The Scientific Revolution and Locke’s Image of the World

Version of 12/20/14

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Acknowledgements

I’m grateful to Antonia LoLordo, Richard Mason, Walter Ott, Chris Yeomans, and two anonymous referees for giving me comments on the whole of this book in draft. I’m grateful to Jeff Brower, Dana Tulodziecki, and Pat Boling for giving me comments on parts. I’ve had useful conversations or e-mail exchanges with Jan Cover, Pat Curd, Martin Curd, Dan Frank, Dan Smith, and Mark Smith.

Antecedents of much of this book previously appeared in other venues. I’m still grateful to all the people who helped me out with those papers. I'll restrict my repetitive thanks to the following: Rogers Albritton, who influenced me more than any other philosopher I ever met, John Carriero, whose arrival at UCLA dramatically improved my intellectual life, and Alex Rajczi, who gave me detailed comments on almost all the papers that went into this book.
References to works written before 1800 are cited in the following format:

**WORKS BY JOHN LOCKE**


Medical Notes Medical notes from Locke’s journals reprinted in Dewhurst 1963.


Morbus Morbus in Walmsley 2000. I expanded superscripts, used ‘th’ for thorns, and ignored deleted text in my quotations.

Review  Locke’s anonymous review of Newton’s Principia, Bibliothèque Universelle et Historique, 8: 363-75, 1688.


References to The Works of John Locke, 10 vols. London: Thomas Tegg, 1823 are by short title, volume, and page. The short titles are as follows:

1st Reply  ‘Mr. Locke’s Reply to the Bishop of Worchester’s Answer to his Letter’
2nd Reply  ‘Mr. Locke’s Reply to the Bishop of Worchester’s Answer to his Second Letter’
Books  ‘Remarks upon some of Mr. Norris’s Books Wherein He Asserts P. Malebranche’s Opinion of our Seeing All Things in God’
Conduct  ‘Of the Conduct of the Understanding’
Exam  ‘An Examination of P. Malebranche’s Opinion of Seeing All Things in God’
Letter  ‘A Letter to the Right Reverend Edward, Lord Bishop of Worchester, Concerning Some Passages Relating to Mr. Locke’s Essay of Human Understanding, in a Late Discourse of his Lordship’s, in Vindication of the Trinity’
Miracles  ‘A Discourse of Miracles’
to Anon.  ‘An Answer to Remarks upon an Essay Concerning Human Understanding’

WORKS BY ANCIENT AUTHORS

Works by Galen:

Other Authors from the Roman Era and from Late Antiquity


WORKS FROM THE MIDDLE AGES

Works by Averroes:


Other Works from the Islamic World:


Roger Bacon’s Opus Majus is cited first to Bridges’s edition and then to Burke’s translation


Works by Thomas Aquinas:
The critical edition of Thomas Aquinas’s works is Opera omnia, iussu impensaque Leonis XIII. P.M. edita, 26 vols. Rome: 1882-. I used the Latin text and search engine at http://www.corpusthomisticum.org and the Latin and English texts at DHSPriory.org


In DSS  Sentencia libri De sensu et sensate

QDP  Quaestiones disputatae de potentia
Ockham’s commentaries on Lombard’s Sentences are cited as follows:


**WORKS FROM THE RENAISSANCE:**

Vesalius’s *de Fabrica* is cited as follows:

de Fabrica *de Human Corporis Fabrica*. Johannes Oporinus: Basel, 1543


Images Nicholas Sanders (as Nicholas Sander). *A Treatise of the Images of Christ, and his Saints: and that it is unlawfull to breake them and lawfull to honour them*. Louvain: John Fowler, 1567.


Melancholy

SEVENTEENTH AND EIGHTEENTH CENTURY WORKS:

Scholastic Textbooks:
- Compendium
- Art
- Institutionum
- Philosophia
- Manuductio

Works by Francis Bacon:
- Confession
- NO

Works by Galileo:
- Assayer
- Discorsi

Work by Thomas Hobbes
- Leviathan
- Seven

Works by René Descartes
- AT
- CSM

Passions  *Passions of the Soul*, cited by section, in *CSM* v. 1 and *AT* v. 11.


Work by Antoine Arnauld and Pierre Nicole


Logic  *Logic or the Art of Thinking*, translated and edited by Jill Vance Buroker, Cambridge: Cambridge University Press, 1996

Works by Thomas Willis:


Brutes  *Two Discourses Concerning the Soul of Brutes, which is that of the Vital and Sensitive of Man: The First is Physiological, Shewing the Nature, Parts, Powers, and Affections of the Same, The Other is Pathological, which Unfolds the Diseases which Affect it and its Primary Seat; to Wit, the Brain and Nervous Stock, and Treats of their Cures: with Copper Cuts*, translated by Samuel Pordage. London: Dring, Harper, and Leigh, 1683.


Margaret Cavendish’s thirtieth *Philosophical Letter* is cited first to the original edition and then to Margaret Atherton’s edition:

Phil. Letters  *Philosophical Letters: or, Modest Reflections upon Some Opinions in Natural Philosophy, Maintained by Several Famous and Learned Authors of this Age*. London: 1664.


Works by Thomas Sydenham:
Methodus 1st  

Methodus 2nd  

Preface  

Works by Robert Boyle:


**Chymist**  
‘The Sceptical Chymist: or Chymico-Physical Doubts & Paradoxes, Touching the Spagyrist’s Principles Commonly Call’d Hypostatical, As They Are Wont To Be Propos’d and Defended by the Generality of Alchymists’

**Colours**  
‘Experiments and Considerations Touching Colours’

**Continuation**  
‘A Continuation of New Experiments Physico-Mechanical, Touching the Spring and Weight of the Air, and their Effects’

**Cosmical**  
‘Tracts Written by the Honorable Robert Boyle about the Cosmical Qualities of Things’

**Excellency**  
‘The Excellency of Theology, Compar’d with Natural Philosophy’

**Mechanical**  
‘Experiments, Notes, &c. about the Mechanical Origine or Production of Divers Particular Qualities’

**OFQ**  
‘The Origin of Forms and Qualities’

**Physiological**  
‘Certain Physiological Essays’

**Producibleness**  
“Experiments and Notes about the Producibleness of Chymicall Principles, Being Parts of an Appendix, Design’d to Be Added to the *Sceptical Chymist*”

**Respiration**  
‘New Pneumatical Experiments about Respiration’

**Spring**  
‘New Experiments Physico-Mechanical, Touching the Spring of the Air, and its Effects’

**Usefulness II.1**  
‘Of the Usefullnesse of Naturall Philosophy. The Second Part. Of its Usefulness to Promote the Empire of Man Over Things Corporeal’

**Usefulness II.2**  
‘Some Considerations Touching the Usefulness of Experimental Naturall Philosophy, Propos’d in a Familiar Discourse to a Friend by Way of Invitation to the Study of It: The Second Tome, Containing the Later Section of the Second Part’

**SPP**  

Works by Benedict Spinoza:

*Spinoza Opera*, 4 vols., Heidelberg: Carl Winters Universitätsbuchhandlung, 1925 are cited by the following short titles:

**Ethics**  

Louis de la Forge’s *Treatise on the Human Mind* is cited as follows


Works by Edward Stillingfleet:

**Trinity**  *A Discourse in Vindication of the Doctrine of the Trinity: with An Answer to the Late Socinian Objections Against it from Scripture, Antiquity, and Reason and a Preface concerning the different Explications of the Trinity, and the Tendency of the present Socinian Controversie*. London: Henry Mortlock, 1697.


Works by Robert Hooke:


Nicolas Malebranche’s *The Search After Truth* is cited as follows


Works by Isaac Newton:


**Principia**  *Sir Isaac Newton’s Principia*, reprint of the 3rd edition, Glasgow: James Maclehose, 1871.


Works by Gottfried Leibniz:


Works by George Berkeley are from *The Works of George Berkeley, Bishop of Cloyne*, edited by A. A. Luce and T. E. Jessop. London: Thomas Nelson and Sons, 1978 and are cited as follows:

**Notebook**  “Philosophical Commentaries,” cited by notebook and section.

**PHK**  *A Treatise Concerning the Principles of Human Knowledge*, in *George Berkeley: Philosophical Works*, cited by section. References are to Part I unless stipulated.

