History of Health in France: A Survey of Recent Developments', *Social History of Medicine,* 3.3 (1990), 437–451.
[102] Quinlan, *Great Nation.*
[103] Riley, *Population.*
[104] In addition to Rusnock's work, quoted above, see Ted McCormick, 'Population', in *Mercantilism Reimagined: Political Economy in Early Modern Britain and Its Empire*, ed. by Philip J. Stern and Carl Wennerlind (Oxford: Oxford University Press, 2013), pp. 25–45; Jean-Marc Rohrbasser, 'Comment compter la population ? La méthode du multiplicateur aux XVIIe et XVIIIe siècles', *Population et sociétés,* 2005, 1–4; Jean-Marc Rohrbasser and Christine Théré, 'Antoine Deparcieux (1703–1768) and Demographic Data Collection', *The History of the Family*, Early European Population Statistics and Censuses, 9.1 (2004), 115–22; Joshua Cole, *The Power of Large Numbers: Population, Politics, and Gender in Nineteenth-Century France* (Ithaca: Cornell University Press, 2000); Karin Johannisson, 'Society in Numbers: The Debate over Quantification in Eighteenth-Century Political Economy', in *The Quantifying Spirit in the 18th Century*, ed. by Tore Frängsmyr, J.L. Heilbron, and Robin E. Rider (Berkeley: University of California Press, 1990), pp. 343–61; Lorraine Daston, *Classical Probability in the Enlightenment* (Princeton, N.J.: Princeton University Press, 1988); Theodore M. Porter, *The Rise of Statistical Thinking, 1820-1900* (Princeton, N.J.: Princeton University Press, 1986); Stuart J. Woolfe, 'Towards the History of the Origins of Statistics: France, 1789-1815', in *State and Society in France, 1789-1815*, ed. by Stuart J. Woolfe and Jean-Claude Perrot (New York: Harwood Academic Publishers, 1984); Fernand Faure, 'The Development and Progress of Statistics in France', in *The History of Statistics: Memoirs to Commemorate the 75th Anniversary of the American Statistical Society* (New York: Macmillan, 1918), pp. 219–329.
[105] Rusnock, *Vital Accounts,* p. 4.

developed methods that could be used to count populations. Particularly when compared to modern demographers, however, eighteenth-century thinkers were rather uninterested in counting people, a preoccupation that would develop more fully in the nineteenth century.[106] As scholars have shown, in the period that concerns us here, writers struggled to define the concept, as much as to develop numerical methods for representing it; the 'population' was not a given, but a concept that was constructed in the Enlightenment across different fields of knowledge and practices.

While historians of science and medicine have analysed the importance of mathematical methods for population statistics, this dissertation looks at strategies for governing living bodies, rather than the submissive souls found in pre-Enlightenment treatises on the politics of absolutism.[107] The notion of the population was, however, still new and rather abstract in the eighteenth century. Writers and readers were still struggling to fill it with meaning and put it into practice. Social insects were particularly useful for this endeavour, as they appeared in large groups that, as in the case of harmful pests or useful bees, often proved challenging to control. Ideas about government of collectives, as well as the notion of population, once it became current in the middle decades of the eighteenth century, belong to what we would now consider political economy, but in the period of the Enlightenment they were not confined to writings that might be classified as such. This does not mean that political economists were necessarily indebted to observers of insects or that one field exerted a linear influence on the other; rather, by looking at the question of population in texts where they are not commonly sought, we can identify a common set of concerns that transcend modern disciplinary boundaries.

5. Paramaters of the Study

[106] Philip Kreager, 'Population and the Making of the Human Sciences: A Historical Outline', in *Population in the Human Sciences : Concepts, Models, Evidence*, ed. by Philip Kreager and others (Oxford: Oxford University Press, 2015), pp. 55–85 (pp. 59–60).
[107] A good overview is given by Peter R. Campbell, 'Absolute Monarchy', in *The Oxford Handbook of the Ancien Régime*, ed. by William Doyle (Oxford: Oxford University Press, 2012), pp. 11–28.

Building on the literatures outlined above, this dissertation argues that 'insects', understood in the vague eighteenth-century definition given by Réaumur and eighteenth-century dictionary entries, provided a crucial lens through which Enlightenment savants could reimagine and represent their societies. The understanding of the functioning of their individual bodies, the close observation of their collective behaviour, and its manipulation and management, helped eighteenth-century scholars, I argue, to conceptualise, and root in nature, their social orders and the changes that they wished to see in them.

I take from scholars in human-animal studies the assertion that animals have had a special role to play in the understanding of human individual and collective self-definition because they seem both very distant and strangely close to us. At a time when the functioning of the physical body, and its passions, was increasingly taken to be the foundation for human individual and collective identity, writers frequently observed, described and represented animal bodies in order to understand the workings of their own societies. The Enlightenment was a period of intense discussions around the nature of animals, and their differences from and similarities to humans.[108] As Cartesian, mechanist conceptions of animals as well as older Scholastic models, based on the powers of the soul, lost their validity, thinkers struggled to understand what made a living being different from the non-living, and what distinguished man from other living creatures. These debates on animals in general and insects in particular, as the chapters that follow will demonstrate, were an important arena for thinking through hotly contested notions of human nature and how it should be organised in the collective. While insect collectives such as bee swarms or ant colonies that had long been used to metaphorically model human societies, in the eighteenth century, these metaphors were reformulated and given an empirical basis. As historians of science have recently pointed out, insects were a particularly popular object of investigation; these scholars have thus shown that these small animals played an important role in the development of new scientific empirical methods.

[108] Guerrini, *Courtiers' Anatomist*; Berchtold and Guichet, 'L'animal'; Brown, *Homeless Dogs*; Cheung, 'Transitions'; Ridley, 'Animals'; Senior, 'Soul'.

Though this thesis is greatly indebted to these studies, its focus is different. Anatomy, microscopy or even the experiments on, for example, the mating patterns of frogs described by Terrall account for individual animal bodies. Instead, this dissertation discusses how observations of animals were used to not only understand particular bodies, but also how these bodies came to form collectives that could be managed and regulated so as to prosper. Hence, its focus on what we now understand as 'social' insects, and bees in particular: no other insect was more obsessively used to think through and represent collective behaviours. Other insects were either observed or used as figures of thought in the eighteenth century. The thesis offers selective readings of texts and groups of texts concerned with insect life in order to show how they related to the broader concern with knowledge, and government, of human individuals and collectives. In doing so, it sheds light on both the history of animals in the Enlightenment and on concerns with redefining the social order.

It is not, however, the aim of this dissertation to provide a comprehensive survey of all writings on insects, let alone animals, in eighteenth-century France. Such a history would have had to include many more species, and 'species' of texts, than could be accommodated in the space of a dissertation. Spiders, for instance, had a history of being used to represent the idea of the 'world soul' and Diderot used them to figure the relationship between body and brain.[109] The term 'parasite' was used to refer to non-productive freeloaders before it was applied to animals (from the late eighteenth century onwards) and as such made memorable appearances in texts such as Diderot's *Neveu de Rameau.*[110] Silkworms, on the other hand, were important contributors to one of France's (or, rather, Lyon's) most competitive industries (although, as Daniel Roche has argued, consumers increasingly replaced silk with

[109] Isabelle Moreau, 'L'araignée dans sa toile. Mise en images de l'âme du monde de François Bernier et Pierre Bayle à l'Encyclopédie', in *Les Lumières en mouvement. La circulation des idées au XVIII e siècle*, ed. by Isabelle Moreau (Paris : ENS, 2009), pp. 199–228; Roland Mortier, 'Un Dieu-Araignée?', in *Enlightenment Essays in Memory of Robert Shackleton*, ed. by Giles Barber and Cecil Patrick Courtney (Oxford: Voltaire Foundation, 1988), pp. 223–29; Jacot Grapa, 'Le Moi-Araignée du "Rêve de d'Alembert" de Diderot'.

[110] Myriam Roman and Anne Tomiche, *Figures du parasite* (Clermont-Ferrand: Presses Universitaires Blaise Pascal, 2001); Michel Serres, *Le parasite* (Paris: Grasset, 1980).

cotton).[111] Unlike bees, ants or even insect pests, however, silkworms, parasitic insects and spiders live relatively solitary lives. Parasitism describes relations between individuals. Silkworms might have conceivably formed part of a complete history of insects' role in eighteenth-century political economy; as Erika Mae Olbricht has shown, however, they were not used to figure social wholes, but rather individual, idle and aristocratic consumers.[112] I am also not arguing that investigations of other non-solitary animals could not be connected to the question of population or of political economy more broadly; a history of breeding practices aimed at improving the population would certainly have to include them. Domestic animals, however, do not appear in the large numbers that insects do, lending themselves less readily to population thinking. Furthermore, herd animals such as cows or sheep had very different literary and political connotations. As Thomas Macho analyses in detail, the image of the herd was extensively used in Christian writings to figure the relationship of the pastor with his 'sheep', whom he knows and cares for individually.[113] In short, this is not a complete textual history of eighteenth-century insects; this dissertation, instead, gives an overview of the different ways in which insect bodies were used to think through the relationship between both natural and social parts and whole. Instead of aiming at comprehensiveness, then, I have selected texts that fulfil two criteria. The first criterion is that 'social' insects, understood insects which appear in great numbers and as a group, play a central. The second criterion is that political economic concerns – in the eighteenth-century sense of concerning the social order, wealth and prosperity of the body politic – can be discerned. As we shall see, these criteria apply to a range of texts on natural history, agronomy or literature.

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[111] Daniel Roche, *The Culture of Clothing: Dress and Fashion in the Ancien Régime*, trans. by Jean Birrell (Cambridge: Cambridge University Press, 1996).

[112] Erika Mae Olbricht, 'Made Without Hands', in *Insect Poetics*, ed. by Eric C. Brown (Minneapolis: University of Minnesota Press, 2006), pp. 223–41.

[113] See especially Thomas Macho, 'Gute Hirten, Schlechte Hirten. Zu Einem Leitmotiv Politischer Zoologie', in *Politische Zoologie*, ed. by Anne Von der Heiden and Joseph Vogl (Zürich: Diaphanes, 2007), pp. 71–88; Thomas Macho, 'Lust auf Fleisch? Kulturhistorische Überlegungen zu einem ambivalenten Genuss', in *Mythos Neanderthal*, ed. by Dirk Matejovski, Dietmar Kamper, and Gerd-Christian Weniger (Frankfurt: Campus Verlag, 2001), pp. 147–62. Foucault had argued that premodern 'governmentality' was modelled on this relationship between pastor and herd; see Foucault. On sheep, see also Boehrer, *Characters*, ch. 5 "Vulgar Sheep".

Given that the 'oeconomy' was not, like our modern 'economy', understood as an autonomous sphere, but as spanning the natural world, natural bodies as well as all forms of social and moral relations, both human and animal life were objects for those trying to and govern the 'oeconomy'.[114] This thesis shows that in the second half of the eighteenth century, insects, in particular the kind of insects that appeared in great numbers, were also thought of in terms of 'population', a concept that connected knowledge of animals and of humans in the eighteenth century. Population, in this dissertation, will be understood as a conceptualisation of a collective of individuals as an entity in itself, living on a given territory and producing its own interests and passions and its own patterns of birth, death, and health. Writings on insects formed part of this growing interest in populations, and, as this thesis shows, contributed to debates about how to conceptualise – and govern – large numbers of individuals living, moving and working in a given space. While historians of science and medicine have analysed the importance of mathematical methods for population statistics, this dissertation looks at strategies for governing living bodies, rather than the submissive souls found in pre-Enlightenment treatises on the politics of absolutism.[115] The notion of the population was, however, still new and rather abstract in the eighteenth century. Writers and readers were still struggling to fill it with meaning and put it into practice. Social insects were particularly useful for this endeavour, as they appeared in large groups that, as in the case of harmful pests or useful bees, often proved challenging to control. Ideas about government of collectives, as well as the notion of population, once it became current in the middle decades of the eighteenth century, belong to what we would now consider political economy, but in the period of the Enlightenment they were not confined to writings that might be classified as such. This does not mean that political economists were necessarily indebted to observers of insects or that one field exerted a linear influence on the other; rather, by looking at the question of population

[114] Vogl, *Kalkül und Leidenschaft*, p. 54; pp. 78-79; Margaret Schabas, *The Natural Origins of Economics* (Chicago: University of Chicago Press, 2009), pp. 1–21; Schabas and De Marchi; Emma Spary, 'Political, Natural and Bodily Economies'.
[115] A good overview is given by Campbell, 'Absolute Monarchy'.

in texts where they are not commonly sought, we can identify a common set of concerns that transcend modern disciplinary boundaries.

6. Chapter Overview

This dissertation is divided into five chapters. Each chapter interrogates different texts on insects, showing how they are concerned with not only the 'oeconomy' of the animal body, but also understandings of the human, both as an individual and in the collective. The chapters are arranged in rough chronological order, with texts ranging from the early decades of the eighteenth century to texts written in the years before the Revolution. The bulk of the dissertation, however, focuses on the years between the 1740s and the 1760s. It was then that discussions of insects were used particularly frequently to define the nature of animal, and, almost always simultaneously human nature, at a time when older definitions came under attack and newer ones were being formulated and debated.

The first chapter, '*Animal* Life should be the Foundation of Laws of nature': Bernard Mandeville's *Fable of the Bees* and its Receptions by Emilie Du Châtelet', uses perhaps the most famous eighteenth-century text to link insects, political economy and the role of the passions in human (and animal) life, Mandeville's controversial *Fable of the Bees* and Emilie Du Châtelet's translation and reinterpretation in order to introduce some of the dissertation's key themes. Mandeville, a Dutch exile in England, and Du Châtelet, a member of the French high nobility, suggest two opposed conceptions of government and its relation to the passions which were deeply couched within the different socio-cultural, political and economic contexts of their authors. The chapter thus introduces the key themes of the dissertation: the question of what it means to be a human being, endowed with passions and, presumably, a rational soul; and, secondly, debates around the way in which politics might be based on conceptions of the body and that these questions were dependent on particular notions of the social existing and struggled over with at a particular moment in time.

The second chapter, ‘Animal Rationality and the Problem of Human Nature’, takes up the first of these concerns. It focuses on a vigorous debate that took place in the middle decades of the century, following a mathematician’s calculations of the geometry of the cells in the bee hive. This prompted naturalists and philosophers to openly reflect on the question of rationality: if bees could perform geometry, the most rational task of all, could they, too, be said to be rational? If so, what did this imply for humans (particularly, of course, the geometers themselves)? As we will see, this concern with rationality of the individual animal or human reflected debates in political economy, similarly concerned with defining rational, as well as sensitive, man.

The third chapter, ‘Parts and Wholes in Nature and Society: Polyps and Swarms’ introduces the polyp, an ‘insect’ whose remarkable capacity to regenerate from severed parts caused a stir in the mid-century Republic of Letters, as well as the swarm as a new form taken on by the bee aggregate. It does so in order to explore the ways in which they were used to interrogate not only the individual, whether rational or ‘merely’ sensitive, but also the way in which particular (animal) bodies came to form collectives. The chapter thus continues the preceding discussion of the properties of the individual body (and mind), such as sensibility and rationality, in order to show how medical, natural historical and literary texts conceived of the way in which animal, human and political bodies could come to form harmonious wholes. The answer to the questions about insects on which the chapter focuses are not only about insect, but also about human bodies: how do the severed parts of the polyp come to form whole polyp bodies? What are the roles of sensibility and reason in the coherence of the body politic? Should we understand the human body as a bee swarm, with parts that together form a new whole, or as a hive, where each part maintains its autonomy? And what does this mean for the body politic?

The fourth chapter, ‘Managing Insect Pests and Governing Human Political Economy: The Notion of the Population in Enlightenment France’ moves from the question of the constitution of natural and political bodies to the question of how to effectively govern them. It is here that the notion of population is introduced, since it

was, after all, a term and a concept that served increasingly as an instrument of government. The chapter compares political economic and medical discourses on what we would now call public health with agronomic writings on controlling insect pests. While historians have shown the pervasiveness of population discourse in the first two fields, the chapter shows that insects too were conceived of in similar terms.

The final chapter, 'Political Economy in Action: The Government of Circulation in Beekeeping Manuals, Natural History and Enlightened Agronomy', returns to what were considered 'useful', rather than harmful insects to show how the concept of population (if not the term) pervaded writings on beekeeping in the second half of the century. The hive, as the chapter will show, was conceived of as a whole in which bodies and their produce ceaselessly circulated. The task of the beekeeper, agronomic treatises increasingly argued, was not to 'govern' despotically, but to ensure that the circuits allowing the bees to produce were never blocked. The chapter thus discussed the importance of 'circulation' for conceptions of both natural and political bodies.

Chapter One. '*Animal* Life should be the Foundation of Laws of nature': Bernard Mandeville's *Fable of the Bees* and its Reception by Emilie Du Châtelet

1. Introduction

When discussing the relationship between eighteenth-century theories of political economy and the debates about the differences between humans and animals, in particular insects, scholars almost always refer to one text: Bernard Mandeville's (1670-1733) infamous *The Fable of The Bees: or, Private Vices Publick Benefits* (1714; 1723; 1729).[1] Mandeville's poem provides one of the most influential expressions of a new notion of the social body and its government, one based not on the God-given power and will of the sovereign expressed and executed on individual subjects through an apparatus of laws and orders, but on the careful observation and management of individual and collective bodies. The satirist, an exiled Dutch physician who had settled in London in the 1690s, subverted the traditional image of loyal, virtuous and monarchical bees when he suggested that prosperity and wealth was not a consequence of those who virtuously acted like these insects, but rather an outcome of the aggregate vices of all citizens. Much has been written about both Mandeville's continuation of the tradition of seventeenth-century pessimism – the idea that all human actions are ultimately the result of egoism and pride – as well as about his role as a precursor of Adam Smith and of political economic thought more generally. The influence of Mandeville's medical profession on his views has also been pointed out: as Neil de Marchi argues, he developed a model of the legislator as 'physician' to the body politic.[2] Catherine Packham, in her study of vitalism across the physiology, literature and political economy of the long eighteenth-century, briefly but intriguingly suggests that Mandeville proposed a vitalist perception of the body politic as a 'Living Creature'.'[3]

This chapter takes Mandeville's notorious poem as a starting point for an investigation into the connections between animal, human and political bodies. While philosopher John Callanan has recently underlined the centrality of animals in

[1] All citations are from the following edition, unless stated otherwise: Bernard Mandeville, *The Fable of the Bees or Private Vices, Publick Benefits. With a Commentary Critical, Historical, and Explanatory*, ed. by F. B. Kaye, 2 vols (Oxford: Clarendon Press, 1924).
[2] Neil De Marchi and Peter Groenewegen, 'Exposure to Strangers and Superfluities: Mandeville's Regimen for Great Wealth and Foreign Treasure', in *Physicians and Political Economy* (London: Routledge, 2001), pp. 67–92.
[3] Packham, *Vitalism,* pp. 106–7.

Mandeville's conception of pride – understood as the trait that distinguishes man from other living beings – his focus has been the poet's philosophical sources (including Hobbes, Montaigne and La Rochefoucauld) rather than his conception of the animal body.[4] As we will see, Mandeville's comparison between men and other animals, crucial to understanding his work, did not sit well with his critics and readers in France, as it was precisely his treatment of human subjects as animal bodies that Mandeville's French readers (many of whom were members of religious orders) took exception to.

Arguing that the choice of bees as the poem's key analogy was not accidental, the pages that follow explore more closely the centrality of animals in Mandeville's view of both human and political bodies, and the political reasons for his negative reception in France, focusing on the critique mounted by Emilie Du Châtelet (1706-1749). The chapter will offer a new interpretation of her rather free translation (probably undertaken between 1735 and 1738).[5] So far, scholars have above all looked at her *Fable des abeilles* to ask whether female savants used translations to enter the male worlds of scholarly pursuits, but they have not analysed her reaction to Mandeville's conception of the difference between animality and humanity.[6] Though she was sympathetic towards some of Mandeville's daring ideas, such as his stance in favour of the consumption of luxuries, the chapter argues that Du Châtelet, as a particularly perceptive critic of the *Fable,* also protested against his animalisation of humans. Du Châtelet, who was a privileged member of the high nobility, continued to view individuals as rational subjects capable of freely willed actions, who could thus assent to the hierarchical laws and the will of the sovereign.[7] Yet, this did not mean that she argued for an insurmountable gap between humans and all other animals, but

[4] John J. Callanan, 'Mandeville on Pride and Animal Nature', in *Bernard de Mandeville's Tropology of Paradoxes*, ed. by Edmundo Balsemão Pires and Joaquim Braga, Studies in History and Philosophy of Science, 40 (Heidelberg: Springer International Publishing, 2015), pp. 125–36.

[5] Ira O. Wade, *Studies on Voltaire with Some Unpublished Papers of Mme Du Châtelet* (New York: Russell & Russell, 1967), pp. 131–87. On eighteenth-century translation practices, see Evelyn L. Forget, '"At Best an Echo": Eighteenth- and Nineteenth-Century Translation Strategies in the History of Economics', *History of Political Economy*, 42.4 (2010), 653–77; Marie-Pascale Pieretti, 'Women Writers and Translation in Eighteenth-Century France', *The French Review*, 75.3 (2002), 474–88.

[6] The view has been defended by Forget, 'An Echo'; Pieretti, 'Women Writers'; Mary Terrall, 'Émilie du Châtelet and the Gendering of Science', *History of Science*, 33.3 (1995), 283–310. It has been contested by Judith P. Zinsser, 'Entrepreneur of the "Republic of Letters": Emilie de Breteuil, Marquise Du Châtelet, and Bernard Mandeville's Fable of the Bees', *French Historical Studies*, 25.4 (2002), 595–624.

[7] I thus agree with Erica Harth's argument that Du Châtelet's embrace of 'intellectual autonomy' goes hand in hand with her 'social and intellectual elitism'. See Erica Harth, *Cartesian Women : Versions and Subversions of Rational Discourse in the Old Regime* (Ithaca: Cornell University Press, 1992), pp. 189–213.

rather that government of self and others should be predicated on understanding the individual as a unique mixture of passions governed by his or her reason, rather than as representative member of the larger political body, or 'population', which functioned independently from reason and will.[8]

Mandeville's satire and its reception across the Channel provide a window into two themes that will concern us in the subsequent chapters of this dissertation. First, as the *Fable*'s critics both in England and in France deplored, Mandeville's poem intervened in contemporary discussions about the nature of the human being as opposed to the animal. For Mandeville, humans in their solitary state were nothing but animal bodies, driven by their passions: they are 'untaught Animals […] only sollicitous of pleasing themselves'.[9] Thus, famously, the Anglo-Dutch physician claimed that even the supposed human virtues were merely masks for the desire to be flattered. This aspect of his text will serve as a way into some eighteenth-century theories of the human faculties – chiefly reason and passions – which will be discussed in more detail in chapter two. Second, Mandeville insisted that 'political bodies' could not be reduced to the self-interested, passionate beings that composed them, taking us to the individual living creature that he referred to as 'the political bodies of civil societies'.[10] Once individuals come together in large numbers, the new political body they formed took on a life of its own, enabling even the most vicious 'private' actions to be converted into 'public benefit', as the poem's famous subtitle announced. The hive, in other words, was more than the mere aggregate of its bees. Mandeville's attempt to think of the social whole as a living body composed of interdependent individual parts would be echoed, as we will see from chapter three onwards, in French writings of the mid-eighteenth-century. Like Mandeville, French naturalists and philosophers attempted to explain how both natural and social bodies could act as a harmonious unity, despite being composed of independent parts.

The chapter is structured as follows. The first half provides some background to Mandeville's work: section 2 addresses the political implications of the *Fable* within Mandeville's own historical context and section 3 explores the importance of animals in Mandeville's work, fleshing out the debates that were raging in his time

[8] For a history of the passions, from Antiquity to the twenty-first century see Noga Arikha, *Passions and Tempers: A History of the Humours* (New York: Ecco, 2007).
[9] Mandeville, *Fable* I, p. 41.
[10] Mandeville, *Fable* I, p. iii.

and that his work was speaking to. The second half of the chapter will concentrate on the *Fable*'s reception. Section 4 will provide a brief sketch of Mandeville's critics on both sides of the English Channel. Section 5 will concentrate on Emilie Du Châtelet's response, which, it is argued, took issue in particular with the English poet's reconception of the relationship between man and animal, and between human reason and the animal passions.

2. Bee-Citizens: The Political Implications of Mandeville's *Fable*

In 1705, the Dutch physician Bernard Mandeville, who had emigrated to London in the late 1690s, published a long verse satire called *The Grumbling Hive: Or Knaves turn'd honest.*[11] Though it went almost unnoticed by the public, this text would become the basis for *The Fable of the Bees: or Private Vices, Publick Benefits,* published for the first time in 1714 with a preface, 'An Enquiry into the Origin of Moral Virtue' and twenty prose 'remarks'. The *Fable* went through several more versions: it was published with added prose remarks in 1723, an additional 'Defense' in 1724 and yet more comments in prose in 1728. The poem's breakthrough, so to speak, came with the 1723 version, when the Middlesex Grand Jury (one of London's two Grand Juries assessing whether cases were strong enough to put before trial juries) decided to present it to the Court of the King's Bench as a public nuisance. The poem's main thesis, as signalled in its subtitle and considered absolutely scandalous by Mandeville's jurors and contemporary readers, was the idea that what was commonly called virtue was no more than a mask for selfish behaviour.[12] Not only did Mandeville's poem claim that there was no such thing as a selfless action, but it also suggested that the wealth and prosperity of a state depended on the egotism and greed of its citizens who should thus not work to restrain them. While the individuals were 'full of vice', the aggregate, thanks to the framework provided by skilful governors, prospered:

[11] For the *Fable*'s publication history and what is known about Mandeville's biography see E. J. Hundert, *The Enlightenment's Fable: Bernard Mandeville and the Discovery of Society* (Cambridge University Press, 2005); Bernard Mandeville, *The Fable of the Bees or Private Vices, Publick Benefits. With a Commentary Critical, Historical, and Explanatory*.

[12] Hence why Roy Porter calls Mandeville's system 'cynical egoism': 'all actually pursue selfish pleasure, if hypocritically denying it.' See Roy Porter, *Enlightenment: Britain and the Creation of the Modern World* (London: Penguin, 2001), p. 260. The gap between supposedly vicious behaviours and positive outcomes for all is referred to as 'the Mandeville problem' in the history of economics. See Marina Bianchi, 'How to Learn Sociality: True and False Solutions to Mandeville's Problem', *History of Political Economy*, 25.2 (1993), 209–240.

> This was the State's Craft, that maintain'd
> The Whole of which each Part complain'd:
> This, as in Musick Harmony,
> Made Jarrings in the main agree;[13]

For Mandeville, that is, the good governor does not suppress vices and passions ('jarrings'), but provides a framework within which their aggregate can create harmony. The *Fable* follows the story of a prosperous hive composed of selfish, hypocritical but happy and rich bee-citizens who begin to listen to moralisers and decide to live virtuously. The result is a disaster, as many bees die and the hive is reduced to a small, uncivilised community; the selfish but civilised 'spacious Hive well stockt with Bees' of the first line reverts back to 'a hollow Tree,/ Blest with Content and Honesty.' Mandeville thereby, using the traditional symbolic role of bees as models of modesty, virtue and monarchical living, unmasked the supposedly virtuous behaviours of his contemporaries as hypocritical, arguing that their wealth and prosperity actually depended on their vices. Literary scholar William Farrell has argued that Mandeville used the image of the bee hive 'to exorcise it'.[14] We should be more precise, however: while the poet rejects the analogy's traditional meanings, the bees are important because they provide an example of an aggregate of natural bodies which, though helpless individually, come to form a harmonious political body which takes on a life of its own. While traditional uses of the analogy only referred to the hives kept by human beekeepers, Mandeville introduced a distinction between the flourishing but vicious artificial hives' and the virtuous 'hollow Tree' of wild bees. As Mandeville claimed, his contemporaries had to make a choice: either live in poverty and virtue, or vice and prosperity. Unlike what Christian moralists liked to believe, he argued, to benefit from the riches of contemporary society while claiming to live a virtuous life was an act of hypocrisy.[15] Starting from the assumptions that human beings are essentially self-interested creatures driven to self-preservation and to

[13] Mandeville, *Fable* I, p. 24.
[14] William J. Farrell, 'The Role of Mandeville's Bee Analogy in "The Grumbling Hive"', *Studies in English Literature, 1500-1900*, 25.3 (1985), 511–27. See also Danielle Allen, 'Burning the Fable of the Bees: The Incendiary Authority of Nature', in *The Moral Authority of Nature*, ed. by Lorraine Daston and Fernando Vidal (Chicago: University Of Chicago Press, 2004), pp. 74–99.
[15] See Roy Porter, *Enlightenment*, pp. 171–75.

increasing their pleasures (as Hobbes had claimed), Mandeville argued that these drives become harnessed into socially useful 'vices'.[16] The Earl of Shaftesbury, who would become his chief opponent with the 1723 edition and the addition of the essay 'A Search into the Nature of Society', believed that man could 'govern himself by his reason with as much ease and readiness as a good rider manages a well-taught horse by the bridle.'[17] For Mandeville, on the contrary, solitary men were neither virtuous nor rational but rather 'untaught animals [...] only solicitous of pleasing themselves', which is why words such as 'appetites', 'impulses', 'inclinations' appear repeatedly throughout the explanatory notes. Neither individual men nor governors were 'good riders' controlling their horse by the bridle; harmony, for Mandeville, would only come about if the body, whether individual or political, could follow its impulses. Of course, the good governor's task is to ensure that harmful impulses neutralise one another. In order to prevent sexual impulses from causing harm, for instance, governors invent the rules of manners and politeness to flatter the pride of men and women; men are allowed to give their impulses freer rein because

> Had equal harshness of discipline been imposed upon both, neither of them could have made the first advances, and propagation must have stood still among all the fashionable people.[18]

The true differences between humans and animals, for Mandeville, flowed from the emergence of civil society and through the manipulative management of clever politicians harnessing people's passions: 'Would you render a society of men strong and powerful, you must touch their passions.'[19] Mandeville's poem, in other words, grappled with the crucial question of the relationship between individuals and the communities they formed (this question will be central to chapter three). The *Fable* asks, in other words, how the crowded city of London, populated by what in the preface (anticipating the entomological image of the *Fable*) is described as

[16] Hirschman, *Passions and Interests,* pp. 18-19; Roy Porter, *Flesh in the Age of Reason* (London: Allen Lane, 2003), pp. 142–43.
[17] Mandeville makes his polemic with Shaftesbury explicit in his 'A Search into the Nature of Society', which he appended to the 1723 edition of the *Fable*; the quote is from Mandeville, 'A Search into the Nature of Society,', *Fable,* p. 131. On the debate between Mandeville and Shaftesbury, see Porter, *Flesh,* pp. 130-147 and Callanan, 'Mandeville on Pride.' Hont argues that with the 1723 edition, Mandeville reshaped his poem into an anti-Shaftesbury polemic; see Hont, 'Luxury,' p. 395.
[18] Mandeville, *Fable* I, pp. 70-71.
[19] Mandeville, *Fable* I, p. 184.

'numberless swarms of people', could be governed in such a way as to produce 'felicity'.[20]

Mandeville's poem has drawn the attention of scholars from a variety fields, ranging from literary studies and history to anthropology and political economy. Literary scholar E.J. Hundert, arguing that Mandeville should be read as a truly 'European' writer, has given an authoritative account of Mandeville's (often French) sources and his influence on figures such as Adam Smith, Hume or Rousseau.[21] Historians have attended to the poem's intervention in the contemporary political struggle in England between the factions of the Whigs and Tories.[22] As Istvan Hont has argued, Mandeville satirised the latter in order to support the cause of the former.[23] Upon George I's succession to the throne in 1714, the long-standing party struggle between Tories (supporters of Roman Catholicism and the Stuarts) and Whigs (the faction in support of the Hanoverian King) resolved in favour of the latter. [24] As the Whigs became the government party, however, they also split into two factions, one favourable to the government (the so-called Court Whigs) and one joining the Tories in the opposition (Country Whigs).[25] In defence of the Court Whigs, Mandeville used his poem to argue that the 'vices' the government was accused of (particularly the political practices of using money and offices to influence political decisions) were, in fact, necessary for prosperity.[26] Mandeville wrote at a time when the classical debate about the effects of luxury on morality was being revived and commentators worried about the decline of civic virtue and honour in the face of increasing wealth. As John Pocock has argued, defenders of the Hanoverian government claimed that wealth and prosperity would foster a new morality based on civility and manners.[27] *The Fable,* of

[20] Mandeville,'Preface,' *Fable* I, p. 11.
[21] Hundert, *Enlightenment's Fable*.
[22] In addition to the discussion below see, in particular, Istvan Hont, 'The Early Enlightenment Debate on Commerce and Luxury', in *The Cambridge History of Eighteenth-Century Political Thought*, ed. by Mark Goldie and Robert Wokler (Cambridge: Cambridge University Press, 2006), pp. 379–418.
[23] Hont, 'Luxury'; Hundert, *Enlightenment's Fable*, p. 1; W. A. Speck, 'Bernard Mandeville and the Middlesex Grand Jury', *Eighteenth-Century Studies*, 11.3 (1978), 362–74.
[24] The classic account remains J. G. A. Pocock, *The Machiavellian Moment: Florentine Political Thought and the Atlantic Republican Tradition*, 2nd pbk. edn. (Princeton N.J.: Princeton University Press, 2003). See also Rachel Hammersley, *The English Republican Tradition and Eighteenth-Century France: Between the Ancients and the Moderns* (Manchester: Manchester University Press, 2010), chapter 1 'Real Whigs and Huguenots: From English Republicans to British Commonwealthmen'; J. A. W. Gunn, *Beyond Liberty and Property: The Process of Self-Recognition in Eighteenth-Century Political Thought* (Kingston: McGill-Queen's University Press, 1983), pp. 96–119. On the Middlesex Jury and Mandeville's Whig involvement, see also Speck, *Mandeville*.
[25] Speck, *Mandeville*, p.363.
[26] Gunn, *Beyond Liberty*, p. 104.
[27] Pocock, *Machiavellian Moment.*

course, fed into this debate by arguing that defenders of civic virtue could not have it both ways: luxury excluded virtue. At the time when Mandeville was writing his poem, Britain was beginning to be perceived as one of the most commercially prosperous nations of Europe. Partly, the country's success was grounded in the formation of new financially institutions; the Bank of England and the London Exchange had both been founded in the 1690s. As the new role of financial capital led to the formation of new, upwardly mobile and non-noble but financially successful elites whose wealth relied on mobile capital rather than on land, it has been argued that Mandeville's poem offered a new morality to subtend these new power hierarchies.[28] As Istvan Hont has shown, the poem served as a defence of the post-1688 regime against the Stuart contender to the throne who, it was thought, would introduce precisely the kind of anti-luxury measures that lead to the downfall of Mandeville's hive.[29] By contrast, the Middlesex Grand Jury, in its condemnation of the poem, argued on the basis of 'Old Whig' principles, or what scholars have described as 'civic humanism'.[30] Thus, according to civic humanists, self-interest, material prosperity and luxury were inimical to their core belief in civil liberty, which instead required virtuous self-restraint.[31] Although by the early eighteenth century British civic humanists admitted the importance of human passions and of self-interest in men's actions, they continued to insist that these needed to be kept in check, preferably through the mechanisms of a 'mixed constitution' and, crucially, of landed property.[32] For early-eighteenth-century civic humanists, private land, enabling private armies, would allow citizens to remain financially and politically independent and thus to behave virtuously (though this did not mean that they were virtuous).[33] In short, by defending the pursuit of private gain through luxury and commerce, the Dutch physician Mandeville was thus also defending the Hanoverian government.[34]

In addition to these analyses of the text's immediate political context, Mandeville has long been seen as one of the most important influences on the development of modern capitalism. Historians Dror Wahrman and Jonathan Sheehan,

[28] Hundert, pp. 20–23.
[29] Hont, 'Luxury,' pp. 387-395. Hont also shows that the poem was a response to Fénélon's *Telemachus* and its aristocratic anti-luxury polemic.
[30] Pocock, *Machiavellian Moment,* p. 463-467.
[31] Hammersley, *English Republican Tradition,* pp. 19-22.
[32] Hammersley, *English Republican Tradition,* pp. 20-27.
[33] Pocock, *Machiavellian Moment,* pp. 463-464.
[34] Indeed, as Gunn shows, government officials themselves began to use Mandeville's argument in their own defence; see Gunn, *Beyond Liberty,* pp. 107-109.

in their recent overview of eighteenth-century imagery prefiguring Smith's 'invisible hand', have used Mandeville's satire as an example of what they see as the emergence of theories of spontaneous order or the 'self-organizing idiom'; the Fable, for these two historians, epitomises a new relationship between selfish individuals and orderly social aggregates.[35]

While Wahrman and Sheehan do not explicitly argue that the *Fable* is an early expression of capitalism, political economists are less reticent to do so. In this, they follow the influential argument of Albert Hirschman, who saw in Mandeville's poem one of the earliest and most important expressions of an idea that would provide the basis for development of modern capitalism.[36] Capitalism emerges, Hirschman claims, when religion is no longer considered capable of keeping men's passions in check.[37] In response to this development in the sixteenth and seventeenth centuries, political theorists suggested two solutions. The first, proposed by Calvin as well as Hobbes, was to institute a repressive state. The second, adopted by Mandeville, was to develop a government that exercises a 'civilising' influences capable of harnessing, rather than repressing the passions. According to Hirschman's reading, Mandeville's text shows that governors need to take 'men as they really are' rather than as they ideally should be, which means for Mandeville to give free rein to the passion for material good instead of appealing to people's moral conscience.[38] In a similar vein, social anthropologist Louis Dumont considered the *Fable* as one of the most cogent expressions of the emerging 'ideology' of modernity, based on individuality and equality: 'for us, every man is, in principle, an embodiment of humanity at large, and as such he is equal to every other man'.[39] This contrasts with the 'holism' and hierarchies of societies such as the Indian caste system, which Dumont had researched for earlier works; these societies 'value, in the first place, order: the conformity of every element to its role in society'.[40] Similarly to Hirschman, Dumont reads Mandeville as a forefather to modern, capitalist ideologies. He emphasises that Mandeville's theory of government is based on the individual, endowed with passions

[35] Jonathan Sheehan and Dror Wahrman, *Invisible Hands: Self-Organization and the Eighteenth Century* (Chicago: The University of Chicago Press, 2015), esp. pp. 5-10.
[36] Albert O. Hirschman, *The Passions and the Interests: Political Arguments for Capitalism before Its Triumph* (Princeton N.J.: Princeton University Press, 1977).
[37] Hirschman, *Passions*, pp. 14-15.
[38] Hirschman, *Passions and Interests*, pp. 17-19.
[39] Louis Dumont, *From Mandeville to Marx: The Genesis and Triumph of Economic Ideology* (University of Chicago Press, 1983), p. 4.
[40] Dumont, *Mandeville to Marx*, p. 4.

and needs and given prior to his or her entry into society. However, Mandeville's emphasis on the necessity of skilled politicians also means for Dumont that Mandeville continues to posit a (for Dumont pre-modern) social framework based on 'subordination'. This contrast between ideas that continue to structure our modern socio-political relations and a monarchical, or absolutist, framework characterises most of the texts discussed in the chapters that follow.

3. Mandeville, Medicine and the Animal Oeconomy

Focusing less on the wider debates over the rise of capitalism based on humans' 'animal nature' than on Mandeville's concept of virtue, John Callanan has recently drawn attention to the use, function and description of animals and the debates over their 'nature' in Mandeville's work.[41] The question of the relationship between man and animals was clearly central, not only to the *Fable*, but to Mandeville's wider oeuvre; the poem thus needs to be read – and this will be another central theme of this dissertation – against the background of the heated debates on the nature, and possible soul, of animals. Leonora Cohen Rosenfield in particular has shown that while the question of the animal soul was not an invention of the seventeenth century, this period saw particularly vigorous debates on the matter. The key episode in its history revolves, of course, around Descartes' theory of the beast-machine.[42] Rejecting the Scholastic notion of the tripartite soul, divided into vegetative, sensitive and rational (with only the latter being a human prerogative), Descartes declared that all bodies were purely machines. Humans, he argued, were the only beings capable of thought and its visible manifestation, language. This was so because they had been given a soul, which the philosopher reduced to and equated with the rational faculties (discursive reasoning and free will).[43] Conscious passions and sensations thus became operations of the soul.[44] Although, Descartes argued, animals sensed, they did so

[41] Callanan, 'Pride'.

[42] The best discussion of the fate of the beast-machine theory in the eighteenth century remains Rosenfield. On the fact that Descartes did, indeed, grant sensation to animals, see Cohen Rosenfield, *Beast-Machine*, pp. 17-18.

[43] Cohen Rosenfeld, *Beast-Machine*, pp. xxiv-xxv. The mind-body relationship in Descartes is complex and has been a matter of much scholarly discussion; a good account of the problem is Gary Hatfield, 'Descartes' Physiology and Its Relation to His Psychology', in *The Cambridge Companion to Descartes*, ed. by John Cottingham, Cambridge Companions to Philosophy (Cambridge: Cambridge University Press, 1992), pp. 335–70.

[44] In his treatise on the passions (first edition 1650), Descartes argued that animals could not feel the effects of the passions, because these depended on the soul and its interaction with the body: 'car encore qu'elles [les bestes] n'ayent point de raison, ny peut-estre aussi aucune pensée, tous les mouvemens des

without being aware of it. Unlike humans, they did not have the will to resist the pull of their appetites and sensations; they were purely matter in motion.[45]

Mandeville was clearly aware with all these debates. During his medical studies at the University of Leiden, he had written a dissertation on the nature of animals (*Disputatio Philosophica de Brutorum Operationibus*, 1689), in which he defended the orthodox Cartesian position of an absolute distinction between thought and feeling of humans and the machine-like nature of all other animals.[46] In his thesis, Mandeville argued against the idea of thought in animals, though he did admit that that they might sense. The satirist would later reverse his position, instead admitting that animals were capable of thought and that all living beings were governed by the principle of 'life' which distinguished the from inert matter.[47] His *Disputatio* shows, in any case, that he had grappled with the question of the animal from early on in his career.

Leiden was, at the time of his studies, one of the most important centres in Europe for natural philosophy and medicine. It attracted Cartesian scholars as well as their detractors, and was thus rightly considered a hotbed for debates about the nature of living bodies, both animal and human.[48] Descartes himself had spent some of his exile in the Dutch city, where he also published his *Discours de la méthode* (1638) and the city remained famous for Cartesian philosophy and physics long after his death.[49] To name one illustrious example of a Leiden Cartesian, Florentius Schuyl (1619-1669), professor of medicine at Leiden from 1664 onwards, published a Latin translation in 1662 of Descartes' *De l'homme,* which set out to develop an entirely

esprits & de la glande, qui excitent en nous les passions, ne laissant pas d'estre en elles, & d'y servir à entretenir & fortifier, non pas comme en nous les passions, mais les mouvemens des nerfs & des muscles, qui ont coustume de les accompagner.' René Descartes, *Les passions de l'âme* (Paris: M. Bobin, & N. le Gras, 1664), p. 75. See also Cohen Rosenfield, *Beast-Machine*, p. 17.

[45] As Gary Hatfiel explains, Descartes took earlier physiological theories and provided a 'translation' into a purely mechanical account; see Hatfield, 'Descartes' Physiology,' p. 353.

[46] Bernard Mandeville, *Disputatio philosophica de brutorum operationibus* (Leiden: Apud Abrahamum Elzevier, 1689). For more on Mandeville's engagement with 'the animal question', see Callanan.

[47] Mandeville, *Fable* II, p. 166.

[48] For natural philosophy in general, see Ann M. Blair, 'Natural Philosophy', in *The Cambridge History of Science Volume 3: Early Modern Science*, ed. by Katharine Park and Lorraine Daston (Cambridge: Cambridge University Press, 2006), pp. 363–406. On Leiden and natural philosophy, see G.A. Lindeboom, 'Dog and Frog - Physiological Experiments', in *Leiden University in the Seventeenth Century: An Exchange of Learning*, ed. by Theodoor Herman Lunsingh Scheurleer and G.H.M. Posthumus Meyjes (Leiden: Universitaire Pers Leiden; Brill, 1975), pp. 279–93.

[49] Harold John Cook, *Matters of Exchange*, pp. 227–59.

mechanistic physiology of the human body.[50] Schuyl's 'Ad Lectorem' focused almost entirely on the Cartesian doctrine of the beast-machine, despite the fact that this was only a minor aspect of Descartes' original.[51] At the hands of some of his followers, Descartes' theory provided a particularly stark way of distinguishing (exclusively human) reason from the purely mechanical body, whether in humans or in animals. The problem of the animal soul was thus linked to questions about the interaction between soul (or mind) and body, the nature of the 'oeconomy' of the living body and − by implicit or explicit analogy − the 'oeconomy' of human individual and collective bodies. The concept of the animal oeconomy, broadly defined as the ensemble of anatomical structures, organs and fluids necessary for the upkeep of the living body, spanned all living beings from insect to man and made the study of one kind of body relevant to that of another.[52] Central to the study of all bodies was the relationship between the rational faculties (reason and will) and the passions. As historians of medicine have outlined, the most influential theory of the animal oeconomy in the early eighteenth century was the iatromechanism of the Leiden physician Herman Boerhaave.[53] For iatromechanists, organic bodies should be conceived of as hydraulic machines, composed of solid and fluid parts representing, respectively, the pulleys, levers, vessels and the liquids (most importantly, the blood) circulating through them. For Boerhaave and his followers, the machine of the body was set in motion and governed by the *sensorium commune.* While Aristotle had located the sensorium commune in the heart, Boerhaave argued that it was to be found in the brain, that it gathered all bodily sensations and that it produced all ideas, emotions and voluntary movements.[54] For iatromechanists, the mechanical laws of the physical interaction of bodies were sufficient to explain the body, while the 'soul' and its 'functions' (such

[50] Lindeboom, 'Dog and Frog,' pp. 283-284; Cohen Rosenfield, *Beast-Machine*, pp. 31-32; Cohen Rosenfield classifies Schuyl as one of several 'physiologists' who, in the decades after Descartes' death, defended the beast-machine theory; see pp. 28-37.
[51] Rosenfield, *Beast-Machine*, pp. 245-249.
[52] Harro Maas analyses the thought of Thomas Reid to show how his understanding of physiology affects his political economic thought: Harro Maas, 'Where Mechanism Ends: Thomas Reid on the Moral and the Animal Oeconomy', *History of Political Economy*, 35.Suppl 1 (2003), 338–60. Catherine Packham has analysed the influence of vitalist physiology on the work of Adam Smith: Packham.
[53] On Boerhaave, see especially Rina Knoeff, *Herman Boerhaave (1668-1738): Calvinist Chemist and Physician* (Amsterdam: Koninklijke Nederlandse Akademie van Wetenschappen, 2002).
[54] Knoeff, pp. 193–94; John P. Wright, 'Boerhaave on Minds, Human Beings, and Mental Diseases', *Studies in Eighteenth-Century Culture*, 20.1 (2010), 289–302. The physiologist Albrecht von Haller adopted the notion of the *sensorium commune* as the 'corporeal antechamber to the non-corporeal soul', while Charles Bonnet went further, seeking to link all sensations, thoughts and language to sensible fibres in the body coordinated by the *sensorium* commune: see Vila, *Enlightenment and Pathology*, pp. 28–37.

as consciousness) had to be bracketed out by the physician. According to the Boerhaavian model, then, there was a clear distinction between the 'soul' and the rest of the body that it set in motion. While the body was to be considered like a machine, the immortal soul was beyond the purview of the physician or anatomist.

The mechanical model of the human-animal difference was contested not only by Scholastic thinkers, but also by thinkers in the sceptical tradition. Particularly influential for post-Cartesian sceptics was, of course, Michel de Montaigne (1533-1592), quoted by Mandeville as a model for his own *Fable;* Du Châtelet, in her effort to make Mandeville palatable to her French audience, described him as 'the English Montaigne'.[55] Montaigne, in his 'Apologie de Raymond Sebond', had argued that animals seemed to possess both reason and morality, and possibly even more so than humans: 'Il se trouve plus de difference de tel homme à tel homme que de tel animal à tel homme.'[56] Montaigne's goal, not dissimilar to Mandeville's, was less to provide an account of animals than to undermine man's confidence, or, more accurately, man's pride, in his own rational faculties: 'Le moyen que je prens pour rabatre cette frenaisie et qui me semble le plus propre, c'est de froisser et fouler aux pieds l'orgueil et humaine fierté.' By linking his poem to Montaigne's work, Mandeville suggested to his readers (at least those who were well read in natural philosophy) that he, too, was engaged in removing rational man from the throne on which Descartes – Mandeville's erstwhile source on the question of animal nature – had placed him.[57]

By contrast, with his claim about the particularity of the living body, be it the individual body Mandeville was treating in his medical practice or the body politic, the satirist was echoing the theories of the German physician Georg Ernst Stahl (1660–1734), even though I have been unable to find explicit references. Stahl, one of the

[55] 'It was said of Montaigne, that he was pretty well versed in the defects of mankind, but unacquainted with the excellencies of human nature: if I fare no worse, I shall think myself well used.' Mandeville, 'Preface,' *Fable*, p. 20. Montaigne, in his 'Apologie de Raymond Sebond', argued that 'Il se trouve plus de difference de tel homme à tel homme que de tel animal à tel homme.' On Montaigne and the animal question, see Hassan Melehy, 'Montaigne and Ethics: The Case of Animals', *L'Esprit Créateur*, 46.1 (2006), 96–107. On how his position got taken up in the seventeenth century, see Peter Harrison, 'The Virtues of Animals in Seventeenth-Century Thought', *Journal of the History of Ideas*, 59.3 (1998), 463–84.

[56] 'Apologie de Raymon Sebond', Michel de Montaigne, *Essais de Michel de Montaigne (1580)*, ed. by André Tournon (Paris: Imprimerie Nationale Éditions, 2003) Livre II, 12.

[57] Descartes tends to omit the names of his sources, he cites Montaigne once, precisely to refute the latter's claims about the intelligence of beasts; see Michael Moriarty, 'Montaigne and Descartes', in *The Oxford Handbook of Montaigne*, ed. by Philippe Desan (Oxford: Oxford University Press, 2016), pp. 347–63; Martine Pécharman, 'Contre le "pensement" et le "parler" des bêtes ou Descartes devenu juge de Montaigne', *Montaigne Studies*, 25 (2013), 105–17.

most famous and influential critics of Boerhaaavian theories, proposed instead an animist conception of the living body as governed in every movement by a soul.[58] He asserted that although the body functioned mechanically, life itself could not be explained entirely by mechanical forces. Instead, living bodies – radically different from inanimate or mechanical objects – were moved by a soul, or *anima*, which was located in the body and directed its motions through mechanical means. Stahl did not completely reject the mechanistic study of the body but argued that there were two fundamental principles, matter (material) and motion (immaterial). Because the soul too was immaterial, it could cause motion, which in turn affected matter.[59] Living bodies, for Stahl, were composed of mixed matter; the harmony between these different compounds, as well as the coordination of parts, was guaranteed by the soul. In the second volume *Fable*, written as a dialogue between two interlocutors called Cleomenes (a man with medical training who shared the *Fable's* suspicion of 'fashionable men' and their supposed virtues) and Horatio ('one of the modish People'), Mandeville makes the connection between his medical thought and the political ideas of the *Fable* more explicit.[60] Mandeville echoes Stahl, for example, in his claim that the usefulness of anatomy, or at least dissection, to medical practice is limited because it can only reveal the structure but not the function of body parts:

> The Structure and Motions of the Body, may, perhaps, be mechanically accounted for, and all Fluids are under the Laws of Hydrostaticks: But we can have no Help from any Part of the Mechanicks, in the Discovery of things, infinitely remote from Sight, and entirely unknown as to their Shapes and Bulks.[61]

[58] Lester S. King, 'Stahl and Hoffmann: A Study in Eighteenth Century Animism', *Journal of the History of Medicine and Allied Sciences*, XIX.2 (1964), 118–30; On the place of Stahl in the European Enlightenment, and especially as a source for mid-century vitalists, see Vila, *Enlightenment and Pathology*, pp. 43–44; Elizabeth A. Williams, *The Physical and the Moral: Anthropology, Physiology, and Philosophical Medicine in France, 1750-1850* (Cambridge: Cambridge University Press, 1994), pp. 30–31; Johanna Geyer-Kordesch, 'Georg Ernst Stahl's Radical Pietist Medicine and Its Influence on the German Enlightenment', in *The Medical Enlightenment of the Eighteenth Century*, ed. by Andrew Cunningham and Roger French (Cambridge: Cambridge University Press, 1990), pp. 67–87.
[59] King, 'Stahl,' p. 123.
[60] For descriptions of the interlocutors, see Mandeville, *Fable* II, pp. 15-19.
[61] Mandeville, *Fable* II, p. 161.

Though Mandeville admitted that anatomy and mathematics were useful for reaching limited knowledge of some body parts, it ultimately could not account for the living body as a whole.[62] The reason for this was that for Mandeville both animal and human bodies are governed by a vital force that radically distinguishes them from inert objects.

> Hor. The main Spring in us is the Soul, which is immaterial and immortal: But what is that to other Creatures that have a Brain like ours, and no such immortal Substance distinct from Body? Don't you believe that Dogs and Horses think?
> Cleo. I believe they do, though in a Degree of Perfection far inferior to us.
> Hor. What is it, that superintends Thought in them? where must we look for it? which is the main Spring?
> Cleo. I can answer you no otherwise, than Life.
> Hor. What is Life?
> Cleo. Every body understands the Meaning of the Word, though, perhaps, no body knows the Principle of Life, that Part which gives Motion to all the rest.[63]

For Cleomenes, both animals and human bodies are driven by an immaterial and unknowable 'principle of life'. Even if an anatomist had complete knowledge of each of the body's parts, that is, he would still be unable to understand the living body as a whole. The same is true, of course, of Mandeville's bee swarm: even if citizens, when looked at individually, seem vicious and depraved, the well-governed body politic as a whole is still harmonious.

Mandeville's most important medical work was his *Treatise of the Hypochondriack and Hysterick Passions* (1711), a dialogue between a physician called Philopiro, who like Mandeville studied in Leiden and his sick patient. Mandeville's medical dissertation (written two years after his general dissertation on animals), like Philopiro's, had been on the role of chyle in digestion; as De Marchi notes, his treatise on hypochondria continued his interest in the stomach and emphasised the importance of good digestion in the treatment of melancholic

[62] On Mandeville's sceptical attitude towards mathematics, see Charles T. Wolfe, 'Vital Anti-Mathematicism and the Ontology of the Emerging Life Sciences: From Mandeville to Diderot', *Synthèse*, (2017), 1–22 (online first).
[63] Mandeville, *Fable* II, p. 166.

'diseases'.[64] Philopiro insisted that 'whilst the strict union that is between the Body and the Soul lasts, they continue to be, as it were, a mixture, the latter cannot act without the assistance of the first'.[65] Every man's or woman's body, Mandeville claimed, was a unique mixture of parts. When, in the *Fable,* Mandeville made the individual as endowed with his or her own passions the basis of society, he was thus also echoing his own medical theory and practice. Because of the uniqueness of each of his patients, Philopiro/Mandeville insisted that doctors become well acquainted with the manner of living of […] Patients' so as to 'better to consult the Circumstances as well as *Idiosyncrasy* of every particular Person: Some have strange Aversions as to Diet; others peculiar Antipathies against some excellent Remedies; and every wholesome Exercise suits not with all People.'[66] While this was a fairly conventional view of health and disease, Mandeville put it to novel use in his *Fable.* In the poem, the insistence on the 'idiosyncrasy' of each man or woman manifests itself in the various paragraphs on members of the different trades, who each have their own dominant passions. For society to become a harmonious whole, lawgivers should not ignore the unique passions or attempt to constrain them through a rigid moral code. Society, in short, was a body of mixed composites animated with its own life force.

Mandeville's anti-Boerhaavian view of the body and his questioning of Descartes' assumption about man as rational in opposition to animals were central to Mandeville's claims about the body politic in more important ways. In the first line of the preface to the 1728 edition, Mandeville relates his understanding of the body politic to the study of animal bodies: 'Laws and government are to the political bodies of civil societies what the vital spirits and life itself are to the natural bodies of animated creatures'.[67] With the very first sentence of his preface, Mandeville thus suggested that the bodies of communities, like the bodies of (human) animals, did not function mechanically but were instead 'animated' by 'vital spirits'.[68] Rejecting the Cartesian mechanism he had himself endorsed in his first publication, Mandeville goes on to mock those who pretended that 'the anatomy of dead carcasses' will yield

[64] De Marchi, 'Mandeville', pp. 69-70.
[65] Mandeville, *Treatise,* p. 128.
[66] Mandeville, *Treatise,* p. 344.
[67] Mandeville, 'Preface,' in *Fable,* p. 19.
[68] Similarly, in one of the remarks, Mandeville describes the leap from private vices to the public benefits found in large and well-governed societies with an image of animal generation: 'those who can enlarge their view, and will give themselves the leisure of gazing on the prospect of concatenated events may, in a hundred places, see good spring up and pullulate from evil, as naturally as chickens do from eggs.' Mandeville, 'Remark H,' *Fable,* p. 60.

knowledge of living bodies.[69] Boerhaavian anatomy as the taking apart of the mechanical body and the construction of automata were two closely related pursuits in the period. The famous engineer Jacques Vaucanson (1709–1782), for instance, based his machines on the teachings of anatomists and intended them to be used to complement their studies.[70] Crucially, both anatomists and engineers of automata dealt only with what could be seen, whether with the naked or through the microscope. This emphasis on the visible meant that the distinctions between animal and machine mattered little to the iatromechanist interested only in the visible, material side of beings. The anatomist, in other words, though he can perhaps observe the individual parts, necessarily misses the vitality of the whole.[71] The same Mandeville, argues in his poem, is true for society: while each individual might seem vicious and driven by selfish passions, the political body as a whole, once 'animated' by good government, becomes prosperous.

Mandeville's definition of 'society' is worth quoting full here, firstly because it shows very clearly how he conceived of the differences between men (in society) and animals, and secondly because it provides one definition of a large human communities in the terms that in this dissertation I have summarised under the notion of 'population'. For Mandeville, large societies form a body that, just like an animal body, is more than the sum of its parts:

> I hope the reader knows that by society I understand a body politic, in which man either subdued by superior force, or by persuasion drawn from his savage state, is become a disciplined creature, that can find his own ends in laboring for others, and where under one head or other form of government each member is rendered subservient to the whole, and all of them by cunning management are made to act as one. For if by society we only mean a number of people, that without rule or government should keep together out of a natural affection to their species or love of company, as a herd of cows or a flock of sheep, then there is not in the world a more unfit creature for society than man.