Works by David Hume:


Works by Other Early Modern Philosophers:

**unto Foster**  Robert Fludd, *Doctor Fludd’s Answer unto M. Foster or the Squeasing of Parson Foster’s Sponge, Ordained by Him for the Wiping Away of the Weapon-Salve*. London: Nathanael Butter, 1631.


|---------------------|-------------------------------------------------------------------------------------------------------------|
Chapter 1   Introductory

1.1  Tales of Science and Philosophy

What’s the relation between the scientific revolution and the history of early modern philosophy? “It is a commonplace,” according to Michael Friedman,

that the articulation of characteristically modern philosophy by Descartes and his successors must be viewed against the background of the scientific revolution of the sixteenth and seventeenth centuries. By emphasizing Descartes’s concern to replace the Aristotelian-Scholastic natural philosophy with the ‘mechanical natural philosophy’ of the new science, we can achieve a fuller deeper understanding of such characteristically modern preoccupations as, for example, the distinction between primary and secondary qualities, the ‘veil of perception,’ the mind-body problem, and so on” (38).

Such commonplaces are easier asserted than justified. In this book, I’ll defend and develop Friedman’s commonplace with respect to one of Descartes’s successors, John Locke. I’ll also try to follow up on Friedman’s promise of “the philosophical importance of a more fine-grained study of the interaction between the history of science and the history of philosophy” (ibid.).

My book works, if it works, on two levels. Friedman’s remarks suggest two projects that I want to take on: first, that by understanding the scientific background to Locke’s thoughts, we can solve persistent and vexing problems of interpretation; and, second, that by looking at the mechanisms by which scientific doctrines affect philosophical beliefs, we can learn something about the character of philosophical principles.

The first project is as an exposition of Locke’s views. Locke is a forthright author of clear English prose, but some of what he says can’t be understood except in light of its scientific background. The results of my approach, I hope, are deeper and better interpretations of his views on mechanism, substance, ideas, perception, and secondary qualities. I want to explain what he means by conceivable, what he thinks we would know
if we had a clear idea of substance, why he thinks matter in motion can’t naturally produce
sensation, why he thinks that we perceive a two-dimensional visual array and not the things
themselves, why he says that our ideas of primary qualities resemble something in bodies,
and why he thinks that secondary qualities are powers to produce ideas in us.

The parts of the book fit together as narrative. I explain why Locke believes that
mechanical qualities are explanatory and belong to bodies as they are in themselves. I next
tell the history behind Lockean ideas and describe their mode of production and their
manners of representation. I then put the pieces together, show how they entail that primary
qualities resemble something in bodies, while secondary qualities do not, and explain the
semantic consequences that Locke draws from these conclusions. Even though there’s a
story here, what comes earlier isn’t for the sake of what comes later. No one would say that
understanding the reasons behind Locke’s analysis of secondary qualities is intrinsically more
important than understanding the origin of the mind-body problem.

My second project is an attempt to reveal some of the machinery underlying the
history of philosophy. In addition to getting a better understanding of what Locke means, I
also want to get a better understanding of the ways the sciences leave their marks in
philosophy. I’ll try to show that his scientific beliefs affect the range of possibilities that he
thinks of as conceivable. I’ll also try to show that they affect his perceptions.

I think of these doctrines as lessons from Thomas Kuhn’s *The Structure of Scientific
Revolutions* (especially Chs. 6 and 10). Kuhn argues that scientific frameworks limit and shape
what their adopters perceive and conceive. Locke’s writings provide especially useful data for
evaluating these theses. He is up to his elbows in natural philosophy and interested in
carefully describing his perceptions and the range of the conceivable. In *An Essay Concerning
Human Understanding*, he uses a “Historical, plain Method” to investigate the workings of his
cognitive faculties (1.1.2). This amounts to looking inward and describing what he finds as he perceives, conceives, and intuits. His descriptions thus provide a petri dish for testing Kuhn’s theses. The experiment works as well as we could hope. It turns out that not everything Locke presents as passing before his mind’s eye is what an idealized and unbiased reflector would find.

Locke assumes that his descriptions of appearances proceed independently of considerations of anatomy, chemistry, and optics. In practice, what we expect to perceive affects what we perceive, and his natural philosophical assumptions affect his descriptions of simple ideas of sensation. Traces of his scientific conceptions may be found in his descriptions of our perceptions of causal connections, of solidity, and of the visual array.

By the time Locke wrote the Essay, almost every part of the medieval theory of perception had been overthrown by discoveries in optics and anatomy, so it isn’t surprising that he abandons most of it. We should attend to the way he rejects it, however. Instead of arguing that light is composed of imperceptibly small bodies on the grounds that that’s our best confirmed hypothesis, he argues that it’s inconceivable that perception works in any other way. Instead of arguing from the character of retinal imagery to the two-dimensionality of the initial presentation of visual experience, he writes as if it’s obvious that bodies present us with a two-dimensional array of color patches and handles the mapping of color patches to the retina separately.

Locke’s can’t conceive of corporeal interactions that go beyond mechanical models. Sometimes he treats the limits of conception as the negations of demonstrated truths, sometimes he treats them as merely psychological, sometimes he treats them as evidence for a rival hypothesis, and sometimes he treats them as mysteries requiring divine intervention. In every case, his favored models of natural philosophical explanation shape his boundaries.
of conception. There’s a feedback loop between his theory of conception and his preferred scientific theories. He presents his premises as if they were self-evident, but their evidence depends on his time, place, and project. The scientific revolution seeps into his first principles and observations without his noticing its contingency.

I assume throughout that fragments of previous theories live on in Locke’s philosophical thinking. This assumption certainly isn’t suggested by Kuhn’s talk of revolutions, but it’s compatible with it. Only the most radical revolution would extirpate every element of the old regime. Daniel Garber (2001) argues against Kuhn’s incommensurability thesis on the grounds that Descartes’s concept of the machine was just like that of his renaissance predecessors. Of course, no one thinks that Descartes invented western culture from scratch. He took some things from those who came before and he left the rest. Kuhn himself emphasized the local character of incommensurability:

Most of the terms common to the two theories function the same way in both; their meanings, whatever they may be, are preserved; their translation is simply homophonic. Only for a small subgroup of (usually interdefined) terms and for sentences containing them do problems of translatability arise (2000b: 16; see Hoyningen-Huene 212-13).

Any plausible version of a Kuhnian history of science or philosophy is going to have to allow for the partial character of scientific transformation.

The fact that fragments of old theories affect later thinkers is a consequence of the uneven development of thought. A new system doesn’t come with all the details filled in, so sometimes elements have to be borrowed or adapted from previous theories. Thus, Locke’s discussion of substance borrows scholastic terminology and principles of inquiry in describing puzzles at the foundations of his preferred theory of matter. His thesis that ideas of primary qualities resemble something in bodies is a leftover from the medieval theory of perception, a leftover that he uses while criticizing another part of that theory. His criticism
and revision of the scholastic analysis of secondary quality judgments sometimes appeals to devices from scholastic linguistics.

Though the major thesis of this book is that opinions from the sciences can determine thought and perception, it’s remarkable how little this malleability gets in the way of inquiry. Locke thinks that action at a distance is inconceivable and he produces a theory of ideas that entails as much. Even so, he let Newton’s work convince him of its actuality. Likewise, Locke sees the world as presenting him with a two-dimensional array of color patches. Even so, he’s never tempted to think that the world is flat and he derides doubts about the existence of the external world.

Many of the psychological effects that I’m interested in are ephemera that can come and go without much affecting the underlying arguments, evidence, and social processes that are the real engines of scientific opinion. A pure version of this view would be optimistic with respect to science (since passing philosophical fads aren’t obstacles to its progress) and cynical with respect to philosophical judgments (since they do no work).

I temper my cynicism about philosophy with three constructive points. First, some of these ephemera are interesting and important. In Locke’s hands sensible species became ideas, the incorrigible objects of perception and thought. People have described appearances for a very long time, but philosophical accounts of appearance had either denigrated them as second-rate judgments or embedded them in doubtful physical theories. Locke constructs ideas as pure seemings and pure conceptualizations, severed off from facts of light and anatomy, so that it doesn’t make sense to say that people could be wrong about them. The invention of ideas in the seventeenth century allowed for the invention of phenomenology as the study of an incorrigibly known realm of entities that may or may not correspond to the external realm.
Second, the notion of conceivability that Locke uses to justify his account of light, sound, and color is a disguised expression of his allegiance to his favored explanatory model. As such it is no better justified than the model, but, by the same token, it’s no worse justified. In my opinion, if we can base a framework of conceivability and intelligibility on our best justified scientific theories we will do as well as we can in tracking the true boundaries of possibility.

Third, there’s more to philosophy than introspecting the boundaries of conception and perception. Even those who consider science to be the best guide to reality and those who consider the ordinary person in the street to be the best judge of the outline of things can still grant useful tasks to the philosopher, for example, integrating science and ordinary thought. Here Locke’s analysis of secondary qualities is a shining model of how to proceed.

The psychological phenomena that Kuhn highlights are bumps on the road of rational scientific progress. The facts that people tend to see what they expect to see, that they assume the truth of first principles of the frameworks they’ve been handed, and that these principles can restrict the range of conceivable possibilities can get in the way of discovery. They are not, however, insuperable obstacles. As examples of those who overcame the barriers of incommensurability, we may include the inventors of new paradigms and their first followers. Kuhn himself figured out how to see things from another point of view by studying Aristotle’s *Physics* in order to teach a science class for non-scientists (2000a: 15-20). Many other people have studied the *Physics* as well, and figured it out in the same way, or by reading Kuhn or some other historian of science, or by taking a class.

The difficulties that Kuhn raises are more jagged in philosophy than in science. Scientists have technology and experiments to keep them honest. Philosophers rely more
upon introspection and inclinations. But if studying the history of science can broaden the range of intelligible possibilities and enable new ways of perceiving the world, then studying the history of philosophy can do the same. The best sort of history of philosophy lets us into the worldview behind philosophical texts that seem alien or foolish to the untutored eye and makes those texts intelligible, reasonable, and, in the ideal case, right. Doctrines that seem like nonsense can come out as sensible with sympathetic understanding and knowledge of background circumstances. I said earlier that some of Locke’s introspective reports of what he perceives and what he finds conceivable don’t seem like the reports of an idealized disinterested and unprejudiced observer. As the poet says, with the name changed, the story is about you.

1.2 Locke and Physiology

My topic is the ways in which Locke’s scientific views affect his philosophical views, so let me describe the origin of some of those scientific views. The story is complicated, interesting, and tells us something about the character of his resulting opinions. Before he writes the first drafts of the *Essay*, his deepest engagement with what we would today call natural science occurs during his physiological speculations in Oxford in the 1660s. Later practical experience with medicine in London sours him on the prospects of speculative explanations. The final result is the chastened and tentative adoption of a mechanical physical theory.

The intelligibility of our artifacts suggests to many seventeenth century thinkers that the principles that ultimately explain the operations of machines also explain the operations of natural bodies. Robert Boyle was among them, arguing, “almost all sorts of Qualities . . . may be produced Mechanically—I mean by such Corporeall Agents as do not appear, either
to Work otherwise than by vertue of the Motion, Size, Figure, and Contrivance of their own Parts” (OFQ 5.302 =SPP 17; Anstey 2000: 2-3). We may call this belief ‘corpuscularianism’ when conjoined with the premise that the details of the analogy between machinery and the natural world depend upon the sub-microscopic textures of ordinary bodies and upon the rapidly moving, imperceptibly tiny corpuscles that surround these bodies. Pierre Coste, who translated the Essay into French under Locke’s guidance (Woolhouse 2007: 425), translates the expression ‘the corpuscularian Hypothesis” as the “hypothesis of materialist philosophers who explain the effects of nature solely through consideration of the size, shape, and motion of the parts of matter” (4.3.16 French).

Around 1660, when Locke is 27, he starts reading Descartes and meets Boyle. A notebook from 1660 contains 36 passages copied from Descartes’s works, mostly from the Principles of Philosophy and mostly on the characteristics of bodies (Rogers 1998a: 25, Milton 1994: 37-39). In a letter that Damaris Masham writes to help compose an elegy for Locke, she reports,

> The first Books (as Mr Locke himself has told me) which gave him a relish of Philosophical studys were those of Descartes. He was rejoiced in reading of these because tho’ he very often differ’d in Opinion from this writer, he yet found that what he said was very intelligible: from whence he was incourag’d to think That his not haveing understood others, had, possibly, not proceeded altogether from a defect in his Understanding (Rogers 1998a: 23-24; Woolhouse 2003: 173; cf. Letter 4.48-49; Woozley 10-11).

At about the same time Locke discovers Descartes, he becomes good enough friends with Boyle to have access to his library and to loan his books out to others (LC #101 1.151; Stewart 1981: 21, 30-31, Woolhouse 2007: 34-35). He begins accumulating Boyle’s works, taking notes on many of them, and he eventually accumulates sixty of these, several of them the gifts of the author (Library ## 413-73; Rogers 1998b: 71).

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1 Some historians of chemistry use the term ‘corpuscularian’ to refer to any chemical theory that appeals to small particles as agents. That isn’t what Locke means in 4.3.16 or what I mean by the term.
Locke’s exposure to Descartes and Boyle leaves a corpuscularian mark. In *Essays on the Laws of Nature*, lectures on the principles of ethics that he gives at Oxford in 1664, he asserts that the affections of bodies, “namely, lightness, weight, heat, cold, colors, and the rest of the qualities obvious to sense . . . can all be brought back in some way to motion” (*Essays* 151; Walmsley 2004: 17). The passage doesn’t exactly commit Locke to corpuscularianism, since qualities might all be reducible to motion in some sense without all the fundamental qualities being mechanical, but the remark is probably offered in a corpuscularian spirit.

In 1663 or 1664, Locke takes up an interest in physiology, and in particular in the physiology of respiration (Milton 2001: 227). The principle that sensible qualities can be explained by motion isn’t evident in this research, nor does he try to reduce everything to mechanical qualities.

Oxford physiologists of the 1650s and 60s thought themselves as heirs of William Harvey’s inquiry into the functions of circulation and respiration, though without some of his Aristotelian assumptions (Frank 1980: xiii-xiv). Thomas Willis, an important member of that community, claimed that fermentations in the blood play a central role in biological functions (*de Ferm* 20-31, 97-117=*Fermentation* 11-17, 57-67; Isler 52-54, Frank 1980: 165-69), a doctrine he shared with his Flemish predecessor, the natural philosopher Jan van Helmont. According to van Helmont, ferments are the source of seminal capacities and combine with water to produce seeds (*Ortus* 29; Pagel 1982: 71).

In 1661 and 1662, Locke attends Willis’s lectures, and he supplements his notes with notes taken by Richard Lower in other lectures Willis gave (*Lectures* 42-46; Dewhurst 1963: 11-12, Frank 1990: 122). Hansruedi Isler (174-79) sees Willis’s influence in Locke’s analysis
of the distinction between idiots and madmen, in his comparison of the understanding to a
\textit{camera obscura}, and in his treatments of reflection and intuition.\textsuperscript{2}

At Oxford in 1664 and 1665 Locke collaborates with Lower in experiments
investigating the physiological role of air and begins speculating on the way that air might
enable fermentations (Walmsley 2007: 459-60). In notebook entries, he conjectures that
since fermentation produces volatile stuffs, animal substances may be volatile because of
fermentation occurring in them (Walmsley 2007: 460-61). He supposes that air normally
contains an agent that makes both combustion and respiration possible (\textit{Usus} 18-19). He also
supposes that the tendency of people to swoon in closed rooms is caused by the extraction
of this agent from the air and that miners’ lanterns and miners both grow weaker as air
becomes exhausted (\textit{Usus} 20-23; Frank 1980: 196, Walmsley 2007: 470, Woolhouse 2007:
69).