[69] Mandeville had expressed a similar scepticism in his medical treatise; see Bernard Mandeville, *A Treatise of the Hypochondriack and Hysterick Passions.* (London: Dryden Leach, 1711), pp. 140–41.
[70] Joan B. Landes, 'The Anatomy of Artificial Life: An Eighteenth-Century Perspective', in *Genesis Redux: Essays in the History and Philosophy of Artificial Life*, ed. by Jessica Riskin (Chicago: University Of Chicago Press, 2007), pp. 96–118 (pp. 97–98).
[71] Barbara Maria Stafford, *Body Criticism: Imaging the Unseen in Enlightenment Art and Medicine* (Cambridge, Mass. ; London: MIT Press, 1991), pp. 47–48.

> A hundred of them that should be all equals, under no subjection, or fear of any superior upon Earth, could never live together awake two hours without quarrelling, and the more knowledge, strength, wit, courage and resolution there was among them, the worse it would be.

Like Hobbes and against Shaftesbury, Mandeville argued that man was naturally selfish, not virtuous, though unlike Hobbes he claimed that a good governor harnessed, rather than repressed people's passions.[72] From the point of the government, at least, a large 'society' (Mandeville is clear that he is discussing, as he writes in the poem's first line, 'A spacious hive' rather than just 'a hundred' men) is thus irreducible to the passionate, supposedly vicious individuals that compose it. In this, Mandeville was echoing the vitalistic conception of the body that he had outlined in his treatise on hysteria; in its preface, for example, he had claimed that the body as a whole could never be completely observed and understood: 'That most minute and subtile Texture, remote not only from the Senses but likewise from the Reach of human Understanding, which the solid as well as fluid Parts are made of in a living Creature, is and will eternally be hid from us.'[73] Just as the human or animal body was more than the sum of its organs, 'society' was a 'body' or 'creature' that had taken on a life of its own. For Mandeville, this also means that some of the subjects had to suffer for the benefit of the greater good, to which they were 'subservient' as soon as they became part of the body politic. In the poem, for example, Mandeville describes how those who could not afford to pay off the judges might be hanged 'For Crimes, which not deserv'd that Fate,/ But to secure the Rich and Great.'[74] '[T]he Desp'rate and Poor', through their drive for self-preservation, contributed to the 'life' of the body politic, but they did so neither through their own volition nor for their own benefit; the creature that was society functioned for its own benefit, not for that of its members.

As we will see in chapter three, the contrast between the swarm of bees that 'act as one' and groups of animals that seemed to remain separate would be used in the middle decades of the eighteenth century by both vitalist physicians (most

[72] On Mandeville and Hobbes, see Hundert, *Enlightenment's Fable*, pp. 24-25; Callanan, 'Pride'; Laurence Dickey, 'Pride, Hypocrisy and Civility in Mandeville's Social and Historical Theory', *Critical Review*, 4.3 (1990), 387–431; James Dean Young, 'Mandeville: A Popularizer of Hobbes', *MLN*, 74.1 (1959), 10–13.
[73] Mandeville, *Treatise*, p. 5. On Mandeville's vitalist scepticism towards mathematization in medicine, see Wolfe, 'Vital Anti-Mathematicism and the Ontology of the Emerging Life Sciences'.
[74] Mandeville, *Fable* I, p. 24.

famously Théophile Bordeu) and materialist *philosophes* (most famously Denis Diderot) to think through how bodily organs or particles (in medicine) or individual subjects (in political speculations) could come to act in concert. In Mandeville's text, then, we can see an early example of this question of the relationship between individuals, endowed with their own mix of passions, and the social whole, the paradoxical harmony of which was guaranteed by the selfish pursuit of the passions rather than on 'knowledge, strength, wit, courage and resolution'. It should be noted, however, that, unlike Diderot (and, to some extent, Adam Smith) Mandeville placed great emphasis on the role of the head, or government in transforming the flock into a swarm.[75] Although each subject was encouraged to follow his or her own passions, they needed to be 'disciplined' by skilful politicians in order to for these passions to be harnessed for the greater good.

Mandeville's *Fable,* then, provides an example of a theory of government that considers what he calls 'society' to form its own (animal-like and swarm-like) body. In the next two sections, I will explore the ways in which Mandeville's text was received in France, and the ways in which the debates around the relations between passionate or reasonable subjects and their social wholes were refracted across the Channel.

4. The Reception of Mandeville's *Fable*

Mandeville's supposedly scandalous presumptions about the nature of humans, animals and God prompted outrage not only in Britain, but also in France.[76] Scholars have given full overviews of both English and French reviews; here, I underline two common aspects of most critiques, the first referring to Mandeville's conception of the relationship between man and animal, and the second referring to the question of an inborn sense of morality.[77] Critics, mostly members of the traditional elites in the

[75] On the differences between Adam Smith's and Mandeville's vitalism, see Packham, pp. 107–8.
[76] *Private Vices, Publick Benefits? The Contemporary Reception of Bernard Mandeville*, ed. by J. Martin Stafford (Solihull: Ismeron, 1997) provides a collection of British reactions to the text. On the French context, see, in addition to Gottmann, 'Châtelet',
[77] On English reviews, see Stafford, *Private vices, publick benefits?*; F. B. Kaye, 'The Influence of Bernard Mandeville', *Studies in Philology*, 19.1 (1922), 83–108. On French reviews, see Elena Muceni, 'Mandeville and France: The Reception of the Fable of the Bees in France and Its Influence on the French Enlightenment', *French Studies*, 69.4 (2015), 449–61; Letizia Gai, Il Man of Devil attraversa la Manica: Mandeville nei periodici francesi del settecento', *Studi filosofici*, 27 (2004), 217–43. Elena Muceni, 'Mandeville and France: The Reception of the Fable of the Bees in France and Its Influence on the French Enlightenment', *French Studies*, 69.4 (2015), 449–61.

universities and among the clergy, objected to the idea that society was formed not by free, rational and virtuous rational souls but by material, passionate bodies.[78] They argued that Mandeville's claim that their authority was based on hypocrisy and deceit rather than God-given superiority would open the door to atheism and moral and political chaos. As William Law (1686-1761), a High-Churchman and former Cambridge don who published an extensive refutation of the *Fable* in 1724 complained:

> For how weak is it to suppose, that the *Animal* Life should be the Foundation of Laws of nature, so as to make it fit for us to act agreeable to its Wants and Desires; and that the *Rationality* of our *Beings*, which is, in some degree, a Likeness to God, should be the Foundations of no Laws of Nature, so as to make it fit for us to act suitable to its Perfection and Happiness.[79]

Law thus complained that Mandeville had made man so similar to animals as to deny that men entered society primarily as reasonable beings, rather than in order to satisfy their 'wants and desires'. In this, of course, he was echoing Shaftesbury, whom, as we have seen, the satirist had critiqued for having mistakenly conceived of reason as a rider controlling his horse.

In France, too, the brunt of the criticism concerned Mandeville's conception of the relationship between (human) reason and the (beastly) passions, and the way in which these entered into the composition of the social whole. Across the Channel some of the *Fable*'s staunchest critics were, predictably, clerics and theologians. A good decade before Du Châtelet embarked on her project, French periodicals published extensive (and mostly negative) reviews, including excerpts as well as translations of British reviews of the *Fable.*[80] French reviewers commented on the scandal the *Fable* had provoked in England and generally agreed on the 'danger' that Mandeville's ideas represented for French audiences. As early as 1725, for example, the *Bibliothèque*

[78] Cook, *Matters of Exchange,* pp. 406-409.
[79] William Law, *Remarks Upon a Late Book, Entitled, The Fable of the Bees, Or Private Vices, Public Benefits: In a Letter to the Author: To Which Is Added, a Postscript, Containing an Observation Or Two Upon Mr. Bayle*, Second Edition (London: William and John Innys, 1725), p. 29. For a (sympathetic) account of Law's critique, see Andrew Starkie, 'William Law and The Fable of the Bees', *Journal for Eighteenth-Century Studies*, 32.3 (2009), 307–19.
[80] For an overview of the reactions in the French periodical press, see Muceni, 'Mandeville'; Gai, 'Il Man-Devil'; Kaye, 'Influence'.

angloise published an extensive summary and some translated passages, giving French readers access to large portions of the text.[81] The first official translation of the *Fable* into French was published in 1740 and was then republished in 1750.[82] The text did not agree with the French authorities, who, in 1745, placed it on the Index of Prohibited Books, had it condemned by the Sorbonne and ritually burned by the public hangman.[83]

One of the *Fable's* earliest reviewers in French summed up the novelty of Mandeville's approach to human morality in the following way: the fabulist's remarks on the connection between bodily sensations and human actions 'font voir que l'auteur a peut-être étudié la Physique plus que la Morale'.[84] According to this reviewer, the poet denies that humans act out of free will – understood as the capacity to follow or reject revealed moral laws – and studies them as one would 'les animaux les plus abjects'. The extracts the reviewer chose to translate were those that showed that for the author of the *Fable,* human sociability was not natural or God-given, but the effect of a series of well-channelled physiological impulses uncontrolled by reason, or 'les passions de l'ame independamment de la volonté'. Most of the reviews' authors considered the *Fable* as an assault on the idea of a universal, God-given, inborn sense for moral 'natural' conduct that when listened to by enough individuals would guarantee social harmony. An image that occurred time and again was the idea, taken from Romans 2:15 and from Aquinas, that these universal moral laws were impressed onto the human heart as the seat of the soul; Mandeville fails to notice, one reviewer complained that:

> Les Loix naturelles, qui sont gravées dans nôtre cœur, dépendent si peu de nous, que les plus grands scélérats ne peuvent les en effacer entiérement, quelques peines qu'ils se donnent pour en venir à bout. Il y a plus, c'est que les

[81] Armand Boisbeleau de la Chapelle, *Bibliothèque angloise, ou, Histoire littéraire de la Grande Bretagne* (Amsterdam: Pierre de Coup, 1725), 13:1, pp. 97–125.
[82] Bernard de Mandeville, *La fable des abeilles, ou Les fripons devenus honnêtes gens. Avec le commentaire où l'on prouve que les vices des particuliers tendent à l'avantage du public. Traduit de l'anglois sur la sixième édition*, trans. by Jan Van Effen (London: aux dépens de la Compagnie, 1740); Bernard Mandeville, *La fable des abeilles, ou Les fripons devenus honnestes gens: avec le commentaire, où l'on prouve que les vices des particuliers tendent à l'avantage du public*, trans. by J. Bertrand (London: Jacques Nourse, 1750).
[83] Hundert, *Enlightenment's Fable,* p.104.
[84] Armand Boisbeleau de la Chapelle, *Bibliothèque raisonnée des ouvrages des savans de l'Europe* (Amsterdam: Wetsteins & Smith, 1729), 3.1, p. 436.

> ignorans même sont convaincus, sans qu'ils y ayent jamais réfléchi, qu'elles sont gravées dans le cœur des autres hommes.[85]

The author of this *Lettre critique sur la Fable des abeilles* opposed what they saw as Mandeville's absurd proposition that human societies could prosper without following inborn and universally valid moral 'natural laws' and accused the Anglo-Dutch poet of ignoring human morality in favour of human physicality.[86] For this author, the social bond is guaranteed through the existence of God-given laws, engraved into the human heart from the beginning of time. For Mandeville, of course, the social bond was formed on the basis of the universal existence of bodily passions. While Mandeville thus considered men in the same way as all living beings – they all tended towards self-preservation – his critics assumed the existence of a set of God-given moral laws, restricted to ensouled humans, which human individuals could know through reason and freely assent to.[87]

5. Emilie Du Châtelet's *Fable des abeilles*

The first translation of the *Fable* into French that is still known to us today is the unpublished version by Emilie du Châtelet, which she drafted beginning in 1735 and probably worked on until about 1738.[88] In the following section, I will argue that Du Châtelet's critique of Mandeville is a critique of his view of the passions as much more powerful than reason. Feminist scholars have rightly insisted on her role as an active member of the Enlightenment Republic of Letters and as translator of Newton's

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[85] Anonymous, *Lettre critique sur La Fable des abeilles de M. Mandeville* (Geneva (La Haye): Henri-Albert Gosse, 1746), p. 14.

[86] For a discussion of natural law in Mandeville's thought through the prism of the question of whether he was an Epicurean or a Stoic, see Hans W. Blom, 'The Epicurean Motif in Dutch Notions of Sociability in the Seventeenth Century', in *Epicurus in the Enlightenment*, ed. by Neven Leddy and Avi S. Lifschitz, Studies on Voltaire and the Eighteenth Century (Oxford: Voltaire Foundation, 2009), XII, 31–52.

[87] On the different conceptions of natural law in the early modern period, see Lorraine Daston and Michael Stolleis, 'Introduction: Nature, Law, and Natural Law in Early Modern Europe', in *Natural Law and Laws of Nature in Early Modern Europe: Jurisprudence, Theology, Moral and Natural Philosophy*, ed. by Lorraine Daston and Michael Stolleis (Farnham, England ; Burlington, Vt: Ashgate, 2008), pp. 1–12.

[88] The history of the composition of Châtelet's translation is murky. Literary historians have used the dates on the four still existing prefaces and letters by Châtelet to date the text. For a summary of the textual scholarship, see Zinsser, 'Entrepreneur of the "Republic of Letters"', p. 604. As Felicia Gottmann points out, René Vaillot concluded a later end date for the project, though using the same sources. See Felicia Gottmann, 'Du Châtelet, Voltaire, and the Transformation of Mandeville's Fable', *History of European Ideas*, 38.2 (2012), 218–32 (n. 4).

Principia (1756-1759), rather than just on her romantic relationship with Voltaire.[89] The exact genesis of her interest in and translation of the Fable is unknown, but scholars generally surmise that Voltaire brought back the original text from his journey to England upon his return in 1728 and presented it to Du Châtelet with the suggestion that she might try her hand at translating it. It is equally uncertain how much Voltaire was involved in the translation, though we might reasonably assume that the pair discussed the *Fable* as well as Du Châtelet's progress, considering they were both staying at Du Châtelet's estate in Cirey at the time she began working on it.[90] While scholars agree that Voltaire benefited from Du Châtelet's work, most also assume that he instigated the project. As the influential Voltaire scholar Ira O. Wade put it in his authoritative 1967 edition of some of Du Châtelet's unpublished papers, 'The importance of her work lies less in its own intrinsic value than in its contribution to the formation and evolution of Voltaire's thought. That he considered her articles important may be deduced from the fact that he carried them from Cirey to Paris to Berlin, and thence to Geneva and Ferney.'[91] This view, however, has recently been challenged by feminist scholars, notably by Adrienne Mason.[92] Du Châtelet's translation has garnered some scholarly attention, though mainly by critics interested in her translation practices and her view of the role of gender in scholarly work, a topic she broaches briefly in the preface to the text.[93] Marie-Pascale Pieretti argues that translation provided an opportunity for women such as Du Châtelet to participate in the intellectual debates of their time whilst also not straying too far from gender conventions.[94] While scholars such as Erica Harth and historians of science such as Mary Terrall and Lisa Gardiner have emphasised Du Châtelet's exclusion from the academies on the basis of her sex, and on her ensuing struggle to participate in the intellectual activities of her time,[95] Judith Zinsser has used her *Fable* to argue that she

[89] Schiebinger, *The Mind Has No Sex?*, pp. 59–65; Terrall, 'Émilie du Châtelet and the Gendering of Science'; Judith P. Zinsser, *Emilie Du Chatelet: Daring Genius of the Enlightenment* (New York: Viking, 2006).
[90] Zinsser, 'Entrepreneur of the "Republic of Letters"', p. 600; Gottmann , 'Du Châtelet', p. 220.
[91] Wade, *Studies on Voltaire,* p. v.
[92] Adrienne Mason, ''L'air du climat et le goût du terroir': Translation As Cultural Capital In The Writings Of Mme Du Châtelet', in *Emilie Du Châtelet: Rewriting Enlightenment Philosophy And Science,* ed. by Judith P. Zinsser and Julie Candler Hayes, SVEC (Oxford: Voltaire Foundation), 2006:1, 124–41 (p. 132).
[93] See, in particular, the articles by Zinnsser, 'Entrepreneur', and Mason, 'L'air du climat'.
[94] Pieretti , 'Women Writers'.
[95] Harth, *Cartesian Women*; Terrall, 'Du Châtelet'; Lisa Gardiner, 'Women in Science', in *French Women and the Age of Enlightenment*, ed. by Samia I. Spencer (Bloomington: Indiana University Press, 1984), pp. 181–93.

was accepted as a *philosophe* by her contemporaries.[96] Voltaire specialists have also mined her translation for possible signs of a Mandevillian influence on Voltaire's views of luxury.[97] Both strands of enquiry – on Châtelet's role as a female savant and on her and Voltaire's view on luxury – have yielded important insights.

Du Châtelet's oeuvre, however, also provides an example of a French, and female, response to the question about the role of individual bodies in the creation of harmonious social wholes posed by Mandeville. Though clearly fascinated by Mandeville's daring ideas on the positive role of the passions, her transformations of large parts of the *Fable* speak to her anxieties surrounding their implications. Du Châtelet's interpretation of the *Fable* needs to be seen in the context of both the shifting social debates around the relationship between passions and reason not only in human beings in general, but particularly in women. The early eighteenth century, as Erica Harth and Jolanta Pekacz have argued, was also a period in which opportunities for women to engage in learning were significantly restricted.[98] New spaces of learned debate such as the Academy were less structured around the privileges of rank, though they also excluded women.[99] While the mixed-gender salons of the early seventeenth century had served as sites of serious intellectual activity, in the eighteenth-century, with the growing importance of the exclusively male Academies, the salons, in the words Erica Harth, 'proved a discursive dead end for women'.[100] Women were also increasingly relegated to directing, rather than participating in, salon conversations, the rules of which followed the strict protocols of politeness rather than the free pursuit of learning or critical inquiry. *Salonnières*, though highly selective in who they admitted to their gatherings, did not choose their members primarily on the basis of social rank. However, both Du Châtelet's father, the Baron de Breteuil, and her husband, descendant of one of Lorraine's first families, were members of the top ranks of France's high nobility.[101] Although Du Châtelet did

[96] Zinsser, 'Entrepreneur of the "Republic of Letters"'.
[97] Gottmann, 'Du Châtelet'; Terrall, 'Du Châtelet'; Wade, *Studies on Voltaire*, p. 27.
[98] Jolanta T. Pekacz, *Conservative Tradition in Pre-Revolutionary France: Parisian Salon Women* (Peter Lang, 1999); Harth, *Cartesian Women*.
[99] Terrall, 'Du Châtelet'.
[100] Harth, *Cartesian Women*, p. 5; see also Pekacz, *Conservative Tradition*; Dena Goodman has argued, on the contrary, that salons were an important site for the emergence of a public sphere: Goodman.
[101] Judith P. Zinsser, 'Emilie Du Châtelet's Views on the Pillars of French Society: King, Church, and Family', in *Political Ideas of Enlightenment Women: Virtue and Citizenship*, ed. by Lisa Curtis-Wendlandt, Paul Gibbard, and Karen Green (Farnham, England ; Burlington, Vt: Ashgate, 2013), pp. 17–32 (p. 17).

attend some of the most famous Parisian salons, her attempt to bridge the worlds of sociability and of learning brought her the mockery of some *salonnières*, who considered her 'masculine' interest in mathematics and physics improper for a woman, as well as of academicians offended by her critiques of their work.[102] One reason for her transformation of the *Fable*, then, is that she is writing as a noble female savant at a time when women were said to be prone to submitting to their passions, which they felt more strongly than men and which thus brought them closer to equally passion-driven animals, and at a time when the social hierarchies of ancient regime France were shifting and a scholarly elite was forming alongside the old elites of birth and rank.[103]

Even though her text remained in manuscript form, her translation was clearly important to her, and not only because she continued to work on it for several years. First of all, the manuscript circulated among select members of the European eighteenth-century intellectual elites. Apart from Voltaire, there are extant letters documenting that Du Châtelet showed her work to Francesco Algarotti (1712–1764),[104] author of the widely read *Newtonianismo per le dame* (1737), and to the novelist Françoise de Graffigny, who stayed with the couple at Cirey in 1738 and seems to have secretly excerpted sections in order to send them to her friend Devaux.[105] Secondly, Du Châtelet put great care into her translation, as the fact that four versions of its preface have survived shows. It was thus clearly not simply an exercise to improve her English, as some interpreters have suggested.[106] Her translation, or, as

[102] Pekacz, *Conservative Tradition*, p. 94. Judith P. Zinsser, 'Emilie du Châtelet: Genius, Gender, and Intellectual Authority', in *Women Writers and the Early Modern British Political Tradition*, ed. by Hilda L. Smith (Cambridge: Cambridge University Press, 1998), pp. 168–90 (pp. 176–77).
[103] Steinbrügge, *Moral Sex*; Julie Candler Hayes, 'Sex and Gender, Feeling and Thinking', in *The Cambridge Companion to the French Enlightenment*, ed. by Daniel Brewer (Cambridge: Cambridge University Press, 2014); Pekacz, pp. 74–75; Lorraine Daston, 'The Naturalized Female Intellect', *Science in Context*, 5.2 (1992), 209–35. The alleged closeness of women to (animal) 'nature' was especially pronounced in the medical discourses of the later century; see, in particular: Anne C. Vila, '"Ambiguous Beings": Marginality, Melancholy, and the Femme Savante', in *Women, Gender and Enlightenment*, ed. by Sarah Knott and Barbara Taylor (London: Palgrave Macmillan UK, 2005), pp. 53–69; Kathleen Wellman, 'Physicians and Philosophes: Physiology and Sexual Morality in the French Enlightenment', *Eighteenth-Century Studies*, 35.2 (2002), 267–77; Londa Schiebinger, 'Skeletons in the Closet: The First Illustrations of the Female Skeleton in Eighteenth-Century Anatomy', *Representations*, 1986, 42–82.
[104] Gabrielle Émilie Du Châtelet to Francesco Algarotti, Cirey, 20 April 1736, electronic enlightenment.
[105] English Showalter, 'Françoise de Graffigny to François-Antoine Devaux, 25 December 1738', in *La correspondance de Madame de Graffigny, 1716 - 17 Juin 1739, Lettres 1-144*, 15 vols (Oxford: Voltaire Foundation, 1985), I, 245.
[106] Zinsser, 'Entrepreneur of the "Republic of Letters"', p. 607.

Felicia Gottmann notes, 'transformation rather than translation',[107] constitutes an active engagement with Mandeville's text, which she found congenial enough to translate and provocative enough to rewrite.

The most notable of Du Châtelet's transformations of the *Fable* is the fact that she chose not to translate the poem itself, instead limiting herself to a selection of Mandeville's notes. In her preface, she claims that this is due to her lack of talent for verse translations. Scholars have so far taken this explanation as sufficient, and if the *Fable* is read in isolation it is persuasive. However, if we look at Du Châtelet's body of work, the decision to omit the fable and thus the image of the bee hive emerges as consistent with her wider view of the rational human subject not as an animal body, but as able to control his or her passions through reason and will. Du Châtelet's status as a woman from the high aristocracy not only influenced her strategies for entering into the eighteenth-century scientific discourses; as analysed by Terrall, she attempted to set up patronage relations between academicians and herself.[108] It also deeply affected her view of individual and political bodies, and thus of Mandeville's *Fable*. Her rendering of the Mandevillian text thus needs to be seen also in the context of noble sociability, dominated by 'polite' forms of interaction. As historian Jacques Revel has argued, following Norbert Elias' suggestion of a 'civilising process', what were considered correct manners became increasingly stratified according to social status in the seventeenth and eighteenth centuries.[109] In the early eighteenth century, codes of manners became so widespread that elites, including members of the high nobility such as Du Châtelet, began to distance themselves from the rigid rules of 'civility'. Instead, as Revel puts it, they understood truly polite manners to be based on the 'freedom to shape appearances independent of all authority'.[110] Du Châtelet's emphasis on finding happiness by using one's reason to govern one's personal 'passions & goûts' is thus also an echo of contemporary understandings of noble politeness.

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[107] Gottmann, 'Du Châtelet,' p. 218.
[108] Terrall, 'Du Châtelet'.
[109] Jacques Revel, 'The Uses of Civility', in *A History of Private Life, Vol. 3: Passions of the Renaissance*, ed. by Roger Chartier, trans. by Arthur Goldhammer, 1989, pp. 167–205 (p. 190). On politeness, see also, among others, Pekaz, *Conservative Tradition*; Robert Muchembled, *La société policée: politique et politesse en France du XVIe au XXe siècle* (Paris: Seuil, 1998), pp. 195–216; E. Bury, *Littérature et politesse: l'invention de l'honnête homme (1580-1750)* (Paris: Presses Universitaires de France, 1996).
[110] Revel, 'Civility', pp. 200-201.

Not only does the *philosophe* eliminate Mandeville's metaphor of the bee bodies; throughout the text, she rewrites the English text's references to the body and its passions, emphasising instead the role of reason. In her preface, she explains to her readers that Mandeville's work – and thus her translation – should be read as a work of moral philosophy, or, as she puts it, as the product of 'raisonnement', not 'imagination'. Mandeville, for Du Châtelet, is not a poet nor a satirist, but a 'manly thinker'. Her claim as to her lack of talent for verse translation can also be read in the light of her emphasis on reason, for poetry was associated, unlike moral philosophy, with the imagination and the passions. Tellingly, in her annotated copy of Antoine Houdard de la Motte's translation of Homer, she condemns the translator for his lack of clarity and his 'passionate need to rhyme'.[111] De la Motte was a celebrated member of the (exclusively male) Académie Française and an important figure in the Parisian cafés, where people could share and debate knowledge regardless of birth and rank.[112] It is thus perhaps not surprising that Du Châtelet agreed with Anne Marie Dacier that verse should not be translated and mentioned her as a model in the preface to the *Fable*; author of the translation of the *Iliad* (1711) to which de La Motte had responded, Dacier described her work as a 'noble' rather than a 'servile' translation.[113] By not translating the poem itself, that is, Du Châtelet presented herself as a rational woman who did not, like De la Motte, get carried away by imaginative poetry.[114] Where Mandeville's poem focused on governing large collectives, or 'vast numbers of [men] with the greater Ease and Security',[115] Du Châtelet insists on the importance of individual experience of the passions paired with the capacity for independent reasoning in order to govern them. This also explains why it is in the preface to Mandeville's *Fable* that she makes one of her rare reflections on the role of gender in

[111] Zinsser gives a very brief overview of these annotations to argue for Du Châtelet's view of translators as free to take liberties with the texts; Zinsser, 'Entrepreneur of the "Republic of Letters"', p. 609.
[112] E. C. Spary, *Eating the Enlightenment: Food and the Sciences in Paris, 1670-1760* (Chicago: University of Chicago Press, 2012), pp. 96–145.
[113] On Dacier and translation practices, see Pieretti, 'Women Writers'.
[114] De la Motte was actually firmly on the side of the Moderns in the *Querelle des Anciens et des Modernes* and would later even advocate the abandonment of rhyme so as to allow literature to follow the 'geometrical' precepts of reason. On the *Querelle* see, among other studies, Larry F. Norman, *The Shock of the Ancient : Literature & History in Early Modern France* (Chicago: University of Chicago Press, 2011); Françoise Letoublon and Catherine Volpilhac-Auger, *Homère en France après la Querelle*, Actes du colloque de Grenoble, 23-25 octobre 1995, Université Stendhal-Grenoble 3 (Paris: Champion, 1999); Joan Dejean, *Ancients against Moderns* (Chicago: University of Chicago Press, 1997); Chantal Grell, *Le dix-huitième siècle et l'antiquité en France, 1680-1789*, 2 vols (Oxford: Voltaire Foundation, 1995).
[115] Mandeville, *Fable* I, p. 47.

intellectual work; as Erica Harth puts it, 'It is perhaps the most extended statement that she made on gender.'[116] Her association of the (manly) faculty of reason with her own intellectual pursuits and her claim to be unable to produce works requiring too much (feminine) imagination is especially ironic in the light of Voltaire's criticism of his lover's preference for Leibnizian metaphysics over Newtonian physics in the preface to the second edition of his *Elements of Newtonian Philosophy* (1741).[117] Leibinizian thought, he argued, was nothing but 'imagination adorned with untruths'. While previous scholars have argued that this proto-feminist reflection appears in the preface to the *Fable* because of the 'feminine' task of translation, we might surmise that its appearance here has at least as much to do with the content of the translated text. If Mandeville, the doctor-turned-poet, reduces social interactions to effects of bodily forces, Du Châtelet as a financially privileged, female intellectual rewrites his satire so as to show that the relation between body and mind is not one of cause and effect. For Du Châtelet, the body is a vessel for experience, but its laws are not the determining factor in moral and social behaviour:

> Pourquoy ces creatures dont l'entendement paroit en tout si semblable a celuy des hommes, semblent pourtant arrestées par une force invincible en deça de la barriere, et qu'on m'en donne la raison, si l'on peut. Je laisse aux naturalistes a en chercher une physique, mais iusques a ce qu'ils l'ayent trouvée, les femmes seront en route de reclamer contre leur education.[118]

That Du Châtelet is concerned with severing the connection between animal and human selves on the hand and animal bodies on the other is evident in the very first sentence of her translation. While Mandeville compares laws to 'Vital Spirits and Life' and society to 'the Natural Bodies of Animated Creatures', his translator reduces the latter phrase to 'Les loix sont a la societé, ce que la vie est au corps humain'. Thus, while the original sentence quite emphatically refuses to distinguish humans from animals, or indeed from any 'animated creatures', the translation unambiguously

[116] Harth, *Cartesian Women*, p. 206.
[117] Terrall, 'Du Châtelet', pp. 295-296. Voltaire, 'Introduction', in *Eléments de La Philosophie de Newton*, ed. by Robert L. Walters and W.H. Barber, Œuvres Complètes de Voltaire (Oxford: Voltaire Foundation, 1992), XV, pp. 98–118.
[118] Wade, *Studies on Voltaire*, pp. 135-136.

refers to humans only.[119] By ignoring the bee allegory, Du Châtelet thus refocused the central problem raised by Mandeville's *Fable.* For her, the paradox of the vicious bees raised not so much the question of the difference between humans and animals, which, as she took for granted, was already sufficiently explained through the human soul. Instead, she is much more interested in reinforcing the capacity of reason to govern and get pleasure from the passions. Instead of a social order based on the aggregate of individual interests, in other words, Du Châtelet emphasises the importance of the will of the individual, at least of those privileged enough to have the ability to exercise it. Hence, social inferiors could be incapable of recognising their own interest and needed strong laws to discipline them; her view of society was strictly hierarchical, with social position corresponding also with the ability for self-government: every man or woman has 'a share [of *liberté*] appropriate to the rank that we hold in nature.'[120] This can be illustrated with an example of a less noticeable intervention in the *Fable of the Bees*, used by Judith Zinsser to illustrate her preference for 'straightforward, didactic prose':[121]

> That these two Passions [Pride and Shame], in which the Seeds of most Virtues are contained are Realities in our Frame, and not imaginary Qualities, is demonstrable from the plain and different Effects, that in spite of our Reason are produced in us as soon as we are affected with either.[122]

This is translated into French as

> La honte et l'orgueil, ces deux sources de nos vertus, ne sont point des qualités imaginaires, mais des ingredients necessaires a nostre composé. Rien ne le prouve mieux que les differents effects quelles produisent en nous malgré nous mesmes.[123]

[119] Wade, *Studies on Voltaire*, p. 138. On this point, see also Zinsser, 'Emilie Du Châtelet's Views on the Pillars of French Society: King, Church, and Family', p. 27.
[120] Wade, *Studies on Voltaire*, p. 27.
[121] Zinsser, 'Entrepreneur of the "Republic of Letters"', p. 611.
[122] Mandeville, *Fable* I, p. 67.
[123] Wade, *Studies on Voltaire*, p. 157.

I would like to highlight two changes made by Du Châtelet here. While she does not fundamentally alter Mandeville's claim about the hypocrisy of most virtues, she does omit the reference to the passions. Though this might, of course, have been a stylistic choice, it is nevertheless interesting to observe that she also translates Mandeville's 'Reason' as 'nous mesmes': whereas the poet-physician's text implies that reason is only one (not particularly powerful) faculty among several, Du Châtelet translates 'reason' to mean 'ourselves'.

Her struggle with Mandeville's presentation of human nature is illustrated by her interpretation of the Leibnizian idea of *vis viva*, the principle that the quantity of energy is conserved in movement, and for its perceived indications for human free will.[124] Though she sided with Leibniz, she was also worried about the implications of the principle of the conservation of energy for the freedom of living beings to create a force that did not previously exist.[125] In a 1738 letter to the mathematician Pierre-Louis Moreau de Maupertuis (1698-1759) she wrote:

> la seule chose qui m'embarrasse à present, c'est la liberté, car enfin je me crois libre et je ne sais si cette quantité de forces toujours la même dans l'univers ne détruit point la liberté. Commencer le mouvement, n'est-ce pas produire dans la nature une force qui n'existait pas?[126]

Written roughly at the same time as her *Fable des abeilles*, the letter expresses both her endorsement of the idea that the universe was organised according to immutable mechanical laws and her struggle to accept that human subjects were organised on the basis of similarly mechanical laws. Unlike Mandeville, according to whose *Fable* all human decisions ultimately reveal themselves to be results of the pursuit of self-interest, she insists – or wants to insist – that humans have the (rational) liberty from

[124] Paul Veatch Moriarty, 'The Principle of Sufficient Reason in Du Châtelet's "Institutions"', in *Emilie Du Châtelet: Rewriting Enlightenment Philosophy and Science* (Oxford: Voltaire Foundation, 2006), pp. 203–25 (pp. 209–10); Mary Terrall, 'Vis Viva Revisited', *History of Science*, 42 (2004), 189–209; Carolyn Iltis, 'Madame du Châtelet's Metaphysics and Mechanics', *Studies in History and Philosophy of Science Part A*, 8.1 (1977), 29–48.

[125] For an explanation of Du Châtelet's take on vis viva, see Iltis, pp. 31–32. For an explanation of Du Châtelet's take on vis viva, see Iltis, 'Du Châtelet,' pp. 31-32.

[126] Gabrielle Emilie Le Tonnelier de Breteuil Du Châtelet, *Les Lettres de la marquise Du Châtelet*, ed. by Theodore Besterman (Geneva: Institut et musée Voltaire, 1958), vol. 1, letter 122 (30.4.1738). Cited also in Moriarty, 'Sufficient Reason,' p. 210; Harth *Cartesian Women*, p. 194; Iltis, 'Du Châtelet,' p. 32.

their passions. Like Descartes, then, she insisted that humans were not automata, as they possessed a free will to govern over their machine-like bodies.[127]

Sometimes, her emphasis on the importance of reason leads to outright contradiction between her own and Mandeville's ideas. Like Mandeville's Jesuit critics, she insists, for example, on universal moral laws given to humans alone. In a passage where the English poet explains his idea that all 'virtues' are merely the result of clever politicians who devised them 'affin de gouverner la multitude avec plus de sureté', she inserts the following comment:

> Mais tous les hommes s'accordent a observer les loix etablies chez eux, et a regarder les actions comme bonnes ou mauvaises selon leur relation ou leur opposition a ces loix. Il y a une loy universelle pour tous les hommes que Dieu a luy mesme gravée dans le cœur. […] et je crois que le sage Lock [sic] a esté trop loin, quand apres avoir detruit les idées innées, il a avancé qu'il n'y avoit point d'idées de morale universelle.[128]

In her considerable changes to Mandeville's text, she subverts his central intuition by showing that human subjects can and should continue to take into account the effects of their common good, rather than, as Mandeville suggests, relying on 'skilful politicians' to produce an almost magical order out of aggregate self-interests. Her refusal to incorporate the bee analogy into her writing reveals that what she found most problematic about a text she nevertheless admired for its insights into human social life was also one of its most important contributions: the suggestion that humans and their communal bonds were formed on the basis of animalistic passions.

This becomes markedly clear when we read her translation and commentary alongside her most important work on moral philosophy, the *Discours sur le bonheur*, which remained unpublished during her lifetime and was published posthumously in 1779. Her interest in Mandeville's positive take on the pursuit of the passions is clearly coloured by the norms of absolutist France and of her own aristocratic circles, rather than by those of Mandeville's commercially oriented Britain and the Low Countries.

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[127] Peter Dear, 'A Mechanical Microcosm: Bodily Passions, Good Manners, and Cartesian Mechanism', in *Science Incarnate: Historical Embodiments of Natural Knowledge*, ed. by Christopher Lawrence and Steven Shapin (Chicago: The University of Chicago Press, 1998), pp. 51–82.
[128] Wade, *Studies on Voltaire*, p. 145.

Like Shaftesbury, she has been accused, by contemporaries as well as by modern biographers, of being blinded by her status as a privileged, rich noblewoman.[129] In her *Discours sur le bonheur*, Du Châtelet elaborates a theory of happiness as the fulfilment of one's 'passions & goûts'.[130] Like Mandeville (and Shaftesbury) before her, Du Châtelet agrees that 'l'amour-propre' is the driving force for all human actions. While Mandeville makes the universal driving force of self-interest the basis of his theory of human social life, however, for Du Châtelet it is the individual differences that matter. What distinguishes her views from Mandeville's theory of the pursuit of self-interest as the key to both individual and communal happiness is the idea that each individual is endowed not only with a unique combination of passions, but also that he or she is capable of rationally governing and enjoying them. Thus, for example, while like Mandeville she argues that being held in high esteem by others is an integral factor in a happy life, she also argues that it is only the esteem of 'honnêtes gens' that counts; now, to determine who these 'honnêtes gens' are, one needs a certain kind of education and social standing. Happiness, for Du Châtelet, is thus not attainable by everybody: 'Mon but n'est pas d'écrire pour toutes sortes de conditions & pour toutes sortes de personnes; tous les états ne sont pas susceptibles de la même espèce de bonheur.'[131] Happiness, then, is not the pursuit of bodily passions and self-interests. Instead, it means savouring the pleasures made possible by one's use of reason:

> Quiconque a su si bien économiser son état & les circonstances où la fortune l'a placé, qu'il soit parvenu à mettre son esprit & son cœur dans une assiette tranquille, qu'il soit susceptible de tous les sentiments, de toutes les sensations agréables que cet état peut comporter, est assurément un excellent philosophe, & doit bien remercier la nature.[132]

[129] As Harold Blom notes, eighteenth-century Epicureans often used Montaigne instead of the much more theologically dangerous Epicure to suggest their allegiance to the doctrines of Epicureanism. Châtelet is thus probably also suggesting Mandeville's, as well as her own, allegiance to Epicurean philosophy. See Blom, XII, p. 47. On Du Châtelet's Epicureanism, see Gottman, 'Du Châtelet'.
[130] Gabrielle Emilie Le Tonnelier de Breteuil Du Châtelet, *Discours sur le bonheur,* ed. by Robert Mauzi (Paris: Les Belles Lettres, 1961).
[131] Châtelet, *Discours sur le bonheur,* p. 7.
[132] Châtelet, *Discours sur le bonheur,* p. 6.

As Catherine Larrère has shown, those French philosophers who were working to construct an enlightened moral science were often kindred in spirit to Mandeville.[133] Du Châtelet's contemporary and fellow anglophile, the abbé de Saint-Pierre, for instance, asserted that 'the mutable minds, opinions, appetites and passions of particular men' were outside the purview of his philosophy. Instead, he proposed a government based on the rational calculation of the population's overall happiness:

> Nous savons deja le prix en argent de certains plaisirs journaliers, & de l'exemtion de certaines peines, & nous le savons par notre depense journaliere & anuelle; or comme nous pouvons comparer plaisir à plaisir, peine à peine, depense à depense, nous pouvons par conséquent par cette comparaison estimer en revenu anuel la jouissance des nouveaux plaisirs anuels, l'Exemtion des nouvelles peines anuelles qu'un bon Reglement nous procurer, car nous pouvons facilement avoir des points de comparaison qui soient eux-mèmes deja bien calculez par une estimation en revenu anuel en argent.[134]

Du Châtelet's highly individualistic pursuit of happiness was, unlike Mandeville's and Saint-Pierre's, not amenable to calculation on the part of government political economists. Unlike Mandeville's untrammelled pursuit of self-interest, it was also not suitable as a means of understanding and governing the masses. It relied, instead, on the elitist language of politeness that Mandeville had satirised as the result of pride.

It is possible that Du Châtelet's status as an intellectual excluded from the most respected circles of learning on the basis of her female body made her more acutely aware of some of the consequences of the growing authority of naturalists' research. Her complaint about naturalists' reduction of immaterial properties such as intelligence to observable physical causes also resonates with discussions of the animal soul. Academicians were not necessarily from noble backgrounds and clamoured for the government to institute salaried posts. As Mary Terrall has noted, this professionalisation made it more and more difficult for women philosophers like

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[133] Catherine Larrère, 'In Search of the Newton of the Moral World', in *Natural Law and Laws of Nature in Early Modern Europe : Jurisprudence, Theology, Moral, and Natural Philosophy*, ed. by Lorraine Daston and Michael Stolleis (Farnham: Ashgate, 2008), pp. 249–64.

[134] Charles Irénée Castel de Saint-Pierre, *Ouvrajes de politique: Projet pour perfectioner le gouvernement des Etats*, 14 vols (Rotterdam: Jean Daniel Beman, 1733), vols 3, 97-98. Quoted in Larrère, 'Newton', p. 253.

Du Châtelet to have access to learned circles.[135] By insisting on the uniqueness of the rationally cultivated mind, Du Châtelet implicitly critiqued the new culture of academic expertise from which she as a woman was excluded. As Erica Harth has shown, the salon culture and the Cartesian dualist philosophy of the seventeenth century afforded a handful of privileged women the opportunity to participate in learned discourse. This culture, however, helped bring about the idea of universally applicable mechanical laws that should be studied by (male) experts in observation and experiment; it thus ended up excluding women like Du Châtelet who insisted on the uniqueness of the human soul.[136] It is, perhaps, not by accident that her vocabulary would be equally suitable for the latter topic: women, like animals, are mere 'creatures' whose apparently intellectual understanding is reduced to physical causes. Although in her work on Newton, she demonstrates the mechanical lawfulness of the universe, she also clearly distinguished between living creatures and mechanical, inanimate bodies; in the letter to Maupertuis, for instance, she wrote:

> dieu peut avoir établi des lois de mouvement pour le choc des corps inanimés par lesquelles, ils conservent, ou communiquent, ou consomment dans des effets, la force qu'on leur imprime, mais cela n'empêche point qu'il ne reside dans les êtres animés un pouvoir soit mouvant, qui est un don du créateur comme l'intelligence, la vie &cc.[137]

Just as for Mandeville, then, for Du Châtelet, there was a mysterious and noble force acting in humans in addition to the material, physical causes of behaviour. However, in order to rise above the physicality of the body, the mind needed certain material conditions, such as the time and money to study. Hence her interest in luxury and the passions as instruments for the pursuit of a rationally governed noble 'self' rather than ends in themselves. Where Mandeville showed luxury to be a spur for self-interested work, (and the concept of 'work' included the labour of the savant and expert),[138] for Du Châtelet it was a precondition for the cultivation of the mind and thus only accessible to those born with enough privilege to enjoy it without physical labour.

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[135] Terrall, 'Du Châtelet'.
[136] Harth, *Cartesian Women*, pp. 237-238.
[137] Châtelet, *Les Lettres de la marquise Du Châtelet*, Letter 122 (30.4.1738). Quoted in Moriarty, 'Sufficient Reason', p. 210.
[138] Cook, *Matters of Exchange*, pp. 408-409.

Both Mandeville and Du Châtelet concurred in their assertion of the importance of the body and its pleasures, which was, perhaps, one of the crucial motivations for the French *philosophe* to begin her translation in the first place. For both, the human body took precedence over God and Christian teachings when it came to explaining and guiding human conduct. However, while the author of the *Fable of the Bees* suggested that humans were fundamentally equal, Du Châtelet insisted − and this is particularly clear in her essay on happiness − that individuals, though they all have bodily desires, differed in their passions as well as in their ability to use their reason to govern them. Of course, we can call Mandeville 'democratic'[139] and it is obvious how Du Châtelet's status as rich aristocrat would lead her to conclude that people of different stations could not be driven by the same motives. At the same time, however, Mandeville's 'democratic' hive does not entail an equal distribution of power; the 'clever politicians', can after all, exploit the self-interests of their subordinates to their own advantage.

Thus, while most of Mandeville's early critics in France attacked him for his refusal to acknowledge the 'universal light of reason', instilled in the human mind by God, Du Châtelet agreed with Mandeville on the importance of the body and its passions, but instead insisted that it should be treated as a vessel for rational self-government. Du Châtelet's oeuvre, then, can be read as a form of resistance to some of Mandeville's ideas about the relationship between the body and the rational faculties, and between individual bodies and the social whole. Though in the debate on luxury she stood firmly on the side of those who endorsed the benefits brought on by the abundance of the 'superfluous' (like Voltaire, in his famous poem 'Le Mondain'), her writings show an uneasiness with a social order based on commerce and a self-interested, competitive human nature. Striving to reconcile physics and metaphysics, her translation of the *Fable* constitutes an attempt to view human beings – or, rather, members of the nobility – as at the same time embodied and as more than a composite of bodies driven by the self-interest. Ultimately, of course, her resistance would turn out to be futile. Her aristocratic ideal of individual and social happiness was, after all, deeply rooted in the feudalistic regime whose fate of which was soon to be sealed. Nevertheless, her struggle to reconcile individual happiness, bodily passions

[139] Jerrold Seigel, *The Idea of the Self: Thought and Experience in Western Europe Since the Seventeenth Century* (Cambridge: Cambridge University Press, 2005), p. 113.

and moral responsibility is a fascinating contribution to the intellectual landscape of Enlightenment France, as well as a reminder of what preceded the spread of free-market political economies based on the notion of whole populations rather than responsible individuals.

6. Conclusion

In Mandeville's *Fable of the Bees,* then, we find a conception of the social whole as a 'natural body' with its own law-like regularities that remained irreducible to the sum of its passionate, self-interested parts. Rather than governing moral subjects, Mandeville's skilful politicians harnessed their animal passions. Mandeville's *Fable,* we might say, provides an early example of a vitalistic body politic, understood almost like an animal body, forms and holds together. As we will see in chapter three, later vitalist authors, particularly after the 1740s, emphasised that bodies held together through spontaneous generation and forces such as attraction or sympathy. Others, like Mandeville, continued to emphasise importance of management of skilful politicians in providing the framework necessary for the harmony of the body politic. These authors, despite their differences, however, agreed that the body of the population took on a 'life of its own': they agreed, that is, that the parts of either animal or political bodies, themselves endowed with desire and passions, would interact and form a new body greater than sum of its part. Like Mandeville, these writers used insect imagery – or observations of living insects – to think through their theories of the social whole; as we will see, relations between animal and political bodies continue to echo one another throughout the century.

Du Châtelet's interpretation, on the other hand, expressed the disagreement of a learned noblewoman not so much with the Anglo-Dutch poet's satire of supposed virtues, but with the Mandevillian suggestion that animal passions cannot be governed by reason and free will. At a time of intense debate around the nature of human nature and its relation to animals, that is, Du Châtelet rejects the suggestion that the human 'self' ('nousmesmes') is dominated by the passions. In the next chapter, we shall see how these debates around animal passions and human reason played out in relation to discussions of insect nature.

Du Châtelet, on the contrary, excluded through her gender from those scientific institutions which increasingly held the authority to define those natural laws,[140] could hardly accept a theory of governmentality based on the physicality of the body that rendered her moral philosophy of the self-fashioned aristocratic woman impossible. Her interpretation of the *Fable* also reflected her place in the shifting French social order, so different from the Dutch and English commercial societies where Mandeville was at home, she refuses this conception of the political body, maintaining instead that society was organised hierarchically, with free, autonomous, self-fashioning individuals standing above the masses. Mandeville's reviewers, many of whom were members of religious orders, had similar, though certainly not identical objections to the scandalous English poem. Their world view depended, after all, on the idea that humans had been endowed with rational souls, which enabled them to consent to God's eternal moral laws, expressed in the feudal hierarchies of their absolutist monarchy. The king's subjects, that is, were not animal bodies, but human beings whose duty was obedience to the laws of the crown and the Church. The subsequent chapters turn to the ways in which this new governmentality of population played out in and was shaped by natural history of animals. Prior to this analysis, then, the French reviews of Mandeville's *Fable*, as well as Emilie Du Châtelet's work, serve, by way of contrast, as a reminder of what the new ideas of governance replaced.

[140] Terrall, 'Gendered Spaces, Gendered Audiences'.

Chapter Two. Animal Rationality and the Problem of Human Nature

1. Introduction

In 1740, the German mathematician Samuel König (1712-1757) caused a stir in the French Republic of letters with the publication in the annals of the Académie des sciences of a mathematical analysis of the shape of the hive's cells.[141] Having measured a sample of beeswax he had received from Réaumur, König could show that bees acted as perfect geometers when constructing their homes. Bees had found the solution to a problem which mathematicians had struggled to solve for centuries: with a limited amount of wax, they succeeded in building the biggest possible cells occupying the smallest possible amount of space in the hive and leaving the fewest empty spaces. The result was perfectly hexagonal cells arranged in double rows and varying in size according to their function. König struggled to provide a mathematical explanation for the bees' complex constructions, but eventually succeeded in calculating (wrongly, as it turned out a few years later) the cells' angles. As this chapter demonstrates, König's concern with providing precise measurements for the geometry of bee architecture, though seemingly a mathematical game, played into crucial Enlightenment debates about human nature, or more specifically the nature of the rational individual.[142] Geometrical truths, for König and Réaumur, reflected the precise, rational and harmonious order of the divinely constructed natural world. The bees' capacity to construct their cells in such a way as to make the most efficient use of their materials was seen as an example of the wider rational ordering of the natural world. The mindset of the human geometers able to mathematically demonstrate the insects' rationality – the 'esprit géométrique' – was, similarly, thought to embody nature's order and thus considered applicable to all areas of investigation.[143] Jean le Rond d'Alembert (1717-1783), mathematician and editor of the *Encyclopédie,* described the geometrical spirit as 'l'esprit de méthode & de justesse'; Bernard Bovier Le Fontenelle

[141] Samuel König, 'Solution du problème des cellules hexagones des ruches des abeilles', *Mémoires de l'Académie des Sciences de Paris*, 1739, 30–35.

[142] Lorraine Daston has discussed how the development of classical probability relied on the idea that mathematics should describe the conduct of 'rational men' under conditions of uncertainty: Daston, *Classical Probability in the Enlightenment*, ch. two, 'Expectation and the Reasonable Man,' pp. 49-110.

[143] As Isabel Knight describe the spirit of geometry, it was used as 'a kind of ritual invocation of a whole cluster of virtues associated with science of all kinds, including the antimathematical science of the empirical tradition.' Isabel F Knight, *The Geometric Spirit: The Abbé de Condillac and the French Enlightenment* (New Haven: Yale University Press, 1968), pp. 18–19.

(1657-1757), the influential member of three of the Parisian Academies, optimistically declared that the geometrical spirit, or '[l]'ordre, la netteté, la précision, l'exactitude' was spreading in all fields of knowledge.[144]

Indeed, the bees' mathematical skills had a long philosophical history of being used as evidence for teleology in nature and for arguments, put forward by Thomas of Aquinas and his followers, which understood animal cognition as the result of divine purpose.[145] The eighteenth-century debate about the bee cell has mostly been read as an attack on his theological motivation; as we will see, there was more still at stake.[146] Several of the most prominent French naturalists and philosophers in the period between the 1730s and 1760s reignited this age-old debate on the mathematics of the bee cell. In the process, they questioned the role of divine order in nature and proposed their own models of the mental and physical faculties of living beings (animal or human) and their differences from automata.[147] Réaumur, who had started his career at the Academy of Sciences as *élève géomètre*, discussed the geometry of the hive's cell at length in his memoir on bees (1740). Réaumur argued that the bees' geometrical skills pointed to the order God had instituted in nature; the bees knew how to construct their cells because He had implanted this order in their souls. Discovering God's order was, for Réaumur, the task of both the mathematician and the naturalist. The two professions, he argued, shared the same 'esprit d'observation', capable of 'appercevoir ce qui a échappé aux autres'.[148] Both mathematics and natural history were, for Réaumur, concerned with perceiving orderly relations between things. Thirteen years later, his fellow academician and rival naturalist Georges-Louis Leclerc, comte de Buffon (1707-1788), launched an attack on Réaumur in his controversial *Discours sur la nature des animaux* (1753). Buffon, though himself a translator of Newtonian mathematics and a proponent of probability theory, asserted that mathematicians, as

[144] Bernard Le Bovier de Fontenelle, *Œuvres de Fontenelle* (Paris: Salmon, 1829), p. 54.
[145] Bernd Roling, 'Die Geometrie der Bienenwabe: Albertus Magnus, Karl von Baer und die Debatte über das Vorstellungsvermögen und die Seele der Insekten zwischen Mittelalter und Neuzeit', *Recherches de théologie et philosophie médiévales*, 80.2 (2013), 363–466.
[146] The classic reference remains Jacques Roger, *The Life Sciences in Eighteenth-Century French Thought*, ed. by Keith Rodney Benson, trans. by Robert Ellrich (Stanford: Stanford University Press, 1997), p. 454. For my take on the question of Providence, I refer the reader to section 4 of the Introduction.
[147] On eighteenth-century automata, see Voskuhl; Simon Schaffer, 'Enlightened Automata', in *The Sciences in Enlightened Europe*, ed. by William Clark, Jan Golinski, and Simon Schaffer (Chicago: University Of Chicago Press, 1999), pp. 126–65.
[148] René Antoine Ferchault de Réaumur, *Mémoire pour servir à l'histoire des insectes: Sur les chenilles & sur les papillons* (Paris: Imprimerie royale, 1734), I, pp. 60–61.

they distanced themselves from their sense perceptions through use of abstractions, could not grasp the reality of living beings. For Buffon, bees were automata, but sensing automata; if they were capable of solving problems for human geometers, they did so thanks to their sensitivity to one another's movements. Buffon was, in turn, attacked by the abbé de Condillac (1714-1780), the foremost thinker of sensationalism in France, agreed with Buffon on the importance of the senses for rational behaviour, but vehemently disagreed with what he thought was a contradiction in Buffon's thought, namely his Cartesianist claim that humans had a rational soul in addition to their sensory experiences.[149]

The answer to the question of the hive's perfect geometry thus depended on one's understanding of human rational conduct, and its connection to the mental different faculties – reason, the passions, the imagination – in determining the behaviour of living beings. The debate on bee cells, in other words, a debate not only about God's role in the government of nature, was also a debate of the (self)government of the animal and human body. The question of whether bees where rational geometers or sensible automata was not, as this chapter suggests, an abstract discussion of animal cognition. The discovery of geometrical skills in animals was also an argument for the rationality of humans. Furthermore, the question of whether man's (unquestioned) superiority over animals was grounded in a stronger 'esprit géométrique' or, on the contrary, in a more acute sensibility, served as the basis for theories of how to organise human social life. Condillac, in his writings on government, and François Quesnay in his writings on the 'animal oeconomy' of the body as well as on political economy, thus interrogated the connection between the rational order of nature, the rationality of animals or humans, and the most rational order for human society.

The following sections discuss the unfolding of these debates in natural historical, philosophical and political economic writings, arguing that discussions of rationality, and the 'esprit géométrique', served as a bridge that linked natural historical ideas of animals, moral philosophies such as Condillac's, and writings on government. The chapter is divided into three sections. Section two gives an overview of the debates around the animal soul, which provide the background to the debate on

[149] Étienne Bonnot de Condillac, *Traité des animaux: où, après avoir fait des observations critiques sur le sentiment de Descartes & sur celui de M. de Buffon, on entreprend d'expliquer leurs principales facultés* (Amsterdam; Paris: Jombert, 1755); Goldstein, *The Post-Revolutionary Self*, pp. 114–15.

the bee cell, which, in turn, is discussed in detail in section three. The final section shows how the same debate on geometry, rationality and sensibility pervaded also writings on political economy.

2. The Self and the Question of the Animal Soul

As we will see in this chapter, discussions about, and observations of, animals revolved around the question of what it means to be an individual mind or body, whether animal or human. Insects, and social insects in particular, provide a pertinent window onto the question of personhood, because they allowed eighteenth-century thinkers to observe and debate the role of the individual in large collectives. In eighteenth-century France, there was no one term for the self; writers variously referred to 'âme', 'personne', 'soi', and 'moi', though the latter two continued to be used mainly as pronouns.[150] Given that each of these terms referred to slightly different understandings of personhood, I will try to use the term favoured by each of the writers discussed.

As discussed in the introductory chapter, the question of the emergence of the modern view of personhood is, of course, not new. An earlier narrative of the emergence of the modern 'self', an independent and rational actor who could thus enter into exchange with similarly atomistic individuals,[151] has been shown, in the wake of poststructuralist theory and cultural history, to have been more complex and uneven.[152] Close to the purpose of this chapter, Jan Goldstein has shown that, modernity has produced not only theories of self-possessive individuals (what she calls 'unitary' or 'holistic' selves) but also of individual 'mental stuff' as

[150] On terminology, see Charly Coleman, *The Virtues of Abandon: An Anti-Individualist History of the French Enlightenment* (Stanford: Stanford University Press, 2014), pp. 14–15; Goldstein, *The Post-Revolutionary Self*, pp. 115–18.

[151] Charles Taylor, *Sources of the Self: The Making of the Modern Identity* (Cambridge MA: Harvard University Press, 1989); Louis Dumont, *From Mandeville to Marx: The Genesis and Triumph of Economic Ideology* (Chicago: University of Chicago Press, 1977); Crawford Brough Macpherson, *The Political Theory of Possessive Individualism: Hobbes to Locke* (Oxford: Clarendon, 1962).