In another notebook entry he reports Robert Hooke’s suggestion that aerial niter
mixes with blood through respiration and allows fermentation to occur (Frank 1980: 117-
21). Niter is saltpeter, which is potassium nitrate, and the idea that an aerial version of it
might be essential to life and combustion goes back to the Paracelsan work, \textit{Liber Azoth}
(Debus 1964). Locke suggests that its absence explains why it’s difficult to breathe on the
peaks of high mountains (Frank 1980: 186, Walmsley 2007: 461-64, see also \textit{Usus} 20-21;
Anstey 2011b: 184). He reports Lower’s experiments showing that blood from veins and the
pulmonary artery is darker than blood from other arteries and speculates that niter in the air
gives arterial blood its color and makes it volatile:

\textit{Aer} probably it is the nitrous salt in the aier that gives it [blood] the

tincture & volatilizes it, & the volatile part in circulation being either

\textsuperscript{2} Paul Cranefield (80) and Bradley Lega (573) argue that Locke was indebted to Willis for the doctrine that all
of our ideas originate in experience, but, as Cranefield observes, the doctrine was common piece of
Aristotelianism, so Locke may have picked it up elsewhere.
transmuted into nourishment of the part, the remaining bloud in the veins is less spiruous & both in colour and consistence comes nearer a caput mortuuum [lit. dead head, the inert remnant of chemical procedures], & therefore is returned by the veins to the lunges & heart to be new volatilized & soe by succession is made all volatile (Frank 1980: 187-88).³

Locke suggests testing this hypothesis by distilling venous and arterial blood and seeing whether the results contained equal quantities of salt (Frank 1980: 188, Woolhouse 2007: 59).

In another entry written in 1666 or 1667 Locke appeals to “seminall principles or ferments” to explain at least some diseases. Both seminal principles and ferments are terms of art from van Helmont, who thought that ferments produce seeds that transmute water into living things (Ortus 139; Dewhurst 1963: 28, Romanell 60, Walmsley 2000: 371). He defines them as “subtile parcelles of matter which are apt to transmute far greater portions of matter into a new nature” (Morbus 391), which is in line with van Helmont’s usage, but doesn’t commit him to every bell and whistle in van Helmont’s. He proposes this as a “more rationall theory of deseases . . . then those either of the Galenests or Paracelsians” (Morbus 390-91; Walmsley 2000: 379-81), though the contrast with Paracelsianism is a little obscure. Van Helmont was a Paracelsan, broadly speaking (Anstey 2002a: 570).

In the notebook entry, Locke first argues for the necessity of seminal principles in the generation of plants by arguing against alternatives.⁴ Plant generation can’t be determined by the matter in which the seed is planted, since different seeds give rise to different plants in the same earth and nourished by the same water.⁵ Nor can it be explained through a

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³ Here and elsewhere, I write thorns as ‘th’.
⁴ In the early 1660s, as an empirical supplement to his study of medicine, he assembles about 1600 specimens of plants from around Oxford (Dewhurst 1963: 8-9); later, by means of his connections in France, he helps transfer seeds back and forth between Montpelier and the Oxford Botanic Garden (Harris and Anstey 2009).
⁵ Locke writes that some changes “seem wholly to depend upon the operation or activity of this seminall principle, & not on the difference of the matter its self that is changd, soe several seeds set in the same plot of earth, change the moisture of the earth which is the common nourishment of them all into far different plants” (Morbus 391). The standard interpretation of this passage (Walmsley 2000: 382, Woolhouse 2007: 76, Anstey 2011b: 198-200) is that Locke supposes the seeds are qualitatively similar, so any difference in their products
straining mechanism, since that wouldn’t explain the different constitution of plant parts
(Morbus 391; Romanell 58, Walmsley 2000: 382-83). (Such a straining mechanism also can’t
explain how a chick with hard parts is produced out of liquid in an egg, Morbus 391.) He then
suggests that it’s worth investigating what diseases are caused by these ferments, and argues
that these corrupt the blood through and through or diseases wouldn’t be localized to
specific parts of the body (Morbus 391-92, Romanell 62).

Willis thought “every disease rouses its tragedies through the power of some
ferment” (de Ferm 26= Fermentation 16), but he seems to have thought of ferments as chemical
processes that upset the normal behavior of bodily fluids. So, for example, he asserts that
epilepsy is at least sometimes caused by “vitriolic and fermenting matters” agitating cerebral
spirits (Lectures 80) and hysteria is caused by excessive fermentive particles being deposited in
cranial fluids, which then provokes motions in the fluids in nerves (Lectures 89). Locke isn’t
thinking of ferments as agents of turbulence. Instead, he’s thinking of them as van Helmont
did, as biological agents that transform matter.

We can’t confidently infer that Locke rejected corpuscularianism at the time on the
basis his appeal to ferments, seminal principles, and aerial niter, since he may have thought
of these as stopgap explanations that could ultimately be explained by corpuscles and their
mechanical qualities. Boyle was interested in fermentation (e.g. Usefullnesse II.1 3.350-58;
Clericuzio 1990: 568), appealed to seminal principles in his writings (e.g. Chymist 2.275-76,
279, 345-46; Clericuzio 1990: 584-87, Anstey 2002a), and published an important experiment
in which he transformed and reconstructed niter (Physiological 2.93-113; Frank 1980: 121-28,
Clericuzio 1990: 574-77, Newman 1998a: 210-12). To be sure, Boyle’s remarks about

have to be due to their internal seminal principles. I think that the “several” seeds are supposed to be
qualitatively distinct and the point is that the difference in the resulting plants is due to the difference in the
seeds and not any difference in the dirt or water from which they arise (see OED s.v. ‘several’ 2c). That would
makes sense of the text and be prosaic botany.
fermentation are about ordinary, undisputed cases of fermentation, and his experiments on niter were on ordinary saltpeter. Still, in his attempts to show that niter was a composite of fixed niter and spirit of niter, he didn’t try to attempt to reduce all their properties to mechanical ones. He was committed in principle to the reduction of explanatory principles to mechanical bases, but he also believed in the legitimacy of explanation through intermediate principles that hadn’t yet been explained (Physiological 2.21-25; Sargent 133-36, Newman and Principe 2002: 254-56).

While Locke investigates respiration and disease he continues to collaborate with Boyle. In 1666, Boyle asks Locke to carry out some barometric observations in a mine in the Mendip hills, a mission that is scrapped when the miners wouldn’t cooperate (LC #197 1.273-97; Dewhurst 1963: 16-17, Woolhouse 2007: 67, Walmsley 2007: 466). Also that year, Locke answers Boyle’s plea for a natural history of weather by undertaking a very long-term project to record temperature, barometric pressure, and the strength of the winds, “apparently the earliest daily sequence that we possess” for English temperature measurements (Manley 391, see also Anstey 2011b: 54-57). Boyle later dedicates his natural history of human blood to Locke, a work that includes queries that Locke may have come up with during this period (Walmsley 2007: 476). Locke prepared Boyle’s General History of the Air for publication during the latter’s last illness in 1691; Though Locke’s speculations

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6 Jonathan Walmsley has usefully emphasized the non-corporeal character of Locke’s physiological speculations. He presents them as criticisms of Boyle’s work (2000: 367, 2007: 454), but I’m inclined to think of them as developments of Boylean suggestions. It is true and important that Locke doesn’t show any concern to fit these suggestions into a wider corporealistic picture, but Walmsley creates some false tension by transforming Boyle’s disjunctive and tentative hypotheses into categorical assertions. So, for example, in Boyle’s essays on his experiments on the spring of the air, he sympathetically presents two hypotheses on the function of breathing and offers some reasons for thinking that neither can be a complete explanation (Spring 1.282-89; Frank 1980: 145-46, Walmsley 2007: 457). Walmsley seems to take the first hypothesis as “Boyle’s theory” and takes Locke’s development of the second hypothesis to be evidence that he was “moving away from Boyle’s views on respiration” (Walmsley 2007: 471, 475). Walmsley also treats Locke’s criticism of an account of plant generation through straining as a criticism of Boyle, even though Boyle doesn’t wholeheartedly embrace such an account, but only declares that the botanical transformations produced by grafting might be done “by the help of some peculiar kind of Strainer, or by the Operation of some powerful Ferment lodged in it, or by both these, or some other cause” (OFQ 5.388; Walmsley 2000: 384, see also Anstey 2002b).
during the 1660s use non-corpuscularian concepts in speculative explanation in a way that we don’t find in his later work, they don’t mark a sharp break with Boyle’s thought.

1.3 Sydenham and Corpuscular Skepticism


Before Locke meets him, Sydenham is a not especially famous doctor who had published an essay on fevers, which had not yet become the object of general acclaim in the medical community (Dewhurst 1963: 34, Anstey and Burrows: 17-18). That book isn’t free from theory, but at certain points he advocates acknowledging ignorance. After giving an account of intermittent fevers as running cycles of tremors, boiling, and expulsion, he considers the question of why a single cycle isn’t enough to get rid of the source of a fever and “plainly confesses that I don’t know” (Methodus 1st 89=2nd 100/101). Sydenham compares the problem to other hard problems and declares, “if a thing is no less difficult and perhaps altogether inexplicable, I would keep hands away from aetiology” (Methodus 1st 90=2nd 102/103; Walmsley 2008: 67).

Locke is enormously impressed with Sydenham. Soon after meeting him, he writes a poem which is appended to the second edition of Sydenham’s treatise on treating fevers. In it, he credits with Sydenham with curing the plague through bloodletting (Methodus 2nd
14/228; Walmsley 2008: 68). In the epistle to the reader at the beginning of the Essay, he lists Sydenham along with Boyle, Christiaan Huygens, and Isaac Newton as “Master-Builders” of the age (Epistle 9-10; Romanell 43-44). In a letter to Thomas Molyneux after Sydenham’s death, Locke describes medical theories “for the most part a sort of waking dreams” to which their advocates “endeavor to sute the phaenomena of diseases, and the cure of them, to those phansies” (LC #1593 4.628). He wonders “that, after the pattern Dr. Sydenham has set them of a better way, men should return again to that romance way of physick.” (ibid. 4.628-29). Hypotheses based on observations of disease might be useful aids to memory “but not to be rely’d on as foundations of reasoning, or verities to be contended for; they being, I think I may say all of them, suppositions taken up gratis, and will so remain, till we can discover how the natural functions of the body are perform’d” (ibid. 4.629). The proper method of medicine, Locke tells Molyneux, is “to observe well, and so by analogy argue to like cases, and thence make to himself rules of practice”; this method is the one “which with so much approbation Dr. Sydenham had introduc’d into the world” (ibid. 629-30; Dewhurst 1963: 309-11).

A good amount of ingenuity has gone into sorting out the relations between Locke and Sydenham. Kenneth Dewhurst (1966: 73) took the bold stroke of claiming that two essays written in Locke’s hand were actually by Sydenham, with Locke acting as a secretary, on the grounds that Locke would not have had the effrontery to present Sydenham’s thought as his own. Following up on arguments by Guy Meynell (1994), Peter Anstey and John Burrows (2009) use computerized stylistic analysis to show that Locke is, in fact, the author of the papers.

The current state of scholarship has swung in the other direction. Meynell (1996, 2006) argues that parts of the preface to Sydenham’s Observationes Medicae are indebted to
Locke. Much of Sydenham’s recent reputation as an epistemologist of medicine rests on that preface; for example, almost all of the references R.M. Yost’s (1950) “Sydenham’s Philosophy of Science” come from it. Meynell (2006: 101) concludes that the preface is still mostly Sydenham’s work, in part because of the high praise that Locke heaps upon him. Anstey is more reluctant to give Sydenham credit, arguing that Locke’s merely praises Sydenham as a representative of experimental philosophy and not for any of his original beliefs (2011a: 470-71).

Locke’s ode to Sydenham in the second edition of Methodus shows at least that in 1668, he thinks that Sydenham is an important, innovative thinker, but here too it’s difficult to separate out Sydenham as he is in himself from Sydenham as he appears to Locke. Locke praises Sydenham for rejecting previous theory (“He doesn’t rashly accuse hidden putrefying fires/nor will there be a fictive humor that warms fevers”), even though humors have a central place in Sydenham’s account of disease (Preface ¶18). As Yost (1950: 101) observes, “in nearly all his published Disease Histories it seems plain that most of the treatments he tried out were those which would be likely to succeed if Hippocrates’ humoral pathology were true” (see also Sydenham 1966: 60-62, Romanell 77). Officially, Sydenham’s method calls for the creation of natural histories that are free of hypotheses (Preface ¶9), a goal which is easier stated than achieved (Kuhn 1970: 16-17).

Locke came into their relationship with more knowledge of Francis Bacon’s epistemology and of theoretical medical literature. Sydenham came with more clinical knowledge and with an anti-authoritarian attitude (Meynell 1996: 65). Upon being asked for book recommendations by a student, Sydenham replied, “Read Don Quixot, it is a very good Book, I read it still,” (Dewhurst 1966: 49, Meynell 1988: 71). After they meet, both
Sydenham and Locke’s views seem to swerve towards skepticism about hypotheses, swerves that I would attribute to their conversations and exchanges.\(^7\)

One of the disputed essays that Locke writes during this period is on anatomy. He argues that the anatomical experiments done in Oxford earlier that decade was of limited use to physicians, who should instead take detailed histories of their patients’ diseases and devise treatments without generating hypotheses about the underlying mechanisms involved. Knowing the fluids that ordinarily come from an organ doesn’t teach us the function of the organ (\textit{Anatomia} 87). Nor does knowing the anatomy of organ tell us the causes of discharges that occur when a patient is sick:

\begin{quote}
when a man findes the excretion & colour of the seed praeternatural in a virulent gonorrhea & he that knows all the texture & constitution of that part is as far from knowing the cause of the yellownesse or acrimony of the seed at that time as he that has never seen \textit{any more of} a testicle, than a \textit{dish} lambstones fried & served up to a table (\textit{Anatomia} 90)
\end{quote}

Physiological causes work at the insensible level, and observational anatomy can’t help us find them (\textit{Anatomia} 91). Working with Sydenham convinces Locke to be skeptical about our prospects for formulating practically useful explanations of how nature produces biological effects (Woolhouse 2007: 80-81, Walmsley 2008).\(^8\)

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\(^7\) On Sydenham’s increasing skepticism about hypotheses, see Patrick Romanell (76-85) and Anstey and Burrows (19, 21-26). Both Romanell and Anstey treat the line of influence on this subject as one-directional. Romanell sees Locke’s agnosticism as present “from the very beginning of his career,” pointing to the passage in \textit{Morbus} where Locke denies that he knows how ferment might produce diseases (85). That denial isn’t really any more general or philosophical than Sydenham’s early concession that he can’t explain why a single cycle of fever and expulsion doesn’t cure an intermittent fever. Perhaps as a way of downplaying Sydenham’s influence, Anstey (2011b: 40) suggests that Locke’s new reflections on anatomy may be triggered by his involvement in the surgical procedure carried out on Lord Ashley. I think it’s more likely that Locke comes to doubt the importance of anatomy for medicine by watching Sydenham treat infectious diseases rather than by considerations connected with surgery, since surgery without anatomical knowledge is just cutting at someone with a knife. The first line of \textit{Anatomia} in Locke’s handwriting concedes “Anatomie noe question is absolutely necessary to a Chirurgien” (85)