[152] As Roy Porter puts it, historians have set out to 'rethink our received grand saga of the self' *Rewriting the Self: Histories from the Renaissance to the Present*, ed. by Roy Porter (London: Routledge, 1997), p. 8. To this purpose, the contributors to the volume address a wide range of contexts (from medieval to postmodern) and issues (such as the importance of theatre or of gendered histories). In a recent revision of the French case, Charly Coleman has analysed currents of thought and practice in eighteenth-century France that relied on or shaped what he calls a 'dispossessive self': Quietists, but also thinkers such as Diderot, Rousseau or Robespierre among others, 'valorised the human person's loss of ownership over itself and external objects.' Coleman, *Virtues of Abandon*, p. 4.

discontinuous and fragmentary.[153] While philosophers such as Taylor argued that there was one continuous story of the Western self stretching from Greek antiquity all the way to the twentieth century, Goldstein has demonstrated that in the eighteenth and nineteenth centuries, the unitary self was contested by sensationist thinkers such as Condillac.[154] Condillac, following John Locke's theory of cognition, argued that all knowledge originates in the senses, rather than in innate ideas. As we shall see, this raised questions as to the differences between humans and animals, given that the latter, just like the former, were evidently capable of sensations. This chapter takes its cue from a remark Goldstein makes in her discussion of Condillac. She argues that the philosopher was never very interested in the question of how distinct sense impressions could form into a coherent, unitary and stable 'moi'. She thus finds it 'comic' that his only affirmation of such a self would occur in his discussion of animals, rather than in his more well-regarded treatises on cognition, and argues that even there, Condillac only asserts a unitary self because he considered himself 'compelled to rebut' Buffon's dualism.[155] As this chapter sets out to show, however, debates on animal cognition, and its similarity to or difference from human cognition, were an important locus for wider debates on what it means to be human, and in particular a rational man. This chapter, then, approaches the question of the self from a new angle by looking not at those writings singled out by historians as most significant in bringing about the shift to the modern self (a lineage of mostly philosophical texts), but by approaching the question sideways, so to speak. When eighteenth-century naturalists observed insects and other animals, they did so on the back of over a century of debates between major thinkers of most European countries on the question of whether or not animals possessed a (rational) soul, and, related to this idea, whether or not they could be considered anything more than machines. The question of the soul was important also because it raised the related issue of rationality: if the soul was the source of rational thought and conduct, why did animals exhibit seemingly rational behaviour?

The consensus before the 1750s, as Cohen Rosenfield has shown, was that animals had some form of soul capable of feeling and some (inferior) degree of

[153] Goldstein, *The Post-Revolutionary Self*.
[154] For Goldstein's take on Taylor, see *The Post-Revolutionary Self*, pp. 16-17.
[155] Goldstein, *The Post-Revolutionary Self*, pp. 114–15.

reason.[156] Positions such as those held by Julien Offray de la Mettrie (1709-1751) were considered a threat to the social order by many of his contemporaries.[157] La Mettrie, in his *L'Homme machine* (1748), had reached the conclusion that the human abilities Descartes had explained through the rational soul were themselves a consequence of the disposition of the material human body; he thus brought to its extreme, materialistic conclusion a century of arguments about the animal as machine.[158] On the contrary, the much more orthodox members of the Academy of Sciences, intent on fortifying their authority as savants contributing to the state's prosperity, strove to put God at the centre of the world they observed and explained, and thus used observations of animals to prove the existence of a feeling and thinking animal soul.[159] Most academicians were what Lorraine Daston calls 'philosophical moderates'. [160] They believed, that is, that though absolutely certain knowledge is impossible to obtain, the world had been divinely arranged according to a rational order, which careful observations and the avoidance of metaphysical speculation on final causes could come reasonably close to describing. Academicians' defence of the existence of the animal soul was part of the wider project of describing the natural world as the realisation of a divine plan.

In one of the most famous and extensive research projects on animals undertaken by the Academy, for instance, the court anatomist Claude Perrault (1613-1688) adopted a mechanist view of the body, but also attributed a self-moving soul to animals.[161] Echoing some of the ideas of one of the earliest opponents of the beast-machine theory, the physician and founding member of the Academy Marin Cureau de la Chambre (1594-1669), Perrault argued in the fourth volume of his *Essais de Physique* (1688) that animals had a soul because they were masters over their own bodies:

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[156] Cohen Rosenfield, *Beast-Machine*, pp. 183-186.
[157] Aram Vartanian, 'Trembley's Polyp, La Mettrie, and Eighteenth-Century French Materialism', *Journal of the History of Ideas*, 11.3 (1950), 259–86.
[158] See Cohen Rosenfield, *Beast-Machine*, particularly Part 2, chapter 2.
[159] Emma Spary, 'Political, Natural and Bodily Economies', pp. 181–83. In addition to the figures of Réaumur and Perrault, cited in this chapter, one might also cite the influential Bernard le Bovier de Fontenelle, who argued that animals, just like men, acted through reason aided by experience. See Bernard le Bovier de Fontenelle, 'Sur l'instinct', in *Œuvres de M. de Fontenelle* (Amsterdam: F. Changuion, 1764), IX, 231–37. See also Cohen Rosenfield, *Beast-Machine*, pp. 125-127.
[160] Daston, *Classical Probability*, p. 58.
[161] On Perrault, who happened to be the brother of Charles Perrault, who populated his famous fairy tales with speaking and thinking animals, see Guerrini, *Courtiers' Anatomists*.

> il est vray que si l'on connoissoit un animal comme on connoît une horloge, on le connoîtroit parfaitement ; parce que la connoissance de l'un & de l'autre ne consiste qu'à sçavoir qu'elles sont leurs manieres d'agir : or comme elles semblent fort differentes, une machine agissant necessairement, & toûjours suivant un certain ordre qui dépend de ses dispositions, & y ayant apparence qu'un animal se sert de ces dispositions de manière qu'il en est le maître ; on ne peut pas dire que l'on soit aussi assuré de sçavoir comment les organes d'un animal agissent, comme il est certain que l'on connoît comment un contrepoids ou un ressort font aller une horloge ; & l'on ne sçait point ce qui est cause qu'un chien qui a perdu son maître ne mange point, comme on est assûré que ce n'est pas le chagrin qui empêche une horloge d'aller.[162]

Perrault, also on the basis of his authority as anatomist, subverted the Cartesian analogy of the beast with the machine by arguing that animals appeared to exhibit both feelings (the dog's sadness) and will (animals are 'masters' of their mechanically functioning bodies). Perrault insisted on the existence of an inorganic soul governing mechanically functioning human as well as animal bodies. With a sense of epistemological modesty later echoed by Réaumur, however, he also affirmed that the ultimate causes of living beings could not be known; the task of the anatomist was to observe what could be seen and if he did hypothesise about the causes of bodily forms and functions, to do so without assuming that humans could ever attain complete knowledge. Perrault's most famous work, an account of the dissected animals of Louis XIV's menagerie titled *Mémoires pour servir à l'histoire naturelle des animaux* (1676) was republished in three volumes in 1733 and 1734, the very year that Réaumur's own memoirs began to appear.[163] While there were crucial differences between the works of the two academicians – most importantly the shift from exotic, spectacular and individualised animals in Perrault to Réaumur's insects – they agreed on the probable existence of the animal soul. Réaumur, careful not to assign causes when these were unobservable, refused to decide on what exactly drove insects to behave in certain

[162] Claude Perrault, *Essais de physique, ou Recueil de plusieurs traités touchant les choses naturelles* (Paris: Jean Baptiste Coignard, 1688), IV, pp. 21–22.

[163] On the publication history of Perrault's memoirs, see Anita Guerrini, 'Perrault, Buffon and the Natural History of Animals', *Notes and Records of the Royal Society*, 66.4 (2012), 393–409. She argues for the similarities between Perrault's and Buffon's works, though on the question of the animal oeconomy and the animal soul, the two men's views differed markedly, as I show below.

ways, let alone on whether they possessed a 'soul';[164] his *Mémoires* are thus peppered with questions like the following: 'Mais pouvons-nous nous promettre de découvrir les differentes fins que [la nature] s'est proposées dans la construction de chacun de ses ouvrages, & dans l'arrangement de chacune de leurs parties.'[165] Like Perrault, the naturalist thus circumvented the theologically problematic question of the animal soul by arguing that the naturalist's task was to make visible what could be observed rather than speculate on immaterial causes.[166]

3. The Geometry of the Bee Cell: Rationality and the Problem of the Human-Animal Distinction

Réaumur's approach to the question of animal nature and animal rationality is exemplified in his discussion of the way in which bees construct their geometrically almost perfect cells. Relating the discussion among mathematicians such as König, the naturalist admits that in order to understand the bees' construction, one needs to be proficient in the newest geometrical theories: 'Il faut même être aussi habile en géométrie qu'on l'est devenu depuis que les Nouvelles méthodes ont été découvertes pour connaître la perfection des regles que les abeilles suivent dans leur travail.'[167] Studying the hive was, for Réaumur, a way of furthering mathematical knowledge, given that God had transmitted His knowledge to the bees which in turn could serve as models for 'nos Archimedes modernes'.[168] It was, however, not only the bees' perfect geometrical skills that the naturalist was interested in (indeed he referred interested readers to König's memoir for the geometrical demonstration itself). In his explanation of the construction of the bee hive in the fifth volume of his insect memoirs, Réaumur emphasised that bees, like human geometers, could err when constructing their homes and then struggled to correct their mistakes:

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[164] Abramovici even goes so far as to find materialist tendencies in Réaumur. He argues that Réaumur's insect history was ultimately too close to a 'rococo' aesthetic to have any deeper influence on Enlightenment science, though this is to disregard both the role personal rivalries that might have led subsequent writers to dismiss him and the echoes of his practices as well as his vision nature that we find in later works of natural history. Jean-Christophe Abramovici, 'Du "merveilleux vrai" des "petits animaux": Réaumur, entre rococo et lumières', *Dix-huitième siècle*, 42 (2010), 305–20.
[165] Réaumur, *Mémoires* I, p. 23.
[166] Harold Cook makes a similar argument with regards to Herman Boerhaave's medical practice; see Harold John Cook, 'Boerhaave and the Flight from Reason in Medicine', *Bulletin of the History of Medicine*, 74.2 (2000), 221–40.
[167] René Antoine Ferchault de Réaumur, *Mémoires pour servir a l'histoire des insectes* (Paris: de l'imprimerie royale, 1740), V, p. 388.
[168] Réaumur, *Mémoires* V, p. 389.

> elles peuvent manquer de donner au premier rhombe la grandeur & les angles qui lui conviennent; mais aussi elles sçavent remédier à leurs méprises. Elles ajustent alors plus de piéces les unes contre les autres, afin que la pyramide prenne une figure qui s'éloigne le moins qu'il est possible de celle qu'elle aurait dû avoir.[169]

Though Réaumur admired the bees' geometrical perfection, it was the insects' capacity to fail that he was most interested in. In his descriptions of the errors committed by bees and of their strategies for remedying them, Réaumur was describing not only the hard-working animals of traditional folklore, but also animals capable of more than simply executing a mechanical programme. As the active voice ('elles ajustent') underlines, the naturalist considered that the bees were more than mere automata driven by mechanical impulsion. Indeed, in several passages on bees, Réaumur explicitly labelled the insects' principal mode of action 'intelligence'. The insects' capacity to choose the most suitable pyramidical shape, for Réaumur, proved that the choice was based on intelligence, not mechanical necessity or randomness. Ultimately, of course, the bees' individuel intelligence was limited for the naturalist, but it pointed to the existence of 'une intelligence, qui voit l'immensité de tous genres, & toutes leurs combinaisons, plus lumineusement & plus distinctement que l'unité ne peut être vû par nos Archimédes modernes.'[170] Though Réaumur saw the geometry of the hive as proof for nature's divinely planned order, he also complicated the strict distinction between human rationality and animal instinctiveness. While he did not explicitly argue for the existence of reasoning processes in insects, Réaumur described how each individual bee acted in the most rational way possible so as not waste the resources of the bee hive as a whole and to contribute to the 'perfection & oeconomie' of its hive's architecture.[171]

Whether or not Réaumur had read Mandeville's *Fable of the Bees,* his natural historical research seemed to contradict the *Fable'*s central claim that it was possible to contribute to the good of the whole without intending to do so.[172] It was not self-

[169] Réaumur, *Mémoires* V, pp. 392–93.
[170] Réaumur, *Mémoires* V, p. 389.
[171] Réaumur, *Mémoires* V, p. 391.
[172] Sheehan and Wahrman, *Invisble Hands*.

interest that drove Réaumur's bees, but the reproduction of their hive; as Réaumur put it, 'l'unique fonction' of insects was to 'travailler à la multiplication de leur espece'.[173] Moreover, rather than indulge in luxury, they worked to produce as much as possible for their commonwealth (and for their human beekeepers). Written at the height of the early-eighteenth-century debates about the moral dangers or advantages of luxury, Réaumur's treatise on bees thus seemed to show that nature's creatures were made to work for the fulfilment of God's order, not to consume excessively for their own benefit. As historians have outlined, the luxury debate revolved around anxieties about the usurpation of the traditional signs of the high nobility's social distinction by the nouveaux-riches, whether lowly nobles or rich non-nobles.[174] In protest against what they considered excessive, members of the high nobility began to champion a return to the supposed frugality and simple aesthetic values of the ancients.[175] Réaumur's description of the bees as hard-working oeconomists fitted neither the high-aristocrats' rejection of luxury (at least for the lower classes) nor Mandeville's praise of luxury as an engine of civilisation; instead, Réaumur's insects anticipate the civic-minded defence of 'patriotic' luxury of the 1760s, endorsed also by the physiocrats. As John Shovlin has argued, 'middling elites', including provincial nobles and rich, rural non-noble landowners repackaged certain kinds of luxury as contributions to the common good by spurring agricultural production.[176] Such a vision also reflects Réaumur's own social situation. His grandfather had been a 'receveur de douanes', and thus one of the rich seventeenth-century bourgeois who had been able to buy a noble title.[177] A life-long bachelor, Réaumur renounced his responsibilities as noble *pater familias* in favour of his career at the Académie des Sciences.[178] As an academician, he considered it his task to improve the monarchy's 'oeconomy' and, like his bees, to make each of

[173] Réaumur, *Mémoires* V, p. 25.
[174] Hont, 'The Early Enlightenment Debate on Commerce and Luxury'; Maxine Berg and Elizabeth Eger, 'The Rise and Fall of the Luxury Debates', in *Luxury In The Eighteenth Century: Debates, Desires and Delectable Goods*, ed. by Maxine Berg and Elizabeth Eger (Basingstoke: Palgrave Macmillan, 2002), pp. 7–27; Katie Scott, *The Rococo Interior: Decoration and Social Spaces in Early Eighteenth-Century Paris* (New Haven: Yale University Press, 1995), pp. 230–38.
[175] Berg and Elizabeth Eger, 'Rise and Fall', pp. 20–21.
[176] John Shovlin, *The Political Economy of Virtue: Luxury, Patriotism, and the Origins of the French Revolution* (Ithaca.: Cornell University Press, 2007). On different taxonomies of luxury, see Kwass. On how naturalists merged the beautiful with the useful, see Daston, 'Attention and the Values of Nature in the Enlightenment'.
[177] Jean Torlais, *Réaumur: Un esprit encyclopédique en dehors de 'L'Encyclopédie'* (Paris: Blanchard, 1961), p. 17.
[178] Terrall, *Catching Nature*, pp. 17; 77.

its parts as efficient as possible.[179] In his observations on anchor construction, Réaumur argued that the application of geometry would significantly improve the quality and quantity of anchors produced. He admitted that geometrical perfection was impossible to obtain, though 'il est toujours avantageux de connaître le but auquel on doit tendre.'[180] Geometry, and the description of the methods obtained thanks to observational and mathematical skills, are thereby considered much more important in the construction process than the workers constructing the anchors (they are hardly mentioned at all in the memoir).[181] The purpose of the project on the arts of which the memoir on anchors formed part was thus to obtain descriptions of the most rational methods of production possible, so that workers anywhere could carry them out. Descriptions of the labour of bees and the labour of human workers in Réaumur's oeuvre thereby echo one another: geometers outline rational instructions, to be executed by labourers capable of following rational plans but not of using their imagination to deviate from them. In contrast to the unenlightened human labourers Réaumur tried to reform followed only a 'routine aveugle', Réaumur praised the bees' capacity to adapt their plans to changed circumstances.[182] Réaumur's attribution of a soul to bees, then, did not make them less docile creatures; on the contrary, it meant that they were capable of amending their errors and thus of labouring more efficiently for the improvement of their hive than (human-built) automata could do.

By contrast, Buffon, Réaumur's opponent in the Academy, emphasised the power of humans to govern themselves and their societies through the wilful creation of their own laws and to creatively transform, rather than merely manage, the natural world.[183] Man, for Buffon, had two 'natures', one material – just like all other animals

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[179] See the quotation below from René Antoine Ferchault de Réaumur, 'Réflexions sur l'utilité dont l'Académie des sciences pourroit être au Royaume si le Royaume luy donnoit les secours dont elle a besoin (dated 1716-1727)'.

[180] René Antoine Ferchault de Réaumur and Duhamel Du Monceau, *Fabrique des ancres, lue à l'Académie en juillet 1723. Avec des notes et des additions de M. Duhamel* (Paris: Saillant et Nyon, 1761), p. 5.

[181] For similar arguments, focusing mainly on descriptions of the mechanical arts in the *Encyclopédie*, see Jean Ehrard, 'La main du travailleur, la plume du philosophe', *Milieux*, 19/20 (1984), 47–53; William H. Sewell Jr., 'Visions of Labor: Illustrations of the Mechanical Arts before, in, and after Diderot's *Encyclopédie'*, in *Work in France: Representations, Meaning, Organization, and Practice*, ed. by Steven L. Kaplan and Cynthia J. Koepp (Ithaca: Cornell University Press, 1986), pp. 258–86; Schaffer, 'Enlightened Automata','Enlightened Autonoma'.

[182] See Jean-Paul Courtheoux, 'Observations et idées économiques de Réaumur', *Revue d'histoire économique et sociale*, 35 (1957), 347–69.

[183] Thierry Hoquet, *Buffon: histoire naturelle et philosophie* (Paris : Champion, 2005), pp. 514–15. In accordance with his view of the importance of the human imagination, but against the rules of the eighteenth-century Republic of Letters, he aroused the ire of his colleagues at the Académie des sciences – and of Réaumur in particular – when he decided to ignore the Académie's instructions in the

– and one spiritual.[184] Both natures had the power to feel sensations and passions, but only the latter had the capacity to develop rational thought, memory and, crucially, spiritual imagination. Although animals (and man's animal nature) could recall past sensations, only human memory was capable of comparing past, present and possibly future sensations. Similarly, Buffon argued that animals and humans shared a corporeal imagination, which represented images of objects to the inner sense and provoked unreflective, even violent and dangerous reactions.[185] This imagination was responsible for turning past and present sensations into passions, which were very difficult for the rational faculty to control and could even lead to the downfall of man;[186] in the case of unenlightened workers, for example, their 'présomption' and 'vanité' made them blind to the advantages of enlightened methods of production.[187] It was this kind of imagination that, as Goldstein has shown, was considered by eighteenth-century philosophers to be the most vulnerable and dangerous of the human mental faculties.[188] The spiritual imagination, on the other hand, was the faculty that gave man the power to compare ideas and images, or, as Buffon put it, 'de saisir

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preparation of his masterpiece, the *Histoire naturelle* (the first volume appeared in 1749). Hoquet, *Buffon*, pp. 60-63; Roger, *Buffon*, pp. 190-193. On the relationship between facts and the imagination in the Enlightenment arts and sciences, see Daston, 'Fear and Loathing'; Burkhardt, *Spirit of System*, pp. 39-42.

[184] Buffon called this the 'homo duplex'; see Robert Wokler, 'From l'homme Physique to l'homme Moral and Back: Towards a History of Enlightenment Anthropology', *History of the Human Sciences*, 6.1 (1993), 121–38.

[185] Buffon, 'Discours sur la nature des animaux', p. 69. In positing two imaginations, Buffon was following the Cartesian philosopher Malebranche, who had similarly claimed that man had one animal and corporeal, and one spiritual imagination subject to the will; see Nicolas de Malebranche, *De la recherche de la vérité. Ou l'on traitte de la nature de l'esprit de l'homme, & de l'usage qu'il en doit faire pour éviter l'erreur dans les sciences* (Paris: André Pralard, 1674), I. Goldstein, *Post-Revolutionary Self*, p. 36. He was not alone in the eighteenth century to posit two imaginations; Voltaire, for instance, in his article for the *Encyclopédie* on the topic distinguished between an active and a passive imagination: "Imagination," in Jean d'Alembert and Denis Diderot, eds., *Encyclopédie, ou dictionnaire raisonné de sciences, des arts et des métiers*, vol. 8 (Paris/Neuchâtel)

[186] Buffon, 'Discours sur la nature des animaux', pp. 77-83. This negative assessment of the passions contrasts with that of other eighteenth-century authors, notably some, though not all, of Diderot's works; see Vila, *Enlightenment and Pathology*, pp. 155–62; but also Denis Diderot, 'Passions', ed. by Denis Diderot and Jean le Rond d'Alembert, *Encyclopédie, Ou Dictionnaire Raisonné Des Sciences, Des Arts et Des Métiers* (Paris: Briasson, 1765), 142–46.

[187] D. M. De La Peirouse, *Traité sur les mines de fer et les forges du Comté de* Foix (Toulouse: 1786), pp. 146-148; quoted in Courtheoux, 'Idées économiques de Réaumur,' p. 355.

[188] Goldstein, *Post-Revolutionary Self*, ch. 1 "The Perils of Imagination at the End of the Old Regime." The dangers of the imagination are also rendered explicit in discussions on the supposed 'convulsionnaires' of Saint-Médard and, later in the century, on Mesmerism; see Riskin, *Sensibility*, pp. 209–25; Jan Goldstein, 'Enthusiasm or Imagination? Eighteenth-Century Smear Words in Comparative National Context', *Huntington Library Quarterly*, 60.1/2 (1997), 29–49; Lorraine Daston, 'Fear and Loathing of the Imagination in Science', *Daedalus*, 127.1 (1998), 73–95 (pp. 79–80); Richard W. Burkhardt, *The Spirit of System: Lamarck and Evolutionary Biology* (Cambridge MA: Harvard University Press, 1977), pp. 67–69.

vivement les circonstances et de voir nettement les rapports éloignés des objets que nous considérons'.[189] The spiritual imagination granted man the liberty to not only discover the predetermined rational course of action but also to create 'des productions nouvelles'.[190] The spiritual imagination distinguished not only man from animal, but also geometers, behaving as if they were automata, from true philosophers.[191] Though Buffon himself had begun his career as a mathematician, in his work on natural history he insisted that the living world could never be understood through the tools of mathematics. In his programmatic discourse on method in natural history, Buffon argued that mathematical truths were a consequence of arbitrary and abstract definitions, and could thus reveal only what mathematicians had themselves presupposed: 'comme les définitions sont les seuls principes sur lesquels tout est établi, & qu'elles sont arbitraires & relatives, toutes les conséquences qu'on en peut tirer sont également arbitraires & relatives'.[192] This was true also for man's capacity for knowledge. Since all knowledge came from the senses, and the senses were themselves effects rather than causes, the most man could only ever know were 'general effects' that explained other effects.[193] Contrary to what geometers wanted to believe, Buffon argued, man could never grasp certainties, only probabilities and 'vraisemblances'. Unlike orthodox Christian thinkers such as Réaumur, Buffon did not put faith in God's creative powers to order the world according to a preordained plan; while both naturalists thus warned against the attempt to speculate about final causes, Buffon went further in asserting that such an order might not exist. Nature's causes were so varied and even disorderly that analogies were the closest man could get to physical truths.[194] Mathematics was of little use in this enterprise, at least

[189] Buffon, 'Discours sur la nature des animaux', p. 69.
[190] Buffon, 'Discours sur la nature des animaux', p. 68.
[191] Diderot makes a similar point in his critique of the geometer, whom he characterises as a 'machine pure, simple, et passive de différents motifs qui l'ont mû, loin d'avoir été libre, il n'a pas même produit un seul acte exprès de sa volonté: il a pensé, il a senti, mais il n'a pas agi plus librement qu'un corps inerte, qu'un automate de bois, qui aurait exécuté les mêmes choses que lui.' The geometer, for Diderot, cannot be a truly free human being because he ignores his desires. See 'Éléments de Physiologie,' in Denis Diderot, *Œuvres Complètes: Le Rêve de d'Alembert (Idées IV)*, ed. by Jean Varloot, Dieckmann-Varloot (Paris: Hermann, 1987), XVII, pp. 485–86. Charles Wolfe argues that Diderot's (and Buffon's) 'anti-mathematical' attitude 'favors an ontology of Life'; see Wolfe, 'Vital Anti-Mathematicism and the Ontology of the Emerging Life Sciences'.
[192] 'De la manière d'étudier & de traiter l'Histoire Naturelle,' in Georges-Louis Leclerc Buffon, *Histoire naturelle générale et particulière : avec la description du cabinet du Roy* (Paris: Imprimerie royale, 1749), I, p. 54.
[193] On Buffon's epistemology, see Roger, *Buffon*, pp. 81-93.
[194] This also applied to the animal oeconomy: 'Je ne prétends donc pas assurer comme une vérité démontrée, que le mouvement progressif et les autres mouvemens extérieurs de l'animal aient pour cause, et pour cause unique, l'impression des objets sur les sens : je le dis seulement comme une chose

initially, given that it could only account for simple, abstract entities, and not the complexities and particularities of living bodies. Buffon was not absolutely opposed to mathematics, but he insisted that it only yielded useful truths when combined with observation, understood as a product of the imagination:

> lorsque vous avez imaginé par la Physique le comment, c'est-à-dire lorsque vous avez vû qu'un tel effet pourroit bien dépendre de telle cause, vous appliquez ensuite le calcul pour vous assurer du combien de cet effet combiné avec sa cause, & si vous trouvez que le résultat s'accorde avec les observations, la probabilité que vous avez deviné juste, augmente si fort qu'elle devient une certitude.[195]

While bees, understood as automatic geometers, were capable of constructing abstract geometrical shapes, only men, using their spiritual imagination for observing natural particulars (note the conflation between 'imaginer' and 'voir'), could be said to reach knowledge of living bodies.[196]

In the polemical *Discours sur la nature des animaux,* included in the *Histoire*'s fourth volume, Buffon spent several pages discussing bees in order to refute the model of animal behaviour – and, implicitly, of human nature – put forward by Réaumur. He used the insects as his main example of an 'animal en troupe' to compare and contrast with 'l'homme en société'.[197] The example of the bee cell served Buffon as an illustration of his claim that animals, even 'social' animals, could never teach man lessons about what he called 'l'art de bien gouverner'.[198] He thus argued for the superiority of human over all other animals, and implicitly accused Réaumur of ignoring the difference between humans, masters of their own fate, and mechanical

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vrai-semblable, et qui me paroît fondée sur de bonnes analogies ; car je vois que dans la Nature tous les êtres organisés qui sont dénués de sens, sont aussi privés du mouvement progressif, et que tous ceux qui en sont pourvûs ont tous aussi cette qualité active de mouvoir leurs membres et de changer de lieu. Je vois de plus qu'il arrive souvent que cette action des objets sur les sens met à l'instant l'animal en mouvement, sans même que la volonté paroisse y avoir part, et qu'il arrive toûjours, lorsque c'est la volonté qui détermine le mouvement, qu'elle a été elle-même excitée par la sensation qui résulte de l'impression actuelle des objets sur les sens, ou de la réminiscence d'une impression antérieure.' Buffon, 'Discours sur les animaux', pp. 17-18.

[195] Buffon, *Histoire naturelle* vol. 1, p. 58.

[196] Buffon does not deny that mathematics could be fruitfully applied to objsects such as the planetary system, which for him more readily lend themselves to abstraction than the bodies studied by natural historians; see Buffon, 'De la manière d'étudier,' pp. 58-62.

[197] Buffon, *Histoire naturelle,* vol. IV, p. 90.

[198] Buffon, *Histoire naturelle,* vol. IV, p. 91.

animals, devoid even of instincts. Man was part of nature for Buffon, which made it possible to include him in a work of natural history. Despite this, however, the naturalist insisted throughout the volumes of his masterpiece that humans were absolutely different from animals because they possessed a second, spiritual nature in addition to their material bodies. In his *Discours sur l'homme*, the author had given two key pieces of evidence for the existence of a soul in man, but not in animals. The first, following a long line of Cartesian thinkers, was the lack of language in other animals.[199] The second and main argument against the animal soul was the fact that man had domesticated animals; human superiority was thus grounded in the capacity to govern and control other beings:

> On conviendra que le plus stupide des hommes suffit pour conduire le plus spirituel des animaux, il le commande et le fait servir à ses usages, et c'est moins par force et par adresse que par supériorité de nature, et parce qu'il a un projet raisonné, un ordre d'actions et une suite de moyens par lesquels il contraint l'animal à lui obéir, car nous ne voyons pas que les animaux qui sont plus forts et plus adroits, commandent aux autres et les fassent servir à leur usage;[200]

Buffon argued, in other words, that humans were superior to animals because they were capable of governing others, not through violence, but through the pursuit of a 'projet raisonné'. Where Réaumur had seen insects as evidence for God's 'projet raisonné', that is, Buffon considered man's subjugation of animals as proof of the human capacity to realise their own creative projects. Buffon, instead, took the fact that bees' architectural skills could be used to illustrate complex geometrical problems pointed as evidence for the insects' mechanical nature. In this sense, the fact that bees succeeded in constructing identical hexagonal cells is easily explained as the consequence of the mechanical arrangement of their bodies, indistinguishable from one another. Just like Réaumur, he honed in on the possibility, or rather, in his case, impossibility, of animals making mistakes. The cells' perfection, he argued, should

[199] Thomas DiPiero, 'Voltaire's Parrot, or, How to Do Things with Birds', *Modern Language Quarterly: A Journal of Literary History*, 70.3 (2009), 341–62. For further examples of the argument based on lack of language, see Cohen Rosenfield, *Beast-Machine*, pp. 15-16; 28; 91.
[200] Georges-Louis Leclerc Buffon, *Histoire naturelle générale et particulière : avec la description du cabinet du Roy*, 15 vols (Paris: Imprimerie royale, 1749), II, p. 438.

not give rise to admiration, since perfection could only serve to prove the mechanical nature of the bees' work. Humans err because they have the privilege of being able to use the related and uniquely human faculties of imagination and reason, while soulless insects (just like any other animal) have no choice but to follow the invariable path set for them by nature and her laws. Buffon's argument here echoes that of Descartes, who similarly denied animals a free will on the basis of the perfection of their actions.[201] The inability of animals to err was thus fundamental to both thinkers' theories of animal nature; for Cohen Rosenfield, Descartes' entire thought stemmed from his realisation as a young man of 'the contrast between the perfect regularity of animal behaviour and the hesitant uncertainty of human rational conduct'.[202] Thus, for both Descartes and Buffon, living bodies, whether animal or human, operated according to the laws of mechanics, and humans alone could use their reason to will some, though not all, of their movements. Bees, according to Buffon, were determined by the physical arrangement of their machine-like bodies. Acting as perfect geometers, they had not willed any of their actions and their architectural skills were the consequence of their physical nature in the same way that, for example, the hexagonal scales arranged on a fish's body or hexagonal salt crystals did not will their form. The comparison between living and non-living forms is not a coincidence. The fact that bees could build perfectly geometrical cells could quite simply be explained as a logical necessity following from their body shape: 'Il est donc nécessaire aussi, puisque le corps des abeilles est cylindrique, que leurs cellules soient hexagones'.[203] Bees' cells are shaped hexagonally because the mathematical arrangement of their body parts gave rise to their mathematically perfect cells.

Despite Buffon's polemical insistence on the mechanical nature of the bees' behaviours, however, he also posited a crucial difference between insects and insensitive automata: insects could receive and process sense impressions.[204] Buffon had explained earlier in the *Discours sur les animaux* how the animal oeconomy of the bee bodies worked; the key for understanding the functioning of living bodies, he argued, lay in the senses. From his comparisons between living and non-living organised beings, Buffon concluded that any movement on the part of the animal must

[201] Cohen Rosenfield, *Beast-Machine*, chapter 2: The doctrine spreads.
[202] Cohen Rosenfield, *Beast-Machine*, p. 20.
[203] Buffon, *Histoire naturelle*, vol. IV, p. 99.
[204] On this point, see also Le Menthéour, 'De la ruche,' pp. 209-210.

be the consequence of a sense impression, without the need for the animal to will its own movements. Once an object had made its impression on the senses of the animal (or the human being), this impression awakened a 'desire' that would prompt the animal to use its body to satisfy it. The same principle applied to needs, which for Buffon were simply inner sense impressions felt by the brain.[205] The difference between the brain and the other organs was that the former possessed greater sensibility and was thus able to preserve the impressions ('ébranlements') made on it for longer than the other sense organs; the brain also transmitted sense impressions to the nerves, which then caused the body to move.[206] One of the main purposes of studying animals thus becomes clear: by comparing actions and behaviours in humans that could be caused by the inner sense of the brain and those that could not, the observer could learn what was a result of the exclusively human spiritual substance, or soul.[207] An important part of this spiritual soul for Buffon was the faculty of the imagination. Beasts, Buffon argued, only feel as long as their senses are moved ('ébranlés') by an object; humans, on the other hand, are capable of imagining an absent object. Where for Réaumur it was necessary to attribute an independent intelligence and the capacity for choice to each insect, Buffon claimed that their sensibility to one another was sufficient to explain the complexities of their collective work. Echoing the opposition between Réaumur and Buffon, Cartesian critics of sensationism argued that scattered sense impressions could not explain the workings of the mind, insisting instead on the existence of the soul as an independent substance.[208] While Buffon seemed to agree with the Cartesian theory of the beast-machine, he combined it with the sensationist insistence on the communication of sense perceptions as the basis for collective existence.[209] It was, then, through the actions of the senses that bees were capable of building their elaborate hives. As each bee sensed the 'impulsions' given to her by her fellow bees, the insects' bodies necessarily arranged themselves into constructing their geometrical cells. While the

[205] Buffon, 'Discours sur les animaux', pp. 21-24. On the history of needs, see Dana Simmons, *Vital Minimum: Need, Science, and Politics in Modern France* (Chicago: University of Chicago Press, 2015); E. C. Spary, *Eating the Enlightenment*. On theories of the nervous system, see Karl M. Figlio, 'Theories of Perception and the Physiology of Mind in the Late Eighteenth Century', *History of Science*, 13.3 (1975), 177–212.
[206] Buffon, 'Discours sur les animaux', p. 28.
[207] Buffon, 'Discours sur les animaux', p. 34.
[208] Goldstein, *Post-Revolutionary Self*, pp. 110-111.
[209] Goldstein, *Post-Revolutionary Self*, pp. 114-115.

single bees 'ont moins de génie que le chien, le singe et la pluspart des animaux',[210] the sensibility of their bodies gave them the appearance of – and similar results to – the workings of intelligence.

Animals act because they sense, but they are incapable of reflecting on and comparing their own sensations; the bees feel pleasure or pain, but do not will or think. While Buffon argued for the unique capacity of humans to shape their own destiny, in other passages it becomes clear that only a small minority of men (rather than women), and only in their adulthood, actually use their 'moral' side.[211] This can be explained through his insistence that the relations between sensing bodies, rather than immaterial souls, can be enough to explain complex social orders. Detailing the differences between the sense of self (what Buffon calls 'âme') in men and in animals, the naturalist asserts:

> d'autres enfin, et c'est la multitude, ont si peu de vie dans l'âme, et une si grande indolence à penser, qu'ils ne comparent et ne combinent rien, rien au moins du premier coup d'œil ; il leur faut des sensations fortes et répétées mille et mille fois, pour que leur âme vienne enfin à en comparer quelqu'une et à former une idée : ces hommes sont plus ou moins stupides, et semblent ne différer des animaux que par ce petit nombre d'idées que leur âme a tant de peine à produire.[212]

If human superiority is grounded in the capacity to form ideas through comparing the past and the present, and if the great majority of men only demonstrate this capacity in negligible, short-lived moments, it follows that most of what Buffon has to say on human excellence applies to a very small minority only. Human superiority was real for Buffon, but he found it not in the individual but in the human collective. Adriana Benzaquén, in her analysis of Buffon's views of childhood, argues that even though Buffon thought childhood did not influence the identity of the adult individual, he posited that the long period of the child's dependency on the adult was responsible for human sociability and thus the difference of the human species from all other

[210] Buffon, 'Discours sur les animaux', p. 93.
[211] Londa Schiebinger, 'Why Mammals Are Called Mammals: Gender Politics in Eighteenth-Century Natural History', *The American Historical Review*, 98 (1993), 382–411 (pp. 388–89).
[212] Buffon, *Histoire naturelle*, vol. IV, pp. 52-53.

animals.[213] Man only became truly human once he was in full control of his rational and sensible abilities; the period of childhood thus did not count towards Buffon's calculations of the length of life for the human.[214] For the spiritual principle to truly develop, human children needed to be educated by others: 'c'est par la communication des pensées d'autrui que l'enfant en acquiert et devient lui-même pensant et raisonnable, et sans cette communication il ne seroit que stupide ou fantasque, selon le degré d'inaction ou d'activité de son sens intérieur matériel.'[215] Man alone, that is, remained on the level of the animal; it was only through sociability (and education) that men and women became truly human.[216] Even if, that is, the multitude of men did not use their capacity to reason, the rational observer could influence them by intervening not on the level of the individual, but by educating the collective.[217] All the while upholding that all men had a dual nature as moral and as physical beings, Buffon thus suggested that for the purpose of governing them, rational observers could treat them as mere sensible bodies, just as they did in the government of domestic and farm animals. Although Buffon insisted on the nobility and superiority of the human mental faculties, his description of the bee swarm also provided an example of a social order based purely on sensations. Thus, defending himself against possible accusations of having presented a highly reductive view of animals, Buffon insisted that

> bien loin de tout ôter aux animaux, je leur accorde tout, à l'exception de la pensée et de la réflexion ; ils ont le sentiment, ils l'ont même à un plus haut degré que nous ne l'avons, ils ont aussi la conscience de leur existence actuelle, mais ils n'ont pas celle de leur existence passée ; ils ont des sensations, mais il leur manque la faculté de les comparer, c'est-à-dire, la puissance qui produit les idées ; car les idées ne sont que des sensations comparées, ou, pour mieux dire, des associations de sensations.[218]

[213] Adriana S. Benzaquén, 'Childhood, Identity and Human Science in the Enlightenment', *History Workshop Journal*, 57.1 (2004), 34–57.
[214] Roger, *Buffon*, pp. 173-174.
[215] Buffon, 'Discours sur la nature des animaux,' p. 70.
[216] On the consequences of Lockean sensationism for theories of education, see Harvey Chisick, *The Limits of Reform in the Enlightenment: Attitudes towards the Education of the Lower Classes in Eighteenth-Century France* (Princeton N.J.: Princeton University Press, 1981), particularly pp. 240-243.
[217] On this point, see also Daston, *Classical Probability*, ch. 2.
[218] Buffon, 'Discours sur les animaux,' p. 41.

The bees described by the naturalist, then, lacked the reason and spiritual imagination, that is the capacity to not only retain and imagine ideas, but also to compare them. Even without this faculty, however, they were capable of forming a complex and (re)productive society. Just as Buffon had said of man, the single bee – the 'mouche solitaire' – had very little 'génie';[219] despite Buffon's own protestations that bees were automata, then, there was, in fact, an important link between bees and men, made possible the idea that the insects were sensible automata: both needed the company of their fellows to develop their 'génie', and both did so by transmitting and receiving one another's sensations.

A third voice to join the debate on the meaning of the bee cell for an understanding of 'rational' man was the philosopher Étienne Bonnot de Condillac, foremost interpreter in France of Locke's sensationism.[220] Condillac radicalised Locke's sensationism by reducing all ideas to the result of sense impressions where Locke had argued that ideas stemmed both from the sense and from reflection.[221] True knowledge was to be reached by a process Condillac called 'analyse', by which he meant the process of breaking down ideas in order to untangle what is based in sense experience from what has been erroneously added by imagination.[222] In his *Traité des animaux* (1755), Condillac pointed out the contradictions in Buffon's assertion that animals were mere machines, and thus in his stark distinction between mechanical animal actions and human reason. Since Buffon admitted that beasts had sensations that gave them pleasure or pain, Condillac denied that they could be reduced to automata.[223] Unwilling to accept Buffon's two natures, Condillac, following Locke, attributed all actions of living beings to sensations. Réaumur had hinted at the possibility that even animals adapt to their changing circumstances, though, of course, according to a fixed range of possible behaviours, implanted into their bodies and souls

[219] Buffon, 'Discours sur les animaux,' p. 93.
[220] On Condillac's interpretation of Locke, see Seigel, *Self,* pp. 171-187; Goldstein, *Post-Revolutionary Self,* pp. 33-35.
[221] Daston, *Classical Probability,* pp. 208-210; John C. O'Neal, 'L'évolution de la notion d'expérience chez Boullier et Condillac sur la question de l'âme des bêtes', *Recherches sur Diderot et sur l'Encyclopédie*, 29 (2000), 149-175 (153–54).
[222] John O'Neal, 'La notion d'expérience, pp. 153-154.
[223] Condillac, *Traité des animaux,* pp. 15-23. Charles-Georges Leroy, author of the *Encyclopédie* article 'Instinct', similarly claimed that the distinction between 'instinct' and 'intelligence' was meaningless; see Charles-Georges Leroy, 'Instinct (Métaph. & Hist. Nat.)' *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers,* ed. by Denis Diderot and Jean le Rond d'Alembert, (University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), ed. by Robert Morrissey and Glenn Roe) <http://encyclopedie.uchicago.edu>; Charles-Georges Leroy, *Lettres sur les animaux,* ed. by Elizabeth Anderson (Oxford: Voltaire Foundation, 1994).

by the Creator. Condillac, by contrast, claimed that animal instincts were nothing but the reactions of the sensory apparatus to circumstances experienced so often that the reaction had become instinctual ('l'instinct n'est que [l']habitude privée de réflexion').[224] Just like Buffon, Condillac argued that animals and humans navigated their environment through their senses – alerting the individual of beneficial or harmful elements in their surroundings through pleasure or pain – in order to fulfil their bodies' needs.[225] If men and animals were so visibly different, this could simply be explained by the fact that men's bodies, and, as a consequence, their needs, were infinitely more complex: 'On voit aisément comment, dans la société, la multitude des besoins et la différence des conditions donnent à l'homme des passions dont les bêtes ne sont pas susceptibles.'[226] Since animals had fewer needs than men, they needed to reflect less and could rely, for the most part, on instincts they had acquired early in their lives.[227]

His treatise on animals, Condillac claimed, had been prompted by Buffon's contradictory *Discours*. Though the abbé agreed with Buffon on the importance of the senses, he could not accept the latter's theory of the 'homo duplex'. Condillac thus took issue with Buffon's explanation of the bee hive as a product of purely mechanical laws. This, he argued, contradicted the naturalist's own realisation that animals were capable of feeling. Using the example of the hive's hexagonal cells, the abbé accused Buffon of the cardinal sin of eighteenth-century natural history, that of creating imaginary arguments 'tout-à-fait contraires aux observations' (and to Condillac's own system of 'analyse'):

> Je lui accorde que les ouvrages de dix mille automates seront réguliers, comme il le suppose, (…) pour-vu que les conditions suivantes soient remplies ; 1.° que dans tous les individus, la forme extérieure et intérieure soit exactement la même ; 2.° que le mouvement soit égal et conforme ; 3.° qu'ils agissent tous les uns contre les autres avec des forces pareilles ; 4.° qu'ils commencent tous

[224] Étienne Bonnot de Condillac, 'Dictionnaire des synonymes de la langue française. Tome IV. Ici-Qui' <http://gallica.bnf.fr/ark:/12148/btv1b90583058> [accessed 5 August 2015].
[225] Condillac, *Traité des animaux*, pp. 87-92.
[226] Condillac, *Traité des animaux*, p. 150.
[227] 'A la vérité, c'est en réfléchissant que les bêtes l'acquièrent : mais, comme elles ont peu de besoins, le temps arrive bientôt où elles ont fait tout ce que la réflexion a pu leur apprendre. Il ne leur reste plus qu'à répéter tous les jours les mêmes choses : elles doivent donc n'avoir enfin que des habitudes, elles doivent être bornées à l'instinct.' Condillac, *Traité des animaux*, p. 109.

> à agir au même instant ; 5.° qu'ils continuent toujours d'agir ensemble ; 6°. qu'ils soient tous déterminés à ne faire que la même chose, et à ne la faire que dans un jeu donné et circonscrit. Mais il est évident que ces conditions ne seront pas exactement remplies, si nous substituons dix mille abeilles à ces dix mille automates ; et je ne conçois pas comment M. de B. ne s'en est pas aperçu: est-il si difficile de découvrir que, la forme extérieure et intérieure ne saurait être parfaitement la même dans dix mille abeilles, qu'il ne saurait y avoir dans chacune un mouvement égal et conforme, des forces pareilles ; que ne naissant pas et ne se métamorphosant pas toutes au même instant, elles n'agissent pas toujours toutes ensemble, et qu'enfin, bien loin d'être déterminées à n'agir que dans un lieu donné et circonscrit, elles se répandent souvent de côté et d'autre?[228]

What observation reveals, according to Condillac, is, firstly, the fact that the animals cannot act like machines given that their bodies – and thus also their sensory faculties – differ from one another. Condillac here echoes Réaumur's erring insects. The bees do not begin to act at the same time, nor do they execute the exact movements (points 4.° and 5.°); they cannot be automata because they rely on sense impressions, which necessarily differ from individual to individual, for determining their course of action.[229] According to Condillac's definition of the term 'instinct' in his *Dictionnaire des synonymes*, instincts are both the consequence of an animal's bodily dispositions – thus innate and inevitable – and acquired habits which require reflection but only the first time an animal (including a human animal) displays a certain behaviour: 'Ce mot comprend toutes les opérations où la réflexion n'a point de part, c'est-à-dire, tout ce que les animaux font en conséquence de l'organisation et des habitudes acquises.'[230] Though Condillac uses the word 'animal', it is clear from his definition that instincts belong to animals as well as humans: both depend on their bodies and both adapt their behaviours to their experiences. For both humans and animals, Condillac collapses the distinction between intelligence and instinct, or between behaviours determined by moral or reasoned deliberation and physical constitution: the two are linked simply by

[228] Condillac, *Traité des animaux*, p. 33.
[229] On this point, see also John O'Neal, 'La notion d'expérience,' pp. 157-158.
[230] Étienne Bonnot de Condillac, 'Dictionnaire des synonymes de la langue française. Tome IV. Ici-Qui'.

an 'et'.[231] Experiences solidify into instincts, but new or unexpected circumstances prove an animal's ability to deliberate and adapt. A similar process applies to the distinction between passions, sensations and desires. Condillac accuses Buffon of defining the passions as simply more intense sensations.[232] Instead, he insists that they are, in fact, desires, that is the feeling occasioned by the gap between a need and the object for its fulfilment, made more intense through their persistence over time (in other words, through habit). Bees have needs and receive sense impressions; this, for Condillac, is enough to prove Buffon's reduction of the insects to automata wrong. In Condillac's philosophy of behaviour, then, there is no need to argue for human rational souls in order to preserve their natural superiority over all other animals.

The second argument is more properly based on observation (though Condillac himself probably never observed bees himself): the insects do not seem to follow regular, patterned movements, as machines would. Even an organism as simple as a bee, seems to go through a decision-making process based on some kind of deliberation. Given that the will, for Condillac, was a direct consequence of a living being's sensations as it transmitted the pleasure and pain promised by an external object, there was no reason not to accord it to animals.[233] The wonder of the bee hive, for Condillac, cannot be understood as that of well-constructed machine; it is, rather, the ability of the bees to coordinate their communal lives into a coherent, highly productive whole as each bee reacts to the sensations produced in it by its surroundings that fascinates the philosopher. Condillac's basic assumption is grounded in the observation that humans and animals share the anatomical faculties for sense perceptions (eyes, ears, and so on) and are thus exposed to similar experiences:

> D'ailleurs, l'abeille a bien d'autres rapports avec nous que celui de nous fournir de la cire et du miel. Elle a un sens intérieur matériel, des sens extérieurs, une réminiscence matérielle, des sensations corporelles, du plaisir, de la douleur, des besoins, des passions, des sensations combinées, l'expérience du sentiment.[234]

[231] Göran Blix, 'The Zoology of Mind: Instinct and Intelligence in Eighteenth-and Nineteenth-Century Natural History', *L'Esprit Créateur*, 56.4 (2017), 49–63 (pp. 58–59).
[232] Condillac, *Traité des animaux*, p. 138.
[233] Condillac, *Traité des animaux*, ch. X 'De l'entendement et de la volonté, soit dans l'homme, soit dans les bêtes'.
[234] Condillac, *Traité des animaux*, pp. 66-67.

Given that insects have a sensory apparatus similar to that of humans, Condillac argues, there is no reason to assume that there is any fundamental difference in the way they navigate and experience the world. Buffon would have not disagreed with this list of faculties shared by animals as well as humans, though of course he would have insisted on man's second, rational nature. Condillac pointed out that Buffon's own admission of sensory experience in the supposed bee-automata meant that man had more in common with the bees than harvesting their produce. While, as we have seen, Buffon accorded memory to all animals and made imagination, at least in its spiritual form, the noblest of the human faculties, Condillac claimed that animals had imagination and, as a consequence, were able also to combine rather than just receive perceptions. While Condillac denied any radical difference between man and animal, he did agree with Buffon that man's manifest superiority was grounded in his sociability. Because beasts, even those living in close proximity to one another, had not developed language, they could not share each other's experiences and thus

> ne font que les progrès que chacune auroit faits séparément. Le commerce d'idées, que le langage d'action établit entr'elles, étant très borné, chaque individu n'a guères pour s'instruire que sa seule expérience.[235]

Ultimately, then, Condillac agreed with Buffon that the individual, animal or human, was a limited creature; it was only in society, developed thanks to human language, that man could become a truly rational, and thus free, being.[236] Through the accumulation of knowledge, which increased from generation to generation, man could even reach knowledge of God.[237]

For Catholic, orthodox observers such as Réaumur, the individual soul was necessary to explain how persons could act in accordance with God's greater plan; bees, in this scheme, contributed to the greater good of the hive because their souls

[235] Condillac, *Traité des animaux*, pp. 182-183.
[236] On Condillac on language, see R. Christopher Coski, 'Condillac: Language, Thought, and Morality in the Man and Animal Debate', *French Forum*, 28.1 (2003), 57–75; *Condillac et les problèmes du langage*, ed. by Jean Sgard (Genève: Slatkine, 1982).
[237] John O'Neal argues that this point was a partly response to accusations of atheism levelled against Condillac after the publication of his *Traité des sensations*; see John O'Neal, 'La notion d'expérience,'

instructed them to do so.[238] Réaumur, though reluctant to discuss explicitly the issue of the animal soul, does at times employ the term 'âme' to explain the seemingly intelligent – which for the naturalist means, above all, the ability to react rationally to changing circumstances – actions of insects.[239] Naturalists and philosophers, particularly from the 1740s onwards, began to posit theories of behaviour that deemphasised, or even denied, the role of the soul. Instead, they found that both animals and men derived the feelings and passions that prompted them to act from the impressions received by their senses. While thinkers as different as Buffon and Condillac agreed on this basic premise, they disagreed on its implications. Condillac granted a sense of self (what he called a 'moi') to even the lowliest creatures. By deriving even the mind's highest faculties from sense impressions rather than innate capacities for rational thought, the abbé thus provided a much more thoroughly materialistic theory of sensationism than Locke had done.[240] Buffon, on the other hand, argued that man consisted of two natures, one animal and one spiritual and thus exclusively human. While the former functioned on the basis of sense impressions and the pleasure and pain derived from them, the latter gave rise to reflection and hence to a 'moi' (even though animals did have consciousness of their own present existence).[241] Buffon dismissed animals as automata, mechanically reacting to their sensations. Consequently, Condillac accused the naturalist of self-contradiction for his claim that knowledge derived from a separate principle all the while attributing sensations the power to guide not only animals, but also human children.

4. The Issue of Human Nature in Political Economy

Before François Quesnay went on to invent the 'new science' of 'économie', he was a student of medicine and physiology. These preoccupations led to the publication of the *Essai physique de l'oeconomie animale* (1736; an expanded edition appeared in 1747) and of the article 'Évidence' published in the *Encyclopédie* (1756), works in which Quesnay reflected on man's bodily and mental faculties. Historians have

[238] An analysis of Réaumur's view of the animal soul, which he discussed only with great reticence, can be found in Virginia Parker Dawson, 'The Problem of Soul in the "Little Machines" of Reaumur and Charles Bonnet', *Eighteenth-Century Studies*, 18.4 (1985), 503–22.
[239] In addition to the discussion below, see Réaumur, I, pp. 22–25.
[240] Although he also insisted that the sensory account of the mind only applied to man in the fallen state; see Seigel, *Self,* pp. 173-175.
[241] Goldstein, *Post-Revolutionary Self,* pp. 113-115.

debated the influence of these medical texts on Quesnay's economic works. While some flatly deny any influence at all, others see a mainly metaphorical relation.[242] Thus, the circulation of the blood is seen to provide an analogy for the circulation of capital.[243] Economic historian Philippe Steiner argues that Quesnay's political economy relies on quantification and thus bears little resemblance to his medical work; however, as I aim to show here, the connection lies in the 'esprit géométrique' that pervades both phases of his oeuvre. Like the authors surveyed so far, Quesnay was trying to answer the question of what it meant to be human as opposed to animal, and, more specifically, what it meant to be a rational living being. If Quesnay's analyses of what we would now class as psychology do not play a big role in the more properly 'political economic' texts, this, I argue, is because in the latter Quesnay is concerned with the population as a whole. Individual motivations and experiences thereby matter much less than the broad and regular patterns emerging from the study of groups of people; these regularities produced by the aggregate of the living then allow the wise, enlightened governors to provide the framework in which individual actors are free to pursue their rational self-interest.

Quesnay was a sensationist, that is, he believed that men (as well as animals) were born as blank slates that received knowledge through their senses.[244] Like Condillac, with whom he was personally acquainted,[245] he emphasised the fundamental importance of the search for pleasure and the avoidance of pain in human individual and collective life.[246] He expounded his views on these in his *Essai physique sur l'économie animale,* where he closely engaged with medical, or what we would now call psychological, writings of his time. Although in his *Essai physique,* Quesnay never references the literature on the animal soul, it provides the clear if implicit background to his outline of the human faculties.[247] In perfectly orthodox manner,

[242] Economic historian Steiner, in particular, argues against a direct relation between the two phases of Quesnay's career; Philippe Steiner, *La 'science nouvelle' de l'économie politique* (Paris: PUF, 1998). In this claim, Steiner follows Georges Weulersse, *Le mouvement physiocratique en France (de 1756 a 1770)*, 2 vols (Paris: Félix Alcan, 1910). Christensen sees the connection in the vital force of fire, or 'ether' ; see Paul P. Christensen, 'Fire, Motion, and Productivity: The Proto -Energetics of Nature and Economy in François Quesnay', in *Natural Images in Economic Thought*, ed. by Philip Mirowski (Cambridge: Cambridge University Press, 1994), pp. 249–88.

[243] As H. Spencer Banzhaf has noted, reading the Quesnay's earlier texts can help us understand 'his paradigms and methodology'. Banzhaf 'Productive Nature', p. 517.

[244] Vardi, *Physiocrats*, pp. 68-73.

[245] Steiner, *La science nouvelle*.

[246] Steiner, *La science nouvelle*, pp. 29-30.

[247] As noted by Paul Mengal in his introduction to the text: Paul Mengal, 'Essai physique sur l'oeconomie animale. Présentation', in *François Quesnay: Œuvres économqiues complètes et autres*

Quesnay insisted on the differences between animals and humans as far as their decision-making process is concerned. The latter, he claims, possess an immaterial, intelligent soul denied to the former. Quesnay thus plants himself firmly on the side of those who insisted on an unbridgeable gap between humans and animals. They are driven by instinct, which means that they are incapable of forming a conscious plan for the future and instead live purely in the (pleasurable) present. At the same time, he concedes that both animals and humans possess instincts, defined as dispositions towards certain behaviours that precede the experiences gained from the senses and that are determined by an animal's physical make-up.[248] Furthermore, all animals – and this term could refer to humans too – have the same fundamental interests towards which all actions tend: preservation of the species and individual subsistence. Like Buffon, Quesnay posited two natures in man, one 'sensitive & passive' and one 'intellectuelle & active'. Just as for Buffon, it was the latter that elevated humans above animals by endowing them with free will. The two men also agreed that most humans did not possess, or at least did not exercise, the quality that made them truly human. Rather pessimistically (and, of course, elitist), Quesnay emphasised that most men were hopelessly dominated by their bodily passions, and thus passive captives to immediate bodily sensations.

Unlike Buffon, however, Quesnay was not interested in emphasising man's creative powers; liberty, for Quesnay, meant the ability to deliberate on the most rational course of action. Where Buffon had extolled creativity and man's 'productions nouvelles', Quesnay praised the few rational men for regulating their passions; the aim of liberty, he explained, was to 'régler notre conduite'.[249] The model for such a rational man anticipates the career of the later Quesnay: he is a merchant, deliberating which merchandise to purchase:

> Un Marchand, par exemple, toujours excité par le desir du gain, veut employer une somme d'argent à acheter quelque marchandise ; il s'en présente à lui de deux sortes, qui peuvent lui être avantageuses ; mais il y en a une qui, au premier aspect, lui paroît plus profitable ; cependant la crainte de se méprendre,

textes, ed. by Christine Théré, Loïc Charles, and Jean-Claude Perrot (Paris: INED, 2005), pp. 5–6 (p. 5).

[248] François Quesnay, *Essai physique sur l'oeconomie animale*, 3 vols (Paris: Guillaume Cavelier Père, 1747), I, pp. 244–45.

[249] Quesnay, *Essai physique,* p. 353.

> lui fait examiner le prix de l'achat de chacune de ces marchandises, les frais qu'elles exigent, le détriment qu'elles peuvent souffrir, la promptitude du débit, le prix qu'il pourra la vendre ; il parvient par des calculs à évaluer toutes ces choses ; & après avoir comparé il se détermine pour celle qui lui paroît la plus avantageuse : ce Marchand est donc d'abord poussé par le desir du gain à faire valoir son argent : il est porté ensuite à délibérer par la crainte de se tromper : enfin il est décidé par la marchandise qui lui paroît la plus profitable, & souvent cette marchandise n'est pas celle qui lui sembloit d'abord la plus avantageuse. L'homme qui se conduit avec raison, n'est donc pas déterminé immédiatement comme les bêtes, par l'objet qui le frape & l'affecte le plus.[250]

The most rational of men, and thus also the most human, is the merchant, able to weigh up and calculate the costs and benefits of his business decisions. The merchant has dominated his sensations and his passions through the use of his reason, and in particular of what for Quesnay is the main instrument of reason, namely attention. For Quesnay, as for Condillac, it was the task of the imagination to separate the sensations transmitted through the nerves to the brain and then to recombine them into ideas. The imagination of irrational men as well as of animals combined only the crude sensations received immediately by the brain; rational men, on the other hand, recombined the sensations only once they had been separated out, using their faculty of attention to focus on distinct sensations and combine them into relevant patterns.[251] Applying a process similar to Condillac's process of 'analyse', the merchant divides the problem at hand into its component parts (price, costs, risks), compares them and then judges between them. Rational man, for Quesnay, does not invent; he applies his reason in order to discover the 'rules' of conduct. Indeed, in Quesnay's *Encylopédie* article 'Évidence' (thought by Rousseau to have been authored by Condillac), 'règle' is the key word. This text echoed many of the same concerns of the 1747 edition of his *Essai physique*, even though its concern was, on the face of it, with metaphysics rather than physiology. In the following short passage from the article, the word 'règle' and its cognate 'déréglement' appear eight times:

[250] Quesnay, *Essai Physique*, pp. 350-351.
[251] Quesnay was relying on Malebranche here; see *Essai physique* vol 3, pp. 249-261. Sonenscher argues that Quesnay's reliance on Malebranche for the idea that intelligence was 'a God-given human ability to put a ruined world right' makes physiocracy a 'theodicy'; Sonenscher, 'Physiocracy as a Theodicy'.