\(^8\)According to Anstey, \textit{Anatomia} “is a further indication of the sort of physician that Locke had become and this is decidedly different to the orientation of Sydenham” (2011a: 463-64). Anstey’s point is not that Sydenham believes in the importance of anatomy. John Ward’s notebook tells us that Sydenham downplayed its importance and Sydenham tells Hans Sloane “as for anatomy, my butcher can dissect a joint full as well; no, young man, all that is stuff; you must go to the bedside, it is there alone you can learn disease” (Dewhurst 1966: 48, 73, Anstey and Burrows 24). Instead, Anstey’s point is that Locke’s attitude towards anatomy is a
In his writings after leaving Oxford, Locke pretty much stops appealing to ferments or other Helmontian notions. Two exceptions are worth noting. In a journal entry from 1684, he describes colic as arising “from a convulsive constriction of the guts furente archaeo [the archeus being enraged]” (Medical Notes 262, Romanell 103-04, Milton 2001: 239). ‘Archeus’ here seems to refer to the governing principle of an organ, which was van Helmont’s doctrine (Ortus 237; Pagel 1982: 100). Locke makes this note even though in Anatomia, he implies that van Helmont’s explanation of the term is “obscure & insignificant” (Anatomia 92; Milton 2001: 241, Walmsley 2003: 422). This goes to show that it’s possible to fall into using expressions that aren’t entirely helpful, for lack of anything better.

Second and more important is a note that Locke writes in 1678 in Orleans:

All doctors up to the present century seem to me to have failed, because in the cure of diseases they have given little thought, or none at all, to the specific nature or particular ferment or fault (whatever in fact that is) of each disease, and considered solely the bile or phlegm or serum which are only the external symptoms of the diseases, and no more concerned with their specific natures than the type and richness of the soil is to the species of plants which may grow in it (Medical Notes 136).

Locke’s point is that traditional medicine emphasizes the ratio of humors to one another, but what ties the symptoms together is something else. In Morbus, his point was that ferments were needed as a mechanism, since straining, for example, couldn’t do the job. Here his characteristic feature of chymical approaches to medicine, and that Sydenham wasn’t an iatrochemist. Let me argue against this inference. First, the iatrochemist with whom Locke has the deepest engagement is Willis, who was a great anatomist and attempted to integrate that knowledge with his medical practice. Second, parts of de Arte Medica and Anatomia are directed against chemical approaches to physiology. In particular, Locke asserts that someone who thinks “acquaintance he has with sulphur & mercury” is useful for treating fevers “may as rationaly beleive that his Cooke owes his skill in rosting & boyling to his study of the elements” (de Arte 81; Walmsley 2012: 267) Locke also argues that digestion can’t be explained by stomach acid, since hearing bad news can upset the appetite, “though noe body can think that the juice in the stomach is by such an accident made lesse acid then it was before” (Anatomia 91) and that knowing that acidity in the blood causes a disease wouldn’t be useful, since we don’t know how to properly deliver a counter-acting agent (Anatomia 92-93; Walmsley 2012: 266-67). And, third, a modified version of Meynell’s argument that Sydenham significantly contributed to the Preface applies here. Locke wouldn’t list Sydenham as among the master builders of the age in 1689, if he thought that there were a better living model for how to think about medicine. So his approach to medicine couldn’t be decidedly different from Sydenham’s (Walmsley 2012: 278-80). For that matter, if his approach to medicine were decidedly different, he wouldn’t have asked Sydenham for advice about his own health (L.C ## 295, 314 1.416, 1.450; Woolhouse 2007: 116, 134).
point is that something different from blood, bile, and phlegm is needed for classifying and treating diseases: “I have no doubt that to cure each type of disease either a fixed method or fixed remedies are needed” (ibid.; Walmsley 2012: 256n32). The preface to Sydenham’s *Observationes* makes some similar remarks about getting at the specific nature of diseases, saying that it was important to describe “peculiar and perpetual phenomena separately from accidental and foreign ones” (*Preface* ¶10; Yost 1950: 91). Locke is using Helmontian terminology to make a methodological point about how to classify diseases.

Locke seems to have given up on the project of finding medically useful explanations for physiological phenomena after working with Sydenham. Whereas he had once been on the forefront of research of respiration, he now concludes that such inquiries were a waste of time:

> whether respiration serve to coole the bloud, or give vent to its vapours, or to adde a ferment to it, or to pound & mix its minute particles . . . .
> controversies about it are like to arise rather more doubts than any cleare determination of the point & all that anatomy has donne in this case as well as severall others. is. but to offer new conjectures & fresh matter for endlesse disputations (*Anatomia* 88; Woolhouse 2007: 86-87, Walmsley 2007: 474, 2008: 71).

He retains this skepticism throughout his life, but it later takes a particular form.

By 1671 Locke assumes, at least as a tentative best hypothesis, that the sensible qualities of a body are determined by the texture of its solid parts, though the particular texture can’t be discovered by us (Yost 1951: 122-30). Garber (1982) calls this doctrine ‘corpuscular skepticism,’ and it raises a puzzle. Corpuscular skepticism is a form of corpuscularianism. Why would natural philosophers believe in corpuscularianism if they didn’t think that it could explain any particular phenomenon? Given his physiological researches in the 1660s, the explanation isn’t that he wasn’t exposed to alternatives to

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⁹ Locke calls the cause of diarrhea a ‘ferment’ in another note from 1678 (*Medical Notes* 108-09; Walmsley 2012: 256n32).
corpuscularianism or that he wasn’t tempted by them. Instead of suspending judgment,
Locke assumes the probable truth of corpuscularianism in his assertions and his illustrations.

Locke left Oxford with a head full of theories. His experience with the practice of
medicine convinces him that we can’t find hypotheses that explain natural phenomena. This
skepticism washes away his confidence in theories whose justification rests their ability to
explain the phenomena. The only reason to believe in irreducible chemical qualities is
because of their success in explaining natural phenomena. Corpuscularianism, however, has
justifying features other than its capacity to explain particular phenomena. In particular,
Locke thinks that its defenders can appeal to persuasive analogies and conceivability
considerations to justify the doctrine. As a result, he comes to think that corpuscularian
principles explains most phenomena in theory, but in practice such explanations are
inaccessible to us.

In Draft A, written four years after *Anatomy*, Locke asserts that cohesion works on
mechanical principles on analogy with carpenter’s joints. There, he declares that if we had
senses that could discover to us the particles of water their figure site motion
&c when it is fluid. And also the different postures of those very particles, or
the addition or seperation of some particles &c when the water was frozen .
. . we should as know the very modus or way whereby cold produces harness
& consistency in water, as we doe the way how a joyner puts several pieces of
wood togeather to make a box or table which by tenants nails & pins we well
enough perceive how it hangs togeather (*Draft A §15*)

If we could see better our knowledge would be like the carpenter’s knowledge of dovetail
It doesn’t tell us why water is liquid at room temperature and iron solid since we don’t know
the particular structures that underlie ice and iron at ordinary temperatures. The view rests

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*Walmsley (2004: 32-33) takes Locke’s mention of addition and separation to be a likely reference to non-
mechanical, chemical accounts of cohesion. This doesn’t seem probable in context. For one thing, the
suggestion neglects Locke’s analogy to carpentry. Gaukroger (64-66) also denies that there’s corpuscularianism
in Draft A, but he doesn’t wrestle with §15. In the preceding section 14, Locke describing the melting of lead as
a case of pulverization, which is a corpuscularian way of thinking of the process.*
on a comparison: the rigidity of iron is a like the rigidity of a chair, and so, perhaps, rests on
a similar basis.

How does Locke’s pessimism about finding explanatory medical hypotheses show up
in his later epistemology? Locke is complicated and his work contains multitudes. He didn’t
give up all hope of dramatic progress in natural philosophy. At Essay 4.17.7 he approvingly
cites Richard Hooker’s hope for new methods of inquiry that would lead to a great leap
forward. At 4.12.15, he suggests that something analogous to algebra might lead to
scientific progress (see also 4.17.11). He does sometime engage in physiological speculation
in the Essay. He lightly touches on the possible material underpinnings of memory in the
chapter on retention (2.10.5), and he advances an account of sensory adaptation of the
sensation of temperature that appeals to the speed with particles travel in our nerves (2.8.21).
These remarks, however, are surrounded by hesitation and apology.