> La loi naturelle se présente à tous les hommes, mais ils l'interpretent diversement; il leur faut des regles positives & déterminées, pour fixer & assûrer leur conduite. Ainsi les hommes sages ont peu à examiner & à délibérer sur leurs intérêts dans le détail de leurs actions morales; dévoüés habituellement à la regle & à la nécessité de la regle, ils sont immédiatement déterminés par la regle même. Mais ceux qui sont portés au déréglement par des passions vives & habituelles, sont moins soûmis par eux - mêmes à la regle, qu'attentifs à la crainte de l'infamie & des punitions attachées à l'infraction de la regle. Dans l'ordre naturel, les intérêts ou les affections se contrarient; on hésite, on délibere, on répugne à la regle; on est enfin décidé ou par la passion qui domine, ou par la crainte des peines.[252]

Where animals and 'deregulated' humans are prey to their bodily sensations, rational humans can train themselves to recognise rational rules of conduct. As is clear from the passages quoted above, man does invent these rules, but discovers them. Rational man is a geometer, which is why Mirabeau could later compare his mentor's political economic system to the science of geometry based on mathematical proofs and demonstrations.[253] The first meaning in eighteenth-century dictionaries given for 'règle' tends to be that of ruler, or 'instrument de mathématique […] qui sert à tirer des lignes droites.'[254] Its other meanings, in the sense of 'Principe, maxime, loi, enseignement, & généralement tout ce qui sert à conduire, à diriger l'esprit & le coeur', are, according to eighteenth-century dictionaries, figurative uses of the mathematical sense.[255] As we saw above, in his description of the geometrical skills of bees, Réaumur

[252] François Quesnay, 'Evidence', *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers,* ed. by Denis Diderot and Jean le Rond d'Alembert, (University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), ed. by Robert Morrissey and Glenn Roe) <http://encyclopedie.uchicago.edu>

[253] 'Address to a Tuesday Physiocratic assembly where he publicizes a course in political economy to be offered by Court de Gébelin', n.d. A. N. Mirabeau papers, M 784 #7; quoted in Vardi, *Physiocrats*, p. 53.

[254] 'Règle', *Le Dictionnaire de l'Académie française. Quatrième édition* (Paris, 1762).

[255] In addition to the article in the *Dictionnaire,* compare also Chevalier Louis de Jaucourt, 'Regle, Réglement (Gram. Synon.)', *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers,* ed. by Denis Diderot and Jean le Rond d'Alembert, (University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), ed. by Robert Morrissey and Glenn Roe) <http://encyclopedie.uchicago.edu> and Goussier, 'Regle, s. f. (Géom.)', *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers,* ed. by Denis Diderot and Jean le Rond d'Alembert,

had granted them ‘la perfection des regles’; although Quesnay insisted on man’s superiority, his rational being thus resembled the naturalist’s insects. This is not a coincidence, but rather the result of both men’s belief in a divinely instituted order; just as the skills of Réaumur’s bees point to the intelligence that created them, Quesnay’s rational rules of conduct are the discovery of nature’s order:

> c'est dans toute l'étendue de cet ordre, ou de ce systéme général, qu'il faut en chercher la régularité, & non dans la distribution égale ou inégale du droit naturel de chaque homme ; c'est aux hommes à se régler sur cet ordre même, & non à le méconnoître, ou à chercher inutilement ou injustement à s'en affranchir.[256]

In healthy minds, the process of reaching a decision consisted in the deliberative weighing up of different sensations, interests, passions, and of possible punishments and rewards, leading to the recognition of the most rational rules. In practice, however, even though all humans were endowed with rational souls capable of judging according to evident natural ‘règles’, most had strayed too far and for too long from intelligent reflection, or had ‘perverted’ bodies making reflection impossible; some were even ‘plus stupides, plus féroces, plus insensés que les bêtes’.[257] These men and women, incapable of recognising their long-term interest, needed the disincentive of heavy punishments. The internal system of checks and balances could be blocked by internal (a lack of education and practice in using one’s judgement, for example) or external circumstances; good government thus depended on ‘hommes sages’, whose habit of using their intellect made them more receptive to nature’s rules. The famous ‘laissez-faire’ doctrine of the physiocrats relied on savants who instituted the framework within which citizens could pursue their self-interest:

> Le Gouvernment du Prince n’est pas, comme on le croit vulgairement, l’art de conduire les hommes ; c’est l’art de pourvoir à leur sûreté & à leur subsistance par l’observation de l’ordre naturel des Loix physiques qui constituent le droit

(University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), ed. by Robert Morrissey and Glenn Roe) <http://encyclopedie.uchicago.edu>

[256] Quesnay, *Essai Physique*, pp. 370-371. On the importance of Providence for Quesnay’s political economy, see also Banzhaf, ‘Productive Nature’.

[257] Steiner, *La science nouvelle*, p. 47 ; p. 57.

> naturel & l'ordre économique par lesquels l'existences & la subsistance doivent être assurées aux Nations & à chaque homme en particulier, cet objet rempli, la conduite des hommes est fixée, & chaque homme se conduit lui-même.[258]

Governors did not 'regulate' the conduct of the individual. Rather, they ensured that the constitution of the state was based on natural law in such a way as to force humans to make rational, and free, decisions. As is also implied in Quesnay's paradoxical formula of the 'despotisme légal', men should be both free ('chaque homme se conduit lui-même') and forced to be free by the legal despot ('la conduite des hommes est fixée').[259]

As Quesnay moves from animal to human oeconomy, his conception of the human decision-making process does not so much change in kind, but certainly in emphasis. While in his *Essai* and in 'Evidence' he insists on the possibility of arriving at free, rational decisions in line with the rules of nature, in his political economic writings the internal decision-making processes mostly disappear from view. As he turns from studying the individual to observing and governing the population, humans are considered not in terms of their experiences and own internal conflicts between passions and interests, but as members of a population-body, naturally striving for self-preservation and increased physical comforts ('aisance'). From the point of view of the governor, that is, individuals are important only as member of the population. The cognitive processes that do count are those of the savants, responsible for instituting and maintaining the framework in which the natural order can unfold. It was their task, in Quesnay's words, to institute a legal framework that corresponded to the rule of nature:

> Les lois positives sont des règles authentiques, établies par une autorité souveraine, pour fixer l'ordre de l'administration du gouvernement, pour assurer la défense de la société, pour faire observer régulièrement les lois naturelles, pour réformer ou maintenir les coutumes et les usages introduits

[258] Victor de Riquetti Mirabeau marquis de and François Quesnay, *Philosophie rurale, ou économie générale et politique de l'agriculture*, 3 vols (Amsterdam: les librairies associés, 1763), I, p. xviii.
[259] As Hirschman puts it, the physiocrats wanted a system in which both the sovereign and the people would be 'impelled, *for reasons of self-interest*, to promote the general interest.' Hirschman, *Passions and Interests*, pp. 96-98.

> dans la nation, pour régler les droits particuliers des sujets relativement è leurs différents états, pour déterminer l'ordre positif dans le cas douteux réduits à des probabilité d'opinion ou de convenance, pour asseoir les décisions de la justice distributive. Mais la première loi positive, la loi fondamentale de toutes les autres lois positives, est l'institution de l'instruction publique et privée des lois de l'ordre naturel, qui est la règle souveraine de toute législation humaine et de toute conduite civile, économique et sociale.[260]

Just as Buffon, in his similarly elitist view of human beings, had located the superiority of the human species in the aggregate rather in the individual, the physiocrats insisted on the importance of education, which served to transmit the rational principles, or 'règles', discovered by a handful of rational men. Defined by their capacity for rational reflection and attentive observation, it was the task of savants such as the physiocrats themselves to recognise the regularities produced by the bodies of the population and to fix them into the nation's legal framework.

Condillac, though nowadays famous above all for his sensationist theories of human (and, to a lesser extent, animal) behaviour, also published a text late in his career that he himself classified as 'science économique', called *Le commerce et le gouvernement, considérés relativement l'un à l'autre: Ouvrage élémentaire* (1776). As historians have outlined, Condillac wrote this work in response to the physiocrats' theories of government, and was eagerly, and very critically, read by the younger generation (Quesnay had died two years before its publication).[261] In many ways, Condillac's work followed physiocratic principles closely. He agreed with their fundamental dictum that the grain trade needed to be free; he thus considered both 'la police sur la circulation intérieure des grains' and 'la police sur l'exportation et l'importation des grains' to be 'attacks' on commerce.[262] At the same time, however, he also insisted – and was rebuked for it by the physiocrats Nicolas Baudeau (1730-1792) and Guillaume François Le Trosne (1728-1780) – that industry and commerce

[260] François Quesnay, *Œuvres économiques complètes et autres textes: Textes polémiques, Documents associés*, ed. by Christine Théré, Loïc Charles, and Jean-Claude Perrot, 2 vols (Paris: INED, 2005), I, p. 108.
[261] Arnaud Orain, 'Condillac face à la physiocratie: terre, valeur et répartition', *Revue économique*, 53.5 (2002), 1075–99; Walter Eltis, 'L'abbé de Condillac and the physiocrats', *History of Political Economy*, 27.2 (1995), 217–236.
[262] Etienne Bonnot de Condillac, *Le commerce et le gouvernement, considérés relativement l'un à l'autre: Ouvrage élémentaire* (Amsterdam; Paris: Jombert & Cellot, 1776), ch. 12 and ch. 13.

were not sterile but productive in the same sense that agriculture was.[263]

The connection between his theories of cognition and his political economical text is not made explicit by Condillac himself. The differences between humans and animals, however, are crucial to understanding his theory of government. Just as he had explained all animal behaviour through the drive to satisfy physical needs, human economic activity begins, for Condillac, with the search for means of subsistence. Further developing Quesnay's (and, more distantly, Mandeville's) ideas on the role of the arts, Condillac explained human sophistication – the fact that we are not 'de vils animaux' – not through inborn 'qualités morales', but through the development of new, historically created needs based on more basic physical ones. He thus distinguished between 'natural' and 'artificial' needs:

> Les uns sont une suite de notre conformation ; nous sommes conformés pour avoir besoin de nourriture, ou pour ne pouvoir pas vivre sans aliments. Les autres sont une suite de nos habitudes. Telle chose dont nous pourrions nous passer, parce que notre conformation ne nous en fait pas un besoin, nous devient nécessaire par l'usage, et quelquefois aussi nécessaire que si nous étions conformés pour en avoir besoin. J'appelle naturels les besoins qui sont une suite de notre conformation, & factices les besoins que nous devons à l'habitude contractée par l'usage des choses.[264]

According to the abbé, then, all living beings have sensory experiences, and thus the capacity to satisfy their needs, though humans had learnt to invent new ones. With this interpretative move, Condillac was able to explain not only human superiority as the consequence of the human sensory apparatus, but also a social order based on production and consumption of superfluous goods. Just as he (and, to some extent, Buffon) had done in his work on animals, Condillac explained the complexity of the human social order not through rational souls, but through the interaction between sensing bodies. In a typical Enlightenment scenario, the abbé began his exposition by imagining a primitive people developing from a group of hunter-gatherers into an organised society. New needs and the developing organisation of the community

[263] Baudeau's and Le Trosne's reaction to Condillac's text is outlined in Eltis, pp. 225–30. I am following Arnaud Orain's reading of Condillac's reception; see especially Orain, pp. 1079–80.
[264] Condillac, *Commerce et gouvernement*, p. 9.

thereby conditioned one another. The isolated individual felt only the most basic needs, the satisfaction of which was essential for his or her survival; as men organised themselves, however, they began to find new means for satisfying their needs. This process of gradual development from agriculture to ever more sophisticated methods and technologies for need fulfilment also led to the development of ever more sophisticated needs. Like Buffon, then, Condillac insisted on the importance of society for the formation of human beings that were truly distinct from animals. The small agricultural society with which Condillac begins his thought experiment knows only the immediate needs dictated by the body. The development of language in turn allows for the 'commerce des idées' that is the hallmark of civilised societies and which 'préside aux sociétés et à ce grand nombre d'habitudes qu'un homme qui vivrait seul ne contracterait point. Principe admirable de la communication des idées il fait circuler la sève qui donne aux arts et aux sciences la naissance, l'accroissement et les fruits'.[265] Condillac parted company with Quesnay not only, as economic historians have noted, on the idea of the sole productivity of agriculture.[266] His insistence that other sectors, too, could create true riches was founded on his emphasis on the human capacity to create new needs and transmit them to others, rather than, as Quesnay had insisted, on the application of reason to the discovery of natural laws.

Some of the physiocrats' and Condillac's contemporaries were appalled by the alignment they had made between subjects and need-driven animals. None other than the abbé de Condillac's brother, the abbé de Mably, passionately decried physiocracy as a crime against morality. Famous in his own right as one of the most 'revolutionary' thinkers of the Old Regime,[267] the abbé de Mably based his rejection of the physiocrats' theories on their attempt to ground human politics in the physical need for subsistence:

> N'est-il pas manifestement évident, nous dit-on, qu'il nous est physiquement impossible de vivre sans subsistances? D'accord; mais n'est-il pas également évident que nous ne pouvons être en société sans qualités sociales? Qui pourroit nier, Monsieur, que les qualités morales n'aient beaucoup plus

[265] Condillac, *Commerce et gouvernement*, p. 360.
[266] Eltis, 'Condillac'; as fellow economic historian Orain argues, Condillac was one of the first thinkers to put use-value at the centre of economic theory, which explains the paradoxical relationship with physiocratic ideas; see Orain, 'Condillac'.
[267] Keith Michael Baker, 'A Script for a French Revolution: The Political Consciousness of the Abbé Mably', *Eighteenth-Century Studies*, 14.3 (1981), 235–63.

contribué à l'établissement de la Société, que le besoin de subsistances?[268]

Like the theorists of natural law critical of Mandeville discussed in the previous chapter, Mably argued that men were fundamentally different from animals.[269] Unlike both the natural law theorists and the physiocrats, Mably wrote in order to subvert rather than strengthen the absolutist state. Influenced by ancient theorists of Republicanism and their seventeenth-century English interpreters, Mably insisted that the passions, resulting from feelings of pleasure or pain and shared by humans and animals, were essential to making humans act at all.[270] Even though a passionless human being would simply stand still, governments also needed to encourage their citizens to regulate their passions by an appeal to their virtue. He thus recommended intervention by the state to prevent poverty, strict regulations of 'moeurs' and censorship.[271] The abbé insisted that human decisions were grounded in men's double nature (physical as well as 'moral', that is in possession of a rational soul) and that rational, wilful choices could give rise to a new organisation of society. As Keith Baker has argued, Mably's goal was to construe 'a definition of situation in which public order in France was perceived not as the expression of tradition or prescription, custom or law, but as the outcome of wilful action.'[272] Like the physiocrats, he was thus engaged in a redefinition of government that steered away from the central importance of the will of the ruler. He agreed with the physiocrats that the aim of government should be the happiness of the population. Unlike the physiocrats, however, Mably wanted to ground this order in man's capacity to create, not to discover, social laws. Instead of the physiocrats' insistence on the importance of agriculture and hence private property, Mably proposed that man's capacity for moral behaviour explained the institution of the first society:

> Notre chasse, devois-je dire, notre pêche, les fruits que nous avons cueillis, tout entre nous sera commun. Quand la fortune n'aura pas favorisé mes recherches,

[268] Gabriel Bonnot de Mably, *Doutes proposés aux philosophes économistes, sur l'ordre naturel et essentiel des sociétés politiques* (La Haye; Paris: Nyon et Veuve Durand, 1768), p. 29.
[269] On Mably as a natural rights theorists with regards to the question of property, see Johnson Kent Wright, *A Classical Republican in Eighteenth-Century France: The Political Thought of Mably* (Stanford: Stanford University Press, 1997), pp. 96–99. On French Republicanism, see Hammersley, *English Republican Tradition*.
[270] Hammersley, *English Republican Tradition*, pp. 91-94.
[271] Wright, 'Classical Republican', p. 106.
[272] Baker, 'A Script,' p. 237.

> les autres me fourniront ma subsistance; & je les consolerai à mon tour de leurs disgraces quand leurs peines seront infructeuses, je partagerai avec les fruits que j'aurai ramassés, ou le gibier que j'aurai pris.[273]

For Mably, as for earlier Republican theorists, government should not encourage the pursuit of self-interest. The physiocrats, he claimed, had confused the misguided self-interests of the property owners, who benefited from a workforce considered only as animals in search of subsistence, with the law of nature. As he noted, the physiocrats wanted to govern humans as one would govern animals, taking into account only their physical and thus neglecting their moral needs. Mably, instead, exhorted his contemporaries: 'Comme de vils animaux, ne nous occupons pas de notre seule pâture.'[274] Mably insisted on the importance of the legislators to exhort citizens to pursue a virtuous life in favour of the common good; virtue, he insisted, was not natural, but had to be artfully invented.[275] Both the physiocrats and their fierce critic were trying to solve the same problem of devising a government in line with human 'nature' rather than with the divinely instituted will of the sovereign. For Mably, however, the physiocrats had mistaken the avarice of privileged landowners for human nature; not property, and the passion of avarice that it engendered, should be the basis of the social order, but virtue wilfully employed to further the common good.

5. Conclusion

The debates on the animal soul and cognition were conducted with such vigour because what was at stake was not just the idea of the animal soul, but a new theory of the human subject. Thinking about the mental and physical faculties of animals became so interesting to Enlightenment writers because it allowed them to think through a new conception of man, according to which, as Albert Hirschman has shown, he (or she) was no longer the simple product of a God-given soul, but a body whose sensations and passions formed the subject through their constant interplay and conflict.[276] As we will see in subsequent chapters, it is only on the back of this new

[273] Mably, *Doutes*, p. 39.
[274] Mably, *Doutes*, p. 34.
[275] On this point, see also Michael Sonenscher, *Before the Deluge: Public Debt, Inequality, and the Intellectual Origins of the French Revolution* (Princeton N.J.: Princeton University Press, 2009), pp. 197–99.
[276] Hirschman; see also: Vogl, *Kalkül und Leidenschaft*, pp. 38–44.

conception of man that collectives become thinkable as a ‘population’, or, in other words as a whole with predictable laws, but made up of unpredictable parts.

In the next chapter, we will see in more detail how exactly eighteenth-century writers thought that these crucial relations between living, sensing bodies could come about. Once more, it was an insect that provided a particularly powerful forum for debates about the relation between human and animal nature, and parts and wholes. Signalling and reinforcing the shift from a collective of souls to a dynamic whole composed of sensible bodies, the next chapter will focus on an extraordinary ‘insect’: the animal that eighteenth-century naturalists baptised hydra or freshwater polyp.

Chapter Three. Parts and Wholes in Nature and Society: Polyps and Swarms

1. Introduction

In the summer of 1740, the Genevan naturalist Abraham Trembley (1710-1784) made a discovery that would send shockwaves through the eighteenth-century Republic of Letters. As he observed a tiny creature that seemed to be a plant as much as an animal, Trembley noticed that the seemingly unremarkable animal that would later be known as the freshwater polyp, or hydra, has a remarkable property: when Trembley cut off its limbs, the polyp did not die; instead, it 'grew' new individuals from the severed body parts.[1] As Trembley himself acknowledged in the preface to the treatise he would eventually publish on the topic, the *Mémoires pour servir à l'histoire d'un genre de polypes d'eau douce* (1744), he was not, in fact, the first naturalist to have observed the creature, though most of his predecessors had dismissed it as a plant and none had noticed its strange ability to reproduce from cuttings.[2]

Nevertheless, the extent to which the discovery of the polyp aroused the curiosity – and sometimes anxieties – of contemporary savants is difficult to overstate.[3] The polyp's strange qualities troubled a range of eighteenth-century assumptions about the nature of animal and plant life, and the more daring writers in France did not hesitate to draw out the implications of the polyp for understandings of human life.[4] The polyp's capacities to regenerate from wounds observers had expected to be fatal, to divide itself into new individuals, as well as the possibility of formerly distinct polyps merging into one animal, posed troubling questions as to the boundaries, and hierarchies, between both the parts of the animal body and between the particular body and the collective.[5] No matter their doctrinal allegiance, naturalists and writers

[1] Though Trembley had communicated his discovery to naturalists across Europe, including Réaumur who presented it to the Académie in Paris in 1741, he published them only in 1744; see Abraham Trembley, *Mémoires pour servir à l'histoire d'un genre de polypes d'eau douce, à bras en forme de cornes* (Leiden: Jean & Herman Verbeek, 1744).

[2] Antoni van Leeuwenhoek (1632-1723) and an anonymous Englishman had published an article in the *Philosophical Transactions* of 1702, discussing the animal's strange properties, in particular its asexual reproduction. See Trembley, *Mémoires*, p. 6. In France, Bernard de Jussieu had ordered drawings to be done for inclusion in Reaumur's *Mémoires*, though Jussieu had assumed that the organism was a plant. See Dawson, *Nature's Enigma: The Problem of the Polyp in the Letters of Bonnet, Trembley and Réaumur*, pp. 110–11.

[3] As Dawson puts it, 'Trembley's polyp made the decade of the 1740s one of crisis.' Dawson, *Trembley's Polyp,* p. 185. For Janelle Schwartz, the polyp provoked a 'paradigm shift' in eighteenth-century theories of classification and of 'vitality' more generally; see Janelle A. Schwartz, *Worm Work: Recasting Romanticism* (Minneapolis: University of Minnesota Press, 2012), pp. 72–74.

[4] In particular, the polyp was used to bolster materialist, even atheist, theories of life; the most important treatment of the materialist polyp remains Aram Vartanian, 'Trembley's Polyp, La Mettrie, and Eighteenth-Century French Materialism', *Journal of the History of Ideas*, 11.3 (1950), pp. 259–86.

[5] As I will discuss below, Charles Bonnet even used the term 'moi' to refer to the polyp.

concerned with the implications of the polyp for wider conceptions of 'nature' considered the tiny animal to provide a crucial piece to the puzzle of how order could arise from apparent chaos.[6] The spontaneity of the polyp's reproduction thus seemed to favour materialist or vitalist theories of life over providentialist explanations according to which God had preordained the order of the living.[7]

In this sense, the polyp was closely connected to a second entomological image (and object of study) frequently used by eighteenth-century thinkers of very different stripes: the bee swarm. By the mid-century, the swarm had become one of the most widely used images among vitalist medical writers to figure interaction between the different parts of the animal oeconomy of the human body.[8] While naturalists such as Réaumur or the writers of beekeeping manuals we will encounter in chapter five defined the swarm as the temporary and highly unstable formation of a collective of bees as they searched for a new home, these medical writers were fascinated by the way in which the swarm seemed to form a new bodily unity irreducible to the insects that formed it. The swarm-body, they argued, mirrored the oeconomy of the human body, similarly composed of seemingly independent parts that became one with the body as a whole. Vitalist writers used the swarm not only to figure, but also to explore and speculate about the relationship between bodily parts and wholes. If each of the swarm's parts was an independent whole in itself (the single bee), how did these parts come to form the swarm? How could the human observer continue to distinguish between the animal's whole and its parts?

The use of the images of the polyp and of the swarm have been discussed by scholars, particularly in their function as metaphors for the materialist ideas of the period.[9] Thus, in a pioneering article, Aram Vartanian argued that the polyp, especially through the work of Julien Offray de La Mettrie (1709-1751), represented a watershed

[6] This question, as Jonathan Sheehan and Drohr Wahrman have recently shown, had become particularly urgent in the second third of the eighteenth century, and occupied intellectuals of all stripes. One answer, the idea of spontaneously emerging orders, or what they term 'the language of self-organisation', provided a shared vocabulary and conceptual toolbox for naturalists and social theorists alike: Sheehan and Wahrman.

[7] For an overview of theories of generation and the polyp's challenge to preformationism, see Shirley A. Roe, 'The Life Sciences', in *The Cambridge History of Science. Volume 4: Eighteenth-Century Science*, ed. by Roy Porter (Cambridge: Cambridge University Press, 2003), pp. 397–416 (pp. 408–11).

[8] Vila, *Enlightenment and Pathology*, pp. 71–73; Charles T. Wolfe and Motoichi Terada, 'The Animal Economy as Object and Program in Montpellier Vitalism', *Science in Context; Cambridge*, 21.4 (2008), 537–79 (pp. 550–54).

[9] Vartanian,'Polyp'; Annie Ibrahim, 'Maupertuis dans Le Rêve de D'Alembert : l'essaim d'abeilles et le polype', *Recherches sur Diderot et sur l'Encyclopédie*, 2011; Tunstall.

moment for materialist theories that strove to explain the living without recourse to the divine.[10] Virginia Dawson, by contrast, has emphasised the Calvinist context of Trembley's Geneva, which she described as more liberal and conducive to the experimental study of nature than Catholic France.[11] Similarly focusing on the Genevan context and on experimental practice, Marc Ratcliff has considered the polyp as enabling the development of microscopy, as naturalist shared observations and specimens across European boundaries, all the while leaving metaphysical speculations to the philosophers.[12] Conversely, historians of vitalist medicine have highlighted the popularity of the image of the bee swarm in descriptions of the human organism.[13] Diderot's use of the image, in particular, has attracted the attention of literary scholars: Kate Tunstall has thus recently analysed the philosophe's use of the image of the swarm for speculating about human beings without an immaterial soul, but also as an image of the collective nature of truth.[14]

In this chapter, I shall present these familiar images as they were used as vehicles for contrasting speculations about both natural and social wholes, and about the different dynamics that various Enlightenment thinkers considered to enable previously independent parts to come together and form such wholes.[15] While the polyp might seem to represent nothing more than a curious aberration from nature's usual patterns, the issues it raised played into contemporary political economic discussions on the relationship between individuals and aggregates. Both polyps and swarms raised a fundamental problem for Enlightenment thinkers: how does a multitude of seemingly distinct parts become a harmonious whole? This also raised the related question of how exactly natural and social wholes were held together. As we will see, the selection of thinkers studied in this chapter gave slightly different

[10] Vartanian, 'Trembley's Polyp'. See also Dawson, *Nature' Enigma,* pp. 155-156; Jacques Roger, *Les sciences de la vie dans la pensée française du XVIIIe siècle: la génération des animaux de Descartes à l'Encyclopédie* (Paris: Colin, 1963), p. 749.
[11] Dawson, *Nature's Enigma*.
[12] Marc J. Ratcliff, pp. 103–24; Marc J. Ratcliff, 'Abraham Trembley's Strategy of Generosity and the Scope of Celebrity in the Mid-Eighteenth Century', *Isis*, 95.4 (2004), 555–75 <https://doi.org/10.1086/430649>.
[13] Vila, *Enlightenment and Pathology*, pp. 71-73; Wolfe and Terada, 'Animal Economy', pp. 537-79.
[14] Tunstall, 'Embodied Mind'; another literary analysis is Colas Duflo, 'Diderot and Ménuret de Chambaud', *Recherches sur Diderot et sur l'Encyclopédie*, No 34.1, 25–44.
[15] Rudy Le Menthéour has analysed both the image of the hive and of the polyp in view of the kinds of 'communities' they are used to imagine. While this chapter is thus close to Le Menthéour's article, I also show that both images could be used to illustrate and think through contrasting theories of social organisation, rather than, as Le Menthéour contends, polyps serving only to illustrate a 'communauté organique' and bees a 'société structurée'.

answers, but these two questions, raised via discussions of bee swarms and polyps, hovered over all writings discussed here.

The link between the natural and social worlds was provided by the notion of the 'oeconomy'. At its most fundamental level, the term 'oeconomy' described the relation between parts and wholes, and as such could refer to human and animal bodies (the 'animal oeconomy') as much as to households (the domestic oeconomy) or the organisation of social bodies ('political oeconomy').[16] As the polyp pushed thinkers to clarify and, in some cases, revise their notion of the animal oeconomy, understood as the interaction between body parts that gave life to the whole, they were thus simultaneously reflecting on the interaction in nature between wholes and parts more generally. The problem raised by these 'insects' (for polyps were classified as such once it was clear that they were, indeed, animals) touched on contentious questions about the interaction between soul (or mind) and body, the nature of the 'oeconomy' of the living body and − by implicit or explicit analogy − the 'oeconomy' of human individual and collective bodies. The following sections will focus on the notion of the (animal) oeconomy in order to explore how reflections on the insect body interacted with, provided images for or shaped reflections on both animal and human bodies as they came to form new collectives irreducible to the particular parts composing them. The concept of the animal oeconomy, broadly defined as the ensemble of anatomical structures, organs and fluids necessary for the upkeep of the living body, spanned all living beings from insect to man and made the study of one kind of body relevant to that of another. Definitions of the animal oeconomy, in other words of bodily 'life', in turn affected understandings of social life.[17] One name sometimes given to the force that 'glued' parts together into wholes was sensibility,

[16] See the definitions provided in Académie française, 'Oeconomie', *Dictionnaire de l'Académie Française* (Paris: Vve J. B. Coignard et J. B. Coignard, 1694), 140; Jean-Joseph Ménuret de Chambaud, 'OEconomie Animale, (Médec.)', *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers,* ed. by Denis Diderot and Jean le Rond d'Alembert, (University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), ed. by Robert Morrissey and Glenn Roe) <http://encyclopedie.uchicago.edu>; Jean-Jacques Rousseau, 'Economie Ou Oeconomie', *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*, ed. by Denis Diderot and Jean le Rond d'Alembert, (University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), ed. by Robert Morrissey and Glenn Roe) <http://encyclopedie.uchicago.edu>
. See also definitions by Lissa Roberts, 'Practicing Oeconomy during the Second Half of the Long Eighteenth Century: An Introduction', *History and Technology*, 30.3 (2014), 133–48; De Marchi and Schabas; Emma Spary, 'Political, Natural and Bodily Economies', pp. 178–79.

[17] Harro Maas analyses the thought of Thomas Reid to show how his understanding of physiology affects his political economic thought; Maas 'Mechanism'.

and its close relative sympathy.[18] In social as much as in physiological bodies, sympathy was a natural force connecting living and sensitive parts through sensation. It thus did not require a conscious mind or will to operate but instead caused immediate, unwilled bodily reactions (such as, in humans, blushing). Sympathy was thought to connect individual bodies into social wholes, but on a smaller scale it also circulated through living bodies ensuring the communication between body parts.

In this chapter, we shall be moving between two broad kinds of answers to the question of the generation and function of organic and social wholes: answers that had recourse to the notion of a providential order, and answers that, instead, theorised the existence of a force (or forces) that, distinguishing the living from the non-living, enabled previously independent parts to form new, self-sustaining wholes. These theories of the bodily wholes will be analysed, first with regards to the polyp and second in writings on the bee swarm, in order to tease out how images of insect bodies were used to think through the ways in which seemingly disparate parts could come to act as one functioning animal or political economy.

2. Trembley's Polyp

As Trembley describes in the account of his discovery and the ensuing experiments (published in 1744), the first problem posed by the polyp's strange qualities was to determine whether the being he had observed was, indeed, an animal.[19] While the hydra's capacity to generate from budding and its unequal number of arms (or, Trembley thought at first, roots) seemed to place it in the category of plants, its ability to move suggested that it was an animal. Though some naturalists speculated that the hydra might provide the 'missing link' between the animal and vegetable kingdoms, using the tiny organism to support the theory of a 'chain of being' according to which all of creation, from mineral to human, was linked through almost imperceptible gradations, both Réaumur and Trembley rejected the idea of the polyp as an

[18] For good definitions of this ambiguous concept, see Vogl, *Kalkül und Leidenschaft*, pp. 83-96; Evelyn L. Forget, 'Evocations of Sympathy: Sympathetic Imagery in Eighteenth-Century Social Theory and Physiology', *History of Political Economy*, 35 Suppl 1 (2004), 282–308; Anne C. Vila, 'Beyond Sympathy: Vapors, Melancholia, and the Pathologies of Sensibility in Tissot and Rousseau', *Yale French Studies*, 1997, 88–101; James Rodgers, 'Sensibility, Sympathy, Benevolence: Physiology and Moral Philosophy in Tristram Shandy', in *Languages of Nature: Critical Essays on Science and Literature*, ed. by Ludmilla Jordanova (New Brunswick: Rutgers University Press, 1986), pp. 117–58.
[19] Trembley's experiments are described in Dawson, *Nature's Enigma.*

intermediate being and classified the animal as an insect.[20] The second problem posed by the polyp was its extraordinary capacity to survive not only all sorts of mutilations to which naturalists and *curiosi* subjected them, but to generate new specimens from the severed parts.[21] This discovery was extraordinary; while naturalists knew of animals able to regrow severed body parts (Réaumur had shown, for example, that crayfish can grow back mutilated legs), an animal able to produce complete individuals from its own bodily matter, without needing a 'head', had hitherto been unimaginable.[22] The discovery of the polyp also raised the spectre of spontaneous or equivocal generation, the Aristotelain idea that animals could generate spontaneously from putrefied matter without requiring a sexual act.[23] Réaumur had entered into a debate on the matter with the Jesuit authors of the *Journal de Trévoux,* who to his dismay continued to defend the theory:

> j'ai mis même au nombre des obstacles qui avoient le plus arrêté le progrès de nos connoissances sur les insectes, l'opinion des anciens qui faisoit sortir de la pourriture de différens corps; car dès qu'on croyoit qu'ils venoient de corruption, la partie la plus curieuse de leur historie, tout ce qui a rapport à la manière dont ils se perpétuent, ne sembloit pas demander à être étudiée.[24]

The error of the Jesuits, Réaumur argued, was to believe that randomness, rather than a host of regular and thus calculable and observable 'circonstances' governed animal (re)production, an idea that contradicted his notion of a natural order governed by regular

[20] Réaumur, as we have seen, included any animal that did not fit the categories of quadruped, bird or fish as an insect; see Réaumur, *Mémoires* VOL 1, pp. 57–58. Trembley's cousin Charles Bonnet did not hesitate to consider the polyp 'an intermediate being', publishing, against Réaumur's advice, an illustration of the 'scale of beings in his 1745 *Traité d'Insectologie*; see Dawson, *Nature's Enigma*, pp. 167-176. The classic study of the chain of being is Arthur O. Lovejoy, *The Great Chain of Being: A Study of the History of an Idea* (New York: Harper and Row, 1960).

[21] Today, the hydra is studied above all as a potentially immortal organism; see Melinda Cooper, 'Rediscovering the Immortal Hydra : Stem Cells and the Question of Epigenesis', *Configurations*, 11.1 (2004), 1–26.

[22] Réaumur discusses the polyp soul's location, presuming that souls should be located in the head ; see Réaumur, *Mémoires* 6, p. lxvii. On the crayfish experiments, see Catherine Abou-Nemeh, 'Réaumur's Crayfish Experiments in Hartsoeker's Système Regeneration and the Limits of Mechanism', in *The Life Sciences in Early Modern Philosophy*, ed. by Ohad Nachtomy and Justin E. H. Smith (Oxford: Oxford University Press, 2014), pp. 157–80.

[23] For a comprehensive analysis, see Peter McLaughlin, 'Spontaneous versus Equivocal Generation in Early Modern Science', *Annals of the History of Philosophy and Biology*, 10 (2005), 79–88.

[24] Réaumur, *Mémoires* vol 2, p. xvi.

laws instituted by divine Providence.[25] Discussions about the nature of polyps, that is, stoked disagreements not only between Catholics and potential unbelievers, but also between adherents of different strands of Catholicism. Unsurprisingly, then, Trembley's discovery of the freshwater hydra only a few years later threatened to destabilise this idea of providential creation. In the introduction to his memoir on the polyp, Trembley reflected on the consequences of his discovery for ideas about the order of animal life, which he subsumed under the notion of the animal oeconomy:

> Je ne regardai cependant le mouvement de ces deux moitiés du même Polype, que comme des signes d'un foible reste de vie. C'est ce que je pensois surtout par rapport à la derniére partie: car pour l'autre, j'étois porté à croire, en supposant le Polype un Animal, que sa tête & une partie du corps pût encore vivre. Je pensai que l'opération que j'avois faite, n'étoit à son égard qu'une mutilation, qui n'avoit pas dérangé essentiellement en elle l'oeconomie animale.[26]

As the Genevan naturalist describes, he had assumed that an animal requires a head – the seat of the faculties of will and consciousness directing the movements of the body – in order to survive. The functioning of the animal oeconomy depended on a constant circulation of 'forces' between the head and other organs. Hence, Trembley expected to see the headless part of the polyp die.[27] To the naturalist's surprise, however, the second part not only continued to live by itself, but to generate a new head and 'arms'. With the discovery that both halves of the polyp continued to live despite his mutilations, Trembley was challenging the mechanist notion of the animal oeconomy: even though he had removed some of the fundamental 'springs' of the polyp body, the 'little machine' continued to function.[28] At the time of Trembley's discovery, as we have seen in the previous chapter, the theory of the animal soul had become generally accepted.[29] The polyp, however, challenged this orthodoxy. If the polyp had a soul, where was it located? What happened to the soul when offspring 'grew' from the

[25] Mary Terrall, *Catching Nature in the Act: Réaumur and the Practice of Natural History in the Eighteenth Century* (Chicago: The University of Chicago Press, 2014), pp. 98–101.
[26] Trembley, *Mémoires*, p. 14.
[27] Ménuret, "Oeconomie Animale", pp. 365-6.
[28] Dawson, *Nature's Enigma*, pp. 112-118.
[29] See also Dawson, 'The Problem of Soul in the "Little Machines" of Reaumur and Charles Bonnet'.

orginal polyp? Were there, as Réaumur speculated, 'ames sécables'?[30] Even when leaving aside the idea of an immortal animal soul, the polyp's divisibility troubled the hierarchy between the head as the seat of the central, directive faculty and the rest of the body. While the iatromechanist theory of the body had suggested that each organ or body part served a distinct function, the polyp's parts seemed able to spontaneously change their function without requiring a central directive faculty. In the absolutist culture of eighteenth-century France, this idea seemed to undermine the established order. In the widespread metaphors equating the human body with the body politic, after all, the head usually served to represent the king, and any suggestion that a living body, be it merely that of a polyp, could survive without the direction of a head thus evoked the threat of political subversion.[31]

The wider reading public first learnt of Trembley's discovery through its publication in the 1741 issue of the *Histoire de l'Académie des Sciences.* As the hyperbolic language of the article makes clear, the polyp's strange capacities pushed thinkers, from the moment of its first discovery, to question the presumed order of organised beings preordained by a providential God:

> Les idées chimeriques de la Palingénésie ou régénération des Plantes & des Animaux, que quelques Alchymistes ont cru possible par l'assemblage & la réunion de leurs parties essentielles, ne tendoient qu'à rétablir une Plante ou un Animal après sa destruction; le Serpent coupé en deux, & qu'on a dit se rejoindre, ne donnoit qu'un seul & même serpent; mais voici la Nature qui va plus loin que nos chimères. De chaque morceau d'un même animal coupé en 2, 3, 4, 10, 20, 30, 40 parties, &, pour ainsi dire, haché, il renait autant d'animaux complets & semblables au premier.[32]

The challenge that the polyp presented to theories of the singular living being that considered it a preordained whole is particularly apparent in Trembley's experiments on the animal's digestive functions. The question of nourishment and digestion was a

[30] René Antoine Ferchault de Réaumur, *Mémoires pour servir à l'histoire des insectes* (Paris: de l'Imprimerie Royale, 1742), VI, p. lxvii.
[31] Arnold D. Harvey, *Body Politic: Political Metaphor and Political Violence* (Cambridge Scholars Publishing, 2007).
[32] *Histoire de l'Académie des Sciences, année 1741* (Amsterdam: Pierre Mortier, 1747) 1: 46. Quoted in Dawson, 7. For the argument that the polyp was associated with wonder, see Schwartz, *Wormwork*, pp. 80-98.

crucial one for Trembley, as these processes were considered key to understanding how the different body parts came together to provide the whole with nutrients. The nutritive faculty of the living being was considered fundamental by both iatromechanists and vitalists alike to the functional unity of the animal, given that during the digestive processes, the individual parts of the body had to interact to nourish the whole. Boerhaave, whom Trembley had studied, had even based the distinction between animal and plant on the criterion of digestion, arguing that animals digested their food through internal and plants through external 'roots'.[33] Even after Réaumur had confidently pronounced the polyp to be an animal rather than a plant, using its capacity to move as the central criterion, Trembley, influenced by Boerhaave, continued to withhold his judgment until he had managed to observe the little animal's nutritional strategy.[34] As Dawson's analysis of Trembley's correspondence reveals, the Genevan naturalist took great care in studying the polyp's digestion, even delaying the publication of his memoirs so that he could confirm his observations. It took Trembley almost a year before he could watch the animal catch its prey with its tentacles and swallow it and then to observe the food enter the cavity that he could only then confirm to be the stomach.[35] Given the importance of digestion for the functional unity of the animal body, Trembley was interested in understanding polyp digestion not only so as to classify the being as either plant or animal but also, once he had settled that question, for understanding the 'oeconomy' at work in the polyp's body. In so doing, Trembley's research resonated with heated debates about animal and human vital functions − of which digestion proved one of the most contentious − and whether or not mechanist explanations could sufficiently account for them.[29]

Trembley assumed that the polyp's structure, rather than its vital forces, could explain digestion. While the polyp had no visible vessels, as required by Boerhaave's model of the body, Trembley could uphold the Boerhaavian model by arguing that the entire body of the polyp was one long vessel.[36] In order to prove this, Trembley

[33] On this point, see Dawson, *Nature's Enigma,* pp. 118-131.
[34] Dawson, *Nature's Engima*, p. 120.
[35] John R. Baker, *Abraham Trembley of Geneva: Scientist and Philosopher (1710-1784)* (London: Edward Arnold, 1952), pp. 60–61.
[29] The debates surrounding digestion as they related to issues of diet and consumption are outlined in Spary E. C. Spary, *Eating the Enlightenment*, ch. 1; Elizabeth A. Williams, 'Food and Feeling: "Digestive Force" and the Nature of Morbidity in Vitalist Medicine', in *Vital Matters: Eighteenth-Century Views of Conception, Life, and Death*, ed. by Helen Deutsch and Mary Terrall (Toronto: University of Toronto Press, 2012), pp. 203–21.
[36] Trembley, *Mémoires*, p. 52. Dawson, *Nature's Enigma,* p. 126.

undertook one of his most famous experiment, turning a polyp inside out 'like a glove'.[37] He thus fed the animal a worm so as to dilate its mouth and stomach and then pierced the polyp with a pig or boar bristle to prevent it from turning back into its original form: 'de faire en sorte que la superficie intérieure de sa peau devienne donc la superficie extérieure, & que l'extérieure devienne l'intérieure.'[38] The chiasmus of this sentence underlines the marvellous nature of an animal body turned inside out, highlighting the way in which the hydra seemed to defy notions of inside and outside, and of a fixed order of organisation for the animal body. In the case of the polyp, it seemed, body parts could be remodelled to serve new functions, all the while maintaining the animal oeconomy. As Trembley notes in the conclusion to his unusual experiment, his new creations were capable of reproduction and could thus be considered functional animals.[39]

In another experiment on digestion, this time aimed at understanding the interaction between seemingly distinct polyp bodies, Trembley inserted one polyp individual into another's stomach. After his observations of the nourishment of polyp bodies, he had decided to study the way in which the two polyps that he had merged together might be able to consume and digest food. Although he attempted to distinguish between what he termed the 'polype intérieur' (the insertee) and the 'polype extérieur' (the inserted polyp), he noticed not only that the polype extérieur did not 'digest' the polype intérieur, but also that the inner polyp digested the worms the naturalist had fed it in a way that allowed the outer polyp, the mouth of which was stuffed by the second animal, to benefit from the nutrients:

> Il a avalé, & après qu[e le ver] a été digéré, le suc nourricier s'est répandu sensiblement dans toutes les parties des deux polypes. […] Il me seroit impossible de dire dans quel état étoit la portion du Polype intérieur cachée dans le Polype extérieur, peu après qu'elle s'est ouverte: mais, je puis assurer, qu'elle s'est ensuite confondue avec la portion *a i* du Polype extérieur, sans ôser, cependant, dire comment cela s'est fait.[40]

[37] The image is Trembley's; *Mémoires,* p. 253.
[38] Trembley, *Mémoires,* p. 253.
[39] 'Ils ont mangé, crû, & multiplié.' Trembley, *Mémoires*, p. 161.
[40] Trembley, *Mémoires*, pp. 286-287. The letters *a I* refer to the book's accompanying illustrations.

Despite its otherwise rapacious character, as Trembley had described in the second part of the *Mémoires*, the polyp refused to consume its own kind even at the risk of starvation. Over the course of the three months that Trembley observed the merged polyps, they continued to share their food, gradually growing into one another and even producing offspring.[41] Trembley's experiments on joining two previously separate polyps was one way of asking the question of how, and when, parts became new bodily wholes. For Trembley's polyp, the answer was not to be found in speculations about the animal soul; rather, he showed that the two polyps became one through the sharing of nutritive matter.

As this short overview of Trembley's experiments has shown, the polyp seemed to challenge notions of the singular animal body as an entity easily distinguishable from other bodies of its kind. The polyp's body subverted the conventional notions of visible and porous surface (the skin and hidden inside (organs, fluids). The experiment on the digestive processes of two merged polyps, on the other hand, seemed to indicate that the polyps' animal oeconomies could interact with each other spontaneously and collaboratively, thus forming a new bodily oeconomy in which nutrients could circulate between body parts formerly belonging to two different wholes. Although the naturalist himself refused to speculate openly about the metaphysical implications of his discovery, as we shall see in the next section, other eighteenth-century writers eagerly took on the challenge posed by Trembley's experiments.

3. Gilles-Auguste Bazin's *Abrégé de l'Histoire des Insectes*: the Polyp and its Moral Lessons

The discovery of the polyp, occurring as it did at a time when authors had begun to capitalise on (and thus reinforce) the wider reading public's curiosity about the insect world, was soon incorporated into entertaining and educational natural history texts.[42] Virginia Dawson has discussed in detail the angle taken by Réaumur on the polyp

[41] Trembley, *Mémoires,* p. 387.

[42] On scientific texts for 'polite audiences', see Aileen Fyfe, 'Reading Children's Books in Late Eighteenth-Century Dissenting Families', *The Historical Journal*, 43.02 (2000), 453–473; Mary Terrall, 'Fashionable Readers of Natural Philosophy', in *Books and the Sciences in History*, ed. by Marina Frasca-Spada and Nicholas Jardine (Cambridge: Cambridge University Press, 2000), pp. 239–54; On Bazin, see Emma Spary, 'Political, Natural and Bodily Economies','Economies'; Marc Olivier, 'Gilles Auguste Bazin's "True Novel" of Natural History', *Eighteenth Century Fiction*, 18.2 (2005), 187–202.

debate; here, I will focus on the writings of his correspondent Gilles-Auguste Bazin (1681-1754), comparing his description of the polyp with that of contemporaneous writings. The aim of this section is to outline different ways in which the polyp was used to model the way in which parts are bound into communities. A close collaborator of Réaumur and himself an avid observer of insects, Bazin summarised the academician's findings to make them palatable and pleasing to a more general, and in particular to a female, readership.[43] While his texts closely follow those of Réaumur and, in the case of the polyp, of Trembley, their rendering in a literary format allows Bazin to spell out the implications of the polyp for his reading public, avid for natural historical knowledge that would serve them in the management of their daily lives. Bazin uses the bodily oeconomy of the polyp to emphasise the 'naturalness' of the household oeconomy he describes in his dialogue: hierarchical, composed of virtuous members and managed by women who are conscious of their duties as managers and mothers and seek to fulfil their role as best they can.

Following his *Abrégé de l'Histoire des abeilles* (1744), which was almost immediately translated into English, Bazin published the four-volume sequel *Abrégé de l'Histoire des Insectes* (1747).[44] It thus seems that Bazin was successful in reaching a wider audience and convincing his readers of the usefulness of the knowledge contained in his texts.[45] The *Abrégé*'s five volumes are constructed as a dialogue between the enlightened naturalist Eugène, explicitly said to be the voice of the author, and two female friends, called Clarice and Hortense.[46] As we learn in the first volume, Clarice is a 'mère de famille, à la tête d'un ménage de campagne' whose friend Eugène (their exact relation is never specified), visits her at her countryside home.[47] In this pastoral setting, Clarice declares that Réaumur's work on bees, recommended to her by Eugène, is written in too 'geometric' a style to suit her needs as a busy mother and

[43] On Bazin as a collaborator of Réaumur, see Terrall, *Catching Nature in the Act: Réaumur and the Practice of Natural History in the Eighteenth Century*, pp. 29–38.
[44] Gilles Augustin Bazin, *Abrégé de l'histoire des insectes, pour servir de suite à l'histoire naturelle des abeilles*, 3 vols (Paris: les Frères Guerin, 1747); Gilles-Augustin Bazin, *Histoire Naturelle Des Abeilles*, 2 vols (Paris: Guerin, 1744), I; Gilles Augustin Bazin, *The Natural History of Bees. Containing An Account of Their Production, Their Oeconomy, the Manner of Their Making Wax and Honey, and the Best Methods for the Improvement and Preservation of Them. Illustrated With Twelve Copper Plates. Translated from the French.* (London: J. and P. Knapton, 1744).
[45] What Emma Spary calls the 'beau monde' of eighteenth-century France. Spary, 'Economies'.
[46] On Bazin's use of the form of the pedagogical dialogue, see Nathalie Vuillemin, 'Le dialogue aux prises avec la science des lumières : Gilles-Augustin Bazin et les langues du savoir', *Comètes, Revue des littératures d'Ancien Régime*, 1 (2004), unpaginated.
[47] Bazin, *Abrégé des abeilles* I, p. 2.

manager of her household. Eugène/Bazin reassures her that bees are not only capable geometers and contributors to the 'improvement' of her household by providing honey and wax, but might also serve as a source of knowledge about her own domestic 'oeconomy'. Like herself, the bees are members of 'un peuple industrieux, laborieux, infatigable, rigide observateur de ses loix, plein de prévoyance, & d'oeconomie, dont la passion dominante est la prospérité et le bien de la famille; d'un peuple, en un mot, qui semble avoir pris modèle sur vous.'[48] As Eugène's introduction to the world of the bees makes clear, the insects in his text will be used to transmit a view of nature, and by implication, a view of society, based on the familial oeconomy as well as on hard work and the 'oeconomic' management of one's resources and on women's willingness to take up their role as managers of the domestic oeconomy.[49]

The dialogue form thereby not only makes Réaumur's natural histories more palatable to women like Clarice. As Eugène takes it upon himself to explain the memoir on bees in the format of the conversation, he also directs the characters' and readers' interpretation of the insect world more closely than the genre of the academic treatise would allow. Eugène thus frequently links the natural history of insects to the lives of his interlocutors, and hence to those readers who might identify with them. By presenting the queen bee as the manager of a large household, for instance, Eugène can use the insects to model Clarice into the ideal female 'agricultural improver', who even promises to disseminate the new beekeeping techniques her tutor had shown her among the peasants working her land. The natural history of insects, as Emma Spary has shown, here serves the purpose of improving the mind of the female observer, who acquires a new sense of civic-mindedness from the industrious creatures she observes.[50] The younger, still unmarried Hortense, on the other hand, is taught to prefer the regulated, 'oeconomic' lives of the insects she observes with her friends to her old life as Parisian socialite. Before she leaves Clarice's estate, she thus declares herself 'converted' to the more austere lifestyle that the rural nobility was then beginning to promote for itself:

> Ces gens tout occupés de jeux, de fêtes, de spectacles, de festins, d'intrigues ambitieuses, de visites, de courses, auront assurément peine à comprendre

[48] Bazin, *Abrégé des abeilles* I, p. 4.
[49] Spary, 'Economies'.
[50] Spary, 'Economies', pp. 285-287.

> comment des plaisirs aussi tranquilles & aussi innocens que ceux que l'on m'a procuré ici, auront été capables d'attacher une personne de mon âge, accoutumée au tumulte & aux bruyans éclats de la ville. Je pensois comme eux en arrivant, & je m'en retournerai pensant comme vous.[51]

The polyp appears relatively late in the series, at the end of the second volume of the *Abrégé de l'histoire des insectes*. After Eugène and Clarice conclude their conversation by expressing their gratitude for the King who guaranteed the peacefulness of the idyllic lands (Alsace) in which they have observed their insects, Eugène sends his female friend, who is said to be occupied with a court trial, an urgent letter. Eugène's summary of the natural history of the polyp at the end of the second volume thus inaugurates the series' switch from the dialogue form to the letter form, subsequently maintained over the remaining volumes.[52] Because, in contrast to the dialogue, we never get to read Clarice's thoughts on the matter, the potential for what Nathalie Vuillemin sees as the dialogue's capacity to 'déjoue[r] les stratégies d'un savoir monologique – et masculin' is removed.[53] As we move from bees to the polyp, the significance of which was contested by writers with very different theories of 'nature', and also through the change in form, Bazin's text works to constrain even further the little room there is to question his interpretation of the insect world.

Eugène's letter begins by explaining the reception of the polyp by the learned, as well as its consequences for contemporary understandings of nature. With the help of a series of hyperboles, he tells Clarice:

> Je n'eus pas plutôt appris cette nouvelle dont je veux vous faire part, que je renonçai sur le champ à ma léthargie. Depuis ce tems j'observe jour & nuit, & je vois des prodiges. Je vous conseille, Clarice, de laisser là vos soins domestiques, de perdre votre procès, de vous plonger dans vos viviers, de

[51] Bazin, *Abrégé des insectes* II, pp. 176-177. On the eighteenth-century 'middling' nobility developing a new, more austere morality, see Shovlin, *The Political Economy of Virtue*.
[52] On the importance of the dialogue for Enlightenment thinking, see Penny Brown, '"Girls Aloud"; Dialogue as a Pedagogical Tool in Eighteenth-Century French Children's Literature', *The Lion and the Unicorn*, 33.2 (2009), 202–18; Claire Cazanave, *Le dialogue à l'âge classique: étude de la littérature dialogique en France au XVIIe siècle*, Lumière classique, 71 (Paris: Champion, 2007); Kevin Lee Cope, *Compendious Conversations: The Method of Dialogue in the Early Enlightenment* (Bern: Peter Lang, 1992); Daniel Brewer, 'The Philosophical Dialogue and the Forcing of Truth', *MLN*, 98.5 (1983), 1234–47.
[53] Vuillemin, 'Le dialogue', p. 12.

> pêcher des Polypes, & de voir le plus étonnant spectacle qui se soit jamais présenté à l'oeil humain; une découverte en un mot qui déconcerte toute la nation des raisonneurs.[54]

Writers like Diderot (as we will see in more detail below) would later speculate about, and figure, a godless universe populated by human polyps as soulless, sexless beings without a fixed species identity.[55] Bazin's civilising mission leads him to give a very different spin to the story of the polyp. The strangeness of the newly discovered animal is thus presented as another example of the wonders found in the insect world, even if a particularly striking one. In the first volume of the *Abrégé*, the author had promised his readers that they would find marvels even in the world of the common bee: 'Mon but n'est autre que que de présenter aux yeux du Lecteur les merveilles que la Nature a opérées dans les Insectes.'[56] Bazin's phrase 'spectacle étonnant' also recalls the abbé Pluche's *Spectacle de la nature,* a multi-volume bestseller that used the dialogue form to teach its readers about the animal, plant and human worlds.[57] As the title indicates, Pluche's *Spectacle* used natural phenomena − with insects representing almost two thirds of the animals discussed − to demonstrate to readers that nature's variety and orderliness (though inscrutable) spoke of God's role as supreme artisan of nature. Just like his source and correspondent Réaumur, Bazin thus believed in the orderliness of the universe and in God's construction of elaborate mechanisms for particular insect bodies and structures, without, however, completely subscribing to the Cartesian assumption of a universe governed by universal mechanical laws.[58] Even a creature like the polyp, which Diderot would fashion into an example of monstrosity, was thus made readable as proof of God's creative powers;[59] the variety of insect forms and

[54] Bazin, *Abrégé des insectes* II, pp. 185-186.
[55] On Diderot's fluid view of categories of species, see Curran.
[56] Bazin, *Abrégé des insectes* II, p. xi.
[57] On Pluche, see Ann Blair, 'Noël-Antoine Pluche as a Jansenist Natural Theologian', *Intellectual History Review*, 26.1 (2016), 91–99; Cynthia Koepp, 'Curiosity, Science, and Experiential Learning in the Abbé Pluche's, Spectacle de La Nature', in *Childhood and Children's Books in Early Modern Europe, 1550-1800*, ed. by Andrea Immel and Michael Whitmore (London: Routledge, 2006), pp. 153–80; Andreas Gipper, 'Vulgarisation scientifique et physico-théologie en France : le spectacle de la nature de l'abbé Pluche', in *Le partage des savoirs : XVIIIe – XIXe siècles*, ed. by Lise Andries (Lyon: Presses universitaires de Lyon, 2003), pp. 21–34; Benoît De Baere, *Trois introductions à l'abbé Pluche : sa vie, son monde, ses livres* (Genève: Droz, 2001); Dennis Trinkle, 'Noël-Antoine Pluche's Le Spectacle de La Nature: An Encyclopaedic Best Seller', in *Studies on Voltaire and the Eighteenth Century*, ed. by Anthony Strugnell (Oxford: Voltaire Foundation, 1998), CCCLVIII, 93–134.
[58] Roger, *Les sciences de la vie*, p. 224.
[59] Curran, 'Monsters'.

behaviours might be evidence that no general, overarching laws of nature existed, but they were, nevertheless, said to be examples of the wonders created by a providential God.[60]

Despite Eugène's dramatic introduction to the wonders of the polyp, the bulk of his letter focuses on the animal's morphology as well as on the behaviours it shares with more well-known animals, such as food procurement or digestion. While he admits that the hydra's capacity to regenerate from budding challenges the explanations of the 'nation des raisonneurs', Eugène insists that form and function are as linked in the polyp as in any other of God's creatures. Eugène's explanation of the polyp's perceptual abilities, for instance, is typical of descriptions of insects based on the providentialist idea that God had perfectly matched each creature's structures to the purpose they served, even if this purpose was not always accessible to the human observer.[61] The polyp, though it has no visible eyes, for example, is nevertheless sensitive to light, because it feeds on insects that are drawn to light: 'Il étoit donc d'une utilité indispensable aux Polypes d'avoir un sentiment qui les conduisît vers la lumiere, pour y trouver leur vie.'[62] While the polyp might destroy some prior assumptions about the general laws of nature, then, Eugène can nevertheless use the insect to inspire confidence about God's creative powers when it comes to the order of animal bodies.