In 1694, soon after the publication of the second edition of the Essay, Locke writes a
notebook entry in which he offers a ringing endorsement of inference to the best
explanation as a method for inquiry. He declares,

The way to finde truth as far as we are able to reach in this our darke & short
sighted state is to pursue the hypothesis that seems to that seems to us to
carry with it the most light & consistency as far as we can without raising
objections or striking at those that come in our way till we have carried our
present principle as far as it will goe & given what light & strength to all the
parts of it” (Method 70-71)

Locke applies the ‘hypothesis’ widely throughout his writings, usually derisively, but
sometimes to conjectures that he means to endorse: for example, his speculations about the
possible mechanism underlying Noah’s flood (Education §192), his doctrine that citizens have
no obligation to obey a legislature that unjustly seizes their property (TT 2.224), the
Copernican hypothesis (Education §180), and the corpuscularian hypothesis (4.3.16;
Farr 56-64). In the 1694 notebook entry, Locke treats the existence of God as a hypothesis (Method 71-72).

Notwithstanding all that, with respect to hypotheses about the real essences that explain the discoverable properties of bodies the official doctrine of the Essay is that we “must beware of Hypotheses and wrong Principles” (4.12.12) and that “most (I had almost said all) of the Hypotheses in natural Philosophy” are “really, at best, but a very doubtful conjecture” (4.12.13; Anstey 2011b: 73). All we can do with respect to individual bodies is observe the co-existence of properties, since we can’t discover the underlying structures on which they depend: “in the Knowledge of Bodies, we must be content to glean, what we can, from particular Experiments: since we cannot from a Sheaves; and in bundles, comprehend the Nature and Properties of whole Species together” (4.12.12). When we can’t see a priori that properties entail one another, the only basis for making judgments about the co-existence of properties is through “Experience, Observation, and natural History” (ibid.). As an illustration of the benefits of the study of nature properly understood, Locke includes use of quinine to treat fevers (ibid.).

Locke’s remarks are a straightforward generalization of the methodological principles advanced in the Preface to Sydenham’s Observationes. Sydenham writes,

And as it is plainly impossible for the doctor to learn the causes of a disease which have no commerce whatsoever with the senses, so neither is it necessary. For it is abundantly sufficient for him to know the immediate source of the harm and those effects and symptoms that effectively distinguish this disease from another, similar one (Preface ¶20).

We can’t hope to understand the mechanisms underlying diseases. The best that we can do is see what symptoms hang together, and then see what treatments give relief (ibid. ¶5-17).

According to Locke, with respect to unknown explanatory structures, “Analogy in these matters is the only help we have, and ‘tis from that alone we draw all our grounds of
Probability” (4.17.12; Hesse 123-24, Anstey 2011b: 80, 158). Insofar as Locke’s corpuscularianism rests on analogies, we want to look at them very carefully.
Chapter 2  Three Varieties of Conceivability

2.1  Mathematics and Machinery

Locke’s Essay is primarily an account of knowledge. Its second book is an account of how we acquire the raw materials of knowledge, and Book IV is mostly an account of how we perceive connections among those raw materials. (Book I is an attack on a rival account, Book III a detour into language.) Two sorts of inconceivability fall out of Locke’s picture immediately: first, a strong variety that attaches to the negation of something known to be true through intuition or demonstration, and, second, a merely psychological sort that arises from the absence of a requisite idea. It turns out that we need to appeal to a third sort of inconceivability in order to make sense of Locke’s argument for a corpuscularian theory of perception. In this chapter I consider the interplay between these three notions of inconceivability and his preferred physical theory; in this first section of the chapter, I’ll discuss the inconceivability of something that’s been demonstrated false.

Locke expresses his belief that this kind of necessity partly governs nature in an indirect analogy that he draws between mechanical explanation and mathematical proof. For him, both are at least potentially like explanations of natural phenomena. He supposes that if we could perceive the sub-microscopic world, then we would be able to understand and predict various power of bodies. For example, we would be able to figure out pharmacological properties independently of experience:

...did we know the Mechanical affections of the Particles of Rhubarb, Hemlock, Opium, and a Man, as a Watchmaker does those of a Watch, whereby it performs its Operations, and of a File which by rubbing on them will alter the Figure of any of the Wheels, we should be able to tell before Hand, that Rhubarb will purge, Hemlock kill, and Opium make a man sleep; as well as a Watch-maker can, that a little piece of Paper, laid on the Balance, will keep the Watch from going, till it be removed; or that some small part of it, being...
rubb’d by a file, the Machin would quite lose its Motion, and the Watch go no more (4.3.25).

Chemistry would also benefit: “the dissolving of Silver in *aqua fortis*, and Gold in *aqua Regia*, and not *vice versa*, would be then, perhaps, no more difficult to know, than it is to a Smith to understand, why the turning of one Key will open a Lock, and not the turning of another” (ibid.). (*Aqua fortis* is nitric acid. *Aqua regia* is a mixture of nitric acid and hydrochloric acid.)

Artisans have what natural philosophers would have if human eyesight were much better.

Locke borrows the expression ‘mechanical affections’ from Boyle, who uses it to denote motion, size, figure, and arrangement of parts “because to them men willingly refer the various operations of mechanical engines” (*OFQ* 5.302= *SPP* 17).11 Even Aristotelians, Boyle argues, are willing to attribute mechanical affections and mechanical principles of explanation to machinery, though they aren’t willing to generalize these explanations to imperceptibly small bodies (*Excellency* 8.107= *SPP* 142).

Locke’s praise of mechanical inferences places him in the ‘maker’s knowledge’ tradition of epistemology, which treats insight that our intentions give us into our productions as a paradigm of understanding (Pérez-Ramos 167-86, Tully 22-27). He argues that since an artisan “fashions in Matter” the essences of artifacts (3.6.40), we can settle questions of classification more easily with them than we can with natural objects. He also argues that since we know the words we will write by our intentions to write them, the conformity of the appearances of the page to those intentions counts as evidence for the reliability of the senses (4.11.7). He appeals to the principle that we understand whatever we

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11 J. R. Milton observes, “Locke’s surviving notebooks contain almost no sign of his reading the work which has figured so largely in most recent discussions of him—namely The Origin of Forms and Qualities. The disparity between the centrality of this work in modern reconstructions and its almost complete absence from Locke’s notebooks (there is only one citation, dating from about September 1666) is remarkable and deserves to be pointed out” (1994: 37). In this case the issue doesn’t matter, since Boyle used the expression ‘mechanical affections’ in many texts, but I don’t really believe that Locke was never exposed to *The Origin of Forms and Qualities*. Either the relevant notebook was lost, or Locke didn’t think that he needed to take notes, or Locke picked up the doctrines Boyle expressed there through other conduits (see Rogers 1998a: 25-26).
create in arguing against Robert Filmer in the first *Treatise of Government*. According to Locke, since we don’t understand the structure and function of every human organ, it follows that parents don’t genuinely create babies, and thus that they do not own them (*TT* 1.52-53; Tully 23).

The analogy between the artisan and the keen-eyed scientist runs deeper than the observations that they both understand the objects of their attention and can make predictions about them. Locke’s comparisons illustrate and justify his belief that microphysical mechanical structures explain the biological and chemical capacities of bodies. He matches the capacity of a piece of paper to stop a watch with the capacity of opium to put a person to sleep, and he matches the capacity of a file to destroy a watch with the capacity of hemlock to kill a person. We may pardon him for not coming up with a mechanical analog to rhubarb.