Bazin's tendency to explain the polyp's strange qualities through the providentialist framework of orderliness and purpose emerges also in his discussions of those deemed the most noteworthy and potentially troubling by his contemporaries.[63] Eugène describes Trembley's experiments on merging polyps, for example, not in the context of the naturalist's 'operations' aimed at testing the animal's capacity to multiply through cuttings, as was the case in the Genevan's *Mémoires*. Instead, Trembley's experiment on polyps that digest as one animal when inserted into

[60] Bazin, *Abrégé des insectes* II, p. xiii.
[61] On providentialist readings of insects, see Roger, *Sciences de la vie*, pp. 224-241; Eric Jorink, 'Between Emblematics And The "Argument From Design": The Representation Of Insects In The Dutch Republic', in *Early Modern Zoology: The Construction of Animals in Science, Literature and the Visual Arts*, ed. by K.A.E. Enenkel and M.S. Smith (Leiden: Brill, 2007), pp. 147–76; Brian W. Ogilvie, 'Natural History, Ethics, and Physico-Theology', in *Historia: Empiricism and Erudition in Early Modern Europe*, ed. by Gianna Pomata and Nancy G. Siraisi (Cambridge, Massachusetts: The MIT Press, 2005), pp. 75–103.
[62] Bazin, *Abrégé des insectes* II, p. 209.
[63] For uses of the polyp to challenge nineteenth-century possessive individualism, see Danielle Coriale, 'When Zoophytes Speak: Polyps and Naturalist Fantasy in the Age of Liberalism', *Nineteenth-Century Contexts*, 34.1 (2012), 19–36.

one another is framed as an experiment not on the boundaries of the singular animal body but as a test of whether or not the polyp could be turned into a cannibal.[64] Rather than describing Trembley's successful merging of two polyps into one (with the help of a boar bristle) that lived as such for several months, Eugène thus chooses to describe a similar attempt by Trembley, the result of which lasted only a couple of days: 'il a trouvé le secret de faire entrer un petit Polype dans le ventre d'un plus gros, qu'il avoit eu soin de tenir affamé. Le petit est quelquefois resté quatre ou cinq jours dans ce ventre, & en est toujours sorti plein de vie, de santé, & tel qu'il étoit entré.'[65] Though further on in the letter Eugène does hint at the experiment that led to the two polyps merging into one another, he quickly glosses over it, neglecting to mention that they share their resources, and instead refers the reader to Trembley's memoirs for the description of 'beaucoup d'autres expériences que je passe sous silence'.[66] Ignoring the more striking result of another iteration of the experiment, Eugène thus simply concludes that rather than eat its own kind, a polyp will fast for as long several months at a time: 'Tout est compassé dans la nature avec une providence admirable.'[67] Nature's oeconomies, in other words, hold together because their order has been planned by Providence.

Eugène describes the polyp body not only as proof of Nature's orderly oeconomy, but also as an example of an insect family. In his descriptions, the distribution of resources depends not on the impossibility of distinguishing between individuals, but on the wise, hierarchical distribution of the polyp 'mother', again, perhaps, gesturing to his female readership and confirming the importance of their own duties as household managers. Though the narrator acknowledges the polyp's hermaphroditism, he begins his description of polyp reproduction by declaring that he has chosen to use the term 'mère' for the reproducing insect, simply because 'il faut s'en tenir à quelque terme'.[68] Calling the unsexed polyp 'mother' allows Eugène to refashion the multiplicity of polyps seemingly contained within an individual as a family. Polyps that digest together, for example, can thus be described as a family of mother and sons: 'nourrissez le fils seul, il transmettra sa digestion à sa mere, & si

[64] Bazin, *Abrégé des insectes* II, pp. 220-221.
[65] Bazin, *Abrégé des insectes* II, p. 221.
[66] Bazin, *Abrégé des insectes* II, pp. 259-260.
[67] Bazin, *Abrégé des insectes* II, pp. 221.
[68] Bazin *Abrégé des insectes* II, p. 231. Réaumur, too, refers to the polyp as 'mother' in his memoir ; see Réaumur, VI, p. lxxvi.

dans ce tems-là il a des petits freres, c'est-à-dire, d'autres Polypes qui soient nés à peu près en même tems que lui, & qui tiennent pareillement au corps de la mere commune, il nourrira toute la famille.'[69] Without attaching too much meaning to Bazin's use of pronouns in his descriptions of newly birthed polyps, it does seem significant that while the generating polyp is called 'mother', the young polyp that in Trembley's experiment manages to feed all polyps growing out of her is described as a male son feeding the entire 'family'. The troubling multiplicity of individual bodies is reimagined as a family, and the hermaphroditic polyp as a fertile mother capable of giving birth to as many as 18 'children'.[70] Linguistically, then, at least in the description of the generative process, the hydra has been subsumed within the conventional distinctions between sexed individuals. Even more importantly, the threat of a spontaneously organising and multiplying community of polyps, composed of infinitely divisible and malleable bodies, has been dispelled through its reduction to a family.

It is not until the end of his letter that the pious Eugène addresses the contentious question of the polyp soul, deemed by Réaumur too metaphysical to lie within the purview of the naturalist.[71] Eugène addresses the question by reporting to Clarice an open-ended dialogue between himself, an averred sceptic on the matter, and an anonymous 'hermetic' philosopher and supporter of the hypothesis of the animal soul.[72] The philosopher argues that the apparently rational behaviours of insects, such as their capacity to adapt their actions so as to increase the likelihood of catching their prey, points to the existence of a soul, or at least what he calls 'une substance pensante, & par conséquent spirituelle; car la matiere est incapable de raisonner'.[73] Eugène agrees with him that there can be no such thing as thinking matter, but the philosopher goes further. Nature, he argues, is imbued with a general 'esprit' 'sans cesse agissant, animal & vivifiant' that comes to inhabit and gives life to the bodies of plants, animals and men.[74] This life force is contained in the multitude of tiny 'germes' that make up living bodies, which, as in the case of polyps, can be divided whilst at the same time

[69] Bazin, *Abrégé des insectes* II, pp. 235-236.
[70] Bazin, *Abrégé des insectes* II, p. 238.
[71] Dawson, 'The Problem of Soul in the "Little Machines" of Reaumur and Charles Bonnet'.
[72] The philosopher's argument here is similar to that advanced by Neoplatonist thinkers such as the microscopist Nicolas Hartsoeker, whose theories – influenced by G. E. Stahl - on animal nature attracted much scholarly attention; see Cohen Rosenfield, *Beast-Machine*, pp. 97-101.
[73] Bazin, *Abrégé des insectes* II, p. 263.
[74] Bazin, *Abrégé des insectes* II, p. 266.

preserving, in each of the severed parts, the vital force that gives rise to the development of new life.[75] The philosopher's theory maintains the dualism of matter and soul that Eugène/Bazin had upheld throughout the volumes; matter could give rise to life only if it had been imbued with the vital 'esprit', particular bodies according to 'les matrices dans lesquelles [cet esprit] opère.'[76]

The philosopher's theory of the life spirit echoes the theory of generation that Trembley's cousin Charles Bonnet elaborated on the basis of polyp observations. One of Réaumur's most famous correspondents, the devout Protestant Bonnet struggled to reconcile the divisibility of the polyp body with both his religion and his belief in the animal soul. In his metaphysical works, published mainly in the 1760s, Bonnet made sense of his observations of the polyp, as well as of other divisible animals (published in1745 in his *Traité d'insectologie*), by adopting the theory of pre-existing souls.[77] According to this theory, all living and thus ensouled beings spring from miniscule 'germes' already contained in the first individuals of each of the fixed species; at each act of creation, whether through sexual reproduction or through budding, one of the previously inactive, solid 'germes' develops into a fully-fledged individual as nutritive fluids begin to circulate in it.[78] Bonnet could thus save the notion of the individual soul, as well as of the independent individual tout court, by positing that all souls had been created at the beginning of time, but required specific circumstances (such as being cut in the case of the polyp) to develop. Instead of spontaneously forming wholes composed of equally spontaneously created individuals, that is, Bonnet posits a preconceived plan according to which clearly demarcated individuals ('Personnes') develop. As Bonnet writes elsewhere, these individuals can live together out of mutual interest and are held together by their sentiments, in 'une sorte de communauté de sentimens et de besoins', all the while remaining independent selves:[79]

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[75] Bazin, *Abrégé des insectes* II, pp. 269-270.
[76] Bazin, *Abrégé des insectes* II, p. 267.
[77] Charles Bonnet, *Considérations sur les corps organisés: Où l'on traite de leur origine, de leur développement, de leur réproduction, &c. & où l'on a rassemblé en abrégé tout ce que l'histoire naturelle offre de plus certain & de plus intéressant sur ce sujet* (Amsterdam : Marc Michel Rey, 1768), p. xxxvi.; Vartanian, *Polyp*, pp. 279-280.
[78] On Bonnet's theory of reproduction, see Peter J. Bowler, 'Bonnet and Buffon: Theories of Generation and the Problem of Species', *Journal of the History of Biology*, 6.2 (1973), 259–81.
[79] As Rudy Le Menthéour argues, Bonnet is here arguing against a Lockean contractual society (on the basis of individuals characterised by sensibility rather than consciousness); Rudy Le Menthéour, 'De la ruche au polype : figures de l'organisation sociale', *Dix-huitième siècle*, 2009.1 (2009), 204–21 (pp. 214–15).

> Une Mère Polype, chargée de sa nombreuse Postérité, compose bien avec elle un seul Tout *physique*, mais non une seule *Personne*. Chaque Rejetton a son *Moi,* puisqu'il a son Cerveau propre, & l'on observe qu'il pourvoit par lui-même à sa subsistance, en saissiant de petites proyes, & en les avalant, comme le feroit tout autre Polype. L'Union étroite de la Mère & de ses Petits & des Petits entr'eux, établit dans ce Tout singulier, une sorte de communauté de sentimens & de besoins.[80]

For Bonnet, the polyps preserve their independent 'mois', even procuring their own subsistence, since they each have their own sensations. While they might form a (possibly temporary) 'Tout physique', that is, they never cease to possess their own 'moi', or 'brain'. While Eugène had thus emphasised that the polyps were bound together by maternal and filial responsibility, Bonnet describes a polyp community of atomistic but equal 'mois' united by their common interests.[81]

For both Bazin and Bonnet, then, the polyp community represents a family in which each body retains its independence all the while communicating, through sentiments (at least for Bonnet) to the maintenance of the whole. The polyp as family, however, not the only metaphor available for making sense of the strange creatures. By way of contrast, we might mention another description of the polyp aimed, like Bazin's dialogue, at a general audience of polite readers. Jacques Christophe Valmont de Bomare (1731-1807) discussed the polyp in two entries of his bestselling *Dictionnaire de l'histoire naturelle* (the first edition of which appeared in five volumes in 1764 followed by an edition of six volumes in 1767-68, nine volumes in 1775 and fifteen in 1791).[82] Bomare's dictionary was a compilation of the most important sources on natural history, though he was also an observer in his own right, and had given a popular lecture series on natural history in his cabinet in Paris. His article 'Polype' echoed the writings of Trembley, Bazin and Bonnet and described the polyp community as a family. In the entry 'coralline', however, Bomare described the polyp

[80] Bonnet, *Considérations,* p. xxxi.
[81] Menthéour,'Ruche', p. 215.
[82] On Bomare, see Robbins, pp. 166–69. The *Dictionnaire* was the third most held natural history book in private libraries after Pluche's *Spectacle* and Buffon's *Histoire naturelle* according to Daniel Mornet, 'Les enseignements des Bibliothèques privées (1750-1780)', *Revue d'histoire littéraire de la France*, 17.3 (1910), 449–96.

community as a 'republic'.[83] Explaining how polyps that had been generated from one another live together, Bomare writes:

> toutes les nouvelles générations de polypes construisent à côté & au dessus les unes des autres; obligées de tendre ailleurs leurs filets, elles forment à leur tour & en tout tems de nouvelles colonies, & celles-ci d'autres avec une fécondité prodigieuse. Comme tous les fourreaux se communiquent les uns aux autres, leurs habitans ne forment alors qu'une seule & même société, où ils se font réciproquement part de leurs butins.

Similarly to the two polyps merged together by Trembley, Bomare's polyp 'republic' share their resources, circulating food among the entire 'social' body. Instead of representing the polyps as a family household, de Bomare describes a dynamic, rapidly growing 'society' of polyps that share their resources even as they branch off into separate 'colonies'. Polyps, Bomare went on to explain, exude a 'matière gélatineuse' that binds them to one another and allows them to share resources. In Bomare's polyp republic, there are no familial hierarchies, and members are not bound together by 'besoins'; they are, instead, physically connected and need to act in concert if they are to survive at all. While Bonnet's polyps remain independent 'mois', for Bomare they not only connect to each other by sentiment, but have become a unity that feels and moves as one.

4. Insects and Materialist Theories of Active Matter

While the writers we have discussed so far used the language of human communities to understand the polyp, thereby naturalising their own vision of human communal living, others went further, making the polyp the basis of radical new theories of living

[83] 'On sait que les *Polypes* sont des insectes qui vivent en maniere de *république* : ils se pratiquent chacun une cellule qui s'obstrue bientôt par une matiere gélatineuse, plus ou moins calcaire , qui exude de leur corps'; see Bomare, Jacques Christophe Valmont de Bomare, *Dictionnaire raisonné universel d'histoire naturelle*, 6 vols (Paris: Didot, 1764), I, art. 'Coralline', p. 679. By the 1771 edition, Bomare had joined the discussion on the polyp into the article 'Polype' only. As Réaumur had discussed in his memoir, the coral was another plant-like organism discovered in the period to be, in fact, an animal; see Réaumur, *Mémoires,* VI, pp. lxxii-lxxviii. On eighteenth-century discussions of 'zoophytes' more generally, see Susannah Gibson, *Animal, Vegetable, Mineral? How Eighteenth-Century Science Disrupted the Natural Order* (Oxford: Oxford University Press, 2015), pp. 43–78.

nature composed not of preordained orderly wholes, but of living particles that organised more or less spontaneously into complex bodies. These writers saw bodies functioning as a unity not because they fitted God's providential plan, but because matter itself was endowed with forces such as desire or sympathy.

Réaumur's greatest rival in the realm of eighteenth-century natural history, the comte de Buffon, did not attempt to make the polyp fit into an idea of a divinely ordained natural system. In the second chapter of the second volume of his *Histoire naturelle*, Buffon set out to explain his ambitious, daring theory of animal generation, and through it his theory of (living) nature more generally, making the polyp's strange regenerative capacity the basis of his entire theory of living nature.[84] While we know that Buffon had been thinking about animal generation at least since 1733, it was with Trembley's discovery of the polyp that his ideas began to assemble into what became one of the most controversial theories of the period (and beyond).[85] Buffon essentially rejected the idea of divine order in nature, arguing that nature consisted of disorder as much as of order. As he put it rather poetically in his introductory *Premier Discours*:

> Le nombre des productions de la Nature, quoique prodigieux, ne fait alors que la plus petite partie de notre étonnement; sa méchanique, son art, ses ressources, ses désordres même, emportent toute notre admiration; trop petit pour cette immensité, accablé par le nombre des merveilles, l'esprit humain succombe: il semble que tout ce qui peut être, est ; la main du Créateur ne paroît pas s'être ouverte pour donner l'être à un certain nombre déterminé d'espèces ; mais il semble qu'elle ait jetté tout-à-la fois un monde d'êtres relatifs & non relatifs, une infinité de combinaisons harmoniques & contraires, & une perpétuité de destructions & de renouvellemens.[86]

Buffon thus agreed with Réaumur that the human mind was incapable of grasping final causes. The two rivals disagreed, however, on why exactly this should be the case. While Réaumur's descriptions of the minute structures of insects hint at his faith in an

[84] Jacques Roger, *Buffon: A Life in Natural History*, ed. by Leslie Pearce Williams, trans. by Sarah Lucille Bonnefoi (Ithaca: Cornell University Press, 1997), pp. 121–29.
[85] On the chronology of Buffon's thought, see Roger, *Buffon*, pp. 28-84. On the reception of his work, see Roger, *Buffon*, pp. 184-201; Loveland.
[86] Leclerc, Comte de Buffon, 'Premier Discours' in *Histoire Naturelle, générale et particulière, avec la description du cabinet du roy*. Tome premier (Paris, 1749), p. 11. See also Roger, *Buffon*, pp.84-89.

orderly world where form matched function, even if the match was not always obvious to the observer, Buffon questioned the very idea of underlying order among living beings, arguing instead the only order man could discover was the order that his own senses constructed for him.

The radical character of this perspective is particularly striking in Buffon's theory of reproduction. Unlike most naturalists and philosophers in the first half of the eighteenth century, Buffon rejected the preformationist hypothesis, according to which God had created all beings that would ever exist at the beginning of time in the form of tiny germs encased ('emboîtés') in one another. Preformationists such as Bonnet argued over how exactly new living beings were generated from these germs, with some claiming that the germ was contained in the mother's egg (the ovist camp) and others asserting that it was the father's sperm that contained the germ (the animalculists).[87] Buffon, on the other hand, outright rejected theories of generation arguing for the preexistence of germs that merely waited to develop. He replaced them with his own theory of 'reproduction', with the polyp providing its prime example. The polyp's capacity to regenerate from limbs cut off at random raised the question (as expressed in Réaumur's 'ames sécables') of where exactly the germs supposedly necessary for the development of a new being were located. The fact that the polyp could produce offspring from its own parts, Buffon asserted, pointed to the existence of what he termed 'organic molecules'. In the wake of the discovery of the polyp, Buffon and his friend the English naturalist John Turberville Needham (1713-1781) observed seminal fluid under the microscope, concluding that the moving particles they saw were proof that all animate beings were composed of the same organic molecules, which radically distinguished them from inorganic matter.[88] Organic molecules did not contain tiny but complete animals; they were the fundamental building blocks for all living beings, rather than just the being preformed in a 'germ'. Through the processes of nutrition, digestion and decomposition they circulated through nature, organising into living beings with help of what Buffon termed

[87] These debates are treated at length in Roe, 'The Life Sciences'; Shirley A. Roe, 'John Turberville Needham and the Generation of Living Organisms', *Isis*, 74.2 (1983), 159–84; Elizabeth B. Gasking, *Investigations into Generation, 1651-1828* (Baltimore: Johns Hopkins Press, 1967); Roger, *Les sciences de la vie*. On the ovist versus animalculist debates, see Clara Pinto-Correia, *The Ovary of Eve: Egg and Sperm and Preformation* (Chicago: University of Chicago Press, 1997).
[88] Spary, 'Political, natural and bodily economies,' pp. 184-185; Roe, 'The Life Sciences,' p. 412.

'penetrating forces' and 'interior moulds'.[89] The 'interior mould' of each organ, as the naturalist explained in his *Discours sur les animaux*, attracted organic molecules with the help of the 'penetrating forces' and formed them according to its shape. Organic molecules thus made Buffon's view of nature a dynamic one, where forces and living matter could organise, decompose and organise again; as he put it in the preface to the twelfth volume: 'la Nature est elle-même un ouvrage perpétuellement vivant, un ouvrier sans cesse actif, qui sait tout employer, qui travaillant d'après soi-même, toujours sur le même fonds, bien loin de l'épuiser le rend inépuisable.'[90] While only God Himself could create or eliminate organic molecules, Buffon attributed Nature the power to constantly change: she could 'altérer, changer, détruire; développer, renouveler, produire'.[91] Given this dynamism, Buffon had much less trouble explaining the polyp than Réaumur or Bonnet: the severed limbs of the polyps were, after all, composed of the same living molecules as the mother-polyp. For Buffon, each of the 'germs' contained by the polyp could act as the 'interior mould' of its offspring; once the 'penetrating forces' had assembled enough organic molecules for all the necessary organs, the remaining molecules could form new germs and thus reproduce the polyp through budding. The new polyp, in other words, was simply the reassembly of living molecules into a new body. Buffon's model echoes, on the level of the individual body, Bomare's image of the republican polyp society, where all elements are connected by a 'gluey' fluid. In his critique of mechanist accounts of physiology, Buffon argued that bodily oeconomies were tied together by a force he calls 'sympathy': 'Qu'avec les Anciens on appelle sympathie cette correspondance singulière des différentes parties du corps, ou qu'avec les Modernes on la considère comme un rapport inconnu dans l'action des nerfs, cette sympathie ou ce rapport existe dans toute l'économie animale.[92] Buffon's polyp body, similarly, was composed of particles of an equal nature ('des parties constituantes semblables') that come together not because of 'besoins' but because of the ultimately undefinable attractive forces of

[89] The forces responsible for attracting the organic molecules to the organs are clearly inspired by Newton's theory of attraction. On Newtonian physiology, see Anita Guerrini, 'James Keill, George Cheyne, and Newtonian Physiology, 1690–1740', *Journal of the History of Biology*, 18.2 (1985), 247–266.

[90] Georges-Louis Leclerc Buffon, *Histoire naturelle générale et particulière : avec la description du cabinet du Roy*, 15 vols (Paris: Imprimerie royale, 1764), XII, p. iii.

[91] Buffon, 'De la nature : Première vue,' *Histoire naturelle* XVII, p. iv.

[92] Buffon, II, p. 487.

sympathy.[93] As the naturalist explained in the seventh volume of his *Histoire naturelle* (1758), the polyp's divisibility was possible because the attractive forces holding its molecules together were not as strong as in higher animals:

> Pour que le sentiment soit au plus haut degré dans un corps animé, il faut que ce corps fasse un tout, lequel soit non seulement sensible dans toutes ses parties, mais encore composé de manière que toutes ces parties sensibles aient entre elles une correspondance intime, en sorte que l'une ne puisse être ébranlée sans communiquer une partie de cet ébranlement à chacune des autres. […] Ainsi l'homme et les animaux qui par leur organisation ressemblent le plus à l'homme, seront les êtres les plus sensibles ; ceux au contraire qui ne font pas un tout aussi complet, ceux dont les parties ont une correspondance moins intime, ceux qui ont plusieurs centres de sentiment, et qui, sous une même enveloppe, semblent moins renfermer un tout unique, un animal parfait, que contenir plusieurs centres d'existence séparés ou différens les uns des autres, seront des êtres beaucoup moins sensibles. Un polype que l'on coupe, et dont les parties divisées vivent séparément ; […] enfin tous les animaux dont l'organisation s'éloigne de la nôtre, ont peu de sentiment, et d'autant moins qu'elle en diffère plus.[94]

The polyp was divisible, in other words, because it had a low degree of sensibility; the more particles could feel one another, the better they would hold together. Sensibility, for Buffon, was what glued disparate parts into harmonious wholes, and polyp bodies were a convenient, though less impressive example of how sensibility worked.

Buffon was not the only eighteenth-century naturalist to posit that living and non-living beings were composed of different kinds of matter. Pierre Luis Moreau de Maupertuis (1698-1759), in his anonymously published *La Vénus physique* (1745), had already speculated that organised beings were composed of particles endowed with varying degrees of 'activeness', and had apparently had several discussions with

[93] Buffon argues that we can never understand these forces 'parce que leur action se faisant sur l'intérieur des corps, et nos sens ne pouvant nous représenter que ce qui se fait à l'extérieur, elles ne sont pas du genre des choses que nous puissions apercevoir.' Buffon, II, p. 45.
[94] Georges-Louis Leclerc Buffon, *Histoire naturelle générale et particulière : avec la description du cabinet du Roy*, 15 vols (Paris: Imprimerie royale, 1758), VII, pp. 9–10.

Buffon on the nature of matter.[95] Thus, for Maupertuis, minerals were formed of the least active matter, while animals and humans consisted of the most active particles. Maupertuis claimed that active molecules, 'endowed' with properties such as desire and aversion, organised through the power of attractive forces.[96] Unlike Buffon, he did not have the concept of an 'interior mould', but instead argued that the molecules had 'memory' of their position in their previous organised forms; he could thus posit that species had formed by accident. In order to illustrate the idea that matter could organise and reorganise dynamically and randomly, among other things in order to form the human body, Maupertuis used the image of the bee swarm: 'c'est ainsi qu'un essaim d'abeilles, lorsqu'elles se sont assemblées & unies autour de la branche de quelqu'arbre, n'offre plus à nos yeux qu'un corps qui n'a aucune ressemblance avec les individus qui l'ont formé.'[97] The bee swarm, for Maupertuis, illustrated that the whole was not only more than its parts, but also constituted a new body fundamentally different from the previously separate bodies that had formed it. Once the bees had left their hive and gathered together as a swarm, or once the human parts had been assembled, it would be wrong to think of them as a collection of individual bodies. Instead, the bees in the swarm as well as the organs of human body had gained new properties that the individual parts could not have; they had irretrievably lost and forgotten their 'sentiment particulier du *soi*' but acquired 'une perception unique, beaucoup plus forte, beaucoup plus parfaite'.[98] Thus, instead of God's preordained plan, Maupertuis posited that it was possible for completely new wholes to emerge. Similar to Buffon's argument that men become truly human only in and through society, for the controversial philosopher collectives, be they of bees or of bodily organs, fundamentally transformed the properties of their parts. Maupertuis' image of the bee swarm would, as we will see in the following section, be echoed by vitalist

[95] Charles T. Wolfe, 'Endowed Molecules and Emergent Organization: The Maupertuis-Diderot Debate', *Early Science & Medicine*, 15.1/2 (2010), 38–65; Shirley A. Roe, 'Radical Nature in the *Encyclopédie'*, in *Science, History and Social Activism: A Tribute to Everett Mendelsohn*, ed. by Garland E. Allen and Roy M. MacLeod (Dordrecht: Springer, 2001), pp. 37–59; Terrall, 'Salon, Academy, and Boudoir: Generation and Desire in Maupertuis's Science of Life'.

[96] In his 'Système de la nature', Maupertuis expanded his earlier position, arguing that a uniform force of attraction could not account for the diversity of living beings and that molecules thus had to have desire, aversion, memory; see 'Système de la nature,' in Pierre-Louis Moreau de Maupertuis, *Œuvres de Maupertuis* (Lyon: Jean-Marie Bruyset, 1768), II, pp. 146–47.

[97] Maupertuis, 'Système de la nature,' pp. 170.

[98] Maupertuis, 'Système de la nature,' pp. 171-172. Italics in the original.

physicians and writers inspired by vitalist medicine, taking on, we might say, a life of its own.

5. From Polyps to Bee Swarms

One of the most radical, and arguably the most famous, uses of the polyp to think through the relation between natural and social parts and wholes occurred long after the moment of 'crisis' in the 1740s: in Diderot's dialogue *Le Rêve de d'Alembert* (1769), interlocutors speculate about a world composed solely of matter, where active and sensitive molecules come together to form anything from stones and polyps to human beings.[99]

The *Rêve* is written as the conversation between the co-editor of the *Encyclopédie* and mathematician, d'Alembert, his friend Mademoiselle de L'Espinasse, and the Montpellier vitalist Théophile Bordeu. The text is divided into three distinct parts, each of which is given a different set-up: the first, titled 'La Suite d'un entretien entre M. D'Alembert et M. Diderot' follows the model of the philosophical dialogue; in the second and most daring part of the text, 'Le Rêve de d'Alembert', Mademoiselle de l'Espinasse reads out her transcript of d'Alembert's dream, which he had himself spoken out aloud earlier, to the doctor Bordeu; in the final part, 'Suite de l'Entretien', de L'Espinasse and Bordeu continue their conversation after d'Alembert leaves.[100]

Famously, the *Rêve* uses three entomological images to unsettle the sense of a coherent, unified and singular human self, all of which appear in the dialogue's middle part: the bee swarm, the spider and the polyp.[101] As the images of the polyp and the bee swarm play complementary roles in Diderot's texts, they need to be read alongside one another; the polyp can thus serve to introduce the set of debates centred around the bee swarm, debates that are related to but not congruent with the issues raised by the discovery of the polyp.

With the polyp, Diderot develops Buffon's idea of the organic molecules and playfully applies it to speculate about human life: if the same living molecules provide the building blocks for all parts of the body, it follows that no part can single-handedly

[99] The edition used is Diderot, XVII, pp. 89–207.
[100] For the implications of this structure for the possibility of a single, unified self, and in particular of the authorial self, see Tunstall, 'Embodied Mind'.
[101] On the image of the spider, see Jacot Grapa, 'Le Moi-Araignée du "Rêve de d'Alembert" de Diderot'.

control the whole.[102] If all living beings are merely different aggregate forms of the same matter then it becomes possible to think of human selves as 'human polyps', formed out of the matter of other humans just as the body adult insect is formed out of its chrysalis. The polyp's ability to divide itself into new individuals from its own matter is thereby used to figure the idea that all life is but a recomposition of matter into different forms. As d'Alembert puts it in his dream: 'vivant, j'agis et je réagis en masse … mort, j'agis et je réagis en molécules … Je ne meurs donc point? Non, sans doute, je ne meurs point en ce sens, ni moi, ni quoi que ce soit. Naître, vivre et passer, c'est changer de formes… Et qu'importe une forme ou une autre?'[103] The image of the polyp that can spawn new individuals from its severed parts, then, serves as an example of, as well as a metaphor for, the idea of particles of matter dynamically organising and reorganising itself into new physical (or social) wholes. The building blocks of matter thereby do not change, but the forms they take do so in seemingly unpredictable ways.[104] Thus, with Diderot's polyps as illustrations of the dynamic relationship between parts and (bodily as well as social) wholes, we have come a long way from providentialist theories of life positing that the reproduction of individuals unfolded according to God's preordained plan.[105]

The image of the bee swarm follows on from the idea of human polyps and is introduced by de l'Espinasse; in the dialogue's typical merging of voices, the dreamer addresses de l'Espinasse directly, who in turn reports the conversation between herself and d'Alembert to the doctor:

> Avez-vous quelquefois vu un essaim d'abeilles s'échapper de leur ruche?… Le monde ou la masse générale de la matière est la grande ruche… Les avez-vous vues s'en aller former à l'extrémité de la branche d'un arbre, une longue grappe de petits animaux ailés, tous accrochés les uns aux autres par les pattes?… Cette grappe est un être, un individu, un animal quelconque… Mais ces grappes devraient se ressembler toutes… Oui, s'il n'admettait qu'une seule matière

[102] On Buffon, bees and the organic molecule theory, see chapter 2.
[103] Diderot, 'Rêve de d'Alembert', p. 139.
[104] See also Wahrman and Sheehan, *Invisible Hands*, pp. 173-174.
[105] On how microscopy, particularly of insects, was used to undergird the argument from design, see Catherine Wilson, *The Invisible World: Early Modern Philosophy and the Invention of the Microscope*, Studies in Intellectual History and the History of Philosophy (Princeton, N.J: Princeton University Press, 1995), pp. 176–214.

> homogène… […] Si l'une de ces abeilles s'avise de pincer d'une façon quelconque, l'abeille à laquelle elle s'est accrochée, que croyez-vous qu'il en arrive? Dites donc? — Je n'en sais rien. — Dites toujours… Vous l'ignorez donc; mais le Philosophe ne l'ignore pas, lui. […] il vous dira que celle-ci pincera la suivante; qu'il s'excitera dans toute la grappe autant de sensations qu'il y a de petits animaux; que le tout s'agitera, se remuera, changera de situation et de forme; qu'il s'élèvera du bruit, de petits cris; et que celui qui n'aurait jamais vu une pareille grappe s'arranger, serait tenté de la prendre pour un animal à cinq ou six cents têtes et à mille ou douze cents ailes…[106]

The swarm here serves as a means for Diderot to play with notions of the singular 'moi', problematising, as with the image of the human polyp, the idea of a unified self, demarcated from both the outside world and other 'mois'. The use of personal and impersonal pronouns in the passages dissolves any simple separation of individual and outside world. D'Alembert moves from using the active ('celle-ci pincera') to the passive voice ('il s'excitera'), thus enacting, through language, the merging of the individual bee with the 'tout' of the swarm. The movement of Diderot's swarm (not dissimilar to Mandeville's) cannot be explained through the intentions of any of its parts, and neither can the swarm be said to be the simple sum of the bees that compose it. The individual bee might decide ('s'avise de') to pinch its neighbour, but she cannot know that her action will result in the agitation of the entire swarm. Similarly, the observer would be hard-pressed to determine the origin of the swarm's movements: as each bee senses her neighbour's movements and thus communicates them to the next insect, the swarm really does seem to act as a whole. None of the individual bees is any sense 'aware' of the consequences of her actions, nor is she contributing to the fulfilment of a preordained plan; the bees act, instead, out of what Anne Vila has termed the 'contagious effect' of sensibility, as they transmit (their seemingly random) sensations from individual to individual.[107] Unlike Bonnet's separate polyp 'selves' with separate sensations and interests, Diderot's bees really do become a 'tout', where one bee's sensations become those of the whole. Just as importantly, Diderot's swarm

[106] Diderot, 'Rêve de d'Alembert', p. 120.
[107] Vila, *Enlightenment and Pathology,* p. 160.

is a community without a leader, where agency is distributed among equal, indistinguishable parts rather than located with a queen that can easily be singled out by the observer. Not only is the bee metaphor a less explicit critique of absolutist politics; even more importantly, perhaps, the implicit comparison between animal and human communities also roots ideas about the latter in 'nature', thus making feudalist hierarchies appear less, and communities of equals more, 'natural'.

The image of the swarm had connotations linking not only to animal and human communities, but also to the human and animal body. Diderot based his image of the swarm on a passage from the medical treatises by the real-life Bordeu, who had used the swarm as an analogy for the harmony between the separate organs forming the whole of the human body.[108] According to Bordeu, the swarm illustrates that each of the body's organs had the theoretical capacity to act independently, but that doing so would disrupt the bodily oeconomy, causing illness and ultimately death. Diderot's fictionalised Bordeu, is able to guess, much to de L'Espinasse's astonishment, the continuation of d'Alembert's dream (as if they were part of a single 'hive mind'), and uses the bees to argue that they act as 'des animaux distincts que la loi de continuité tient dans une sympathie, une unité, une identité générale.'[109] 'Sympathy' is a key word of this passage; closely tied to the vitalist view of the human body, it was used in the eighteenth century to connote both the physical and the moral means for parts to communicate with the whole.[110] Ménuret de Chambaud's use of the term in his article "Observation" is instructive in this regard, and not only because he uses two different animal swarms to illustrate the functioning of sympathy in as well as between bodies; refuting mechanist physiologist who study each of body part as separate building blocks of the bodily 'machine', Ménuret writes:

> Il semble dans leurs écrits qu'il y ait dans l'homme autant d'animaux différens qu'il y a de parties & de fonctions différentes; ils sont censés vivre séparément, & n'avoir ensemble aucune communication. […] On pourroit, suivant l'idée de ces auteurs, comparer l'homme à une troupe de grues qui volent ensemble dans

[108] Vila, *Enlightenment and Pathology,* pp. 70-71.
[109] Diderot, 'Rêve de d'Alembert', pp. 121-22. As Tunstall writes, Diderot's mind 'is not only embodied, [but] also extended' and all characters participate in it; Tunstall, 'Embodied Mind,' p. 216.
[110] As Vila states, analysing Jaucourt's article "Sympathie" in the *Encyclopédie*: 'Jaucourt's descriptive language not only makes moral sympathy analogous to organic sympathy, but actually suggests that the former is little more than a higher-level expression of the primordial mechanism by which all vital entities communicate.' Vila, 'Vapors,' p. 89.

> un certain ordre, sans s'entr'aider réciproquement & sans dépendre les unes des autres. Les Medecins ou Philosophes qui ont étudié l'homme & qui ont bien observé par eux mêmes, ont vû cette sympathie dans tous les mouvemens animaux, cet accord si constant & si nécessaire dans le jeu des différentes parties les plus éloignées & les plus disparates; ils ont vû aussi le dérangement qui résultoit dans le tout du désaccord sensible d'une seule partie. Un médecin celebre (M. de Bordeu) & un illustre physicien (M. de Maupertuis) se sont accordés à comparer l'homme envisagé sous ce point de vûe lumineux & philosophique à un grouppe d'abeilles qui font leurs efforts pour s'attacher à une branche d'arbre, on les voit se presser, se soutenir mutuellement, & former une espece de tout, dans lequel chaque partie vivante à sa maniere, contribue par la correspondance & la direction de ses mouvemens à entretenir cette espece de *vie* de tout le corps, si l'on peut appeller ainsi une simple liaison d'actions.[111]

The human body, Ménuret claims, is more like a bee than a bird swarm.[112] Each organ can only be understood in relation to other parts; rather than governed by a central controlling instance, the bees, just as the organs in their bodies, are tied to each other by their sensitivity to one another. Even disparate body parts, Ménuret explains, 'communicate' with and depend on one another via the transmission of sensations from one part to the next.

Where Aristotle had classed 'man, bees, wasps, ants, cranes' as 'social animals', defined as 'gregarious animals' 'which have some one common activity', vitalist writers like Ménurest insisted on a distinction between flocks and swarms.[113] Rewriting the political image of the animal society into a physiological analogy, he is rejecting here not only Aristotle's monarchical bee hive and its long reception history

[111] Ménuret de Chambaud, J.-J. (1765). Observation(Gram. Physiq. Méd.). In D. Diderot & J. le Rond D'Alembert (Eds.), *Encyclopédie ou Dictionnaire des arts et des métiers* (Vol. XI, pp. 313–321). Paris: Briasson. On Maupertuis as a source for Diderot's swarm and polyp images, see Ibrahim, 'Maupertuis dans Le Rêve de D'Alembert','Maupertuis dans le Rêve'.

[112] He is echoing here the image used by Mandeville to describe civilised 'society': for Mandeville, the 'body politic' should be described as a bee swarm rather than 'a herd of cows or a flock of sheep'. See chapter one for discussion of this image.

[113] Aristotle, *History of Animals*, trans. by A.L. Peck (London; Cambridge MA: Harvard University Press, 1965) vol. I, 1, 488a33 ff.

in favour of the swarm;[114] cranes, too, had a long history of being used to illustrate monarchical (from Aristotle onwards) but also republican (in sixteenth- and seventeenth-century Italy) governments.[115] In the French context, the influential theorist of sovereignty Jean Bodin (1529/30–1596), had followed Aristotle in equating bees and cranes as monarchical animals; arguing that monarchy is the most natural form of government, he writes: 'If we should inspect nature more closely, we should gaze upon monarchy everywhere. To make a beginning from small things, we see the king among the bees, the leader in the herd, the buck among the flocks or the bellwether (as among the cranes themselves the many follow one).'[116] Bodin's monarchical hive and flock cranes are, of course, the exact opposite of Ménuret's swarm. Rather than a body guided by its head, the swarm is composed of equal and interacting parts. In addition to describing life as the result of constantly communicating and interacting parts, the metaphor of the bee swarm as unified body implies that this process extends from the oeconomy of individual animal bodies to the oeconomy of their societies. Terms such as 's'entraider', 'font leurs efforts', 'désaccord' and, of course, 'sympathie' could thus easily be applied not only to the harmony of the healthy body, but also to the oeconomy of the body politic. Where Aristotle and Bodin had figured bees and cranes as members of societies led by an extraordinary individual, Ménuret used the image of the swarm to represent a physical body as dynamic entity composed of equal parts. Like Diderot's swarm community, Ménuret's image of the body thus runs counter to absolutist theories of the body politic.

The Montpellier vitalists themselves were intent on avoiding political and religious controversy, and thus did not reconvert the swarm from a physiological into a political image.[117] Diderot, as we saw above, had fewer qualms, at least in his

[114] For an overview, see Eva Johach, 'Der Bienenstaat: Geschichte Eines Politisch-Moralischen Exempels', in *Politische Zoologie*, ed. by Anne Von der Heiden and Joseph Vogl (Zürich: Diaphanes, 2007), pp. 219–33.
[115] Sabine Kalff, 'Are Cranes Republicans? A Short Chapter in Political Ornithology', in *Zoology in Early Modern Culture: Intersections of Science, Theology, Philology, and Political and Religious Education*, ed. by K. A. E. Enenkel, P. J. Smith, and Tamás Demete (Leiden, Netherlands: Brill, 2014), pp. 437–59.
[116] The original appeared in Latin as *Methodus ad facilem historiarum cognitionem in 1566; see* Jean Bodin, *Method for the Easy Comprehension of History*, trans. by Beatrice Reynolds (New York: Norton, 1969), p. 271.
[117] As Williams notes, 'Although Montpellier writings on the vital principle were decidedly secular in tone, never resorting to divine action or intervention to explain the workings of nature or the body, they were also determinedly respectful of orthodoxy, religious feeling, and the church.' Williams, *The Physical and the Moral*, p. 63.

unpublished *Rêve*. The implications of the oeconomy of the swarm-body for social organisation are rendered most explicit in one of Diderot's *Observations sur le Nakaz* (written sometime between 1777 and 1780). Diderot wrote the *Observations* on the way back from his extended stay in St. Petersburg in the winter of 1773-1774, responding to Catherine II's proposal for a reform of the Russian code of law (*nakaz* means 'instructions').[118] Diderot's *Observations* advocated the abolition of Russian 'despotism' through a reform of the political system and particularly the institution of a permanent national assembly, and was written as a dialogue not only with Catherine the Great, but also with physiocratic ideas.[119] As he moves from considering the composition of the body to the government of the Russian social body, thus returning to the traditional metaphorical implications of the bee society, Diderot uses not the image of the swarm, but of the productive hive (possibly echoing Mandeville as much as his own swarm):

> Lever tous les embarrass de la circulation intérieure et des échanges au-dehors. Protéger le commerce, le favoriser sans s'en mêler ; jamais un souverain n'entendra aussi bien les intérêts du commerce que les commerçant. Le prix des denrées s'établit de lui-même. L'agriculture, la population et le commerce se tiennent indivisiblement ; leur décadence et leur prospérité sont les suites d'une seule et même cause. Ne point donner de coups de pied dans la ruche, laisser travailler les abeilles en repos.[120]

Like the swarm of the *Rêve*, the order and well-being of Diderot's political 'hive' depends on the constant communication between its members. Interference on the part of the sovereign in the form of regulations that favour one aspect of the country's oeconomy over another is thus considered to 'block' the interbodily communication required for the prosperity of the whole.[121] Echoing Buffon's ideas on the sensitivity

[118] Denis Diderot, 'Observations Sur Le Nakaz', in *Diderot: Political Writings*, ed. by Hayden Mason and Robert Wokler, (Cambridge Texts in the History of Political Thought (Cambridge: Cambridge University Press, 1992), pp. 77–164.
[119] Franco Venturi, 'La vieillesse de Diderot', trans. by Patricia Coppola and Sylviane Coppola, *Recherches sur Diderot et sur l'Encyclopédie*, 13.1 (1992), 9–30 (pp. 11–15). Catherine refused to read Diderot's text until after his death, when she ordered it to be burnt.
[120] Denis Diderot, 'Observations sur le Nakaz', in *Œuvres : Tome III, Politique*, ed. by Laurent Versini (Paris: Laffont, 1995), pp. 507–78 (p. 573).
[121] As a consequence of this stance, Diderot also proposes, for example, that Catherine move the capital to a more central region: 'quelle que soit leur etendue [des empires], le centre est donc le vrai lieu de

of bodies and body parts, Diderot imagines the political community as an interconnected whole where no part can be moved without affecting the harmony of the whole. Just as the bees in their swarm transmit sensations to one another and by doing so move as a whole, the oeconomy of a country consists in an interrelated system in which food prices, population numbers and the exchange of goods all depend on one another 'indivisibly'; if their system of communication (what in natural bodies allows sensations to travel) is interrupted, it can no longer function.

Diderot, and his medical sources, then, used the bee swarm as a tool for imagining life as a quality that spontaneously emerges from the constant interplay of different, sensitive parts. Many of the leading naturalists of insects, however, described the bee collective in very different terms, emphasising instead the role of the queen as the 'head' of the bee community. As Buffon's erstwhile collaborator Louis-Jean-Marie Daubenton (1716-1800) points out in his article 'Essaim', for example, it is the queen that decides when it is time to swarm and that guarantees the unity of the swarm:

> l'*essaim* ne subsisteroit pas s'il ne s'y trouvoit une reine, c'est-à-dire une abeille femelle. Dès qu'elle quitte la ruche, elle est suivie d'un grand nombre d'abeilles ouvrieres, & en moins d'une minute toutes celles qui doivent composer l'essaim s'élevent en l'air avec la reine, elles voltigent, & quelques-unes se posent sur une branche d'arbre pour l'ordinaire, d'autres s'y rassemblent; la reine se tient à quelque distance de ce grouppe, & s'y joint lorsqu'il a grossi à un certain point. Alors toutes les abeilles s'y réunissent bientôt; & quoiqu'elles soient à découvert, elles y restent en se tenant cramponnées les unes aux autres par les jambes: on ne voit voltiger autour du grouppe, qu'autant de mouches qu'il s'en trouve autour d'une ruche dans un tems chaud: mais lorsqu'il n'y a point d'abeille femelle dans un essaim, il revient bien-tôt à l'ancienne ruche.[122]

communication. La lisière est le vrai lieu de la défense et des échanges ; plus un empire est étendu, plus la circulation intérieure doit être facilitée ; plus il faut y multiplier les villes ; plus il doit y avoir de grandes villes. Ce sont les grandes villes qui créent les bourgs ; ce sont les bourgs qui créent les villages ; ce sont les villages qui créent les hameaux. C'est cette distribution qui forme et concentre un empire.' Diderot, 'Observations sur le Nakaz', pp. 561-562.

[122] Daubenton, 'Essaim', *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*, ed. by Denis Diderot and Jean le Rond d'Alembert, (University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), ed. by Robert Morrissey and Glenn Roe) <http://encyclopedie.uchicago.edu>

The very moment in the natural history of the bees that writers like Diderot, Bordeu and Maupertuis thus used as an image of the continuity of the body of the group in which individual identity is dissolved is here shown to depend on the behaviours of the queen. As the repetition of the terms 'reine' and 'abeille femelle' in virtually every sentence of the paragraph underlines, she is the governing principle of the swarm body. Daubenton's description, in other words, presents the hive as a body dependent on the queen as its auhtoritative head, echoing an image of the relationship between monarch and people used by Louis XIV himself.[123] Although Daubenton switches from the plural 'elles' to the singular 'il' (for both 'grouppe' and 'essaim) to indicate that the swarm has indeed become a unified whole, he also singles out the 'abeille femelle' as a singular body. Although the bees are linked to each other in a way that echoes the continuity of Diderot's swarm ('cramponnées' this continuity is only temporary. Without the queen's presence, as Daubenton's description suggests, the swarm can only ever be a coherent whole for a limited period, before the bees seek shelter in their old, monarchical hive again. Bazin, using characteristically anthropomorphic language in his dialogue between Eugène and Clarice, compares the process of swarming to a human people setting out to colonise a new territory, even liking the bees to Colombus' expedition.[124] Like Daubenton, he insists that it is only the presence of a queen that will determine a group of bees to the risky decision of leaving their old home: 'C'est un parti pourtant qu'elles ne prendroient jamais, si elles n'y étoient déterminées par un Chef, & si elles n'avoient parmi elles une Reine propre à perpétuer l'Empire qu'elles vont fonder.'[125] Without the queen at their head, the bees would rather perish in their overcrowded hive than found a new settlement.[126] In Daubenton's descriptions, the moment of swarming is not an image of a natural community, but a short-lived, and dangerous, period of transition in the life of the hive. Much of the article is thus taken up by strategies for beekeepers to ensure that the bee community does not disintegrate during its unproductive transitional phase; for Daubenton, the bees only live in a stable 'society' whilst they are firmly tied to the hierarchical, productive hive reigned over by the queen.

[123] Louis XIV, *Mémoires, suivis de Manière de montrer les jardins de Versailles*, ed. Joël Cornette (Paris: Tallandier, 2007).
[124] Bazin, *Abrégé des abeilles* II, p. 211.
[125] Bazin, *Abrégé des abeilles* II, p. 184.
[126] Bazin *Abrégé des abeilles* II, p. 185.

Making a similar point, Réaumur claimed in his *Mémoire* on bees that it was not only common knowledge that a bee community would eventually leave its hive to swarm in order to find a new home, but also that 'cet essaim est conduit par un chef, par un Roi qui doit être une Reine, ou plus simplement une mère Abeille.'[127] The term 'chef' is worth dwelling on here, for it points to the way in which the natural history of swarm was linked to wider ideas about animal, as well as political, oeconomy. 'Chef' was thus commonly used in poetic descriptions of the relationship between mind and body. According to the definition of the *Dictionnaire de l'Académie française* of 1762, the term 'chef' refers primarily to the human head, and is only used figuratively in the modern sense of 'celui qui est à la tête d' un Corps, d' une Assemblée, qui y a le premier rang & la principale autorité'.[128] Where the vitalists had used the bee swarm to illustrate their vision of the human body as a composite of equally important and harmoniously interacting parts, Réaumur made clear that the swarm body was guided by the queen bee, just as Cartesian theorists of the mind-body relationship insisted that the human mind guided the body.

While we cannot know for sure whether speculative writers such as Maupertuis and Diderot were responding directly not only to vitalist imagery but also to the description of the swarm put forward by Réaumur and other naturalists, it is nevertheless interesting to note that Réaumur himself uses the analogy of the 'grappes d'abeilles' to describe a group of bees attached to one another by their legs. However, it does not appear in his description of the 'essaim' preparing to find a new home. Réaumur's 'grappe', instead, appears in his observations on the interior life of the hive, when the insects are safely attached to the home assigned to them by their beekeeper.[129] The following passage on the bees' sleeping habits is thus couched between a description of the 'spectacle' of their work and of the description of the different hives built different types of bees:

> On considére même avec plaisir, des masses ou des grouppes de ces mêmes abeilles, qui, en prenant le repos qui leur est devenu nécessaire, se mettent en état de recommencer leurs travaux. Les arrangements des abeilles tranquilles

[127] Réaumur, *Mémoires* vol. 5, p. 297.
[128] 'Chef', *Dictionnaire de l'Académie française* (Paris: Vve. B. Brunet, 1762), p. 291. Dictionnaire 4e édition, t.1.
[129] Réaumur, *Mémoires* V, p. 308

> qui forment ces grouppes, forment de chaînes dont toutes les chaînons sont animés. Souvent ces espéces de chaînes sont disposées en maniére de guirlande. Chaque abeille est accrochée par ses deux jambes antérieures, ou seulement par une, à une des jambes, ou aux deux jambes postérieures de celles qui la précéde. Ainsi la premiére est chargée du poids de toutes celles qui se trouvent jusqu'à l'endroit le plus bas de la guirlande. Les grouppes ne sont, pour ainsi dire, qu'un assemblage de chaînes mises les unes auprès des autres; je veux dire que les mouches qui forment les plus gros massifs, les plus grosses grapes, sont accrochées les unes aux autres par les jambes, qui donnent des prises plus commodes que le corps, & que les autres parties.[130]

Réaumur's use of the image of the bees as a 'grappe' differs from that of Diderot's and his sources not only in that the bees attached to one another are not a swarm but a temporary cluster of bees resting in preparation for more hard work contributing to the hive's oeconomy.

In Diderot's description of the swarm, its formation means that the bees transmit their sensations to one another so as to become one living, moving and, most importantly, feeling body: 'il s'excitera dans toute la grappe autant de sensations qu'il y a de petits animaux; [que] le tout s'agitera, se remuera, changera de situation et de forme'. Réaumur's bees, on the other hand, are 'tranquilles'; as the second, inorganic image of the 'chaînes' emphasises, their formation is orderly and stable rather than excitable. Réaumur's description of the 'grappe d'abeilles' leads to his description of the structure of the hive via a reflection on the wonders of the bee 'society'. The naturalist thus asks how the physical arrangement of the bee body − the bee's 'animal oeconomy' − enables the bees in the hive to not only form chains, but to organise the 'oeconomy' of their household: how do the multitude of bees coordinate their bodies so as to produce honey and wax?[131] In reply to his own question, Réaumur suggests that the bees organise themselves, or, rather, seem to organise themselves, through the rule of law: 'Dans tant de mouches réunies, & qui travaillent pour une même fin, on croit voir en petit ce que la raison a fait de plus grand & de plus utile pour nous; une société, qui, comme celle de nos républiques ou de nos monarchies, est gouvernées

[130] Réaumur, *Mémoires* V, p. 217.
[131] Réaumur, *Mémoires* V, p. 218.

par des loix.'[132] Réaumur's bees are thus driven by a common goal imprinted into their very being, rather than moved by the sense impressions transmitted from bee to bee. The 'laws' of their community have been conceived (assumedly by the Creator himself) to achieve the preconceived goal, namely the production of honey and wax as necessary steps for the reproduction of the insects. The 'grappe' as described by Bordeu, Maupertuis, Diderot and Ménuret, on the other hand, serves no purpose; in fact, the description of the swarm, without any reference to the hive and its (re)productive oeconomy, means that there can also be no reference to the 'oeconomy' of the hive. Réaumur's bees leave the hive because they have become too numerous in order for the balance between population numbers and the amount of resources the insects can produce and store in their home. The terms he uses to describe the swarming of the bees reflect the importance of the hive and its productive oeconomy to the bees as described by Réaumur: 'une grande partie des mouches prend l'essor pour aller chercher ailleurs une nouvelle habitation'; 'cette espéce de colonie quitte le lieu de sa naissance'.[133] The bees in these descriptions are in a phase of transition between hives, and they leave their former home in search for one that enables greater productivity. In Diderot's dialogue, on the other hand, d'Alembert asks de l'Espinasse whether she has observed 'un essaim d'abeilles s'échapper de leur ruche', as if the hive were a prison from which the insects could free themselves. For Réaumur, what ties the (monarchical) bees to one another is the presence of the queen; this happens not through the transmission of sensations, but rather because of an inborn sense of devotion the perpetuation of their hive. The swarm, that is, was used to conceptualise bodily and political wholes in different, and in some cases contrasting, ways. For all thinkers discussed here, however, images of insect bodies provided a key for understanding the organisation of the natural oeconomy as a whole as well as, by implication, the most 'natural' ordering of human society.

6. Conclusion

This chapter has discussed a variety of ways in which eighteenth-century thinkers conceived of the connection between organic as well as social parts and wholes, using images of insect bodies to think through the ways in which seemingly disparate could

[132] Réaumur, *Mémoires* V, 235.
[133] Réaumur, *Mémoires* V, 235.

come to act as one functioning animal or political economy. While for the more religious thinkers discussed in this chapter such as Réaumur, Bazin or the Protestant Bonnet, bodily or domestic oeconomies functioned on the basis of a preformed order; other writers critical of mechanical theories of bodily wholes theorised, via the images of the swarm and the polyp, ways in which formerly distinct parts could spontaneously form new wholes which could not be reduced to the simple sum of their parts. As we have seen, different thinkers had different solutions for the problem of the unity of wholes, explaining through forces as sensibility, its cognate sympathy or even 'penetrating' or 'attractive' forces. For both groups, however, polyps and swarms provided models for theories of the organisation of physiological and political wholes. In the next chapter, we shall move to the perspective of those whose task it was to manage such wholes.

Chapter Four. Managing Insect Pests and Governing Human Political Economy: The Notion of the Population in Enlightenment France

1. Introduction

> Les insectes causent des ravages étonnans : ces animaux cherchent dans la parenchime des feuilles, la substance de l'écorce & du fruit des plantes, leur asyle & leur nourriture. L'on a vu des armées de sauterelles, moissonner des prairies entieres, des légions de chenilles, de limaçons & de hannetons, ronger tout dans une province, &c.[…] Les moucherons s'attachent à l'écorce des plantes & à leurs feuilles, y déposent des millions d'œufs, l'irritation qu'ils y causent fait soulever l'écorce & rouler la feuille, qui se dépouillant de sa propre substance pour nourrir ces insectes, périt d'épuisement, & sa perte entraîne la ruine partielle, souvent totale des plantes, même des arbres.[134]

As the military language of the above quoted passage underlines, insects were considered in the eighteenth century as a threat because they appeared in large numbers ('des milliers d'oeufs'), and because their appearance in swarms, or as 'armies' and 'legions', enabled them to profoundly transform or even destroy the territory on which they appeared. The extract is taken from a 1766 article in the *Journal oeconomique*, with which the anonymous author intended to describe the advantage of what he calls 'science économique' for controlling harmful insects and thus improving agricultural yields. After his dramatic description of the potential damage done by insects, he continues, in typical Enlightenment manner, to explain how natural historical observations and new agricultural techniques could help his readers avoid such biblical scenes of destruction. He acknowledged that the risk of outbreaks of insect infestations was impossible to eliminate completely, but provided his readership with means for controlling the extent of the risk developed through the observation of insect bodies, both of individuals and groups. Instead of passively accepting insect plagues as divine punishment for sin or recommending small-scale methods aimed at killing individual specimens, that is, he proposed systematic

[134] Anonymous, *Journal oeconomique, ou mémoires, notes et avis sur l'agriculture, les arts, le commerce, & tout ce qui peut avoir rapport à la santé, ainsi qu'à la conservation & à l'augmentation des biens des familles, & c* (Paris: Antoine Boudet, 1766), 78.

techniques for controlling and managing insect 'populations'. Natural historical knowledge of food sources, birth rates and illnesses of various kinds of insects, the author (like other eighteenth-century writers interested in pest control) claimed, would reduce the damage to crops to a minimum and thus prevent the decline of the human population depending on them for their subsistence.

In the mid-1750s, writers of political economic texts began to describe groups of people as a population, with regular birth rates, patterns of health and illness and of subsistence needs. This chapter shows that writers concerned with the understanding individual and collective behaviour of insects also conceived of their subjects in these terms. It argues that eighteenth-century investigations of insects – whether for the purposes of natural history or for its concrete application in pest management – provided one of the sites for the construction of the concept of 'population'. It reads writings on pest control alongside political economic treatises as well as medical literature on the management of epidemics and epizootics to show that thinkers in all of these fields were concerned with one of the most fundamental discussions emerging in the late seventeenth century and intensifying during the eighteenth century: the question of how to govern the population, on which the strength and prosperity of the kingdom was thought to depend.[135] As scholars such as Joseph Vogl and Stuart Elden have recently argued (following Foucault's theory of biopolitics), population was thereby not understood as a collection of individuals, but increasingly considered a 'natural body' governed by its own laws, which guided the interaction of the individual bodies composing it and with the territory on which the population lived.[136]

They have shown that eighteenth-century government, that is, took as its object not merely the control of the territory, but also the health and well-being of the population that occupied this territory.[137] The concern with the health and prosperity of the population provided new areas for the state to intervene in; new methods were

[135] In what is generally considered one of the first works of European political economy, for example, Antoine de Montchrétien writes: 'Mais de ces grandes richesses la plus grande, c'est l'inepuisable abondance de ses [du Roi] hommes, qui les sçauroit manger : car ce sont gentils esprits, actifs et plains d'intelligence, de qualité de feu, composés par une ingenieuse artifcielle nature, capables d'inventer et de faire.' Antoine de Montchrestien, *Traicté de l'oeconomie politique : dédié en 1615 au Roy et à la Reyne mère du Roy*, ed. by Théophile Funck-Brentano (Paris: E. Plon, Nourrit, 1889), p. 24.

[136] On this understanding of population, see Vogl, *Kalkül und Leidenschaft*, pp. 77–82. For a consideration of the construction of the concept of the territory in France, see Jacques Revel, 'Knowledge of the Territory', *Science in Context*, 4.1 (1991), 133–61. For a braoder consideration, see Stuart Elden, *The Birth of Territory* (Chicago: The University of Chicago Press, 2013). Foucault, p. 342.

[137] On the notion of territory, see Elden, *Territory*; Revel, 'Territory'.

thus invented to regulate both individuals and their passions (such as the policing of family relations) and the population as a whole (such as the rise of statistical methods).[138] As medical historians have shown, one important area where this concern with the population was developed were the measures used to deal with epidemics, that is with illnesses affecting whole populations such as plague and smallpox. As Colin Jones has demonstrated, for example, physicians and state bureaucrats in the eighteenth century no longer saw plagues as either divine punishment or as a disease that could be eradicated by treating every single patient.[139] As Daston and Park outline in their account of the Enlightenment's campaign against the marvellous, 'the new sensibility' and 'the new metaphysics' of the eighteenth century pushed natural philosophers to abandon their search for supernatural or theological causes of unusual phenomena such as insect plagues, instead viewing them as connected to and explained by stable natural laws.[140] Modifying the seventeenth-century conception of natural laws so that these were not only immutable, but also gave rise to 'regular and uniform' natural phenomena, eighteenth-century natural philosophers effectively dispensed with the idea of the miraculous.[141] Events such as plague or insect epidemics, previously considered divine punishment for human sins, were thus naturalised. As Colin Jones notes in his analysis of plague tracts, writers in the early modern period progressively reduced God's role in the causality of epidemics.[142] By the eighteenth century, Jones argues, all writers agreed that the disease had to be explained 'in terms of material, secondary causality' rather than as a consequence of 'first causes', or direct divine intervention.[143] During the very period in which strict

[138] On new quantitative technologies for managing populations see Andrea Alice Rusnock, *Vital Accounts: Quantifying Health and Population in Eighteenth-Century England and France*, Cambridge Studies in the History of Medicine (Cambridge: Cambridge University Press, 2002); William Clark, 'On the Table Manners of Academic Examination', in *Wissenschaft als kulturelle Praxis: 1750-1900*, ed. by Hans Erich Bödeker, Peter Hanns Reill, and Jürgen Schlumbohm (Göttingen: Vandenhoeck & Ruprecht, 1999), pp. 33–67; Poovey, ch. 2, pp. 29–91.

[139] Colin Jones, 'Plague and Its Metaphors in Early Modern France', *Representations*, 53 (1996), 97–127.

[140] Lorraine Daston and Katharine Park, *Wonders and the Order of Nature, 1150-1750* (New York : Cambridge, Mass: Zone Books, 1998), pp. 329–31.

[141] Daston and Park, *Wonders*, pp. 350-352; Daston and Park also describe this shift as one from 'regularity of causes to regularity of effects' (p. 352). On the earlier conception of miracles, see Simon Schaffer, 'Comets and Idols: Newton's Cosmology and Political Theology', in *Action and Reaction: Proceedings of a Symposium to Commemorate the Tercentenary of Newton's Principia*, ed. by Paul Theerman and Adele Seef (Newark: University of Delaware Press, 1993), pp. 206–31; Peter Harrison, 'Newtonian Science, Miracles, and the Laws of Nature', *Journal of the History of Ideas*, 56.4 (1995), 531–553.

[142] Jones, 'Plague and Its Metaphors'.

[143] Jones, 'Plague and Its Metaphors,' pp. 113-114.

disciplinary measures such as the *cordons sanitaires* (implemented from the mid-seventeenth-century onwards) began to show their effectiveness, medical writers argued that it was precisely the divisions among the social body effected by the cordons, and the concomitant interruptions in regular exchange of people and goods that caused the afflicted to die.[144] Historians have also discussed how eighteenth-century savants developed new techniques for managing animal epidemics affecting cattle or horses. Dorothee Brantz, for instance, argues that state-funded physicians in France and Germany shifted their approach from 'ad-hoc measures' combating outbreaks as they happened to 'anticipatory measures'.[145] This, we might reformulate, meant that savants treated the animals as populations; given that they were a crucial resource for increasing the state's (agricultural) wealth, managing their health was an essential task for governors. Building on insights from medical history as well as from the history of political economy, this chapter looks at methods for pest control as a hitherto overlooked area in which the concept of 'population' was developed. Insects could do great damage to an agricultural nation such as France, and knowledge of their bodies was thus also 'useful knowledge' that could be deployed in the service of agriculture. Both for the control of insect and of human populations, writers elaborated techniques for conceiving of natural bodies in relation to the material elements of the territory, including the trees, plants and crops ravaged by insects. Insect pests had to be managed because they blocked the production of goods of a territory. At the same time, they began to be conceived of in terms of 'populations' which could not directly be controlled but managed only by taking into account their natural laws. Insects, in short, were considered in terms that echoed those used in medical and political economic texts; these animals, which appeared in the aggregate, provided an example of a 'natural' body to be observed and managed.

To highlight the ways in which political, economic and medical writings echoed those on insect pests, I first outline the changing understanding of the concept of the 'population' in treatises of political economy. This is followed by an overview of the use of the notion of 'population' in writings by physicians concerned with the management of epidemics and epizootics. This then allows me to draw out the strong

[144] Jones, 'Plague and its Metaphors,' pp. 116-117.
[145] Dorothee Brantz, '"Risky Business": Disease, Disaster and the Unintended Consequences of Epizootics in Eighteenth- and Nineteenth-Century France and Germany', *Environment and History*, 17.1 (2011), 35–51.

parallels between discussion of government of humans and the increasingly rational methods for pest control. Discussing a period when political economists such as François Quesnay were trained physicians, and when naturalists were concerned with the political economic task of increasing the wealth of the kingdom, this chapter suggests that just as political economist texts theorised government on the basis of a conception of the human as, fundamentally, a need-driven animal, writings on animals described them also in political economic terms.[146]

2. The Naturalness of the 'Population': Reproduction and Subsistence in Physiocracy

Before moving on to the ways in which physicians and naturalists conceived of the bodies they observed, I shall briefly remind the reader of the conceptualisation of the collective as a population in the writings on political economy of mid-eighteenth-century, when the concept of the population is usually thought to have emerged. Before this period, 'the population question', though vigorously debated, had referred above all to the issue of France's supposed depopulation. The idea that more men meant more labouring hands and thus more wealth and prosperity for the crown was rarely, if ever, questioned.[147] The reasons for decreasing numbers were sought above all in the moral, and much less in the material realm. On the contrary, in the middle decades of the century, writers such as, most famously, the physiocrats, argued that men, like all other animals, were fundamentally driven by their sensations and their needs, most crucially their need for subsistence. Even religious freedom became a material issue, as it increased men's ability to work for their subsistence unencumbered by fear of prosecution. They also severed the assumed link between high population numbers and good government, insisting instead that the 'natural' and thus right number of subjects depended on the territory and the subsistence it offered. The earliest political economic texts of the late seventeenth century and early eighteenth century, such as Nicolas De LaMare's influential *Traité de la police* (1705-1738), insisted on the importance of the population, though by this they invariably

[146] On the changing conception of needs, see Simmons, *Vital Minimum*; E. C. Spary, *Feeding France: New Sciences of Food, 1760–1815*, Cambridge Social and Cultural Histories, no. 21 (Cambridge: Cambridge University Press, 2014), pp. 270–77; E. C. Spary, *Eating the Enlightenment*, pp. 234–38.
[147] Carol Blum analyses depopulation discourses in her *Strength in Numbers: Population, Reproduction, and Power in Eighteenth-Century France* (Baltimore and London: The Johns Hopkins UP, 2012).

meant a large population.[148] Political economists around the middle of the eighteenth century, on the other hand, complicated the association between prosperity and high population, increasingly insisting that rather than focusing on increasing the mere quantity of the population, governments should ensure also people's 'happiness'. This was to be ensured by public administration, or 'police', concerned not only with the containment of crime or disorder, but with fostering the material and spiritual welfare not just of the individual but of the population. As the *Encyclopédie* article on police explains, using the Greeks as an ideal model for eighteenth-century France : 'Chez les Grecs, la police avoit pour objet la conservation, la bonté, & les agrémens de la vie. Ils entendirent par la conservation de la vie ce qui concerne la naissance, la santé & les vivres. Ils travailloient à augmenter le nombre des citoyens, à les avoir sains, un air salubre, des eaux pures, de bons alimens, des remedes bien conditionnés, & des médecins habiles & honnêtes gens.'[149] The tasks of the police were therefore thought to concern all areas connected to the 'public good'. New technologies such as the medical police or statistics would account for and ensure the health and happiness of the population. Rather than 'simply' a matter of encouraging population growth, government was conceived of as embracing almost all areas of life: the fertility of individuals, their family relations, their health and happiness all became concerns, as well as tools, for governors. Population growth depended, political economic treatises argued, on a large number of factors, chief among which was the relation between means of subsistence and population numbers. In one of many similar works published in the middle decades of the century, for instance, Joachim Faiguet de Villeneuve (1703-1781) exhorted his fellow citizens

> remontons a la source des vrais biens, des biens fisiques et réels; et cherchons, avant tout, le secret de les multiplier a proportion de nos besoins. [...] bientôt

[148] Nicolas de La Mare, *Traité de la police, où l'on trouvera l'histoire de son etablissement, les fonctions et les prerogatives de ses magistrats; toutes les loix et tous les reglemens qui la concernent*, 4 vols (Paris: J. et P. Cot, 1705).

[149] Anon., 'Police', *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*, ed. by Denis Diderot and Jean le Rond d'Alembert, (University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), ed. by Robert Morrissey and Glenn Roe) <http://encyclopedie.uchicago.edu>
On police, see also Marc Raeff, 'The Well-Ordained Police State and the Development of Modernity in Seventeenth- and Eighteenth-Century Europe: An Attempt at a Comparative Approach', *American Historical Review*, 80.5 (1975), 1221–43; Matthew Ramsey, 'Public Health in France', in *The History of Public Health and the Modern State*, ed. by Dorothy Porter (Amsterdam: Rodopi, 1994), pp. 45–118.

> la population s'augmentera parmi nous: mais, après tout, visons encore plus au perfectionnement de l'espece humaine, qu'a l'augmentation numérique des individus.[150]

Even though de Villeneuve maintained the association between a healthy body politic and a large population, he also shifted the focus from the latter to the former. Population numbers, he argued, would 'naturally' correspond to the available resources.[151] The task of government was to provide resources for the satisfaction of the physical needs of the population.

The conception of collectives in terms of a population (no longer conceived as just the number of people in a territory) but as a natural entity – moving, growing, declining – with its own natural laws was present in writings on animals too. Among the comprehensive reforms proposed by De Villeneuve, quoted above, he recommended that political economists model their ideas on the practices of animal and plant breeders. He thus suggested that Church and State encourage marriage among the strongest, most productive members of the population, rather than condemn them to infertility through celibacy laws or poverty: 'Dans toutes les espéces d'animaux que les hommes ont domestiqués, on choisit, pour la propagation, les individus les plus beaux et les plus parfaits ; qui le croirait, c'est le contraire dans l'espéce humaine ?'[152] De Villeneuve, rather troublingly, suggests that in order to improve the 'body' of the population, governors should adopt an approach well known to animal breeders. While this was a rather unusual proposal, De Villeneuve agreed with other writers that there was a connection between animal and human populations and species. The first eighteenth-century definition of 'population', Étienne-Noël Damilaville's *Encyclopédie* article 'Population' argued that the term applied to all 'species':

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[150] Joachim Faiguet de Villeneuve, *L'économe politique: projet pour enrichir et pour perfectioner l'espèce humaine* (London and Paris: Moreau; Pissot; Knapen; Brocas et Humblot, 1763), pp. 2–3.
[151] 'La nature tend assez d'elle-même a la propagation sans aucun secours etranger ; il s'agit seulement de n'y pas mettre obstacle, et de seconder ses vues a propos.' De Villeneuve, *L'économe politique*, p. 2.
[152] De Villeneuve, *L'économe politique*, pp. 115-116. For anxieties around degeneration of mankind, see Quinlan, *Great Nation*; E. C. Spary, *Utopia's Garden*, pp. 102–17.

> ce mot est abstrait, pris dans l'acception la plus étendue, il exprime le produit de tous les êtres multipliés par la génération; car la terre est peuplée non - seulement d'hommes, mais aussi des animaux de toutes especes qui l'habitent avec eux. […] Mais cette expression s'applique plus particulierement à l'espece humaine; & dans ce sens particulier, elle désigne le rapport des hommes au terrein qu'ils occupent, en raison directe de leur nombre & inverse de l'espace.[153]

'Population' thus referred to a group of individuals as members of a 'natural' (animal or human) 'species' in relation to a given territory.

Damilaville's use of the term 'species', in turn, echoes the definitions given by naturalists; though the most famous natural historians of the Enlightenment, the Swedish Carl Linnaeus and the French Buffon disagreed on such fundamental issues as the purpose of classification in natural history, they agreed (at least Buffon did so in his early writings) on the basic definition of species, a term that eighteenth-century naturalists, unlike their predecessors, applied to animals, plants and humans.[154] The naturalists argued that despite the astonishing variety of individuals, there existed fixed species boundaries which could be empirically tested: if two animals could breed together, they belonged to the same species.[155] A 'species' was thus made up of 'a succession of individuals' that could reproduce together.[156] The term 'population' and 'species' were frequently used together, indicating the importance of the population's productive, and reproductive bodies as the object of government. What matters most for my purposes is that despite the individual differences in conceptions of 'species',

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[153] Étienne-Noël Damilaville, 'Population, (Physique, Morale, Politique)', *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*, ed. by Denis Diderot and Jean le Rond d'Alembert, (University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), ed. by Robert Morrissey and Glenn Roe) <http://encyclopedie.uchicago.edu>;
note also the three categories under which population is classified, indicating that it was understood both as a physical and a political entity.

[154] Nicholas Hudson, 'From" Nation" to" Race": The Origin of Racial Classification in Eighteenth-Century Thought', *Eighteenth-Century Studies*, 29.3 (1996), 247–264 (pp. 252–53).

[155] Buffon, I; On Buffon's concept of species, see Paul L. Farber, 'Buffon and the Concept of Species', *Journal of the History of Biology*, 5.2 (1972), 259–84.
As Paul Farber has shown, in less polemical contexts Buffon supported the notion of immutable species, even though species tended to be the only division admitted by Buffon to be natural. Buffon did admit the possibility of change according to climactic conditions, among other factors, but species were determined by what Buffon idiosyncratically called the 'moule intérieure', by which he meant a primary force giving shape to individuals of a species. Changes, and degeneration in particular, were possible, but within limits. These contradictions remained unresolved, as Buffon never rewrote his account of animal generation. See Farber, 'Buffon,' pp. 281-282.

authors agreed that man should be classed as part of the animal kingdom. As Nicholas Hudson has shown, authors before the seventeenth century distinguished humans not according to their skin colour or other bodily characteristics, but according to the government under which they lived.[157] As historians have argued, in the eighteenth century, the redefinition of human differences as based on their bodies in a sense reversed this logic; government was now thought to have to take into account the characteristics of the bodies making up the population.[158]

As historians remind us, the main innovation of the physiocrats was to make population dependent on the available means of subsistence – and thus on variables such as the fertility of the soil, the kinds of products one could grow or the climate – rather than vice-versa.[159] If governmental policies ensured a blockage-free framework, the number of citizens would 'naturally' increase (this is the doctrine associated with the famous phrase 'laissez-faire, laissez-passer', though it was, in fact, Quesnay's contemporary Vincent Gournay, and not the physiocrats who coined it).[160] As for de Villeneuve, agricultural growth preceded population growth. This view of the anteriority of wealth to population growth differed from the ideas of most of Quesnay's and Mirabeau's predecessors, who argued that population growth would lead to increased wealth.[161] Even Mirabeau, before his 'conversion', had sometimes asserted that the wealth of a nation lay in the number of its citizens.[162] For Quesnay and the later physiocrats, however, such measures could not be effective, no more than trying to force bees or silkworms to multiply without increasing their food supply. As Mirabeau, the more 'literary' writer in the collaborative pair he formed with Quesnay,[163] put it somewhat crudely with the help of an animal analogy: 'Les hommes se multiplient comme des Souris dans une grange, s'ils ont le moïen de subsister sans limitation.'[164] The sovereign's (or his political economic advisors') task, in other

[157] Hudson, 'From nation'.
[158] This argument is also made in Vogl, *Kalkül und Leidenschaft*, 78-81; Raef, 'Well-Ordered'.
[159] Though dated, the following essay by Landry provides a very useful overview: Adolphe Landry, "Idées de Quesnay sur la population", *Revue d'histoire des doctrines économiques et sociales*, 2 (1909), 41–87.
[160] See Hochstrasser, 'Physiocracy and the Politics of *Laissez-Faire*,' p. 422.
[161] Although Quesnay had important predecessors, such as Richard Cantillon. See Landry, "Idées de Quesnay," p. 44.
[162] Vardi, *Physiocrats*, p. 47.
[163] As Vardi argues; see Vardi, *Physiocrats*, p. 91.
[164] Mirabeau, *L'ami des hommes ou traité de la population, nouvelle édition corrigée* , vol. 1 (Avignon: 1758), p. 16. This formulation appeared also in Cantillon's *Essai sur le commerce*, written around 1730 but unpublished until 1755: Richard Cantillon, *Essai sur la nature du commerce en général. Traduit de l'anglois* (Londres: Fletcher Gyles, 1755), p. 110.

words, was not to formulate a plan for increasing the population and then inducing his citizens to follow it, whether by force or by appeals to their self-interest.[165] Instead, the sovereign, guided by the enlightened *économiste*, had to work on the natural elements provided by the territory in order to ensure that nothing stood in the way of increases in the productivity (though not necessarily the numbers) of the population. Famous for his flowery language, Mirabeau frequently employed metaphors from the animal realm; in one famous passage of his immensely successful bestseller *L'ami des homme*, for example, he writes:

> Si la multiplication d'une espéce dépendoit de sa fécondité, certainement il y auroit dans le monde cent fois plus de loups que de moutons. Les portées des louves sont très-nombreuses, & aussi fréquentes que celles des brebis qui n'en portent qu'un. L'homme condamne au célibat des armées de moutons; & je n'ai pas ouï dire qu'il fît aux loups cette espéce d'injustice. Il tue beaucoup plus de moutons que de loups; & cependant la terre est couverte de la race des premiers, tandis que celle des autres est très-rare. Pourquoi cela? C'est que l'herbe est fort courte pour les loups, & très-étendue pour les moutons.[166]

These animal metaphors, if we take them seriously, highlight the physiocrats' understanding of the human population as a natural entity. Even though economic actors seem to act rationally, the physiocratic observer is interested not in inner motivations, but in broad patterns visible only at the level of the group. In the eighteenth century, naturalists and agronomists insisted on the interconnectedness of all aspects of nature's oeconomy; tackling an insect plague, for instance, required knowledge not only of the reproductive mechanism of the species in question but also of the external factors that influenced the number of individuals. The same principles hold true for the physiocratic theory of population.[167] As Mirabeau and Quesnay put it in their collectively written primer on physiocracy, the *Philosophie rurale* (1763):

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[165] As Ann Firth explains with reference to James Steuart's theory of government; see Ann Firth, "From Oeconomy to `the Economy': Population and Self-Interest in Discourses on Government," *History of the Human Sciences*, 11.3 (1998), 19–35 (25–26).
[166] Mirabeau, *L'ami des hommes,* 16.
[167] Indeed, one economic historian defines their concept of population as a 'dependent variable'. Yves Charbit, *The Classical Foundations of Population Thought: From Plato to Quesnay* (Dordrecht: Springer, 2010), p. 124.

> Comme tout est astreint aux besoins de la subsistance commune, l'étendue d'une espece est une invasion sur le territoire prétendu par une autre espece. Delà vient que tout s'entredévore ici-bas. Il résulte de cette loi inviolable de la nature, que le principe de la propagation est sans bornes, & que celui de sa réalité est astreint aux bornes de la subsistance.[168]

Bodies pertaining to a 'species', whether animal or human, are infinitely fertile in principle, but limited in reality by the available means for subsistence. Just as the number of crop-devouring caterpillars, for instance, depends on the number of its enemies and on available food sources, human populations depend on the amount of territory and the food they can find and grow within it.

At a time when new theories of government increasingly relied on a conception of the human body as defined and driven by animal needs which had been fixed by natural laws and regularities, naturalists' methods and findings on animal bodies and their needs contributed to thinking through the question of how to observe and control all living bodies. Insects were particularly prone to be considered in this light because they could only be understood – just like the Crown's human subjects – as they appeared on a specific territory and, crucially, in the aggregate. This distinguished them from, for example, the exotic, 'noble' beasts favoured by the court's anatomists in the seventeenth century, at the height of the Sun King's reign.[169] I am not arguing that the physiocrats and other political economists concerned with population later in the century had necessarily read naturalists' texts on insect pests. Instead, what I am proposing is that natural historical, agronomic, medical and political economic texts share common and often overlapping ideas on how to conceive of human, and animal, individuals and collectives.[170] Rational methods for dealing with insect pests were published by members of the *Académie des sciences* who also wrote treatises on forestry or civil engineering (such as Duhamel Du Monceau) or investigated how to improve techniques used by artisans (such as Réaumur), as well as by landowners who

[168] Victor Riquetti Mirabeau marquis de and François Quesnay, *Philosophie rurale, ou économie générale et politique de l'agriculture*, 3 vols (Amsterdam: Libraires associés, 1763), vol. 2, 3.
[169] Peter Sahlins, "The Royal Menageries of Louis XIV and the Civilizing Process Revisited," *French Historical Studies*, 35.2 (2012), 237–67.
[170] In this, I am adopting an argument from literary economic anthropologists, who argue that different kinds of writings are all engaged in the formulation, critique and consolidation of different views of humankind. See Bauer, pp. 20–25.

published observations on how to improve agriculture or how to deal with harmful insects, but also devised ambitious plans to regenerate France as a whole. The same people, that is, could pursue different areas of knowledge which, they thought, would contribute to improving the wealth and prosperity of the kingdom. Part of this wider project of improvement was to ensure the health of both humans and animals, not only individually but also in the collective.

3. Physicians Managing the Population: Human and Animal Epidemics

As historians of medicine have shown, writings on epidemics from the mid-century onwards were particularly prone to considering the Crown's subjects as a population. Andrea Rusnock, in particular, has analysed how medical writers became interested in the health not only of indiviudals but also of the population, and developed new numerical methods for accounting for the links between disease, deaths and population numbers.[171] Partly, she argues, physicians' interest in the aggregate rather than the individual can be explained by the resurgence in the eighteenth century of Hippocratic medicine, and its concern environmental factors such as airs and waters, occasioned by the increasing awareness of the differences in health practices in distant colonial spaces.[172] Hippocratic physicians emphasised the importance of climate for health and disease, thus forcing the practitioner to take into account not only the individual patient, but also the space he or she inhabits. Though the basis for these ideas were, of course, ancient medical writings, Enlightenment physicians put them on new empirical grounds.[173] Thus, efforts were made to record and correlate meteorological data, topographical information and disease.[174] All across Europe, it thus became fashionable for savants to keep so-called weather journals, in which they recorded

[171] Rusnock, *Vital Accounts*; Rusnock, 'Biopolitics'.
[172] Rusnock, 'Biopolitics,' p. 55; James C. Riley, *The Eighteenth-Century Campaign to Avoid Disease* (New York: Macmillan, 1987); Wesley D. Smith, *The Hippocratic Tradition* (Ithaca: Cornell University Press, 1979).
[173] Sean M. Quinlan, *The Great Nation in Decline: Sex, Modernity and Health Crises in Revolutionary France c.1750-1850* (Aldershot: Ashgate, 2007), pp. 63–85; Riley, *The Eighteenth-Century Campaign to Avoid Disease*, pp. xv–xvi; L. J. Jordanova, 'Earth Science and Environmental Medicine: The Synthesis of the Late Enlightenment', in *Images of the Earth: Essays in the History of the Environmental Sciences*, ed. by L. J. Jordanova and Roy Porter (Chalfont St. Giles: British Society for the History of Science, 1979), pp. 119–46.
[174] Lorraine Daston, 'Super-Vision: Weather Watching and Table Reading in the Early Modern Royal Society and Académie Royale Des Sciences', *Huntington Library Quarterly*, 78.2 (2015), 187–215; Andrea Rusnock, 'Hippocrates, Bacon, and Medical Meteorology at the Royal Society, 1700–1750', in *Reinventing Hippocrates*, ed. by David Cantor (Aldershot: Ashgate, 2002), pp. 135–56.

factors such as temperature, climate and diseases.[175] In France, the establishment of the Royal Society of Medicine enabled Parisian savants to collect standardised data from provincial observers, whom they provided with instructions for both record-keeping and the instruments to be used.[176] One of the main tasks of the newly established Société would be to collect information on 'physical situation, weather, common diseases, food, and mode of living of the inhabitants and sanitary conditions.'[177] This search for disease patterns contrasted with the older methods for dealing with epizootic (or epidemic) outbreaks, where officials had sought advice from the medical community only in emergency and as needed.[178] This new interest in factors affecting not only individuals but entire populations, as several scholars have shown, was especially apparent in the heated debates over smallpox inoculation. Defenders and opponents weighed up the benefits and risks of inoculation for either the individual (who might die as a result) or for the 'population' as a whole (on the level of the population, it was hoped, smallpox would one day be eradicated).[179] As Rusnock has shown, the practice had become increasingly popular among French aristocrats, even though its effectiveness, and the relative harmlessness of smallpox caused by inoculation, could not be explained by contemporary medical theories.[180] Unlike in England, where physicians embraced mathematical methods, in France it was often mathematicians, and not physicians, who advocated for the practice.[181] In the process, Rusnock has shown, they developed sophisticated mathematical and probabilistic methods for representing populations numerically.

The conceptualisation of the patient-body as part of a population whole is exemplified by the catchy aphorism coined by the mathematician Charles Marie La Condamine (1701-1744): 'La petite vérole nous décime, l'inoculation nous millésime'. La Condamine here implied that the death of some individual bodies

[175] Daston, 'Super-Vision'.
[176] Andrea Rusnock; Caroline Hannaway, 'Environment and Miasmata', in *Companion Encyclopedia of the History of Medicine*, ed. by William Frederick Bynum and Roy Porter (London: Routledge, 1993), p. 299; Jordanova, 'Earth Science and Environmental Medicine: The Synthesis of the Late Enlightenment'.
[177] Hannaway, 'Société Royale,' p. 267.
[178] Hannaway, 'Veterinary,' p. 434.
[179] Rusnock, *Vital Accounts*, chapter three *'The Limits of Calculation: French Debates over Inoculation in the 1760s,' pp. 71-91* Anne Eriksen, 'Cure or Protection? The Meaning of Smallpox Inoculation, ca 1750–1775', *Medical History*, 57.4 (2013), 516–36; Catriona Seth, 'Calculated Risks, Condorcet, Bernoulli, d'Alembert and Inoculation', *MLN*, 129 (2014), 740–55; Catriona Seth, 'L'inoculation contre la variole : un révélateur des liens sociaux', *Dix-huitième siècle*, 41 (2009), 137–53.
[180] Rusnock, *Vital Accounts*, pp. 90-91.
[181] Rusnock, *Vital Accounts*, pp. 71-72.

would be offset by the benefits for the social body.[182] His Swiss colleague Daniel Bernoulli (1700-1782) used pioneering methods in the mathematics of probability, based on a series of simplifications such as the idea that one's risk of contracting the disease remained constant throughout one's lifespan, in order to determine the benefits of inoculation.[183] He too admitted that individuals might suffer from the practice, but insisted that the concern should be with the population as a whole: 'L'humanité veut qu'on assure et qu'on conserve la vie à chaque particulier, soit jeune, soit vieux: l'intérêt de l'État demande la population du Royaume.'[184] Critics of inoculation, on the other hand, attacked precisely the idea that the two levels – of particular bodies and of the population body – were comparable. D'Alembert, though a defender of the practice, attacked Bernoulli for applying mathematics to calculate the value of a life; no one could blame a father, he argued, for refusing to expose his child to a potentially lethal practice, even if it benefitted the state. In addition to mathematical calculation, d'Alembert stated, one had to take into account moral considerations: the decision whether or not to inoculate one's child would thus depend 'non-seulement du degré auquel [le père] aime son fils, mais de la manière dont il l'aime, si c'est, par exemple, comme son fils, ou comme son héritier; si c'est par tendresse, ou seulement par devoir; si c'est comme son bien, ou comme le bien de l'État'.[185] For d'Alembert, that is, the interest of the individual citizen was not automatically identical to the interest of the state, which was by necessity concerned with the social rather than the particular body.

Although many physicians, especially from the conservative Paris Faculty of Medicine, were sceptical, smallpox inoculation gradually became accepted medical practice.[186] Arguments focusing on the social rather than on the particular body

[182] I am following Catriona Seth's outline of the debate here; for the quote from La Condamine, see Seth, 'Calculated Risks, Condorcet, Bernoulli, d'Alembert and Inoculation', p. 741. On the debate between Bernoulli and d'Alembert, see also Rusnock, *Vital Accounts*, pp. 81-86.
[183] Daston, *Classical Probability in the Enlightenment*, pp. 82–89.
[184] Daniel Bernoulli, 'Réflexions sur les avantages de l'inoculation', in *Mercure de France* (Paris: Chaubert, Jorry, Pissot, Duchesne, Cailleau, Cellot, 1760), pp. 173–90 (p. 178). For an outline of Bernoulli's calculations, see Seth, 'Calculated Risks,' pp. 744-748.
[185] Jean Le Rond d'Alembert, 'Réflexions sur l'inoculation', in *Œuvres de D'Alembert* (Paris: Belin, 1821), I, p. 486. Diderot criticised his friend for claiming that one could separate the interests of the private individual from that of the state; see Seth, 'Calculated Risks, Condorcet, Bernoulli, d'Alembert and Inoculation', pp. 753–54. D'Alembert also emphasised what Daston calls 'psychological experience' in calculating the risks of inoculation, particularly the difficulty of accounting for the idea that older patients would gain years of a much lower quality of life than a younger patient. The difficulty of accounting for these moral considerations, which also differed from individual to individual, made d'Alembert increasingly pessimistic about the capacity of probability to describe, let alone prescribe, moral decisions. See Daston, *Classical Probability*, pp. 85-89.
[186] Rusnock, *Vital Accounts*, pp. 90-91.

became increasingly convincing to eighteenth-century readers. Thus, as Anne Eriksen has shown, while before the 1760s, arguments in favour of smallpox inoculation foregrounded the interest of the individual, in the later period the focus was on the more abstract notions of society or population.[187] Initially, the new methods of probabilistic calculations were not used to determine the benefits for the population at large, but rather to calculate the potential positive effects on the individual. Medical writers argued that inoculation would save individual lives, not necessarily that it would contribute to the prevention of new outbreaks of the epidemic.[188] Given that external causes were considered less important than the constitution of the patient him- or herself, physicians were not yet concerned with the immunity of the population. Gradually, however, they began to think of smallpox as an independent object to be fought, rather than as inextricably linked with the individual's constitution. The efforts on the part of civic-minded to control the prevention and containment of epidemics, but also of epidemics among animals, which threatened agricultural revenue, culminated in the establishment of the Royal Society of Medicine in 1778, which worked to replace the locally operating medical police, faculties and guilds with a centralised bureaucratic system.[189] As enlightened reformers became increasingly concerned with the welfare of all of the Crown's subjects, the Société, whose members were in general much more favourable towards inoculation than those of the Faculty of Medicine, was established to facilitate centralised disease control, rather than entrust the health of French individuals to their regional intendants.

Smallpox, however, was not the only motivation for the founding of the Academy. Indeed, its founding story exemplifies the close connection between epizootics and epidemics in the period. As Caroline Hannaway notes, the controller-general Anne-Robert Jacques Turgot (1727-1781), inspired by the physiocrats and with the advice of the academician and future medical commissioner Félix Vicq d'Azyr, set up the Société in the wake of an outbreak of the cattle plague, or Rinderpest, in 1774.[190] Turgot charged Vicq d'Azyr with the direction of a

[187] Eriksen, 'Cure or Protection?'
[188] Eriksen, 'Cure or Protection?', p. 528.
[189] Ramsey, pp. 47–48.
[190] Caroline Hannaway, 'Veterinary Medicine and Rural Health Care in Pre-Revolutionary France', *Bulletin of the History of Medicine*, 51.3 (1977), 431–47. On Turgot's relationship with the physiocrats, see Vardi, *Physiocrats*, pp. 7–20. On Vicq d'Azyr, see Rafael Mandressi, 'Félix Vicq d'Azyr : l'anatomie, l'État, la médecine', *BIU Santé, Paris* <http://www.biusante.parisdescartes.fr/histoire/medica/vicq.php> [accessed 27 June 2017].

commission that would both fight the outbreak and collect information that would help them to prevent future epizootics. The commission was assisted by students from the veterinary schools that had recently been set up in Lyon (1761) and Alfort near Paris (1764), thus underscoring the fact that state bureaucrats were increasingly focused on collecting knowledge that would help them to prevent future outbreaks.[191] The result of Vicq d'Azyr's missions was published in 1776 as *Exposé des moyens curatifs et préservatifs qui peuvent être employés contre les maladies pestilentielles des bêtes à cornes*.[192] For Vicq d'Azyr (as well as for Turgot), the Rinderpest outbreak proved that merely local measures targeting particular bodies only were ineffective in fighting the disease. What was needed instead, they argued, was careful observation of regular disease patterns in both animals and humans, thus enabling savants and farmers to anticipate, rather than merely combat outbreaks.[193] He recommended that in the event of an outbreak, all affected animals should be killed and affected areas cordoned off from trade routes. Vicq d'Azyr argued that Rinderpest should be considered in the same manner as the human plague, a consideration that would lead him to advocate for the institutionalisation of comparative medicine and anatomy. However, in addition to adhoc measures that mirrored the plague measures instituted by the absolutist state from the middle of the seventeenth century onward,[194] Vicq d'Azyr also drew parallels with the smallpox. Indeed, physicians and curious farmers had experimented with inoculation cattle throughout Europe from the mid-century onwards.[195]

Building on the debates on the smallpox, the academician studied, among other things, the effectiveness of inoculation (the procedure had failed in most of his test cases) as well as the differences in symptoms, duration and severity of the illness in different regions, which depended, among other factors, on climate and 'atmosphere'.[196] By gaining knowledge of the 'lois ordinaires' of healthy and diseased

[191] Hannaway, 'Veterinary Medicine'.
[192] Félix Vicq d'Azyr, *Exposé des moyens curatifs et préservatifs qui peuvent être employés contre les maladies pestilentielles des bêtes à cornes* (Paris: Mérigot l'aîné, 1776). Turgot's reflections can be found in Anne-Robert-Jacques Turgot, 'Mémoire instructif sur l'exécution du plan adopté par le roi, pour parvenir à détruire entièrement la maladie qui s'est répandue sur les bestiaux en Guyenne et dans les provinces circonvoisines', in *Œuvres de M. Turgot* (Paris: Delance, 1809), VII, 169–86.
[193] Hannaway, 'Veterinary Medicine,' p. 437; Brantz, 'Epizootics,' pp. 39-43.
[194] Jones, 'Plague and Its Metaphors,' p. 99.
[195] Christian Huygelen, 'The Immunization of Cattle against Rinderpest in Eighteenth-Century Europe', *Medical History*, 41.2 (1997), 182–106.
[196] Vicq d'Azyr, *Exposé*, p. 210.

animal and human populations as they interacted with their environment, the savants of the Academy of Medicine thus concerned themselves with collective, rather than with individual bodies. As with the smallpox debates, it was not always easy to convince farmers to sacrifice their cattle for the health of the population of the wider territory. Peasants continued to smuggle infected animals out of cordoned off areas, and others dug up dead animals to sell their hides.[197] Nevertheless, Vicq d'Azyr was convinced of the importance of his studies for controlling, if not eradicating, the disease. His observations, as Brantz puts it, were supposed to transform the 'threat' of cattle plague into a predictable, calculable 'risk'. Just as with human populations, veterinary doctors thus saw it as their task to manage animal populations in health and disease. In sum, physicians, whether they treated animals or humans, became concerned in the eighteenth century with treating not just individual 'patients', but entire population bodies.

4. Seeing Insect Pests as 'Populations'

The focus on the body of the population as opposed to on particular bodies as highlighted by medical literature pervades fields of knowledge in the eighteenth century that have not hitherto been considered to use the concept of the population. Insects, like cattle, were a fundamental element in France's agricultural economy. Even more so than cattle, however, insects could be conceptualised as populations, given that they appeared in large 'swarms'. My aim in this section is to discuss how state officials, writers of practical rural oeconomy manuals and articles wrote of insect pests and their elimination in terms echoing medical and political economic writings on the human population. I will argue that writings on pest control conceptualised the insects as a collective body which depended on and transformed the territory on which it lived; they conceptualised the insects, in other words, as populations. As we will see, writings on pest control reflect and make use of parallel developments in apparently distant scholarly fields, particularly human and veterinary medicine and political economy. Questions and concerns of writers attempting to eradicate insect pests, either on behalf of the state administration or in the form of advice to individual farmers, interacted with wider scientific, political and even moral questions and

[197] Brantz, 'Risky Business,' p. 41; Turgot, *Mémoire*, pp. 170-171.

concerns.[198] While the topic of pest control might appear excessively narrow or of a purely technical nature, in the eighteenth-century texts on pest control formed part of a wider project to 'improve' the land and people of the French monarchy. Furthermore, as this chapter demonstrates, they reflected and put into practice a way of thinking about communities that is encapsulated in the new term 'population'. While the texts by political economists, medical writers and naturalists or agronomists discussed in this chapter are usually seen as distinct fields, they are linked by their conceptualisation of the collective as a population.

Antoine Ferchault de Réaumur (1683-1757), whom we already encountered in the previous chapters, did much to define what was meant by the laws of animal bodies. Although he did not, as far as I can ascertain, employ the term 'population' in his descriptions of insects, many of what would soon become the key elements of the population discourse in the field of political economy are present in his *Mémoires pour servir à l'histoire des insectes* (1734–1742). Modern entomologists concerned with insect pest control have claimed Réaumur as forefather to their discipline, given that he 'probably gave the earliest published recommendation for biological pest suppression' on the basis of the 'dynamics of natural population'.[199] For Réaumur, that is, insects could only be understood in relation to the dynamic variables of the territory they inhabited. Studying caterpillars that attack fruits and grains, for example, Réaumur described issues such as the insects' natural enemies; the probable effects of climate on their population numbers; what they eat and during which season and how manipulation of these food sources could affect the birth and death rates of harmful insects. Réaumur has recently been studied as the exemplary eighteenth-century observer of 'nature'.[200]

His attentive observations, however, need to be considered in the light of his role as one of the most influential members of the Paris Académie des sciences,

[198] The focus lies on insects that ravages fields, rather than individual bodies; for eighteenth-century conceptions of bedbugs, see Lisa T. Sarasohn, '"That Nauseous Venomous Insect:" Bedbugs in Early Modern England', *Eighteenth-Century Studies*, 46.4 (2013), 513–30. A French text that deals with insects feeding on human bodies and that went through several editions is Pierre-Joseph Buc'hoz, *Histoire des insectes nusibiles à l'homme, aux bestiaux, a l'agriculture et au jardinage; avec les moyens qu'on peut employer pour les détruire, ou s'en garantir, ou remédier aux maux qu'ils ont pu occasionner* (Paris: Laporte, 1781).

[199] Harry C. Coppel and James W. Mertins, *Biological Insect Pest Suppression* (Berlin, Heidelberg: Springer, 1977), 17.

[200] Terrall, *Catching Nature in the Act: Réaumur and the Practice of Natural History in the Eighteenth Century*.

founded in 1666 by the minister Jean-Baptiste Colbert (1619-1683) in order to increase France's financial and natural resources.[201] Réaumur was certainly not a disinterested and curious observer, but working from the perspective of an academician funded by the state (and interested in increasing the state's funding for the Academy's mission). This is manifest also in his volumes and articles on insects, produced over the course of almost his entire career at the Académie. In the preface to the first volume of his *Mémoires,* the naturalist thus promised his readers that knowledge of insects would not only provide a pleasurable pastime and a means of worshipping the creator through his creations, but also the means to augment '*les biens réels*'.[202] Among other possible applications of a natural history of insects, Réaumur singles out the possibility of using natural historical knowledge to prevent insect pests from ravaging harvests and thus preventing the Crown's subjects from receiving adequate food supplies:

> La conservation des grains est un des plus grands objets que puissant se proposer ceux qui gouvernent des Etats; leur attention & leur zele pour le bien du genre humain ne seroient-ils pas dignes d'éloges, s'ils excitoient, par des recompenses promises, à découvrir le secret de défendre nos bleds contre les insectes qui y font de si grand ravages, lorsqu'ils se sont introduits dans les greniers, qui y réduisent les plus gros tas de grains à n'être plus que des tas d'un son léger ! De pareils secrets ne sçauroient être trouvés que par ceux qui étudieront bien ces insectes.[203]

The study of insects, then, was, according to Réaumur, a significant contribution towards the task of government, thought to consist in the cultivation and accumulation of resources.[204] The naturalist thus used this traditional principle of government to argue for the importance of state-funded ('des recompenses') knowledge production.[205] In a country as dependent on agriculture as eighteenth-century France, reducing the often considerable damages done by crop-devouring insects, Réaumur

[201] Alice Stroup, *A Company of Scientists: Botany, Patronage, and Community at the Seventeenth-Century Parisian Royal Academy of Sciences* (Berkeley: University of California Press, 1990).
[202] Réaumur, I, p. 4; italics in the original.
[203] Réaumur, *Mémoires*, vol. 1, p. 9.
[204] Firth, 'From Oeconomy', p. 21. De Marchi and Schabas.
[205] On the language of secrecy, see William Eamon, *Science and the Secrets of Nature: Books of Secrets in Medieval and Early Modern Culture* (Princeton, N.J.: Princeton University Press, 1996).

could describe his research into the 'mœurs' and anatomy of their bodies as a matter of national political-economic importance.

One aspect of the natural history of insects that made (and makes) it particularly plausible to think of them in terms of a population were the high fertility rates of most species, and particularly of those feeding on human crops. They thus allowed their observers to find an example in nature of an aggregate of large numbers of individuals and to test methods for controlling their numbers and their movements across the territory. In a nation as dependent on agricultural produce as eighteenth-century France, savants at the Académie des sciences – working for the state – were alert to the effects of insect fertility. In the introduction to the second volume of his insect memoirs, Réaumur announced detailed observations on a particularly ravenous insect:

> une singularité dont nous nous sommes mal trouvés, & qui seul méritoit que nous fissions un article particulier de ces chenilles, c'est que, quoiqu'elles m'eussent toûjours paru assés rares, elles se sont multipliées prodigieusement en 1735. elles ont fait d'étranges ravages dans une grande partie du Royaume, & sur-tout aux environs de Paris, où elles ont dévoré des champs entiers de légumes.[206]

The case of crop-devouring caterpillars thus seemed a particularly apt field of exploration for an observer as intent on contributing to national prosperity as Réaumur: knowledge of the reasons for increases in fertility and techniques for manipulating them promised higher yields for human farmers. He recognised, however, that there was never just one factor involved, but that the number of insects depended on a range of external factors such as temperature, humidity, the number of enemy specimens, or the availability of an insect's preferred food. The plague of 1735 was caused, Réaumur argued, by particularly unfortunate weather patterns favourable to the pests and hostile to their diseases and enemies.

This represents a shift from earlier considerations of insect plagues, even by Réaumur's immediate predecessors. Sheila Wille, in an article on British writings on the ichneumon fly, argues that it was not until the late 1790s that naturalists began to

[206] René Antoine Ferchault de Réaumur, *Mémoires pour servir a l'histoire des insectes. Suite de l'histoire des chenilles & des papillons; & l'histoire des insectes ennemis des chenilles* (Paris: Pierre Mortier, 1737), vol. 2, viii.

advocate intervention in the balance of nature; before then, they trusted that Providence would equilibrate insect populations.[207] The English natural theologian William Derham (1657-1735), for instance, in his efforts to explain every detail in nature as created by God for the benefit of mankind, considered the sudden proliferation of harmful insects a punishment for man's sinful infraction of God's laws: 'That as to Man, those Creatures are not without their great Uses, particularly in the Cure of some of the most stubborn and sinful Men. And I am apt to think that the Nations which know not God, are the most annoy'd with those noxious Reptiles, and other pernicious Creatures.'[208] As a consequence, for Derham there was little man could do to prevent such scourges.

In France, on the other hand, observers were, at least from the early century onwards, proposing methods for managing, if not eliminating, insect pests. In doing so, they echoed the greater emphasis on state control on the part of French political economist in comparison to their English counterparts.[209] As naturalists diminished God's role in nature to the establishment of fixed laws, they retained Derhams's insistence on natural balances. Nature, they argued, constituted a self-regulating system with checks and balances, such as the relationship between prey and predator. Nevertheless, they admitted that this balance was fragile and that its hospitality to humans fluctuated.[210] Similarly to writings on plague epidemics, in explanations of insect plagues, such as the one mentioned by Réaumur, both abundance and scarcity occurred naturally, not because of God's direct interventions but because of the laws of correlation between different variables. The language employed by Réaumur does echo Biblical, or mythological, descriptions of insect plagues: the animals cause

[207] Sheila Wille, "The Ichneumon Fly and the Equilibration of British Natural Economies in the Eighteenth Century," *The British Journal for the History of Science*, 48.4 (2015), 639–60. Wille, accordingly, focuses on the notions of 'stability' and 'just equilibrium' in her analysis of the fly.

[208] William Derham, *Physico-Theology, Or, A Demonstration of the Being and Attributes of God from His Works of Creation: Being the Substance of Sixteen Sermons Preached in St. Mary-Le-Bow Church, London, at the Honourable Mr. Boyle's Lectures, in the Years 1711, and 1712 : With Large Notes, and Many Curious Observations* (London: William and John Innys, 1720), 398–99.

[209] David McNally, *Political Economy and the Rise of Capitalism* (Berkeley: University of California Press, 1988), 123.

[210] See also Fredrik Albritton Jonsson, 'Rival Ecologies of Global Commerce: Adam Smith and the Natural Historians', *The American Historical Review*, 115.5 (2010), 1342–63, who argues that Smith's optimistic view of the balance of nature contrasted with the darker view of naturalists, particularly of those who had observed the rough conditions in the colonies. On scarcity, see Steven L. Kaplan, *Bread, Politics and Political Economy in the Reign of Louis XV*, Second edition (London: Anthem Press, 2015); Foucault, p. 60.

'prodigious' and 'strange' ravages.[211] However, Réaumur's purpose in his description of the noxious animals is, precisely, to explain the outbreak as the consequence of a concurrence of factors that conceivably occur at regular intervals, and thus as the consequence of 'les lois ordinaires de la nature'. As insect infestations came to be considered a natural, regularly occurring phenomenon, they thus also became a phenomenon that could be rationally managed.

Réaumur's research on insects remained the reference point for most subsequent investigations of insects in the Enlightenment period, even as observers turned to piecemeal investigations of individual insect species, rather than attempting anything as ambitious as the academician's project.[212] From the 1750s onwards, both state-funded academicians and 'curious' individuals multiplied observations of both useful (discussed in more detail in the next chapter) and harmful insects. Réaumur's insistence on the usefulness of observations of animal bodies was easily absorbed into the vogue for practical literature on agronomy, defined by one if its most important historians as a scientific movement emerging in the 1750s.[213] Agronomists built on an older literature dealing with the rational improvement of one's estate, of which Olivier de Serre's often republished *Théâtre de l'agriculture* (1611) is the most successful and influential example.[214] As Chandra Mukerji has argued, De Serres' techniques for 'improving' all aspects of rural estates served the construction of 'a "second nature" to improve the abundance and value of estate lands.'[215] Similarly, proponents of agronomic reform advocated for more rational and thus more productive methods of agricultural practice.[216]

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[211] He uses the same terms, for example, as Mallet in his description of grasshopper plagues in Edme-François Mallet, 'Harpies', *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*, ed. by Denis Diderot and Jean le Rond d'Alembert, (University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), ed. by Robert Morrissey and Glenn Roe) <http://encyclopedie.uchicago.edu>

[212] 'Le célèbre Monsieur Réaumur' is frequently cited as the foremost authority of insects; by way of example, see Duhamel and Tillet, *Histoire d'un insect*e, pp. 20; 45-60, 168, 173, 209-214, 27; *Journal oeconomique*, October 1762, pp. 458-560; March 1769 127-128.

[213] André J. Bourde, *Agronomies et agronomes en France au XVIIIe siècle*, 3 vols (Paris: SEVPEN, 1967), I.

[214] Olivier de Serres, *Le théatre d'agriculture et mesnage des champs: où est représenté tout ce qui est requis & necessaire pour bien dresser, gouverner, enrichir & embellir la maison rustique* (Geneva: Mat Hiev Berjon, 1611).

[215] Mukerji, *Impossible Engineering*, p. 24.

[216] Bourde, I, Préface; See also: E. C. Spary, *Feeding France*, chapter 2. Shovlin, *The Political Economy of Virtue*; Charles Coulston Gillispie, *Science and Polity in France at the End of the Old Regime* (Princeton, N.J.: Princeton University Press, 1980), pp. 360–68. A good bibliography of agronomic literature can be found in Victor Donatien de Musset, *Bibliographie agronomique: ou, Dictionnaire raisonné des ouvrages sur l'économie rurale et domestique et sur l'art vétérinaire* (Paris: Colas, 1810).

The rise in interest in pest control forms part of this larger vogue for texts on the enlightened 'improvement' of the land. Particularly in the wake of the publication in French of Jethro Tull's work, an English agronomist translated by none other than the comte de Buffon, French writers began experimenting with and publishing on topics such as farming equipment, crop rotation or, as we will see in the next chapter, beekeeping. These writings would form what would soon be known as 'agronomia', or the vogue for enlightened agricultural practices that were aimed at the economic regeneration of France according to the model of the supposedly much more enlightened English agricultural industry.[217] The texts discussed in this section were written either for the benefits of individual landowners, as in the case of most articles in the proliferating agronomic journals, or, like Réaumur's *Mémoires*, for the benefit of administrators concerned with the wealth and well-being of the state as a whole. Despite these different perspectives, however, most authors of mid-eighteenth-century texts on insect pests proclaimed for themselves a role in improving not only their own land, but the land and people of France as a whole; as the editors of the *Journal economique* stated in the preface to their first issue, the journal would give 'd'avis capables de fournir des nouveaux secours à ceux qui s'y adonnent et de les mettre en état d'accroître de plus en plus le bien général en travaillant à leurs fortunes particulières.'[218] As we will see, authors emphasised that outbreaks of insect infestations were rarely confined to individual gardens, and that the actions of one landowner or gardener could have implications for the oeconomy of France as a whole.

Some twenty years after Réaumur's experiments with caterpillars, as the physiocratic movement was in full swing, the academicians Duhamel Du Monceau and Mathieu Tillet were commissioned by the Academy of Sciences to carry out investigations on the cause of a particularly devastating insect plague in the province of Angoumois (today's Charente).[219] The region's provincial intendant had called for

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[217] Bourde, *Agronomie*, pp. 277-312.

[218] *Journal oeconomque*, January 1751, p. 6.

[219] Henri-Louis Duhamel Du Monceau and Matthieu Tillet, *Histoire d'un insecte, qui devore les grains de l'angoumois. Avec les moyens que l'on peut employer pour le détruire.* (Paris: H.L. Guerin & L. F. Delatour, 1762); For a different take on this text, see Etienne Stockland, "'La Guerre Aux Insectes": Pest Control and Agricultural Reform in the French Enlightenment," *Annals of Science*, 70.4 (2013), 435–60. Stockland uses the text to trace the construction of networks of observers, landlords and amateurs and analyses the role of patriotic discourse in natural historical practice, particularly for recruiting helpers. On the Angoumois grain moth, which continues to ravage human fields, see Steve Jacobs and Dennis Calvin, "Angoumois Grain Moth (Department of Entomology)," *Department of Entomology (Penn State University)*, 1990 <http://ento.psu.edu/extension/factsheets/angoumois-grain-moth> [accessed 14 September 2016].

help from experts in natural history from the capital since a species of moth – still today called the 'Angoumois grain moth' – had become so widespread in the region as to threaten entire harvests of grain.[220] Using a whole battery of experimental and observational techniques, the two Parisian naturalists set out to determine the causes of the increase in the moth's population and to find methods for controlling the damage done by the insects. Methods for controlling harmful insects shared in the same 'knowledge substrate' on theories and practices of government as political economic writings. The observations of naturalists helped produce new ways of managing the insect bodies via the manipulation of the variables determining their lives; the term 'government' is particularly appropriate here because observers admitted that even scientifically informed pest control could never eliminate, only ever reduce crop-devouring insect populations. As they developed methods of 'rationally' combatting insect plagues, savants emphasised that the individual's perspective was not sufficient to eradicate the plague, even if diligent farmers would benefit, at least temporarily, from applying the recommended methods. In the same decades as the intendents began to seek centralised sources of support in controlling epizootics, Duhamel's and Tillet's treatise served not only to instruct local officials about how to react to acute outbreaks. Rather, the systematic study of the 'history' of the insect in question and the authors' detailed description of its anatomy, reproduction and behaviours were intended to further understanding of how the pest spread and thus possibly to prevent it from doing so.[221]

In the case of insect pests, particularly in the writings of state employees like Duhamel and Tillet, however, the impossibility of containing the rapidly reproducing insects prompted considerations of the interests of entire regions, as opposed to merely the individual farmer.[222] Keith Tribe has argued that seventeenth-century texts on rural oeconomy considered the farm in isolation, in no way connecting it to the wider concerns of the nation.[223] In the eighteenth century, on the other hand, rural oeconomists appealed to the self-interest of the farmer, now conceived of as an

[220] Monceau and Tillet, *Histoire d'un insecte,* 5–7.
[221] 'Nous trouvions dans notre route l'insecte en beaucoup d'états différents, & nous acquérions insensiblement des connoissances sur son histoire. C'étoit un préliminaire nécessaire pour découvrir le moment où on pourroit l'attaquer avec plus d'avantage : nous essayions aussi d'approfondir ce qu'on nous disoit sur la cause de sa propagation', Duhamel Du Monceau and Tillet, *Histoire d'un insecte* pp. 16-17.
[222] Anne Eriksen, 'Cure or Protection', pp. 531-532. On eighteenth-century probability, see Daston, *Classical Probability in the Enlightenment*.
[223] Tribe, *Land, Labour and Economic Discourse*, p. 61.

inextricable element in 'a series of exchanges'.[224] In pest control texts of the eighteenth century, accordingly, we find one of the most important aspects that would come to define the concept of population: rather than consider the outbreaks of insect plagues as singular events, savants and authors of practical rural oeconomy manuals represented insect pests as a constant risk that could not be completely eradicated. Like practitioners of medicine – both human and veterinary – shifted from a discourse of cure to a discourse of prevention, the first writers to propose 'rational' measures of pest control urged their audiences to factor harmful insects into their farming plans.[225]

One of the first experiments the two academicians carried out was an adaptation of Réaumur's realisation that temperature directly influenced an insect's lifespan. In order to determine the conditions under which the crop-devouring caterpillars were most likely to flourish and to gauge the weather's influence on the numbers of the dangerous insects, Duhamel and Tillet set up a series of vases, each housing a caterpillar, and subjected them to different temperatures.[226] The two naturalists were interested not only in the effect of the external temperature on breeding rates, but took into account the way in which the insect's bodily temperature reacted to its surroundings. In particular, they had noticed that grains infected with insects produced more heat, thus surmising that hot and humid weather enabled the caterpillars to generate more heat themselves and thus procreate particularly fast:

> Peut-être aussi cette grande chaleur des grains remplis de chenilles, vient-elle de l'humidité que produisent ces insectes, & qu'il en résulte une fermentation capable de faire éclore les œufs, de faire croître les chenilles, d'avancer leurs métamorphoses & de faire sortir les papillons, en même temps qu'elle endommage les grains.[227]

Studying the insects' body temperature, the weather in the months before they bred, and the temperature inside the granary, the men could thus determine the conditions that allowed the caterpillars to breed at particularly high rates. Although they could not, of course, influence the weather, knowledge of the conditions best suited to meet

[224] Tribe, *Land, Labour,* p. 66.
[225] On the management of epizootics, see Brantz, 'Risky Business'.
[226] Monceau and Tillet, *Histoire d'un* insecte, pp. 67–68.
[227] Monceau and Tillet, *Histoire d'un insecte,* pp. 69–70.

the insect's needs did help them determine when attempts to eliminate them would be most favourable; the population could not be fully controlled, but it could be managed.[228] Thus, Duhamel and Tillet admitted that their enlightened method for preserving the grain from hungry insects could not completely prevent the loss of grains, but only cut them down to about one fifth.[229]

As we have seen, physicians in the period showed a renewed interest in the effect on health of environmental factors such as airs or the weather. Similarly, Duhamel's and Tillet's tests on the association between temperature and reproduction of the Angoumois moth constituted an attempt at mapping the association between climates and insect pests so that regional administrators and farmers could prepare, and possibly prevent, outbreaks. In another experiment described in Duhamel's and Tillet's treatise, a local helper and 'zealous citizen' planted seven wheat grains in crystal containers; a mere 27 days later he had observed the butterflies hatch. The Parisian naturalists, treating the local as a mere provider of observational facts rather than as a naturalist in his own right, used his observations to calculate the insect's fertility rate. They estimated that out of the seven insects (each grain could only house one insect) three would be female, which could in turn give birth to 180 new caterpillars; if temperatures would remain high until the end of September, this meant that the approximately 90 new females could give birth to a staggering 5400 caterpillars.[230] Studying the insects' body temperature, the weather in the months before they bred, and the temperature inside the granary, the men could thus determine the conditions that allowed the caterpillars to breed at particularly high rates. Although they could not, of course, influence the weather, knowledge of the conditions best suited to meet the insect's 'needs' did help them determine when attempts to eliminate them would be most favourable. Clearly, it made little sense trying to kill insects on one's small plot of land, and Duhamel and Tillet admitted that their enlightened method for preserving the grain from hungry insects could not completely prevent the loss of grains, but only cut them down to about one fifth.[231] The pests, in other words, could not be fully controlled, but they could be managed.[232] Just as political economic texts urged governors to respect the natural passions of the population instead of

[228] Monceau and Tillet, *Histoire d'un insecte,* p. 75; 133-134.
[229] Monceau and Tillet, *Histoire d'un insecte,* p. 243.
[230] Monceau and Tillet, *Histoire d'un insecte,* p. 138.
[231] Monceau and Tillet, *Histoire d'un insecte,* p. 243.
[232] Monceau and Tillet, *Histoire d'un insecte,* pp. 75, 133-134.

suppressing them, that is, Duhamel and Tillet argued that those trying to control insect pests should base their efforts on knowledge of their natural needs.

As a solution to the problem of the moths' enormous fecundity, Duhamel and Tillet proposed ovens in which the insects would be killed but the grains preserved. Hard-working farmers could do much to reduce the damage by using these ovens, while lazy ones would suffer the consequences of neglecting these measures through significantly diminished harvests, and would thus ultimately accept that using the ovens was in their self-interest. However, given that it was in the interest of the common good that the neglectful farmers acted in their own best interest immediately rather than once the damage was done, Duhamel argued that the state's 'police' should force neglectful farmers to exterminate the moths in their fields and granaries so that they wouldn't attack those of their more conscientious neighbours.[233] Self-interest was a powerful motivation for most farmers, but self-interests did not regulate themselves. The farmers, that is, required the help and supervision of savants for controlling those subjects who did not understand either their own, or the commonwealth's, interests.

Réaumur, Duhamel and Tillet wrote their works in their capacity as state-funded savants, who saw it as their task to reduce the damage done by insects not just on the fields of individual farmers, but rather as they affected France as a whole. As we saw in Duhamel's and Tillet's treatise, the particular and the common interest did not always harmonise; where individual farmers refused to comply with the instructions deemed by the savants to be most advantageous to the common good, it became the task of the 'police', or state administration, to ensure that they could not harm the larger population.[234] In addition to publications like Duhamel's and Tillet's, written with the intention of ensuring food supplies for the French population, publicly-minded individuals, often landowners themselves, began to experiment with, and share, new methods for 'enlightened' pest control. Members of the propertied, middling elite who sought to better both their own social position and regenerate French competitiveness, thus began to publish observations in the growing number of

[233] Monceau and Tillet, *Histoire d'un insecte,* pp. 299–300.
[234] A similar conflict arose in the field of epizootics, as state savants began to implement mass cullings, often against the will of the affected farmers who frequently continued to sell infected animal parts illegally. See Brantz, 'Risky Business', p. 45. On theories of the relationship between private and public interests, see also chapter one of this dissertation.

agricultural or 'oeconomic' journals.[235] Like the publications of the *Académie*, these writings do not only deal with insect plagues as and when they erupt, advising to solve them by eliminating the animals individually, but also consider the pests as a constant risk that needed to be managed by considering the insects not as individual bodies, but as a 'population' with its own natural laws.

One of the most important avenues for sharing theories and practices for improving land and people was the *Journal oeconomique*, the first of about half a dozen periodicals dealing with 'oeconomic' matters from the 1750s onwards.[236] Published between 1751 and 1772, the *Journal*'s editors and contributors aimed to inform a readership of rural landowners on how to improve their 'oeconomic' activities, or, as the editors promised in the first volume 'un recueil de mémoires récents sur l'agriculture, les arts et le commerce'.[237] Insects featured frequently in its pages, either in their useful form (new techniques of beekeeping or silkworm rearing) or, just as often, as the harmful enemies of the dedicated oeconomist.[238] As such, the *Journal* was aimed not at giving advice to state administrators, but to individual readers.

Following articles on combatting the 'chenilles de choux' (April 1751), garden insects (June 1751) and even bookworms (August 1751), the *Journal* featured one of its hitherto most extensive pieces on managing insect pests in November 1752. Goyon de la Plombanie (also spelt Plombanye), the author of the article, would later publish a two-volume agronomist text titled *La France agricole et marchande* (1762), a work that combined arguments for the revival of the supposedly decadent French agriculture with descriptions of ingenious practical inventions, including a national 'credit society' to ensure the circulation of money, new ploughs and even a chariot driven by a 'machine à feu'.[239] Even more pertinent to the argument of this chapter, de la Plombanie published, more than a decade after his article on insect pests, a political economic work on how to increase both numbers and well-being of the French population, titled *L'homme en société, ou Nouvelles vues politiques et économiques*

[235] Shovlin, *Political Economy of Virtue*; Christine Théré, 'Economic Publishing and Its Authors, 1566-1789', in *Studies in the History of French Political Economy: From Bodin to Walras*, ed. by Gilbert Faccarello (London: Routledge, 2002), pp. 1–56.
[236] On agromania, see Shovlin, *Political Economy of Virtue,* pp. 51-53.
[237] *Journal oeconomique*, Janvier 1751, p. 6.
[238] The *Journal* succeeded in attracting this readership: regional economic societies met to read its issues together; Shovlin, *Political Economy of Virtue,* p. 85.
[239] Henri Goyon de la Plombanie, *La France agricole et marchande*, 2 vols (Avignon: Antoine-Chrétien Boudet, 1762).

pour porter la population au plus haut degré en France (1763).[240] This text defined population, and the happiness of its members as the object of political economic knowledge. This could be achieved by increasing population numbers, though that alone would not suffice. Instead, de la Plombanie echoed Mandeville, as well as the vitalist theorists of physical bodies, in his claim that the happiness of the population depended on the harmony emerging from men's varying interests. The task of the sovereign was, as a consequence, to harness the different variables affecting the population, or as de la Plombanie put it, 'savoir mettre à profit les différens genies de tous ses sujets, saisir tous les avantages que lui offrent le climat, les qualités du terrein, sa situation respective avec les peuples de son voisinage'.[241] As an early iteration of this more general project for a renewal of French political oeconomy, de la Plombanie used the *Journal oeconomique* as an outlet to emphasise the importance of effective pest control. As in the case of human epidemics, writers concerned with insect 'attacks' frequently blamed 'bad air' or 'miasmas' for the spread of insect pests. According to this explanation, bad health – whether of plants or of humans – was caused by a blockage in air circulation. Thus, the Swiss physician Auguste Tissot argued that smallpox epidemics were caused primarily by 'infected air'.[242] Echoing this emphasis on preventing 'stagnant air', De la Plombanie suggested that in order to prevent caterpillars from spoiling grains, rural 'oeconomists' should install windmills on their granaries: 'ainsi l'air étant renouvellé par le movement continuel du ventilateur, le bled se trouvera toujours rafraîchi; ce qui le préservera contre la fermentation, & par conséquent empêchera les œufs des charansons d'éclore'.[243] De la Plombanie's instructions for fellow 'oeconomists' are based on the idea that the natural oeconomy – whether of human or animal bodies, individually or in the aggregate – required constant circulation between its parts.[244] Just as political economic texts argued that a healthy population was based on the free circulation of goods, people, money and even air, de la Plombanie claimed that a lack of circulation would prevent insects from reproducing. Thus, in addition to advising his readers on

[240] Henri Goyon de la Plombanie, *L'Homme en société, ou nouvelles vues politiques et economiques pour porter la population au plus haut degre en France*, 2 vols (Amsterdam: Marc Michel Rey, 1763).
[241] De la Plombanie, *L'Homme*, p. 6.
[242] Eriksen,'Cure or Protection,' p. 529.
[243] *Journal oeconomique* Novembre 1752, p. 13. De la Plombanie explained the success of his ventilator as a consequence of its ability to disperse the 'esprits volatils' given off by the freshly cut grains and by 'leur action insensible & circulaire' which counteracted the causes of fermentation.
[244] On the importance of circulation for the eighteenth-century view of the oeconomy, see chapter 5; Vogl, *Kalkül und Leidenschaft*, pp. 223-246; Riskin, *Sensibility*, p. 112.

how to ensure sufficient air flow in their granaries, he also suggests that they build a well for preserving the grain for periods longer than a year. To do so, he writes, readers should build a circular well, surrounded by a solid circular wall and a hemispherical vault; the vault would, in turn, carry a second wall allowing just the right amount of air to circulate.[245] This also echoes Quesnay's ideas on public health, published in his medical texts;[246] ill health on the level of the population, Quesnay had claimed, could be explained by blockages in France's natural order that could only be alleviated by the intervention and care of savants operating on behalf of national, rather than regional or corporate, interests.[247] De la Plombanie's advice, then, consists in preventing insects from proliferating by ensuring that the farmer's fields or granaries correspond to the way in which the oeconomy of nature, just as the political oeconomy of exchange, is organised: on the basis of constant circulation.[248]

Another agronomic article on the question of how to reduce the damage done by insects to crops also suggests the use of a 'ventilator' in one's granaries, arguing that air circulation works better to kill the insects than the traditional method of burning the grains.[249] Published in a report on the winning answer to the prize contest of the agricultural society of Limoges by a Monsieur de Joyeuse, in the first volume of the *Journal de chimie, d'histoire naturelle et des arts* (1777), the advice given by de Joyeuse summarises many of the concerns of earlier writers.[250] Like Duhamel and Tillet, the self-proclaimed agronomist emphasises that pest control is a matter that concerns not just the individual farmer, but entire communities. He claimed that small-scale 'gardeners' should be able to easily combat the insects; his concern, instead, was with 'l'apprivoisement d'une ville, d'un hôpital, d'une armée, de la marine, &c.' The emphasis on 'le grand' rather than 'les petits détails' applies not only to the size of the land to be freed from insects, but also to the way in which the harmful animals themselves are to be considered and managed. Whereas Pierre-Joseph Buc'hoz, for example, in his treatise *Histoire des insectes nusibiles à l'homme, aux bestiaux, a*

[245] De la Plombanie, *Journal oeconomique* pp. 16-19.
[246] François Quesnay, *Essai physique sur l'oeconomie animale* (Paris : Cavelier, 1747).
[247] The extent of the paralelles between Quesnay's work as a doctor and as an economist is a matter of scholarly debate, though the importance of circulation is clealry present in both phases; see Groenwegen, 'From Prominent Physician'; Banzhaf, 'Productive Nature'.
[248] For a more detailed treatment of the problem of circulation, see chapter five of this dissertation.
[249] *Journal de physique, de chimie, d'histoire naturelle et des arts*, ed. by François Rozier and Henri-Marie Ducrotay Blainville (Paris: Le Jay & Barrois, 1777), pp. 602–3.
[250] On prize contests, see Jeremy L. Caradonna, *The Enlightenment in Practice: Academic Prize Contests and Intellectual Culture in France, 1670–1794* (Ithaca: Cornell University Press, 2012).

l'agriculture et au jardinage, addressed explicitly to 'jardiniers', recommended finding and killing each harmful caterpillar individually, de Joyeuse argued that such an approach was not feasible on the larger scale. Rather than seeking out individual insect specimen, de Joyeuse's advice in the *Journal* (as well as by the other prize entries – and by Duhamel and Tillet) focused on treating the territory as a whole. He used, that is, observations of the insects' natural histories to develop methods for preventing, rather than combating, the outbreak of insect plagues. One of the recommended strategies, for instance, used knowledge of the weevils' mating habits to target them during mating season, thus preventing 'les dégats qu'ils auroient causé au bled, en détruisant les populateurs avant le tems de la ponte.'[251] By contrast, Buc'hoz counselled his readership of gardeners to search their plants for specimen and then squash them.[252] As we move from small-scale farming or gardening to plans for supplying entire communities, the insect pests threatening the supplies were considered not as individual specimens but as, we might say, populations, and knowledge of their natural histories became the basis for methods of controlling them.

These descriptions of crop-devouring insects rendered visible, and thus supposedly 'true', the idea that bodies could be more easily managed when considered as a 'population' with its own natural laws of vitality and mortality. This idea, perhaps, was unacceptable to the peasants who refused to have their methods controlled by Parisian observers. As naturalists demonstrated that the quantity of insects depended on factors such as the availability of their chosen foodstuff, the climate, or the quantity of their enemies, they had, essentially, shown how to think of the collective – whether of insects or of humans – as a natural entity, with its own natural laws of fertility, mortality, health or life expectancy. Writers concerned with insect pests had also pointed out that insect populations could never be fully eliminated, only managed; an idea that was central to the doctrines on the government of humans put forward in texts on political economy and medicine.

5. Conclusion

This chapter has highlighted the parallels between texts on the management of insect and human populations in regard to the 'health' of population and the avoidance of

[251] *Journal de Physique* 1777, p. 604.
[252] Buc'hoz, *Insectes nuisibles*, p. 340.

epidemics and insect pests Most importantly, in texts on both rural and political oeconomy we have observed a shift in the management of the bodies to be governed, be they animal or human. Physiocratic political economists, agronomists as well as medical writers advocated a focus not on individual bodies but on considering them as elements of an aggregate body, with its own natural laws and regularities. In the case of managing invasive insects, this meant preventively heating grain or installing ventilators in granaries; in the case of the political economists it meant providing the framework within which French subjects could follow their natural interests, rather than employing measures targeting individual subjects.[253] As 'population' increasingly became the focus of writings on government, the same concerns with the relationship between territory, subsistence, anatomical constitution and population numbers animated writers in both fields, and they thus developed similar theories and practices of governance. This does not necessarily mean that the authors analysed here had read and thus directly influenced each other's works. It means, instead, that 'population' became a fundamental building block structuring their shared knowledge substrate.

In a study on failed projects of high-modernist state-planning, sociologist James C. Scott argues that administrators from the eighteenth century onwards began to standardise and rationalise complex customs and practices in order to 'make the terrain, its products, and its workforce more legible – and hence manipulable – from above and from the center.'[254] Interestingly, he uses the 'homely analogy' of the transformation of the beehive in the eighteenth century as an introductory illustration for his argument on how previously 'illegible hieroglyphs' were transformed by early-modern administrators into 'a legible and administratively more convenient format'. As I have suggested throughout this dissertation, however, in the eighteenth century the beehive or the ant hill served as more than an analogy. As this chapter has argued, the management of invasive insect bodies was one in area in which new techniques for 'making legible' were thought through and applied. Eighteenth-century naturalist and agronomists thus used insect populations – composed of hundreds of individuals – to both explore new ideas on how to govern a large 'population' and to provide a

[253] Ann Firth gives a useful analysis of this theoretical shift in British political economy; see Firth, 'From Oeconomy'.
[254] James C. Scott, *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed*, Yale Agrarian Studies (New Haven: Yale University Press, 1997), p. 2.

visible example to state administrators and their fellow citizens of how these ideas 'worked' in nature. The next chapter will turn to beekeeping manuals in order to explore how their authors promoted new enlightened methods of 'governing' honeybees. Unlike Scott, it will not read the enlightened hive as a mere analogy, but will show that it served both as a means of training citizens to accept 'population' as the new target (and means) of government and, through the increased production of wax and honey, as a real contribution to the wealth of the state.

Chapter Five. Political Economy in Action: The Government of Circulation in Beekeeping Manuals, Natural History and Enlightened Agronomy

1. Introduction

In his famous *Travels to France 1787, 1788, 1789* (published in 1792), the British observer Arthur Young reported on a meeting of French revolutionary agronomists, noting the close association between political and agricultural reform:

> The 9th. At breakfast this morning in the Thuilleries. Mons. Desmarets, of the Academy of Sciences, brought a *Memoire presenté par la Societé Royale d'Agriculture, a l'Assemblée Nationale*, on the means of improving the agriculture of France; in which, among other things, they recommend great attention to bees, to panification, and to the obstetrick art. On the establishment of a free and patriotic government, to which the national agriculture might look for new and halcyon days, these were objects doubtless of the first importance.

Young singles out three areas of priority for French revolutionary reformers. Firstly, 'Panification', or the art of making bread out of different substances, expressed the revolutionary call for equality as the right of every citizen to the same quality bread.[1] Secondly, 'The obstetrick art' provided ways to control survival and reproduction of the population rationally.[2] To the modern reader, subsistence and reproduction will seem natural priorities for a revolutionary government attempting to stabilise its regime. The third area, beekeeping, might seem more surprising, especially since Konrad Sprengel's (1750-1816) discovery of bees' role in the pollination of plants was not published until 1793 and received rather coldly by his contemporaries.[3] However,

[1] Emma Spary has analysed attempts at panification from foods other than wheat, and their political implications, in the last decades of the ancien régime and the revolutionary years; E. C. Spary, *Feeding France*, chapter two: 'The Kingdom of Bread,' pp. 55-88; See also Steven L. Kaplan.

[2] Lianne McTavish, *Childbirth and the Display of Authority in Early Modern France* (London: Routledge, 2017); Lynn Salkin Sbiroli, 'Generation and Regeneration: Reflections on the Biological and Ideological Role of Women in France (1786–96)', in *Literature and Medicine during the Eighteenth Century*, ed. by Marie Mulvey Roberts and Roy Porter (London: Routledge, 1993), pp. 266–85; Joan B. Landes, 'Representing the Body Politic: The Paradox of Gender in the Graphic Politics of the French Revolution', in *Rebel Daughters: Women and the French Revolution*, ed. by Sara E. Melzer and Leslie W. Rabine (Oxford: Oxford University Press, 1992), pp. 15–37; Isabelle Brouard-Arends, *Vies et images maternelles dans la littérature française du dix-huitième siècle*, Studies on Voltaire and the Eighteenth Century (Oxford: Voltaire Foundation, 1991); Jordanova, *Sexual Visions*.

[3] Stefan Vogel, D.G. Lloyd, and S.C.H. Barrett, 'Christian Konrad Sprengel's Theory of the Flower: The Cradle of Floral Ecology', in *Floral Biology* (Boston, Massachusetts: Springer, 1996), pp. 44–62; Gerhard Wagenitz, 'Sprengels "Eentdecktes Geheimniss der Natur im Bau und in der Befruchtung der

as this chapter demonstrates, beekeeping had been held up during the late eighteenth century as a way of providing food, medicine, luxury goods, work and a model for good government.[4]

This chapter considers how Enlightenment writers conceived of the relation between working bodies, the territory and the productivity of the whole through the observation of insects, focusing in particular on beekeeping manuals published between 1740 and 1780. During this period, the publication of beekeeping treatises skyrocketed; not by coincidence, it is also the period during which astonishing numbers of texts on political economy, understood as the art of governing and increasing the state's wealth, were written.[5] The chapter argues that texts on beekeeping – often called 'le gouvernement des abeilles' – were an important means of disseminating new ideas of government based on respecting the 'naturalness' of the (bee) population rather than on the sovereign will of the 'governor', as had been the case in images of the hive as model monarchies from Aristotle onwards. French texts on labouring insects taught their readers, in the mainland and in the colonies, the new relationship to their absolutist ruler that the realisation of these theories of governance required. As these treatises reshaped the bee or ant from a loyal subject into a productive contributor to its society, human readers, too, were taught that they were no longer subjects simply obeying decrees from above, but should see themselves as part of an interconnected, circulating and productive 'whole'.

As we will see from the descriptions of bee hives and ant colonies, the main principle driving these systems was circulation. Circulation had become central to nascent theories of government in the eighteenth century, though it had first emerged at the end of the sixteenth and beginning of the seventeenth as the question of how to execute the sovereign's strict regulations.[6] Faced with increasingly free, international trade and population growth, political thinkers began to propose ways of opening up

Blumen" aus dem Jahre 1793 und seine Wirkung', *Nachrichten der Akademie der Wissenschaften in Göttingen: 2, Mathematisch-Physikalische Klasse*, 1 (1993), 1-11.

[4] For the history of the discovery that bees act as pollinators, see Verne Grant, 'Arthur Dobbs (1750) and the Discovery of the Pollination of Flowers by Insects', *Bulletin of the Torrey Botanical Club*, 76.3 (1949), 217–19.

[5] Christine Théré, 'Economic Publishing and Its Authors, 1566-1789', in *Studies in the History of French Political Economy: From Bodin to Walras*, ed. by Gilbert Faccarello (London and New York: Routledge, 2002), pp. 1–56..

[6] Vogl, *Kalkül und Leidenschaft*, pp. 222–46; Joseph Vogl, 'Oekonomie und Zirkulation um 1800', *Weimarer Beiträge*, 43.1 (1997), 69–78.

city walls, as well as its juridical, economic and administrative structures.[7] Over the course of the eighteenth century, rather than enabling the modification of goods, people and natural processes according to the sovereign will, writers began to understand circulation as the framework that allowed that allowed goods, bodies and their needs to enter into exchanges with one another and thus to self-equilibrate.[8] The task of government was to keep the 'economic machine' running without interruption, ensuring the circulation of goods, people, money and natural resources. As Stuart Elden has shown in his work on the 'birth' of the modern conception of space, eighteenth-century administrators and urban planners replaced the older model of the 'segregated town' with the idea of a 'milieu'; the aim of governing over the territory, that is, became to connect cities and rural areas to allow for the circulation of goods, people, and even, for health reasons, air.[9] Political economists of various stripes agreed on the crucial role of circulation in a 'healthy' body politic. In a 1754 article for the *Journal oeconomique,* defending the free grain trade, the marquis d'Argens argued that 'il est surtout d'une nécessité indispensable de ne jamais arrêter la circulation intérieure, pour éviter tout appareil public, tout sujet de murmures, d'alarmes et de désordres.'[10]

Circulation came to be seen as a 'natural' feature of good government, and metaphors based on natural phenomena (most famously the circulation of blood) abounded;[11] Quesnay's collaborator Mirabeau, for example, compared his master's *Tableau économique* to a system of canals : 'Cette circulation a, comme toutes les autres, des regles exactes de flux & de reflux, qui empêchent également &

[7] Richard Etlin, 'L'air dans l'urbanisme des Lumières', *Dix-huitième siècle*, 9.1 (1977), 123–34; Robert Favre, 'Du «médico-topographique» à Lyon en 1783', *Dix-huitième siècle*, 9.1 (1977), 151–59; Jean-Louis Harouel, 'Les fonctions de l'alignement dans l'organisme urbain', *Dix-huitième siècle*, 9.1 (1977), 135–49; Vogl, *Kalkül und Leidenschaft*, p. 241; Jean-Louis Harouel, *L'embellissement des villes: l'urbanisme français au XVIIIe siècle* (Picard, 1993).

[8] Foucault, p. 344; Vogl, *Kalkül und Leidenschaft*, p. 241. The most important example of a political economy based on circulation is, of course, Quesnay's *Tableau économique*, which according to its inventor represented the natural 'economy' because the incomes of the three 'classes' at the end of the year enter back into circulation; 'Tableau économique,' in François Quesnay, *Œuvres économiques complètes et autres textes: Textes polémiques, Documents associés* (INED, 2005).

[9] Elden, *The Birth of Territory*; Stuart Elden, 'Governmentality, Calculation, Territory', *Environment and Planning D: Society and Space*, 25 (2007), 562–80.

[10] René Louis de Voyer d'Argenson, 'Arguments en faveur de la liberté du commerce des grains, Journal économique, mai 1754, pp. 64-79', in *Politique et économie au temps des Lumières*, ed. by Gérard Klotz (Paris: Université de Saint-Etienne, 1995), pp. 45–56.

[11] Vernon Foley, 'An Origin of the Tableau Economique', *History of Political Economy*, 5.1 (1973), 121–150.

l'épuisement des canaux & leur engorgement.'[12] Chandra Mukerji has demonstrated that the Canal du Midi, constructed under Colbert from the 1660s onwards, transformed the nature of politics into what she calls 'impersonal rule': through the Canal, the King demonstrated his power over the territory to replace older 'patrimonial politics' with the power of the state.[13] In the eighteenth century, she notes, publications on canals and waterways proliferated,[14] reflecting, we might add, the increasing concern with the possibility for exchange of people and goods. Mirabeau's analogy between the circulation of water and circulation in the economic sense thus underlines not only the fundamental importance of circulation to physiocratic political economy, but also the way in which circulation connected the natural and the political elements of the French state.

In what follows, I will demonstrate that this logic of circulation as the connection between territory, population, money and goods subtends writings on insects, where we might not have expected it. I begin with an analysis of apicultural treatises, and in particular two of the most-discussed areas of innovation. Attempts to find the best methods for harvesting honey and wax and for building the best hives will thus be shown to be attempts to ensure circulation of bees, air and produce in the hive. This will be followed by a discussion of the way in which labour was reconceived in the circulating body politic, using descriptions of ant and bee workers as a window onto this issue. The chapter ends with an examination of how the product of the bees' work was reconceived in relation to the work of female and colonial subjects. Bees as a natural resource were thus thought to connect French agronomists to the household as well as to the empire's most remote corners. The enlightened hive thus improved not only the French mainland, but its emerging global empire too.

2. The Image of the Beehive as a Political Metaphor

The use of bees as symbols for political organisation from Classical times onwards has, of course, been studied by literary scholars as well as by historians. Scholars of the early modern period and of the eighteenth century have been particularly interested in the representations of gender in descriptions of the hive, in the wake of Jan

[12] Victor de Riquetti Mirabeau marquis de, *Philosophie rurale: ou Economie générale et politique de l'agriculture*, 3 vols (Amsterdam, 1764), I, p. 36.
[13] Mukerji, *Impossible Engineering*.
[14] Mukerji, *Impossible Engineering*, p. 207.

Swammerdam's discovery of the true sex of the queen bee. Jeffrey Merrick has analysed the 'gender politics of the bee hive', arguing that early modern texts on bees were used 'to ratify patriarchal values'.[15] Cultural historian Dror Wahrman has shown how allegories of the bee hive in eighteenth-century British texts reflect the transformation of women's role in the household oeconomy. He argues that the replacement of the image of the Amazon queen with that of the mother reflects a growing concern after 1780 with limiting women's power within the rigid boundaries of motherhood.[16] According to Wahrman, writings on bees record a wider 'cultural revolution', as they begin to portray the queen bee now longer as an aristocratic Amazon queen but increasingly as a mother. This, he argues, mirrors a shift away from the 'looseness and playfulness' of gender categories in the first three quarters of the century to a deterministic view of masculinity and femininity, now thought to be unchanging.[17] Deirdre Coleman, on the contrary, argues that representations of the bee hive do not show the 'clear pattern' from regality to motherhood suggested by Wahrman, but instead serve as an expression of the instability of often contradictory gender roles in the late eighteenth century.[18] Closer to our purposes, Kevin Bourque, in an article on the representation of the bee in the *Encyclopédie,* argues that the articles 'Ruche' and 'Abeille' rewrite the hive from an image of monarchy in order to support emerging republican discourses.[19] Arguing that bees came to stand in as republican symbols, Bourque quotes a fascinating passage from Jaucourt's *Encyclopédie* article 'Zone':

> Pourquoi dérober la ruche pesante, & massacrer dans leur demeure ses habitans? Pourquoi l'enlever dans l'ombre de la nuit favorable aux crimes, pour la placer sur le soufre, tandis que ce peuple innocent s'occupoit de ses soins publics dans ses cellules de cire, & projettoit des plans d'économie pour le

[15] Jeffrey Merrick, 'Royal Bees: The Gender Politics of the Beehive in Early Modern Europe', *Eighteenth-Century Culture*, 18 (1988), 7–37.
[16] Dror Wahrman, 'On Queen Bees and Being Queens: A Late-Eighteenth-Century "Cultural Revolution"?', in *The Age of Cultural Revolutions: Britain and France, 1750-1820* (Berkeley: University of California Press, 2002), pp. 251–80.
[17] Wahrman, 'On Queen Bees,' pp. 274-275.
[18] Deirdre Coleman, 'Entertaining Entomology: Insects and Insect Performers in the Eighteenth Century', *Eighteenth-Century Life*, 30 (2006), 107–34.
[19] Kevin Bourque, '"Tout est en désordre dans la ruche": Gendered Labour, Patriarchal Strategy, and the Bees of the Encyclopédie', in *Studies on Voltaire and the Eighteenth Century* (Oxford: Voltaire Foundation, 2006), XII, 361–76.

> triste hyver? Tranquille & content de l'abondance de ses trésors, tout-à-coup la vapeur noire monte de tous côtés, & cette tendre espece accoutumée à de plus douces odeurs, tombant en monceau par milliers de ses domes mielleux, s'entasse sur la poussiere. Race utile! étoit - ce pour cette fin que vous voliez au printems de fleurs en fleurs? étoit - ce pour mériter ce sort barbare que vous braviez les chaleurs de l'été, & que dans cet automne même vous avez erré sans relâche, & sans perdre un seul rayon du soleil? Homme cruel, maitre tyrannique! combien de tems la nature prosternée gémira - t - elle sous ton sceptre de fer? Tu pouvois emprunter de ces foibles animaux leur nourriture d'ambroisie; tu devois par reconnoissance les mettre à - couvert des vents du nord, & quand la saison devient dure, leur offrir quelque portion de leur bien. Mais je me lasse de parler à un ingrat qui ne rougit point de l'être, & qui le sera jusqu'au tombeau.[20]

Bourque is right, of course, to read Jaucourt's discussion of the bee, itself a rather free translation of James Thomson's (1700-1748) *The Seasons* (1730), as a critique of the absolutist monarchy. However, more than a full-scale defence of republicanism, the passage represents a critique of tyranny as a specific kind of absolutist rule, given that the critique of tyranny and the ensuing right of the people to disobey was a trope in Republican discourses, but also in texts defending the (non-tyrannical) monarchy.[21] Jaucourt is describing, after all, a ruler who assumes the right to kill his insect-subjects instead of fostering their well-being. Given the interest in bees as representatives of a new and more productive social order as expressed in beekeeping treatises, it is interesting to note Jaucourt's choice of analogy for his critique of the monarchy.

Unenlightened beekeepers are figured as tyrants, while good governors use more 'humane' methods, not because of the bees' inherent right to life, but because of principles of economic efficiency. At the heart of the critique of killing bees we find the idea that over-regulation causes a decline in their economic productivity. Jaucourt is not implying that man should no longer be the 'master' of bees, but rather that he should govern them in a rational, calculating way, aimed at their life rather than death

[20] Bourque, "Tout est en désordre", p. 367.
[21] See Hammersley, *Republicans*, particularly pp. 198-200; Peter R. Campbell, 'Absolute Monarchy', in *The Oxford Handbook of the Ancien Régime*, ed. by William Doyle (Oxford: Oxford University Press, 2012), pp. 11–28.

(and human profit).[22] Killing productive insects thereby becomes the ultimate act of the tyrant understood as the opposite of the enlightened governor, as the metaphor of darkness pervading the passage ('dans l'ombre de la nuit', 'la vapeur noire') makes clear. The hard-working bees are 'oeconomical' in the original sense of the word: as good householders, they make 'des plans économiques' to survive the winter. However, in order to do so they need the space – physical as well as metaphorical – to follow their drive to work hard. It is no coincidence that Jaucourt's bees appear in an article on the geographical subject of 'zones tempérées'. The treatment of the bees on the part of the tyrant is particularly scandalous considering how their work makes the land productive, as does the farmer harvesting grain in the paragraph following the description of the bees. Taking the lives of so many workers is thus even worse in the areas blessed with what for Jaucourt is the perfect climate, favourable to agricultural production: the 'zones tempérées' which include, above all, France: 'Enfin, il n'est point sur la terre de température plus heureuse & plus favorable que celle d'une partie de l'Espagne, de l'Italie, & sur-tout de la France.' The ruler should ensure the well-being of bees and agricultural workers, then, because they harness the natural resources of his territory and thus increase the wealth of all members of the community.

Though Bourque describes Jaucourt's critique of bee-killing practices as a move towards a republican ideology, this leitmotif of the 'enlightened' hive comes from texts written by authors of beekeeping treatises who, far from being radical republicans, intended their work as contributions to the strength of the monarchy.[23] The remainder of the chapter will read not the subservive articles of the *Encyclopédie*, but rather 'patriotic' beekeeping treatises which formulated and disseminated a theory of government focused on the well-being of a productive 'population', but within the framework of monarchy.

3. Beekeeping, Agronomy and Political Economy

Before moving on to a discussion of the political meaning of beekeeping treatises, a brief explanation of the genre is required. In the eighteenth century, beekeeping – or

[22] Hence Montesquieu's comment about kings learning to act in their interests rather than on the prompting of their passions; see Hirschman, *Passions*.
[23] On the social standing of these authors, see Shovlin, *Political Economy of Virtue*, Introduction.

at least writings about beekeeping – represented an important point of intersection of agronomy, or the 'oeconomy' of the rural household, natural and the wider political economic ideas on theories and practices of government.[24] Treatises on beekeeping were produced at a particularly high rate in the second half of the eighteenth century and French language apicultural treatises were sold in destinations all over Europe, from Belgium, Italy and Sweden to Portugal and Russia.[25] This trend was part of the more general vogue for agronomic texts of the mid-eighteenth century, described by John Shovlin as an attempt by the 'middling nobility' to reclaim its moral and economic roles.[26] This category included 'provincial nobles of modest means, […] part of the non-noble elite drawing its income mainly from land, the professions, and office holding', who sought to further both their own interests, and, so they claimed, those of nation, by improving agricultural productivity.[27] Thus, even though most of the beekeeping treatises discussed in this chapter were addressed to private landowners, they framed their advice as contributions to the prosperity of France as a whole. Civic-minded writers of beekeeping treatises thereby concurred with the judgement of the academician Duhamel Du Monceau, who argued that beekeeping could provide a much-needed boost to France's weath: 'Il est très-intéressant pour l'Etat, 1°. d'apprendre aux paysans à conserver les abeilles en prenant leur miel: 2°. de les exciter à en élever le plus qu'il est possible.'[22] Bees were good targets for agricultural improvers, as they had an important economic role to play in the eighteenth century: their honey was the basis for medical remedies, and their wax was a crucial made into candles, ointments and cosmetics.[28] As Jaucourt put it in his article for the *Encyclopédie:*

[24] A '*lieu de rencontre'* of different sciences (though he does not explain which) as André Bourde puts it in his classic three-volume work on agronomy, still the most authoritative account of this eighteenth-century field of knowledge. Bourde, I, p. 15.
[25] Simon Burrows and Mark Curran, 'The French Book Trade in Enlightenment Europe Project, 1769-1794, Browse Keyword: Beekeeping', *The French Book Trade in Enlightenment Europe Project, 1769-1794*
<http://fbtee.uws.edu.au/stn/interface/query_books.php?t=keyword&e=rawsales&id=k0081&g=everywhere&d1=01&m1=01&y1=1769&d2=31&m2=12&y2=1794&d=table> [accessed 24 March 2016].
[26] Shovlin, *Political Economy*.
[27] Shovlin, *Political Economy,* p. 8.
[22] Henri-Louis Duhamel Du Monceau, *Ecole d'agriculture* (Paris: les frères Estienne, 1759), p. 91.
[28] André J. Bourde, *Agronomies et agronomes en France au XVIIIe siècle*, 3 vols (Paris: SEVPEN, 1967), II, pp. 894–95.

> Elle est devenue d'une si grande nécessité dans plusieurs arts, dans plusieurs métiers, & dans la vie domestique, que le débit qui s'en fait est presque incroyable; sur-tout aujourd'hui qu'elle n'est plus uniquement réservée pour l'autel & pour le Louvre, & que tout le monde s'éclaire avec des bougies, l'Europe ne fournit point assez de *cire* pour le besoin qu'on en a.[29]

Furthermore, honey, still the main sweetener in France, was presented as a more 'natural' alternative to sugar, the production of which depended heavily on slave labour overseas.[30] While the production, consumption and re-exportation of sugar in France steadily and massively increased over the course of the eighteenth century, the French sugar trade was heavily affected by both the War of the Austrian Succession (1740-1748) and the Seven Years War (1754–1763). The British sugar trade, by contrast, benefited from these wars, as British merchants rushed to fill the void in sugar supply opened up on the European continent by the reduction in French colonial commerce. The growing interest in beekeeping was thus entangled with discourses about both the competition with Britain and France's own efforts to establish her colonial empire. As we will see, rather than suggesting the replacement of sugar with honey produced in the mainland, beekeeping treatises instead constructed what they considered a more 'natural' (and thus supposedly morally just) form of colonial relations.

What we see exemplified in beekeeping treatises is the use of observations of insects as a technology for disseminating ideas on a government aimed not only at the citizens' subjection via the traditional technologies of absolutist sovereignty (such as laws, regulations, torture), but at the management of their bodies in order to make them more productive.[31] They can thus be read, I suggest, as educating their readers into accepting the new ideas on government based on rendering populations more productive. Apicultural treatises, written for landowners overseeing large estates, taught their readers to recognise and pursue their enlightened self-interest. The

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[29] Louis de Jaucourt, 'Cire', *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*, ed. by Denis Diderot and Jean le Rond d'Alembert, (University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), ed. by Robert Morrissey and Glenn Roe) <http://encyclopedie.uchicago.edu>

[30] Robert Stein, 'The French Sugar Business in the Eighteenth Century: A Quantitative Study', *Business History*, 22.1 (1980), 3–17.

[31] On natural history as means to improve the individual, see Emma Spary, 'Political, Natural and Bodily Economies'.

methods for enlightened beekeeping described in eighteenth-century manuals thus formed the hive into a model of enlightened government of insect populations; through the increased profits generated, they demonstrated to their readers the advantages of their new ideas on government. The connection between the economic activity of beekeeping and the education of the new citizen, who considered him- or herself responsible for the prosperity of the whole, is rendered explicit from the very titles of many eighteenth-century apicultural manuals. The art of beekeeping is thus often referred to as 'l'éducation des abeilles' or 'l'éducation économique des abeilles',[32] and treatises discussed the best 'Maniere d'élever des abeilles'.[33] As the old admiration for the very human-like virtues of bees was transformed by a new concern for using experience and observation of the insects to maximise their output of honey and wax, so too did writers of beekeeping treatises proudly proclaim to have found methods for improving not only the labouring bodies of the bees, but also of the peasants responsible for looking after them.

Thus, authors of beekeeping treatises thus offered advice not only on how to educate bees, but also on how to educate those who kept them.[34] Writers of beekeeping manuals considered themselves mediators between the 'nature' to which their observations gave them direct access to and what they considered the unlearned agricultural workers whose labour made 'nature' profitable. They were responsible, that is, for making the knowledge created by observation circulate among all those who might benefit from it. One writer claimed in his preface that the key to increasing profits by improving beekeeping was to convince not the peasants who already kept bees, but rich landowners.[35] Eventually, he argued, peasants would emulate them because their drive for profit would lead them to imitate the new methods:

> Il est en effet d'expérience constante, que quoique souvent très-bouchés pour les choses de raisonnement, pour les choses même qu'on leur a démontré être

[32] Jacques Joseph Ducarne de Blangy, *Traité de l'éducation économique des abeilles: où se trouve aussi leur histoire naturelle : avec figures* (Paris: Gueffier, 1771), I.
[33] Noël Chomel, *Dictionnaire oeconomique [...] Ouvrage composé orginairement par M. Noel Chomel, curé des S. Vincent à Lyon. Nouvelle Édition, entièrement corrigée, et très-considérabelment augmentée, par M. De La Marre* (Paris: Ganeau; Bauche; les Frères Estienne; d'Houry, 1767), I, p. 578.
[34] On the importance of education of the lower classes for enlightened political economies, see Chisick, *Limits*; Vardi, *Physiocrats* p. 72.
[35] On the elitism of agronomists, see Steven L. Kaplan, pp. 119–25; Keith Michael Baker, *Inventing the French Revolution: Essays on French Political Culture in the Eighteenth Century* (Cambridge: Cambridge University Press, 1990), pp. 154–56; Gillispie, pp. 368–87.

> les plus avantageuses, ils sont très-habiles à imiter ce qui rapporte du profit, pourvû qu'on leur donne l'exemple.[36]

The language the author (a nobleman named Guillaume Louis Formanoir De Palteau) employs here is revealing of the way in which he conceived of his role. The unenlightened poor are closed to reason, he argues, but can be 'unblocked' by the savant who knows that the key to converting them to rationality lies with their natural self-interest. Criticisms of De Palteau's hive pointed to his failure to take into account the peasants' needs, interests, and budgets, despite being well adapted to the bees' instincts. but his critics agreed with him that literate, rich landowners should read their manuals and then transmit their newly gained knowledge by practising what they preached, inciting the poorer farmers to imitate them. [37] As Pierre-Louis Massac put it in the preface to his work on wooden hives, addressed to the 'chers habitans des campagnes':[38] 'c'est à nous à vous développer ces objets, c'est à vous à les mettre en pratique. Profitez donc de nos études, & de nos lumières'.[39] As Nira Kaplan has shown, the concept of emulation was transformed to mean not simply imitation of the selfless virtues of the Classical heroes (an important aspect of seventeenth- and eighteenth-century pedagogy, particularly among Jesuits) but the increased drive, fostered by competition, to social productivity.[40] In this endeavour to claim the right to govern over those supposedly unable to use their reason, the rational agronomists found a particularly germane topic in bees, whose government, as we will see, represented a point in case.

De Palteau's critics agreed that his hive construction had failed to fulfil its, since building it was not within the budget of poorer countryside dwellers. It was not, in other words, adapted to the interests of poorer farmers who stood to benefit most from productive hives. Proving the superiority of one's own hive model over that of one's predecessors was, of course, also a marketing strategy, but it also shows the way

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[36] Guillaume Louis Formanoir de Palteau, *Nouvelle construction de ruches de bois, avec la façon d'y gouverner les abeilles* (Metz: Joseph Collignon, 1756), p. xiii.
[37] This criticism is another link between agronomists and the physiocrats, who were also accused of ignoring the needs of the poor. See Florence Magnot-Ogilvy, 'A Body without a Voice: A Literary Approach to Linguet's Opposition to the physiocrats over the Free Trade in Grain', *The European Journal of the History of Economic Thought*, 22.3 (2015), 420–44.
[38] Massac, *Mémoire sur les abeilles*, p. 12.
[39] Massac, *Mémoire sur les abeilles*, p. 21.
[40] Nira Kaplan, 'Virtuous Competition among Citizens: Emulation in Politics and Pedagogy during the French Revolution', *Eighteenth-Century Studies*, 36.2 (2003), 241–48.

in which these agronomist authors understood the concept of improvement as aimed both at animal bodies and human workers. The most important promise made by these manuals, then, was not simply that readers would learn how to increase their honey and wax production. Rather, the treatises suggested that the improvements they proposed would make visible a utopian government which connected animals, their natural products, beekeepers, and consumers, in a productive whole.[41]

4. Technologies of Government for Enlightened Beekeepers

4.1. How to Build the Perfect Hive

Much of the debate on the matter of beekeeping focused on the question of how to construct the perfect home for the bees so that they would be able to supply as much honey and wax as possible. The question of the perfect hive was not just a technical issue; it was a practical manifestation of the idea that the main task of a good governor was to provide the framework best suited to the natural historical characteristics of the insect 'population'.[42] Considering this, it is not surprising that the spatial arrangement of the hive was a crucial target of the beekeeper's intervention. Many of the treatises even make this their central issue, as can be gleaned from titles such as *Mémoire sur la manière de gouverner les abeilles dans les nouvelles ruches de bois*[43] or *Culture des abeilles, ou, Méthode expérimentale et raisonnée sur les moyens de tirer meilleur parti des abeilles par une construction de ruches mieux assorties à leur instinct.*[44] Despite their seemingly specialised titles, these works contained an extensive survey of many aspects of beekeeping, beyond the best hive construction. The fact that their titles should choose to focus on this issue, however, suggests that it this was a central question requiring reform in the eyes of enlightened beekeepers. Determining the

[41] What we might conceptualise as a 'state'. For a concise overview of discussions over the emergence of the modern 'state', see Elden, *The Birth of Territory*, pp. 321–23.

[42] As Stuart Elden has shown, from the mid-seventeenth-century onwards, 'politics was fundamentally conceived as operating with discrete, bounded spaces under the control of a group of people, usually the state'. However, before the middle decades of the eighteenth century, the concern of the absolutist ruler was above all with the control and extension of the territory itself. By contrast, with the emergence of the new concept of the 'population' as the main focus of government, territory was thought of predominantly in relation to this new entity; its government now depended on understanding and managing the changing relations between population and territory. See Elden, *Birth of Territory*, esp. pp. 328-329.

[43] Pierre-Louis Massac, *Mémoire sur la manière de gouverner les abeilles dans les nouvelles ruches de bois* (Paris: Ganeau, 1766).

[44] François Xavier Duchet, *Culture des abeilles, ou, Méthode expérimentale et raisonnée sur les moyens de tirer meilleur parti des abeilles par une construction de ruches mieux assorties à leur instinct: avec une dissertation nouvelle sur l'origine de la cire* (Vevey : P.A. Chenebié, 1771).

shape and material of the hive that would suit the bees' 'instincts' was a matter of the author's technical ingenuity, but also of his ability to apply the methods of natural history − long-term observation and experimentation − to apiculture. As the titles of beekeeping manuals indicate, the knowledge of insects frequently seems to shade into knowledge of humans. Bees, like men, had to be 'governed' or 'educated', preferably in 'oeconomic' fashion, and their hives had to be adapted to their natural 'instincts'.

What we see with beekeeping manuals, then, is a transformation of the old allegories of the political hive into a physical territory where principles of government could be both observed and enacted. Most new models of the hive promised their governors that they would allow the bees to circulate freely and thus never cease to produce. Just as importantly, these models offered the possibility to observe every corner and to intervene whenever an element of the hive did not contribute to, or even obstructed, the (re)productivity of the population as a whole. The enlightened hive, that is, was completlety transparent to beekeeperd and, consequently, could be asily managed by them. As one writer described the advantages of his model of the hive:

> Nos cultivateurs, en découvrant l'intérieur des ruches, sont à portée de voir et d'examiner leurs besoins, les accidens et les maux qui peuvent les affliger: les propriétaires des autres ruches, au contraire, gouvernent les leurs à tâtons, sans rien voir distinctement de ce qui leur est nécessaire, et ne peuvent faire que des conjectures sur l'état de leurs maladies.[45]

The governors of these kinds of hives thus had total knowledge of needs, health and well-being of their insect populations, which allowed them to intervene only when absolutely necessary.[46] As the author of this treatise promised, his hive would prevent illnesses, prolong the bees' lives and allow them to work uninterrupted through all four seasons.[47] This promise of absolute control through minimal intervention clearly echoes the physiocrats' project for the ideal human government. Quesnay had dreamed of a government capable of observing the entirety of French territory and, as a

[45] Abbé della Rocca, *Traité complet sur les abeilles, avec une méthode nouvelle de les gouverner telle qu'elle se pratique à Syra, île de l'Archipel. Précédé d'un précis historique et économique de cette île*, 3 vols (Paris: De L'Imprimerie de Monsieur, Bleuet père, 1790), III, pp. 52–53.
[46] Rocca, *Traité des abeilles*, vol. 3, p. 55. By making the hive visible to the beekeeper, Della Rocca thus advocates the principle of legibility that for political scientist James Scott is the necessary precondition for the formation of the modern state: James C. Scott, *Seeing like a State*.
[47] Rocca, *Traité des abeilles*, vol. 3, p. 53.

consequence, ordering the governed space in such a way that it allowed a constant flow of goods, people and natural objects, each according to their own instincts and natural needs. Beekeepers, on the other hand, claimed to have created the perfect hive, in which bees could move as freely as their instincts told them to do.

One of the most important characteristics that distinguished a hive based on enlightened observation from its supposed earlier traditional counterpart was its ability to adapt to variations in bee population, both in a single hive over time and between hives. Agronomists invented various contraptions to get around what they saw as the traditional hives' rigidity, which made it hard for beekeepers to see inside the hive and forced them to open the entire hive instead of allowing them to intervene in selected sections of the hive only. Olivier de Serres, author of the extremely popular rustic oeconomy manual *Théâtre de l'agriculture*, the first edition of which was published in 1600, recommended wooden hives built all in one piece.[48] He justified this idea by arguing that wild bees usually live in tree trunks, a model of hive construction that would become the stereotype of the unenlightened hive that a true agronomic improver would reject.[49] De Serre's model of the hive, however, presented a crucial disadvantage: it only had one opening and hence required the beekeeper to disturb the entire population if he wanted to examine its health or harvest their produce. De Palteau, whose apicultural manual was quoted by most subsequent writers, proposed to improve De Serres' model with a hive made from oak wood, with three separately detachable boxes ('hausses'), with a hole in each box to enable the bees to easily migrate from one to the other. The key to the success of De Palteau's hive, that is, was the fact that the bees could circulate freely through the hive. The enlightened hive, as proposed by De Palteau, was designed so that the beekeeper could both see and manage the entire at one glance. One of the main advantages of his construction, he argued, was the ease with which the beekeeper could harvest the insects' produce. Rather than having to disturb the entire bee population when doing any manoeuvre at all, from cleaning the hive to taking the honey, the detachable boxes enable the beekeeper to make the bees migrate to one box while he or she was tinkering with another. The beekeeper did not need to interrupt the bees' work even at the time of the harvest, thus making increased profits whilst intervening less in the bees' life.

[48] On De Serres and the older tradition of mesnagement, see Mukerji, *Impossible Engineering*, pp. 23–25.
[49] Serres, *Théâtre*, p. 382.

In addition to enabling the beekeeper to supervise all corners of the hive and to harvest the insects' produce without interrupting their work flow, another crucial selling point put forward by enlightened inventors revolved around the bees' health. The Levantine priest and traveller Della Rocca, for instance, argued that the superiority of his hive was based on its many holes, which allowed air to circulate, preventing infections:

> cette manière de poser les ruches droits en forme de cloches, ou autrement, fermées de tous côtés, n'y ayant qu'un passage, quelque grand qu'il soit, dans leur partie inférieure, ne vaut rien; elle est faite précisément pour y mettre l'infection, pour la hâter, et pour la conserver longtemps; mais au contraire la position horizontale des nôtres, les trous que nous y faisons autour du couvercle antérieur, et ceux mêmes que nous pouvons faire à celui de derrière, empêcheront toujours que l'air ne s'y corrompe; le mouvement des abeilles et de leurs aîles, favorisé par ces ouvertures, y produira une circulation d'air presque continuelle; [50]

In the enlightened hive proposed by Della Rocca, the circulation of air was created by the movement of the wings of freely circulating bees, which in turn assured healthy bodies, an uninterrupted workflow and more profit for their human governors. Beekeeping thus became the perfect exercise in enlightened political economy, as all bodies involved in economic production, from the very air to the insects and the beekeepers, were supposedly given the possibility to fulfil their natural potential to flourish; as one writer puts it, the best hive construction would fulfil the 'conditions requises pour le bien des abeilles & pour les faire prospérer' and guarantee 'la commodité de l'oeconome'.[51] The enlightened hive was thus commercially useful, but also represented a space where the utopia of a society where people and goods could circulate freely and without obstruction seemed realisable.

4.2 The Honey Harvest

[50] Rocca, *Traité des abeilles*, vol. 3, pp. 53-55. On the importance of air circulation in eighteenth-century medical theory, see Eltlin, 'L'air dans l'urbanisme des lumières'; Hannaway, 'Environment and Miasmata'.

[51] Société oeconomique de Berne, *Encyclopédie oeconomique ou système général: 1° d'oeconomie rustique 2° d'oeconomie domestique 3° d'oeconomie politique* (Yverdon, 1771), X, p. 28.

However different the structure or content of their works, authors of beekeeping treatises all concurred in according a central role to the process of harvesting the insects' produce. The enlightened, well-informed beekeeper knew how to take only 'leur superflu', as if bees were producing honey beyond what they could consume just so as to share it with their human keepers.[52] The reason for the centrality of this issue is seemingly obvious: if writers want to increase revenues through beekeeping, the moment of the harvest is clearly crucial. The rhetoric used to discuss supposedly innovative practices, however, points to a much more far-reaching project underlying the development of new techniques for harvesting the bees' produce. Taking the product of the bees' hard labour without harming –rather improving – their bodies exemplified the ideal of enlightened government, respectful of the needs of its population but nevertheless harnessing them to increase the wealth of the state. In the writings of reform-minded agronomists, harvesting the bees' produce is described not only as a self-interested activity, but as a duty; if the insects are left with too much of their own produce, readers of beekeeping treatises are admonished, they will transform from productive workers into idle insects, as the excess produce will block storage space and thus production. These lazy insects contrasted with the self-presentation of the agronomists, who fashioned themselves as enemies of both noble idleness, fuelled by luxury, and the idleness of the poor, at a time when living off charity instead of ome's own labour was considered both a crime in itself and a school for worse crimes.[53] Echoing these mid-century debates about the potential dangers of idleness, Noël Chomel argued in his *Dictionnaire oeconomique* that taking away the bees' 'superflu' not only helped the human governor, but also kept the bees healthy and thus rendered them more productive:

> Ce qu'on enleve de la sorte aux abeilles, dans un tems où elles peuvent le remplacer assez vite, est un superflu ; dont le retranchement les met plus à l'aise, leur donne lieu de faire de nouvel ouvrage ; & peut-être même contribue à leur santé.[54]

[52] Palteau, *Nouvelle construction*, p. 398.
[53] On the luxury debates, see chapters 1 and 2. On debates about the idleness of the poor, see Thomas McStay Adams, *Bureaucrats and Beggars: French Social Policy in the Age of the Enlightenment* (Oxford: Oxford University Press, 1990).
[54] art. 'Mouche,' in Chomel, I, p. 597.

Superfluous honey and wax, in other words, block the productive flow of the hive; by removing just the right amount of produce, the beekeeper ensures that the insects are motivated enough to continue to cycle of productivity, but also that they are provided with enough subsistence in order to be able to do so. On the one hand, then, the production of superfluous produce is necessary for the exchange between bees and beekeepers to be possible, on the other hand removing the produce beyond what's necessary for the upkeep of the hive would interrupt the cycle of productivity. Beekeeping treatises thereby mirrored very closely contemporaneous theories of political economy positing that the origin of modern civilised 'économie' was located in the balance between need and superfluity.[55] Enlightened beekeeping also echoed the heated debates on the dangers of luxury, considered as a danger to this balance.[56] Lessons in enlightened honey-harvesting unambiguously represent a lesson in enlightened government: they teach their readers that good governors do not intervene directly in their subjects' lives, but know how to maximise their productivity.

Authors describe the superiority of their new techniques by asserting that these do not interrupt the course of the insects' productive lives. As the bees happily go about producing more honey and wax, the beekeeper thus benefits from their work without the insects even noticing. What is more, they insist that by removing just the right amount of produce, the bees become even more productive. In particular, authors throughout the century vigorously rejected a method for harvesting the insects' produce by suffocating the insects by burning them to death. They referred to it as 'barbarous' and thus the opposite of an enlightened practice based on the principles of natural history. Every single apicultural author, throughout the last two thirds of the century, lamented the persistence of this practice, which they attributed to the stubbornness of illiterate farmers.[57] Given the repeated insistence on the futility of the

[55] See, for example, Melon's image of three islands, each of which produce only one item (grain, wine, wool); only because the islands lack something will all three begin to exchange and produce competitively. See Jean François Melon, *Essai politique sur le commerce* (Amsterdam: François Changuion, 1735), pp. 1–14. Another example of this understanding of the relationship between the superfluous and the necessary can be found in *L'ami de l'homme,* where Mirabeau argues that commerce distributes the superfluous to where it is necessary; Victor de Riquetti marquis de Mirabeau, *L'ami des hommes, Ou traité de la population* (La Haye: Benjamin Gibert, 1759), IV, p. 75. *See* also Istvan Hont, *Jealousy of Trade: International Competition and the Nation State in Historical Perspective* (Cambridge MA: Harvard University Press, 2010), esp. 30-37.

[56] Hont, 'The Early Enlightenment Debate on Commerce and Luxury'; Berg and Elizabeth Eger; John Shovlin, 'The Cultural Politics of Luxury in Eighteenth-Century France', *French Historical Studies*, 23.4 (2000), 577–606; Pierre Rétat, 'Luxe', *Dix-huitième siècle*, 26.1 (1994), 79–88.

[57] On enlightened views of the illiterate, see Chisick, *Limits.*

practice, it seems strange that any reader after the 1750s would still need to be warned against it. The repetition of the condemnation of this practice seems to have been less a reminder to beekeepers interested in the best methods for harvesting honey than a confirmation for reform-minded landowners and agronomists of the importance of their own knowledge of natural historical facts as opposed to that of poorer peasants. Killing off one's hive thus became an emblematic example for the unenlightened blocking of nature's flow and of the older idea and practice of sovereignty as rule over life and death of the subject. It was also a reminder of the superiority of formalised knowledge and scientific observations and experiments rather than of the knowledge of illiterate practitioners, even if the former relied on the latter.[58]

As the physiocrats and other political economists worked hard to convince their fellow citizens and administrators that regulations of the grain trade represented such a blockage,[59] the example of the hive, based on the same idea of nature as a system of circulation, had become widespread. One text in which we can begin to track this recurring rhetorical reminder is Louis Liger's *La Nouvelle maison rustique* (first published in 1700), a comprehensive handbook on how to run a rural estate that was so successful that it went through countless editions, official and pirated, throughout the century.[60] While the second edition (1701) of Liger's handbook still endorses killing the bees as a possible, though not preferable, strategy for harvesting their produce, when we turn to the sixth edition, published in 1749, we find that the editors unequivocally condemn the practice as 'une barbarie'.[61] Other authors echoed Liger's judgement. This barbarous practice was possible, they argued, only because the principles of beekeeping had not followed naturalists' discoveries on the 'nature' of bees. As the Swiss writer Duchet put it in his *Culture des abeilles*, it was only because beekeepers had not yet adapted their practices to the bees' 'génie' − meaning their instincts, needs and behaviours − that beekeeping could have been considered an unprofitable activity: 'Tout dépend donc de connoitre & de feconder cet instinct

[58] Another example of enlightened expert 'discoveries' based on the knowledge of the illiterate are the colonial botanists who used indigenous informants without acknowledging their contribution: Schiebinger, *Plants and Empire: Colonial Bioprospecting in the Atlantic World*.
[59] Riskin, *Sensibility*, pp. 128–33.
[60] On Liger, see Bourde, *Agronomie*, vol. 1, pp. 55-57; E. C. Spary, *Feeding France*, pp. 21–25.
[61] Louis Liger, *La Nouvelle maison rustique, ou Économie générale de tous les biens de campagne, donnée ci-devant au public par le sieur Ligier ["sic"]. 6e édition, augmentée considérablement et mise en meilleur ordre, avec la Vertu des simples, l'Apoticairerie et les décisions du droit françois sur les matières rurales*, 6th edn (Paris: Saugrain fils, 1749), p. 464.

naturel, c'est le vrai & unique moyen de faire tout aller à souhait.'[62] Echoing contemporary political economists, beekeeping treatises suggested that enabling insects freely to follow their natural instincts, made apparent through observation, could increase revenue. Killing the bees was thus described as a failure to let the nature of bees take its course, both out of greed and out of ignorance of the natural facts of insects.

5. The Idea of Circulation Through the Labour of Insects

5.1. Naturalising Insect Work and Human Labour

To understand how natural historical practices helped conceptualise 'work' as the result of productive wholes interconnecting goods, populations in space in the eighteenth century, there is no better example than descriptions of the insect that had been used for centuries as a symbol for hard labour: the ant. In Proverbs 6:6 Solomon sent the sluggard to the ants to learn how to work, while Pliny praised their diligence, memory and indefatigable labour.[63] In his memoir on these insects and their highly organised communities (unpublished during his lifetime), Réaumur set out to combat what he considered the naïve anthropomorphism of pre-seventeenth-century writers.[64] He thus began his memoir with a list of all the sublime moral qualities attributed to ants by Pliny and his successors. After almost two pages of examples, he summarises his complaints:

> Mais on ne s'en est pas tenu à admirer ce qu'elles nous permettent de voir. On a cherché a [sic] interpréter à leur avantage toutes leurs actions, celles mêmes dont les motifs sont le moins pénétrables.[65]

In other words, the natural history of ants is in need of renewal because Réaumur's predecessors did not know how to observe. Yet, despite his protestations, Réaumur did not debunk the myth of the hard-working ant. On the contrary, he used the practices of the enlightened observer to put them on a firmer grounding. The ant that Réaumur

[62] Duchet, *Culture des abeilles*, p. 7.
[63] David Badke, 'Ant', *The Medieval Bestiary*, 2011 <http://www.bestiary.ca> [accessed 8 September 2016].
[64] René-Antoine Ferchault de Réaumur, *Histoire des fourmis*, ed. by E.-L. Bouvier and Charles Pérez (Paris: Paul Lechevalier, 1928).
[65] Réaumur, *Fourmis*, p. 10.

claimed to have made visible was thus no longer the Solomonic ant teaching the individual the importance of hard work, but an insect that embodied the 'naturalness' of the perfectly disciplined worker contributing to the wealth of her nation. This implied a reconception of the idea of 'work' itself. The ants' hard 'work' no longer required moral virtues such as 'donner de charitables secours à leurs malades' or strict laws punishing those who refuse to spend their time wisely.[66] Instead, 'work' was connected to the two fundamental laws of collective animal life: the drive to reproduce and to produce means for subsistence: 'c'est le bien général de leur espèce qui les anime.'[67]

What Réaumur claimed to be visible to the attentive naturalist, in other words, were no longer the virtues of the individual ant (including her dedication to the common good), but her contribution to the production and reproduction of her colony, in which the labouring ants, their food and building materials constantly circulated. Jean Ehrard has argued that the depictions of labourers in the *Encyclopédie* served to render their actions perfectly transparent and hence manageable to enlightened factory owners in towns, thus sharply contrasting with the supposed secrecy of the urban workers organised in guilds.[68] In his work on the arts and crafts, most of it unpublished during his lifetime, Réaumur too had argued that knowledge needed to circulate and not be kept secret by selfish guilded labourers.[69] Unlike the secretive human labourers, ants could be observed by enlightened naturalists. Although, of course, descriptions of ant labour would not help managers of human craftsmen, they did underscore the importance of circulation as the natural mechanism leading to the productivity of a population.

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[66] Réaumur, *Fourmis*, pp. 13-14.

[67] Réaumur, *Fourmis*, p. 100. The cliché of the tireless ant has recently been disproven. It seems that ants take hundreds of short 'naps' throughout their working lives, resulting in 9.4 hours of sleep per day for the queens and 4.8 hours for the workers. Deby L. Cassill and others, 'Polyphasic Wake/Sleep Episodes in the Fire Ant, Solenopsis Invicta', *Journal of Insect Behavior*, 22.4 (2009), 313.

[68] Jean Ehrard, 'La main du travailleur, la plume du philosophe', *Milieux*, 19/20 (1984), 47–53.

[69] He wrote, for example: 'Outre qu'un amour de la liberté porte à souhaiter qu'il soit permis aux hommes de faire ce sur quoi ils ont naturellement autant de droit que les autres, c'est que si les établissements se font de la sorte plus lentement d'une manière moins brillante, ils se feront d'une manière plus utile au Public. Comment s'assurer d'une societé qui ne soit pas trop avide de gain ? C'est le grand inconvenient des Privileges, qui d'ailleurs lient les mains à ceux qui n'en ont pas obtenu de pareils, & qui auroient été en état d'en faire de meilleurs usages ; qui auroient plus de talens pour perfectionner les nouvelles inventions. Ce n'est pas que les particuliers n'aïent pour le profit une ardeur égale à celle de Compagnies ; mais la crainte que leurs voisins ne vendent plus qu'eux, l'envie d'attirer le Marchand, leur fait donner à meilleur marché.' 'Préface', René Antoine Ferchault de Réaumur, *L' Art de convertir le fer forgé en acier et l'art d'adoucir le fer fondu, ou de faire des ouvrages de fer fondu aussi finis que de fer forgé* (Paris: Michel Brunet, 1722), unpaginated.

In contrast to Aelian's supposedly naïve anthropomorphisms, Réaumur limits himself to the outsider's perspective, watching the anthill from above. His preferred technology for observing the ants thereby literally muted the animals' conversations transcribed by Aelian: Réaumur used various glass containers to force the insects to perform their work of production and reproduction under his very eyes. These containers include glass bells used for plants and other everyday objects, but the naturalist's preferred observatory were the transparent hives he had built for observing bees, enclosed by another pane of glass to prevent the ants from escaping.[70] These hives had the advantage of separate drawers, each of which the naturalist could open and observe individually without disturbing the ants' industrious workings. Indeed, the fact the ants were unaware of the presence of the observer was crucial to the advantage of the glass hives:

> Les connoissances de ces insectes, s'ils ont des connoissances, ne vont pas jusques à sçavoir que ces volets et ces carreaux si commodément disposés n'ont pas été mis là pour eux ; ils ne prévoyent pas que leurs établissements ne sçauroient être de longue durée que tout y sera bouleversée par le premier curieux qui viendra ouvrir les volets.[71]

The naturalist had created a space perfectly transparent to the omniscient observer's gaze without the observed animals even noticing his presence. Just as the Creator of the natural laws of the ants' society was invisible but omnipresent, the naturalist could observe the insects unnoticed. One of the most important myths for Réaumur to disprove was that of the ants' habit of storing food for the winter.[72] This, the naturalist argued, was unnecessary: the ants were productive when the weather allowed it, but as soon as it became too cold, they would stop moving and hence did not require food. Productivity, Réaumur observed, meant circulation, not accumulation of food. The only time he observed the ants in his glass hive move the grains he had prepared for them was when these blocked their paths: '[les fourmis] n'ont déplacé que ceux qui embarroissient les passages'.[73]

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[70] Réaumur, *Fourmis*, pp. 28-29.
[71] Réaumur, *Fourmis*, pp. 28-29.
[72] Réaumur, *Fourmis*, pp. 32-35. In fact, while it is true that the species observed by Réaumur do not store grains, the Mediterranean ants observed by classical writers do. Réaumur, *Fourmis*, p. 32, fn. 2.
[73] Réaumur, *Fourmis*, p. 33.

The crucial importance of circulation was reflected too in the ants' construction of their nests. These, as Réaumur's glass hives had enabled him to see, were not the spacious palaces described the ancients but a space designed exclusively for the (re)production and circulation of food and workers:

> Ce sont des villes qui ne sont composées que de rues couvertes, ou si nous nous contentons de comparer les fourmillères à des édifices destinés à contenir beaucoup d'habitants, (elles) sont uniquement composés d'escaliers qui se croisent les uns les autres et les endroits les plus spacieux de chaque fourmillère sont très petits et peuvent être comparés au palliers des escaliers[.][74]

Like the bee cells described in chapter two, Réaumur's ant nests wasted no space or material; even seemingly empty holes contribute to the circulation of producers and produce: 'Aucune de ces cavités n'est aveugle, elles communiquent toutes les unes avec les autres'.[75]

Through deconstruction of unenlightened moral lessons and their replacement with descriptions of his own observations of his transparent glass hives, Réaumur could thus find in ants the disciplined workers he desired for his own society: efficient bodies, tireless work (without intervention from the queen), and communal spaces that served production as efficiently as possible. Assuming no intentions other than the (re)production of the species, Réaumur had thus been able to observe and explain ants' behaviours in a way his predecessors, interested in invisible morality as well as visible behaviours, had been unable and unwilling to do. Réaumur did not simply go to the ant to teach his readers about the value of hard work. By reconstructing the image of the hard-working ant through the means of enlightened observation, he could also observe how the production functioned in a large society organised not by a sovereign (the queen does not play an important role in his observations), but by the supreme sovereign, nature herself.

In his summary of the natural historical knowledge up to early decades of the eighteenth century, the abbé Pluche (1688-1761) made the link between observing

[74] Réaumur, *Fourmis*, p. 24.
[75] Réaumur, *Fourmis*, pp. 26-27.

insects and observing workers even more explicit. His *Spectacle de la nature, ou Entretiens sur les particularités de l'histoire naturelle qui ont paru les plus propres à rendre les jeunes gens curieux et à leur former l'esprit* (first editions published in 1732-1742), a compendium of nine volumes on the marvels of nature used as examples of God's greatness, was, according to the classic study by Daniel Mornet on the contents of eighteenth-century private libraries, one of the most successful texts published during the entire century.[76] It was written as a pedagogical dialogue between a young noble man, a young noble mother who hosts him during his school holidays and the educated local prior. The dialogues' main character, whose schooling is complemented by walks in the countryside leading to conversations on natural phenomena, is taught how to find, observe and dissect insects. In the middle of a conversation about spiders, his hostess recounts how her own son benefited from his training in the seemingly innocent art of observation as it taught him how to observe the artisans working for him and thus judge the quality of their products: 'Il suivoit un Tireur d'or, un Imprimeur, un Horloger, & un Teinturier des quinze jours & trois semaines: il donnoit autant au Menuisier & au Serrurier, encore plus au Charpentier. Il ne quittoit point son homme, qu'il ne l'eût vû dans toutes les attitudes & dans toutes les entreprises de sa profession.'[77] The young gentleman follows all the rules of natural historical that he had learned whilst looking at insects: he divides the production process into its various steps and the worker himself into a series of postures.[78] As his mother proudly recounts, the skill of observation enables the young nobleman to closely control those who work for him: 'Un ouvrier fripon ne le trompera pas: mais il sait aussi rendre justice à l'ouvrage d'un habile maître.'[79] The art of observing insects could thus directly be used as a tool for the disciplining of workers.

The lavish attention Pluche pays to artisans and their crafts in his *Spectacle de la nature*, is thus not only a sign of his progressive, enlightened outlook, as Cynthia

[76] Daniel Mornet, 'Les enseignements des bibliothèques privées (1750-1780)', *Revue d'Histoire littéraire de la France*, 17.3 (1910), 449–96.
[77] Noël-Antoine Pluche, *Le spectacle de la nature ou Entretiens sur les particularités de l'histoire naturelle: première partie, contenant ce qui regarde les animaux et les plantes : tome premier* (Paris: Veuve Estienne et Fils, 1749), p. 92.
[78] On eighteenth-century practices of observation, see Terrall, *Catching Nature in the Act: Réaumur and the Practice of Natural History in the Eighteenth Century*; Daston and Lunbeck; Patrick Singy, 'Huber's Eyes: The Art of Scientific Observation Before the Emergence of Positivism', *Representations*, 95.1 (2006), 54–75; Daston, 'Attention and the Values of Nature in the Enlightenment'.
[79] Pluche, *Spectacle*, vol. 1, p. 92.

Koepp has argued.[80] Pluche's nobleman has learnt from his training in natural history how to keep his workers under constant surveillance; both employer and employee are thus perfect examples of the disciplinary structure of the French absolutist state up until the mid-eighteenth century.[81] Pluche's descriptions of ants are equally focused on the obedience of that insect to 'ses loix & sa police' and his ant community follows a rigid code of rules and regulations.[82] Their paths from the nest to the food source, for instance, are described by Pluche as tightly regulated (though less so when the food is outside rather than indoors): 'pour y aller & pour en revenir, la marche est réglée. Tout le monde a ordre de se rassembler par un même sentier. Ces ordres sont moins sévères, & il y a liberté de courir, quand elles trouvent du gibier dans la campagne.'[83] Although Réaumur and Pluche agreed on the orderliness of the natural oeconomy, as illustrated in the bodies and 'moeurs' of insects, their descriptions of ants are two different examples of theories of government, the first focused on the discipline of workers, and the second on the well-being of the 'population'. While Pluche argued that ants and workers needed strict policing, what Réaumur finds fascinating about them are not their 'police' but, precisely, the way in which they are organised into an orderly whole in the apparent absence of a disciplining sovereign.

5.2 The Circulation of Worker Bees

Ants, like bees, then, helped imagine and put into practice ways of governing which were centred on knowledge of the bodies governed. While historians focusing on images of the queen bee have shown that representations of the hive moved from figuring it as the perfect monarchy to descriptions of the bee republic, the problem of circulation shifts our focus from the queen to her workers. Bees had long been a symbol for hard work ('diligentes ouvrieres' writes one eighteenth-century fabulist),[84] but their industriousness was usually taken as a sign of loyalty and subjection to their

[80] Cynthia Koepp, 'Advocating for Artisans: The Abbé Pluche's Spectacle de La Nature (1732-51)', in *The Idea of Work in Europe from Antiquity to Modern Times*, ed. by Josef Ehmer and Catharina Lis (Farnham: Ashgate, 2009). On Pluche, see also Ann Blair; De Baere; Dennis Trinkle, 'Noël-Antoine Pluche's Le Spectacle de La Nature: An Encyclopaedic Best Seller', in *Studies on Voltaire and the Eighteenth Century*, ed. by Anthony Strugnell (Oxford: Voltaire Foundation, 1998), CCCLVIII, 93–134.
[81] For enlightened ideas about how to rationalise the labour force via discipline and surveillance, see Schaffer, 'Automata,' pp. 126-129; Jr.
[82] Pluche, *Spectacle*, vol. 1., p. 215.
[83] Pluche, *Spectacle*, vol. 1., p. 217.
[84] François-Joseph Terrasse Desbillons, *Fables du Père Desbillons, traduites en françois par le même*, 2 vols (Strasburg: Anne-Catherine Bassompierre, 1779), II, p. 15.

king or queen. Now, eighteenth-century writers depicted bees no longer as symbols of simple diligence, but as examples of the capacity of natural bodies to increase their productivity. Bees were no longer simply symbols of hard though also mechanical and unchanging work; since they could be understood to have progressed from a wild life in tree trunks to a civilised existence in productivity-enhancing human-built hives, they were also living proof for the idea that work was not a stable category, with each group within the hive invariably fulfilling the same tasks to the same extent, but subject to 'improvement'.

In her analysis of the plates for the *Descriptions des arts et métiers*, Geraldine Sheridan has argued that the depictions of women highlight what the accompanying text omits: the fact that female labourers were an absolutely integral part of French economic production. Though women were necessary for the production of goods, they were increasingly excised from writings on production. At the same time, the value of their reproductive labour was increasingly highlighted.[85] While Sheridan argues that visual depictions of labour processes belied the absence of female workers in written texts, descriptions of workers in the beehive might serve as another unexpected location for discussions of the importance of female labour. While the queen, as Wahrman has shown, was gradually reduced to her reproductive function, the sterile female workers of the hive were represented as ideal productive bodies. The preceding discussion on the notion of circulation in natural and political bodies thus opens up an additional perspective on Wahrman's 'cultural revolution' as observed through the females in the beehive. Not only might we question Wahrman's claims regarding the suddenness of this shift − after all, Réaumur's memoirs are already peppered with references to both the bees' maternal instincts and their role as leader of the hive − Wahrman is certainly right to point out the increasing emphasis on the queen's role as the hive's sole mother. Women's bodies and their reproductive labour reflected the (re)productivity of nature, not by coincidence still often represented as a female figure.[86] By giving birth, that is, women ensured that 'the economic machine' did not experience blockages in her reproductive cycle.

[85] Lieselotte Steinbrügge, *The Moral Sex: Woman's Nature in the French Enlightenment*, trans. by Pamela E. Selwyn (Oxford: Oxford University Press, 1995), pp. 25–28.
[86] Daston, 'Attention and the Values of Nature in the Enlightenment'; L. J. Jordanova, *Nature Displayed: Gender, Science and Medicine 1760-1820* (London: Longman, 1999), Part I, chapter two: 'Feminine Figures - Nature Display'd.'

This role of women as safeguards of economic circulation is evident already in Réaumur's experiments from the 1740s. He had shown that even the value of the queen (a single mother rather than a good wife) depended on her productive contribution to the hive. In one telling experiment, the naturalist decided to remove the queen without immediately replacing her. The results suggested that the queen's role in the hive was indeed a crucial one, but in no way that of a lawgiver. As soon as he deprived his bees of their sovereign, they ceased to work, instead consuming the honey and wax that remained in the hive and that they collected out in the fields. As soon as the queen was lost, the workers ceased to exist as a community, instead breaking into a multitude of idle individuals who 'se contentent de vivre au jour la journée, d'aller prendre leurs repas dans la campagne, sans s'embarrasser de faire des provisions dans la ruche.'[87] Since the experiment showed that the worker bees accepted any fertile queen, this suggested that their loyalty depended not on her inborn dignities, but simply on the health of her reproductive organs; or, in other words, on her capacity for reproductive labour. The absence of a fertile female thus ground the honey production in the hive to a halt, dissolving the bee community into atomised, self-interested individuals. Réaumur's observations on economic circulation in the bee hive mirrored the concerns of writers in the later decades of the century also in his suggestion that the body of the queen be monitored so as to prevent blockages in the economic machine of the hive.

This was echoed in gynaecological texts. As scholars have pointed out, texts such as Diderot's article 'Accoucheuse' worked to delegitimise the work of female midwives in order to strengthen the role of the male surgeon.[88] Diderot's main critique is that the midwives fail to observe the female body and accept its nature: 'L'art des accouchemens ne convient que lorsqu'il y a quelque obstacle: mais ces femmes n'attendent pas le tems de la nature; 'elles déchirent l'*oeuf*, & elles arrachent l'enfant avant que la femme ait de vraies douleurs.' Unlike the good beekeeper described by Réaumur, the midwife intervenes instead of paying attention to possible blockages. The *Encyclopédie*'s medical articles, on the other hand, detail the ways in which (male) doctors should observe the female body, and in particular the circulation of fluids. Women's refusal to breastfeed could thus be reimagined as an unnatural

[87] Réaumur, *Mémoires*, vol. 5, pp. 274-275.
[88] Steinbrügge, *The Moral Sex*, p. 29; see fn. 2 for additional references on eighteenth-century midwifery/obstetrics.

blocking of the body's circulatory apparatus;[89] as the doctor Barthez writes in his article 'Femme':

> Si l'accouchée ne peut ou, ce qui n'est que trop ordinaire, ne veut pas être nourrice, il faudra bien mettre sur son sein & contre l'intention de la nature, des remedes propres à faire évader le lait; mais si l'accouchée est assez sage pour vouloir nourrir son fruit, on se contentera de lui tenir la gorge couverte avec des linges doux & mollets: alors la mere nourrice observera seulement d'attendre quatre ou cinq jours, avant que de donner le teton à son enfant

Thus, the principle of circulation at the heart of eighteenth-century physiological theories of the role of fluids in the body as well as in the political economic models of the economy pervaded accounts of the amazingly productive and reproductive bodies of bees, further substantiating the naturalness of the enlightened ideas of the female body.[90] At a time of supposed population decline, women were, as Londa Schiebinger has shown, increasingly reduced to their biological and hence reproductive sex.[91] Schiebinger argues that the term 'mammal' was chosen 'alongside and in step with political realignments undermining women's public power and attaching a new value to women's domestic roles.'[92] In a period that looked to nature for models of social organisation, queen bees thus served as another useful image for underscoring the importance of women's reproductive act.

Like the queen, the rest of the hive's individuals were reconfigured as defined by their contribution to the productivity of their society. Most of the historical work has focused on the figure of the queen, but notions of the sterile females within the hive reflected cultural shifts as well. This is evident from their very name: whereas

[89] Leslie Tuttle, *Conceiving the Old Regime: Pronatalism and the Politics of Reproduction in Early Modern France* (Oxford: Oxford University Press, 2010); Nancy Senior, 'Aspects of Infant Feeding in Eighteenth-Century France', *Eighteenth-Century Studies*, 16.4 (1983), 367–88; Schiebinger, 'Why Mammals Are Called Mammals'; Nina Rattner Gelbart, *The King's Midwife: A History and Mystery of Madame Du Coudray* (Berkeley: University of California Press, 1998).

[90] On political economy, see Schaffer, 'Enlightened Automata', p. 143 ; M. Norton Wise, 'Mediations: Enlightenment Balancing Acts, or the Technologies of Rationalism', in *World Changes. Thomas Kuhn and the Nature of Science*, ed. by Paul Horwich (Cambridge, MA: MIT Press, 1993), pp. 207–56'Mediations'; Foley; On physiology and circulation, see Quesnay, *Essai physique sur l'oeconomie animale*, I, p. 214; Barbara Orland, 'The Fluid Mechanics of Nutrition: Herman Boerhaave's Synthesis of Seventeenth-Century Circulation Physiology', *Studies in History and Philosophy of Biological and Biomedical Sciences*, 43 (2012), 357–69.

[91] Schiebinger, 'Mammals'.

[92] Schiebinger, 'Mammals,' p. 384.

earlier writers referred to them above all as 'females' (sometimes also as males) in the eighteenth-century most writers called them 'ouvrieres', insisting on the idea that their sterility aside, they fulfilled the majority of tasks in the hive, from building and cleaning the cells to collecting honey and defending the hive from outside enemies. In his *Natural History*, Pliny had explained that the hive consisted in the king, the 'genuine bees' and the drones. He thus distinguished the different types of bees by their anatomy: the king, who was 'larger'; the bees and the drones, their 'slaves', whose stingless and weak nature allowed 'the bees [to] exercise over them a rigorous authority, compel them to take the foremost rank in their labours, and if they show any sluggishness, punish them without mercy'.[93] Closer to our period, Jan Swammerdam still referred to the workers mostly as 'common bees'. Their role in the hive was defined not in relation to production, but to reproduction: 'the common Bees have no ovary, and therefore, like women who have lived virgins till they are past child-bearing, serve only the purpose of labour in the oeconomy of the whole body. These are thus by nature rendered incapable of doing any other business but that of nourishing and educating the young off-spring.'[94] In Swammerdam's description, the bee's labour is not a positive description that somehow defines the bee, but a chore, carried out only because she is incapable of reproduction as the true purpose of any living being. By contrast, Réaumur's introduction to the hive's social groups stresses the value of the bees' work: 'Les premiéres sont celles que tout le monde connoît; leur nombre est sans comparaison plus grand que celui des autres; elles sont uniquement nées pour le travail; tout celui de la ruche roule sur elles, aussi les nommons-nous les ouvriéres.'[95] Here there is no sense that the worker bees are defined by a lack of fertility; instead, their biological conditioning to work is both their primary and thus name-giving characteristic and a positive feature.

Both the reproductive labour of the queen and the productive labour of her workers were essential to the economy of the hive as a whole; this contrasted, of course, with the fate of the greedy drones. In a recent study of early-modern vermin, Lucinda Cole suggests that the analogy of Robinson Crusoe's island colony as a 'great hive' points to the 'sacrificial economy' at the roots of the modern imperialist state:

[93] Pliny the Elder, *The Natural History*, trans. by John Bostock and Henry T. Riley (London: Taylor and Francis, 1855), ch. 11.11 Drones.
[94] Matthew Cobb, 'Jan Swammerdam on Social Insects: A View from the Seventeenth Century', *Insectes Sociaux*, 49 (2002), 92–97 (p. 96).
[95] Réaumur, *Mémoires*, vol. 5, p. xiv.

‘The famed efficiency of the hive, its legendary industry, depends (according to seventeenth- and eighteenth-century naturalists) on the systematic extermination of hungry members whose use-value has been expended.’[96] Beekeeping treatises, in addition to providing an example in nature of the sacrifice of those who have lost their ‘use-value’, both made visible the necessity of sacrificing the unproductive elements of the population and instructions on how to do so , or rather, how to let the bees do it themselves. The practice of killing the bees could thereby come to stand for unenlightened government because unlike the targeted massacre of the drones it took into account only the ease and convenience of the governor, not the well-being of the insect population. Eighteenth-century beekeepers, on the other hand, argued that enlightened government of bees required helping the insects in their massacre if, and only if, the bees themselves had not managed to do so. Enlightened apiculturists were fascinated by the peculiar role played by the male drones. As one treatise describes them: ‘Chaque couvain en fournit à peu près quatre cens. Après que le dernier couvain de l’été est éclos, ils fécondent la Mere pour la derniere fois. Aussitôt les Abeilles ouvrieres les tuent, & les jettent hors de la Ruche.’[97] Although the fact that the female worker bees of a hive killed all the males once the mating process was completed troubled assumptions about the role of docile women and of mothers, authors reminded their readers that the drones’ survival threatened the hive. In his pedagogical dialogue, De Palteau explained at length the necessity of the massacre. His narrator Ariste thus described the first weeks of their short lives as a life of idleness reminiscent of critiques of unproductive eighteenth-century nobles, getting up at eleven in the morning and leaving the hive only for ‘des parties de plaisirs & de divertissemens, ou tout au plus une preparation à un bon repas en gagnant de l’appétit par le grand air & un exercice modéré.’[98] The descriptions of this extravagant life style of noble idleness made the killing of the drones at the end of the mating season (late July) to prevent them from consuming the hive’s resources needed for the winter seem justifiable. Some drones apparently even committed suicide. For Ariste, the drones’ death was a necessary act of self-sacrifice: ‘Le bien public exige ce sacrifice.’[99] If too many drones

[96] Lucinda Cole, *Imperfect Creatures: Vermin, Literature, and the Sciences of Life 1600-1740* (Ann Arbor: University of Michigan Press, 2016), p. 170.
[97] Pierre François Bienaymé, *Mémoire sur les abeilles: Nouvelle manière de construire des ruches en paille, & la façon de gouverner les abeilles* (Paris: Didot; Durand, 1780), p. 19.
[98] Palteau, *Nouvelle construction,* p. 114.
[99] Palteau, *Nouvelle construction,* p. 115.

escaped the workers and refused to commit suicide, the hive was almost certainly going to die, either because they consumed too much of its resources or because they caused infectious diseases.[100] In such a case of failure of the bees' self-protective mechanism, the beekeeper, having observed the hive carefully, should intervene: 'vous pourrez utilement pendant tout ce mois [d'août] vous amuser à tuer avec des pinces, tous les faux-bourdons qui vous tomberont sous la main.'[101] The task of the beekeeper was to ensure, through constant observation, that the hive's cycle of production and reproduction was never interrupted. The killing of the bees as supposedly practised by the unenlightened thus comes to represent an interruption of this cycle. The enlightened beekeeper knew that in most cases he did not need to kill the bees: instead, the working bee population killed the drones as soon as they had made their contribution to the task. Unlike their human governor, the bees knew exactly which elements of their hive to kill and at what moment (before the winter).

Authors' frequent repetition of a clear-cut case where natural historical research could disprove the long experience of traditional farm labourers did not simply serve the purpose of enlightening their readers on the harmfulness of killing bees (at least by the end of the century, probably would have known already). It was not just the practice itself that authors of beekeeping treatises were transmitting, but also the lesson that an enlightened governor intervened as little as possible in the lives of his insect population. They also taught that to be a citizen meant being productive, or risk the fate of the lazy drones.

5.3 Beekeeping and Colonialism

Scholars have noted that the hive could serve as a model for colonial government, as Lucinda Cole argues it did in *Robinson Crusoe.* Karen Ordahl Kupperman, too, shows how the colonial experience of the English in America transformed political analogies of the hive and contributed to arguments in favour of self-government of the colonies: 'Just as bees swarmed from the over-full hive to take up productive roles in a new model of the old hive, a new plantation was indeed like a swarm. As a replica of the parent hive it was not an extension, but a separate society.'[102]

[100] Palteau, *Nouvelle construction,* p. 116.
[101] Palteau, *Nouvelle construction,* p. 395.
[102] Karen Ordahl Kupperman, 'The Beehive as a Model for Colonial Design', in *America in European Consciousness, 1493-1750* (Chapel Hill: UNC, 1995), pp. 272–92 (p. 288).

In French treatises on beekeeping practices overseas, the hive was more than a model for political organisation of the colonies. Instead, their authors used their natural historical studies of the differing characters of colonial and mainland bees to argue for differences in their human inhabitants. Articles on beekeeping practices in the colonies can be found in several journals and books on overseas countries. As part of larger-scale projects to survey the natural history of colonial people, plants and animals, bees are mentioned as evidence for the immense variety of behaviours and anatomies within the same animals depending on the climate.[103] Historians of eighteenth-century colonialism have shown that colonial subjects were frequently portrayed as passive and idle, living off what Nature gave freely rather than using their hands and minds to transform and improve her produce. Patrick Carroll, in a study on the role of the sciences in the formation of the British Empire, shows how, as early as the mid-seventeenth century, the Boate brothers described the native Irish as too lazy to improve their lands, arguing that their 'passivity in the face of nature' demonstrated that they were 'barbaric'.[104] Through their supposedly empirical study of the natural history of the Irish, English colonisers as masters of agricultural and industrial improvement and thus more civilised saw themselves as justified to transform both the uncivilised minds of the Irish and the physical nature of their land.[105] The association between a civilised mind, improving hands and colonial power also applies to the case of eighteenth-century France. Just as writers concerned with human variability asserted, following a theory most famously expressed by Montesquieu, that climate and other geographical factors significantly influenced the socio-political structures, norms, national 'character' and 'moeurs' of a people, naturalists often had recourse to the hot climate as an explanation for the differences between European and colonial bees.[106] The latter, they claimed, were smaller, weaker and less productive. Some of

[103] Antonio de Ulloa and Lefebvre de Villebrune, *Mémoires philosophiques, historiques, physiques, concernant la découverte de l'Amérique, ses anciens habitans, les produits des trois règnes de la nature avec des observations et des additions leur immense produit ignoré jusqu'ici, par Don Antonio de Ulloa, traduit par J. B. de Lefebvre de Villebrune* (Paris: Buisson, 1787), p. 200.
[104] Patrick Carroll, *Science, Culture, and Modern State Formation* (Berkeley: University of California Press, 2006), p. 71.
[105] In a recent study of early-modern vermin, Lucinda Cole argues that the image of the hive, and particularly the killing of the drones, in *Robinson Crusoe* 'exhibit[s] a kind of Mandevillian logic: both the Indians and the formerly "wild" colonists […] have been "Disciplin'd" through a "Superior Force" or "Persuasion" – including near-starvation – to work together with supposedly hive-like efficiency.' She thus provides another example (in fictional writing) of how insects could serve to imagine a new social order based on imperialism; Cole, *Vermin*, p. 168.
[106] Robert Wokler, 'From l'Homme Physique to l'Homme Moral and Back: Towards a History of Enlightenment Anthropology', *History of the Human Sciences*, 6.1 (1993), 121–38 (p. 127).

them did not even possess a sting, and if they did, its force was significantly weaker than that of a French bee.[107] In a report on beekeeping on the Isle de Bourbon (present-day La Réunion), for example, the *Journal de physique* stated that bees there

> sont de même nature que celles de France, mais moins grosses & plus longues. Elles ne sont jamais engourdies par le froid à l'isle de Bourbon; ils y trouvent toujours des fleurs, & cependant elles ne travaillent pas toute l'année. […] Les abeilles sont peu actives, ce qui dépend peut-être de la trop grande chaleur du climat.[108]

As a consequence, naturalists and agronomists suggested introducing the much more productive European bee species to the French Isles. The abbé Della Rocca even claimed that this project had been successfully carried out in Louisiana and Cuba.[109] He proposed beekeeping as a technique for the improvement of the people and land of the colonies, by which he meant an increase in commercial goods produced for the benefit of Europeans, both in the colonies and at home. He lamented the lack of artificial hives in the Caribbean despite the fact that the native inhabitants depended on the bees' produce and praised the English settlers who had introduced bees to Cuba as models everywhere to be followed.[110] For Della Rocca bees were ideal contributors to a globalised natural and political economy. The nature of the lazy colonial bee populations seemed to be beyond improvement. Once replaced by productive European species, introduced by European settlers, the most hard-working kinds of bees would produce enough honey and wax to cover not only the needs of the inhabitants of the colonies, but also for exportation back to the homeland. The European bee population, in other words, realised the natural productivity of the colonial territory. What this meant for the native bees was never specified.

The imperial overtones of reports on bees in the colonies are even clearer in discussions of the beekeeping practices of the native (human) inhabitants. In addition to the natural history of the bees themselves, the author of the *Journal de physique*

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[107] Ulluoa and Villebrune, *Mémoires philsophiques,* p. 199.
[108] Palteau, *Nouvelle construction,* p. 141.
[109] abbé Della Rocca, *Traité complet sur les abeilles avec une méthode novuelle de les govuerner, qu'elle se pratique à Syra, île de l'Archipel. Précédé d'un Précis historique et économique de cette île*, 3 vols (Paris: De L'Imprimerie de Monsieur, Bleuet père, 1790), I, p. 247.
[110] Rocca, *Traité sur les abeilles,* p. 367.

article included a report from a M. de la Nux, correspondent of the Académie des sciences, on the invention of a new hive based on the beekeeping practices of the island's native inhabitants. De la Nux's hive takes inspiration from the hives built by the 'sauvages' of the island, who house their bees in hollowed-out tree trunks which they either carve out themselves or find hollowed out in nature. The article makes it very explicit, however, that the native beekeeping practices only provided the inspiration for de la Nux's hive, who developed it according to his own experiments and observations and after having read De Palteau's and other French writers' manuals. The native beekeepers, like the Irish described by Carroll and like the lazy native bees, simply take what they find, while the Frenchman uses his knowledge and reasoning power to improve both the bees' natural productivity and the naïve practices of the 'sauvages'.

Bees were imagined to improve the life of the colonised in other ways, too. While demand for wax increased over the course of the century, honey lost its role as the most widely used sweetener. As historians of France's colonial relations have noted, the country dramatically increased its production and consumption of sugar in its Caribbean colonies (predominantly in Saint-Domingue, but also in Martinique and Guadeloupe), with the amounts of sugar registered in French ports tripling every 60 years between 1670 and 1790.[111] Because of the labour intensity of sugar production, it was closely tied to the slave trade, which, in turn, gave rise to criticism of the treatment of slaves in the sugar industry. The Rousseauist writer Gaspard Guillard de Beaurieu (1728-1795), author of a text using the natural history of insects to turn young readers into moral citizens, linked his critique of civilisation and its hunger for luxury goods to the inhumane treatment of slaves abroad.[112] He suggested that instead of importing sugar, European consumers should 'return' to using honey as the more 'natural' product: 'nous prouverons combien il seroit plus avantageux à tous égards, de substituer le miel au sucre, & d'employer les Nègres, avec plus d'humanité à d'autres travaux'.[113]

One such occupation, we might surmise, could be the government of bees. The treatment of bees hereby mirrors the treatment of the slaves: as even as Rousseauist

[111] Stein, 'French Sugar Business,' p. 6.
[112] On Beaurieu, see Marc Olivier, 'Through a Flea-Glass Darkly: Enlightened Entomologists and the Redemption of Aesthetics in Eighteenth-Century France', in *Insect Poetics* (Minneapolis: University of Minnesota Press, 2006), pp. 242–61.
[113] Gaspard Guillard de Beaurieu, *Abrégé de l'histoire des insectes* (Paris: Panckouke, 1764), II, p. 157.

an author like Beaurieu agreed, using bees to produce honey, though not in the insects' 'nature', was not morally wrong in itself, as long as beekeepers did not use 'inhumane' practices like their routine killing. As 'Nature' seemed to demonstrate by increasing the beekeeper's revenue, such practices were not only cruel but also against the bees' natural laws. This argument from natural-historically inspired agriculture is transposed onto the management of slaves: it is not the government of the French over the Haitians that is deemed wrong, but only their misguided, unproductive and 'unnatural' employment in the sugar industry.

The natural history of bees, then, served as a lesson on how to manage and improve those labouring in the service of the improver; by using natural history, writers argued, landowners could learn, on the one hand, how to increase their financial revenues, and, on the other hand, how to treat their insect and human labourers in a fashion that seemed morally just.[114]

6. Conclusion

The particular appeal of bees lay in their usefulness as both metaphors and literal contributors, through their honey and wax, to the wealth and prosperity of the nation. Bees helped imagine a community that did not rely primarily on an absolute sovereign, nor on an absent God, for its cohesion, but on a productive population. Eighteenth-century beekeeping treatises reminds us of the two-faced nature of Enlightenment projects for improvement: though authors loudly professed their intention to help improve the lot of France's poor, insisting on the importance, even nobility, of agriculture, they simultaneously worked to ensure that they would depend on their rational knowledge. In the treatises examined, natural knowledge of bees served as the basis for their 'government' and as an early model for thinking about humans as natural bodies, rather than as legal subjects. As enlightened improvers dreamed of governing a space where animals, humans, commodities and physical entities such as air could circulate freely, it is clear that they did not envision the abandonment of hierarchies. Though they promised that all bodies involved would be able to pursue their interest, they also insisted that native Caribbeans, poor labourers, rich landowners

[114] As Ingrid Tague has shown, animals were frequently used in the eighteenth century to prove the benefits of a 'benevolent paternalism' towards slaves, quelling uneasiness about the practice itself. Ingrid H. Tague, 'Companions, Servants, or Slaves? Considering Animals in Eighteenth-Century Britain', *Studies in Eighteenth Century Culture*, 39 (2010), 111–30 (p. 112).

and rational agronomists could never have the same interests. With the help of social insects, that is, political economists and agronomist conceptualised – and to put into practice – a political economy based on the idea of the 'naturalness' of those to be governed.

Chapter Six. Conclusion and Outlook

In a passage of the *Salons* of 1769, Diderot addresses several of the issues that have been central to this dissertation. Diderot writes:

> J'ai bien peur, mon ami, que la prédiction du grand chancelier d'Angleterre ne soit sur le point de s'accomplir en France; c'est que la philosophie, la poésie, les sciences et les beaux arts tendent à leur déclin du moment où, chez un peuple, les têtes, tournées vers les objets d'intérêt, s'occupent d'administration, de commerce, d'agriculture, d'importation, d'exportation et de finance.[…] On disserte, on examine, on sent peu, on raisonne beaucoup, on mesure tout au niveau scrupuleux de la logique, de la méthode et même de la vérité; et que voulez-vous que des arts qui ont tous pour base l'exagération et le mensonge, deviennent parmi des hommes sans cesse occupés de réalités et ennemis par état des fantômes de l'imagination, que leur souffle fait disparaître? C'est une belle chose que la science économique; mais elle nous abrutira.[115]

In this fascinating passage, Diderot laments the rise of the kind of empirical knowledge of which Francis Bacon, the 'grand chancelier', was thought by Enlightenment writers to be the founding father. Knowledge, Diderot asserts, has been reduced to useful knowledge; the practitioners of the useful 'science économique' have become so rational that they have abandoned the imagination and sensibility that makes them truly human, rather than mere 'brutes'. The *philosophe* thus reminds of the close association in the eighteenth century between competing conceptions of the pursuit of knowledge, political economic concerns and the differences between humans and animals. Diderot opposes two images of the human. The first is the one brought forward by the representatives of 'science économique', who reduce themselves to being calculating, interest-driven 'brutes'. Like the geometrically-minded bees we encountered in chapter two, Diderot's economic scientists are supremely rational beings, able to recognise and pursue their material interests. Echoing Buffon's critique of Réaumur's mathematically skilled bees, Diderot describes them as machine-like

[115] Denis Diderot, *Œuvres Complètes, Tome 16: Salon de 1767, Salon de 1769*, ed. by Else Marie Bukdahl, Michel Delon, and Annette Lorenceau (Paris: Hermann, 1990), pp. 656–57.

animals: they are rational, but their single-minded pursuit of their interests suggests that they have abandoned the liberty to be irrational. In opposition to these animalised calculators, Diderot describes artists and savants who, we might say, exploit their humanity to the fullest. They feel, and they use their (often irrational) imagination. This extract from Diderot's *Salons* thus summarises some of the opposing conceptions of individual bodies and minds and social wholes that we have encountered in the preceding chapters. Political economists and conservative naturalists increasingly presented a conception of the human as interest-driven and rationally calculating, a conception that echoed descriptions of hard-working bees calculating the most efficient use of materials for their constantly productive hives. Their critics, on the other hand, emphasised not the bees' geometrical talent, but their ability to feel and to respond to one another's movements.

While Diderot and the naturalist Georges Leclerc de Buffon, avidly read by Diderot, at times emphasised human uniqueness, arguing that insects differed from humans in that they could not use their creative, if occasionally dangerously irrational, imagination, they also showed that both human and animal sociability was the product not of geometric calculations, but of sensibility. Radical thinkers like Diderot or Buffon, but also the medical writers of the Montpellier School that we encountered in chapter three, thus stressed the differences between man and insect in their conception of the imaginative individual, but also their closeness to animal societies such as bee swarms when they conceptualised the workings of sensibility. Political economists and agronomists, on the other hand, though they shared these thinkers' conception of social bodies as more than the sum of their parts, were not interested, as Diderot criticised, in their irrational, imaginative elements. Instead, they looked to animal bodies in order to learn how to order and govern them. The discussions of insects that I have traced in the preceding chapters have been shown to contribute not only material to the emerging global networks of commodity exchange, nor just empirical evidence for political ideas, but also a conceptual model of the social order that linked humans, animals and 'nature' to understand how society should be governed (or governs itself with the help of natural checks and balances). Discussions of insects contributed to this endeavour by helping imagine how natural bodies – insect as well as human, individual as well as social – could fall within the purview of government.

As we have seen, one conception of society emerging in the eighteenth century was that of the social whole as a 'population'. 'Population', as this dissertation has

demonstrated, is not a way of thinking about human or animal communities that arises 'naturally' from aggregations of large groups, but the historically and geographically specific construct through which governmental power has been thought to operated, at least in France, since the eighteenth century. As naturalists and political economists wove humans, animals and other natural resources into one continuous whole, to be governed, controlled and improved by the state, they thus made possible subsequent conceptions and practices of an 'economy' based on the government of natural bodies. Why this transformation in the conceptualisation of the object of government should have occurred is a question that lies beyond the purview of this dissertation. The concept emerged as part of much wider transformations of the socio-political landscape; any explanation would thus likely have to involve an unwieldy number of factors. The aim of this dissertation has been less to explain why what Foucault termed 'biopower' might have emerged in the period; instead the thesis has analysed how a series of texts grappled with the question of the social order demonstrate the connection between Enlightenment discourses of (human) political economy and of the nature of animals, and to show at the centre of both was a concern with the relationship between individual and collective bodies. The thesis has thereby shown that areas of knowledge that might seem distinct to the twenty-first-century mind were, in the eighteenth century, connected by a common nexus of questions around animal nature and its difference from human nature; these discussions, in turn, allowed thinkers to devise new definitions of the social order.

In the first chapter, we saw that Diderot was not the only one among the *philosophes* to warn against reducing the individual - human or animal - to the universal rules of self-interest. With Diderot's critique, written at a time when the population discourse was in full swing, we thus come full circle from Emilie Du Châtelet's early-eighteenth-century interpretation of the differences between humans and animals, and the relationship the bodily passions and reason. Though only eleven years younger than Emilie Du Châtelet, the differences between the take on the emerging political economy of the rich noblewoman and the son of a cutler from Langres is striking. While both objected to the idea of subsuming individuals under a scientifically observable and calculable abstraction such as 'the population', they did so for different reasons. For Du Châtelet, the pursuit of happiness could never be universal, for it depended on material and intellectual resources that could only ever be accessible to a tiny elite.

Chapter two further has interrogated new conceptions of human and animal individuals. It shows that the Enlightenment construction of the rational self took place also in discussions of the nature of insects. One the hand, the geometrical skills of bees, as we have seen, could thus serve either as a reminder of the rational order according to which a providential God had arranged the human as well as the natural (including the insect) world. Those thinkers, on the other hand, who conceived of the human self not only as rational, but also as sensitive, reduced the geometry of the hive to the result of automatic programming, emphasising instead that the complex social formation of the hive is the result of the interactions between sensible bodies.

Chapter three has explored how eighteenth-century writers described the way in which individual bodies, whether they thought of them as natural or social, primarily rational or sensitive, could come together to form harmonious wholes. In this chapter, debates about the newly discovered polyp and the order of the bee swarm have been taken as examples for discussions around the organisation of natural bodies.

Chapter four has analysed one conception of ordered wholes that became increasingly dominant in the second half of the century: the idea that bodies in the aggregate formed a 'population'. It examines the parallels between changing approaches to insect pest control, health epidemics and the Physiocratic concept of the population to argue that there were strong parallels in which both animal and human populations were thought of and governed.

The final chapter has shown how the concept of population, natural historical investigations of insects and the Enlightenment concern with improvement were taken up by writers of beekeeping treatises in the latter half of the century. These authors did not belong to either the intellectual circles of the French capital or the high nobility, but that had absorbed the spirit of improvement and reform. Partly as a way of re-enforcing the importance of their own role as provincial, newly enriched landowners,[116] partly, we can assume, out of a genuine desire to improve the lot of the labouring poor, their beekeeping treatises employed the concept of circulation to describe and put into action a theory of government that, by respecting nature's dictates, harmoniously combined and rendered productive insects, the plants they fed on, farmers and their land, landowners and consumers. Diderot, though also a

[116] John Shovlin, *The Political Economy of Virtue: Luxury, Patriotism, and the Origins of the French Revolution* (Ithaca, N.Y.: Cornell University Press, 2007).

proponent of a government that would respect the natural limits of humans, animals and even plants, perceived that this conception of nature as geared towards productivity reduced men to 'machines' or animals ('les abrutira'). As we have seen, this reduction was also crucial to both the rise of the state administration in France and the growing colonial enterprise abroad. Agronomists' efforts to increase the productivity of their honeybees, whether at home or in the colonies, led them to export European, supposedly more 'hard-working' species as well as European, enlightened beekeeping methods, and to import honey produced abroad. Beekeeping is only one example of how insects in the eighteenth century strengthened the ties between colonies and colonisers, linking often very distant ecosystems. Just like beekeeping, efforts to revive and enhance sericulture, or attempts to break the Spanish monopoly on cochineal, benefited colonisers and colonised in unequal ways and transformed landscapes as well networks of knowledge and trade.[6] Much more is known about colonial plant trade even though insects evidently played a significant role in the formation and consolidation of European empires[7], both as resources and as living proof of the beneficial connection between the political economies of Europe and overseas.

By offering the first sustained investigation of the links between discussions of insects, of the human individual and of theories of social wholes and the best ways to govern them, this dissertation has contributed to the growing body of studies by scholars in the humanities on the roles of animals, and in particular of insects, in constructing human social orders. Rather than consider the 'animal' as the inevitable counterpart of the 'human', however, it has emphasised that animals and our relationships with them need to be understood historically. While human-animal scholars reflexively locate the construction of the rational human subject, whose animality has been suppressed, in the Enlightenment, it is clear that the situation was much more complex. Enlightenment writers thus indeed stressed human uniqueness, whether they found it with the faculties of reason or imagination. At the same time, however, the same thinkers also explicitly and purposefully brought animals and

[6] Edward D. Melillo, 'Global Entomologies: Insects, Empires, and the "Synthetic Age" in World History', *Past & Present*, 223.1 (2014), 233–70.
[7] *Colonial Botany: Science, Commerce, and Politics in the Early Modern World*, ed. by Londa L. Schiebinger and Claudia Swan (Philadelphia: University of Pennsylvania Press, 2005); Londa Schiebinger, *Plants and Empire: Colonial Bioprospecting in the Atlantic World* (Cambridge Massachusetts and London: Harvard University Press, 2004).

humans closer together. More conservative writers thus saw in animals an example of the rational order that governed over all bodies, human ones included. More radical writers, on the other hand, emphasised not a shared rationality, but a shared sensibility, which they saw as the basis for human and animal sociality. In the eighteenth century, animals also began to be used as a means for developing nascent methods for governing human bodies as a 'population', as well as for controlling the animal bodies that became crucial contributors to the functioning and prosperity of human societies. Retracing how eighteenth-century observers used animals to develop and make 'visible' the idea of the 'population', the thesis has thus, through the lens of the insect, given a new picture of the emergence of the modern state which uses 'population' as its main basis for government.

My account has focused on the middle decades of the eighteenth century and ends before the years of the French Revolution. The connection between the observation of animals and theories of how to govern the population does not end there, however. On the contrary, the new political and institutional situation brought the 'population' as a technology for governing on the basis of physiological assumptions about 'human nature' – determined on the basis of observation of animals – to the forefront.

I would like to use the remainder of this conclusion to sketch briefly the relation between knowledge of animals and knowledge of how to govern human individuals and groups it has traced would go on to dominate political, economic and cultural theories. The upheavals of the Revolution accelerated the developments whose foundations I have analysed in the preceding pages. In the attempts of the new revolutionary regime to devise a government based not on the old feudal hierarchies but on the natural laws of the human species, population became the foundational concept through which they hoped to understand and govern France's citizens.[117] The statistical accounts of the population that the Physiocrats could only dream of were thus finally realised and the first full census took place under Napoleon in 1802. At the same time, the scientific study of animals' behaviours and anatomy continued to flourish. Even at the height of the Revolution, authorities invested heavily in making public the natural history collections at the *Muséum d'Histoire Naturelle,* which

[117] See in particular Joshua Cole, *The Power of Large Numbers: Population, Politics, and Gender in Nineteenth-Century France* (Ithaca and London: Cornell University Press, 2000).

opened in 1793.[118] Historians have examined the political function of the new *Muséum* and its elaborate displays as an instrument for public instruction; showing animals and plants was meant to persuade the public of the capacity of the new regime to transform and regenerate the natural and social worlds.[119]

As eighteenth-century fields of knowledge separated increasingly into professionalised, clearly demarcated disciplines,[120] students of animal and human societies respectively grew increasingly wary of accounts that explicitly used one field to explain or influence the other. The new discipline of biology, however, continued to support reconceptions of the human political, social and economic orders. Sometimes in subtle, sometimes in more open ways, animals provided models of or evidence for particular ways of governing human bodies. Social scientists continued to work on the basis of the concept of the 'naturalness' of the subjects of their science, while biologists continued to infer human 'nature' from animal, and insect, observations.[121] Natural history and biology in their many guises continue, to this day, to contribute to the formation of new technologies of liberal governmentality.[122] As naturalists began to complicate contemporary conceptions of animals as either God's messengers or as machines, and as they outlined ways in which even the vilest insects could be made useful and productive to the state as a whole, they simultaneously made it possible to think of men as infinitely more complex animals to be governed and controlled on the basis of similar methods. Throughout the nineteenth century, public administrators as well as social scientists made population control - in the forms of public hygiene, crime statistics, worries about over- and underpopulation - their central goal.[123] At the same time, biologists put forward theories of the evolution of the human species which could be used to support the expansion of commerce - at

[118] E. C. Spary, *Utopia's Garden: French Natural History from Old Regime to Revolution* (Chicago: University of Chicago Press, 2000), ch. four.
[119] Pierre Serna, 'The Republican Menagerie: Animal Politics in the French Revolution', *French History*, 28.2 (2014), 188–206; Spary, *Utopia's Garden*.
[120] *Entre belles-lettres et disciplines : Les savoirs au XVIIIe siècle*, ed. by Franck Salaün and Jean-Pierre Schandeler (Ferney-Voltaire: Centre International d'Etude du XVIIIe siècle, 2011).
[121] Timothy Clark, *The Cambridge Introduction to Literature and the Environment*, Cambridge Introductions to Literature (Cambridge ; New York: Cambridge University Press, 2011).
[122] Jake Kosek, 'Ecologies of Empire: On the New Uses of the Honeybee', *Cultural Anthropology*, 25.4 (2010), 650–78.
[123] Joshua Cole, in his account of population statistics in the nineteenth century, argues: 'the statistical portrait of population that became so ubiquitous in the nineteenth century had arisen first from the fertile imagination of the eighteenth-century Enlightenment.' Joshua Cole, *The Power of Large Numbers: Population, Politics, and Gender in Nineteenth-Century France* (Ithaca and London: Cornell University Press, 2000), p. 5.

home and in all corners of the Empire - as a tool for improving biological as well as social bodies.[124] Biological research thus continued to provide ways of experimenting with the question of how to reconcile individual and social bodies. In that sense, much of the Physiocrats' project, despite its initial failures, far outlived its theorists.

Despite the fact that the notion of 'population' as a political tool and its links with understandings of animal beings emerged in the eighteenth century, eighteenth and twentieth or twenty-first century uses of both the term and the tool are, of course, not identical. While it now seems 'natural' to us that governments should want to collect statistical information about the numbers, health, the birth and death rates, of their citizens, other aspects of the nexus between the natural sciences, theories of government and population have been lost with the changing historical circumstances. In particular, eighteenth-century theorists such as Quesnay, Mirabeau or the countless authors of agronomical texts insisted that their work brought genuine improvement to all strata of the population, as well as to the natural resources, animate and inanimate, of the state's territory. Of course, as we have seen, and as historians have frequently pointed out, the new eighteenth century tools for the government of self and others had ambiguous effects (and intentions). Enlightened practices for agricultural improvement, for example, brought a more comfortable life to many farmers. At the same time, as the example of beekeeping treatises has shown, the discourse and practices of improvement enabled writers and privileged landowners to treat their labourers as natural resources and thus exploit them further; filling the few hours of leisure time of property-less labourers with the manufacturing of bee hives, for instance, might improve the productivity of the farm, but not necessarily the lot of the workers, bee or human.[125] It has even been shown that the modern honey-bee body has gradually been transformed by the practices of her human keepers to lead a more productive but also shortened life.[126] This ambiguity between improving the lot of

[124] Peter J. Bowler, *The Fontana History of the Environmental Sciences* (London: Fontana, 1992), pp. 306–7.
[125] On changing labour relations during the period, see, among others: Michael Sonenscher, *Work and Wages: Natural Law, Politics and the Eighteenth-Century French Trades* (Cambridge University Press, 2012); Josef Ehmer and Catharina Lis, *The Idea of Work in Europe from Antiquity to Modern Times* (Farnham: Ashgate, 2009); William H. Sewell Jr., 'Visions of Labor: Illustrations of the Mechanical Arts before, in, and after Diderot's Encyclopédie', in *Work in France: Representations, Meaning, Organization, and Practice*, ed. by Steven L. Kaplan and Cynthia J. Koepp (Ithaca and London: Cornell University Press, 1986), pp. 258–86; *Manufacture in Town and Country Before the Factory*, ed. by Maxine Berg, Pat Hudson, and Michael Sonenscher (Cambridge: Cambridge University Press, 1983).
[126] Kosek, 'Ecologies of Empire'.

some while threatening the survival of others has, of course, only sharpened in our post-colonial world of environmental, social and financial crises. The circulation of goods, humans, animals and natural resources aimed at improving the lot of individuals and groups projected by Enlightenment improvers has thus been transformed by neoliberal post-war economists into a network of marketable values, maintained through the management and manipulation of the biological body of the 'population'. Exactly how the biological sciences from the nineteenth century onward have shaped, and have been shaped by, this transformation of political-economic theories is a matter that leaves us with open questions for future investigations.

Furthermore, despite rapid technological advances, insects continue to inform agricultural and scientific practices as well as understandings of human individuals and cultures. Insect pests continue to threaten the human food supply and insect vectors still cause world-wide epidemics, at the same as we become increasingly aware of the role of many insects - most famously crop-pollinating bees - in the maintenance of the fragile balance between human, animal or plant ecologies. Technologies continue to be developed in the context of pest control, but used for, and sometimes even driven by, military purposes or profits for multi-national firms. Similarly, we might argue that even as broad a social movement as environmentalism was influenced in no small part by the realisation that insects could not simply be eradicated through the use of synthetic chemicals,[127] but that even the most harmful species point to ecological processes that we do not fully understand. In that sense, environmentalists have inherited the perception of Enlightenment improvers that human well-being depended on taking into account the natural facts of humans and non-humans alike. Much has changed in research on animal life since Réaumur's investigations into the 'moeurs' of caterpillars or the mother instincts of spiders, but nevertheless we continue to turn to the insect world to further our understanding of ourselves. Evolution has of course replaced Providence as the framework through which the connection between insects and humans is perceived, but scientists and their readers continue to assume the possibility of learning about and controlling our own human behaviours, desires and relationships by studying our very distant evolutionary cousins. In order to overcome the problem of the massive scale of the human brain in the study

[127] As scientist and writer Rachel Carson famously exposed in her famous novel: Rachel Carson, *Silent Spring* (Boston: Houghton Mifflin, 1962).

functioning, for example, scientists are investigating the honey-bee brain as a small-scale model to help them understand decision-making and subjective consciousness.[128] At the same time, their colleagues funded by the US military complex are using bees to gain an edge in their empire-building 'war on terror'.[129]

One aim of this dissertation has been to show that insects have been mobilised for governing humans as well as animals. Observing insect life mattered in the eighteenth century because of the historically specific purpose of reshaping sovereign power so as to take into account the needs and passions of 'natural' human bodies. As naturalists peered down their microscopes to observe the 'nature' of insects, they thus learned how to observe and govern human 'nature'. Political economic goals shaped observations of bodies in 'nature', but these observations, in turn, shaped the meaning of 'human nature'. The search of such a 'nature', was, at least in the eighteenth century, closely linked to the exercise of power.

Reading some of the eighteenth-century scientific, literary and political-economic texts that have made it possible to conceive of humans and insects as bound together by natural as well as socio-economic processes can thus help us understand that neither the association itself nor the political economies to which it has contributed are 'natural' or unchangeable. While perceiving the link between insects and humans was as crucial to the maintenance of the balance of nature in the eighteenth century as it is to containing our present-day environmental crisis, we should not forget that the way we conceive of and shape this perceived link is inseparable from the theory of government in which is firmly embedded.

[128] James Gorman, 'Do Honeybees Feel? Scientists Are Entertaining the Idea', *The New York Times*, 18 April 2016, section Science.
[129] Kosek, 'Ecologies'.

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