Locke also suggests that the explanation of why keys open some locks but not others will be like the explanation of why *aqua fortis* dissolves some noble metals but not others (Boyle had drawn the analogy earlier *OFQ* 5.309-11=*$PP$ 23-24). Elsewhere Locke suggests that the internal structure of a human being is like the internal structure of the clock at Strasbourg (3.4.3; Woolhouse 1983: 99-103, cf. Laudan 1966). He supposes that the explanations used by watchmakers and locksmiths would transfer smoothly to natural philosophy, if we knew the sub-microscopic textures of bodies.

Right before Locke compares natural philosophers who know the very fine textures of bodies to artisans, he compares such philosophers to mathematicians. If we could “discover the Figure, Size, Texture, and Motion of the minute Constituent parts of any two Bodies, we should know without Trial several of their Operations one upon another, as do we now the Properties of a Square, or a Triangle” (4.3.25, see also 2.31.6). He supposes that
if we knew the inner constitutions of two bodies, then our grasp of the interactions between those bodies would be something like our grasp of mathematical properties. As we’ve seen, he thinks that if the chemist and the physiologist knew the internal constitutions of bodies, then their methods would be like the methods of the watchmaker and the locksmith. Since he implies that the methods of a chemist or physiologist with much improved vision would be like the methods of the mathematician as well, then it seems to follow that he thinks that the methods of the artisan are, in some respect, like the methods of the mathematician.

The derivations are hypothetical in the case of the naturalist who might discover the microphysical texture of bodies, but actual in the analogous cases of seventeenth century artisans. If we are to understand why Locke considers corpuscularianism especially intelligible, we will do well to examine the indirect comparison he draws between mechanical inferences and mathematical ones.

Locke frequently compares the relation between the real essence of a body and its derivative properties to the relation between the real definition of a geometrical figure and its derivative properties (at 2.31.6, 3.3.17, 3.6.8, 3.11.23, 4.3.25, and 4.6.11). His review of *Principia* opens with the promise that mechanics might be raised to the level of mathematical rigor:

> If those working in mechanics perfectly understood the rules of geometry, or if they were complete masters of their subject, they might never fall short their goal, and they might give their books all the exactness and perfection that mathematicians are able to imagine. This is why philosophers and especially the modern ones have imagined that God has prescribed for similar laws for the formation and maintenance of these works, and thereby attempt to explain various effects of nature. Mr. Newton proposes the same end and takes the same path in this treatise (Review 363-64).

Locke suggests that God dictates laws of nature that are similar to the rules of geometry and that, if we knew them, mechanics could be as rigorous as mathematics. Given how often he
returns to the comparison between mechanical and mathematical inference, we should take it as seriously as reasonability allows.

On the other hand, Hume’s argument that effects can’t be derived from their causes can strike readers with the force of a theorem:

There is no object, which implies the existence of any other if we consider these objects in themselves, and never look beyond the ideas which we form of them. Such an inference wou’d amount to knowledge, and wou’d imply the absolute contradiction and impossibility of conceiving any thing different. But as all distinct ideas are separable, ‘tis evident there can be no impossibility of that kind. When we pass from a present impression to the idea of any object, we might possibly have separated the idea from the impression, and have substituted any other idea in its room (Treatise 1.3.6.1)

For any supposed entailment between cause and effect, we can always imagine a different effect having been brought about, so there can never be a deductive entailment from cause to effect. Once someone swallows this argument, it works on the mind. Hume has given us a schema for conceiving causes without their usual effects. Once we’ve understood this schema, it becomes hard to conceive what pre-Humean philosophers meant when they said causes entail their effects. The inconceivability of cause without its effect becomes, in this way, inconceivable to us.

As a way of recapturing that inconceivability, consider the following inferences concerning millstones and their shafts from the Port Royal Logic:

when someone has concluded through his reasoning that the iron axle that goes through two millstones could turn without making the one below turn if, being round, it went through a round hole; but that it could not turn without making the one above turn if, being square, it were embedded in a square hole in the upper stone, then the claimed effect follows infallibly. (Logique 43=Logic 28; Ayers 1991 2.135)

A round axle in a round hole can rotate in a way that a square axle in a square hole cannot.

So much, according to Arnauld and Nicole, is obvious to reason.
In a book published the year of Locke’s death, Pierre-Sylvain Régis argues against occasionalism, on the grounds that there’s a manifest connection between secondary causes and their effects:

one sees, for example, that the production of flour is also necessarily connected with the manner in which the mill modifies the motion of the water and the wind which comes immediately from God. One sees again that a house that someone builds is also necessarily connected with the manner in which he modifies the movement of the stones, and it’s connected with the same movement, and similarly for all the other effects that God produces through the secondary causes (Usage 208; Ott 2009: 125).

A version of the example of the builder and the building can be found in Aristotle’s discussion of actual and potential causes. An actual cause such as building a house exists during the same stretch of time as the effect that a house is being built. A potential cause, such as a builder, may pre-exist the house (Phys. 195b4-5, 195b16-21). More to the point, in the same chapter Aristotle distinguishes proper causes from accidental causes. Sculptor is a proper cause of a sculpture; Polyclitus is an incidental cause. A pale man or a musical man are even more incidental causes of sculpture (Phys. 195a32-195b3). Aristotle doesn’t say so in so many words, but the distinction seems to be that the statement of a proper cause allows for the derivation of the effect, but the statement of an accidental cause does not.

In this light, reconsider Locke’s examples of keys and watches. If the pins in a lock falls into holes in a bolt in the right way, then the lock can’t be opened without breaking the pins or the bolt. If there are wards in a lock attached to the pins in the right way, and prongs in a key line up with those wards, then turning the key will open the lock. If the prongs don’t line up in the right way, then it won’t.

If one gear is interlocked with a second, then when the first turns clockwise, the second will turn counter-clockwise. When a tooth on one gear passes the point of contact between two gears then a tooth on the other gear will as well. So, when one gear rotates, the
ratio between the number of teeth on the two gears will determine how far the second one will rotate. If a series of these gears are interlocked, then alternating gears will travel in the same direction and the ratio of teeth between the first and last gear will determine how far the last one rotates when the first one turns. These are the sorts of inferences that Locke has in mind when he tacitly compares mechanical inferences to mathematical ones.

Part of the transformation of the western conception of matter is the transformation of mechanics from the science of machines at the beginning of the seventeenth century to the science of force and motion at its end. In the sixteenth century, the main project of mechanics was the reduction of complex machines to simple machines, in particular, to the lever, balance, pulley, inclined plane, wedge, and screw (Bertoloni Meli 2006: 18). During the following century, the list of machines studied in mechanics were supplemented by other mechanical apparatuses, e.g. pendula, pierced cisterns, billiard balls on tables, and springs (ibid. 2). Studying simple devices such as these allows for restricting the number of variables involved in an experiment, allows for replication in different locations, and reduces the number of hidden structures in play.

The machines that physicists built in the seventeenth century to test the principles of force and motion were almost always cases of partially constrained motion. The pendulum bob can’t go everywhere but it still swings freely. The examples that Locke and the Port Royal logicians offer are mostly examples of constrained motion. A millstone that fits around a square axle has to turn, if a key turns, the wards have to turn in this way, and if one gear turns clockwise, an interlocking gear must turn counter-clockwise. This reflects a philosophical ideal that leaves no gaps and leaves nothing unexplained. The mechanical philosophy, which attempted to explain the motions of bodies as fully constrained by surrounding impeding and pushing bodies, often conflicted with the new mechanics, which
attempted to explain the partially free motion of bodies under the influence of forces

We see an interesting interplay between this demonstrative ideal and new theories of
matter in one of Locke’s main criticisms of the Aristotelian account of real essences. Locke
deﬁnes ‘real essence’ as “the real internal, but generally in Substances, unknown constitution
of things, whereon their discoverable qualities depend” (3.3.15). He distinguishes two
substantive accounts of the real essences of bodies: ﬁrst, the Aristotelian theory according to
which they are “Forms or Molds” and, second, the corpuscularian, “more rational Opinion”
that the real essence of bodies is some “real, but unknown Constitution of their insensible
Parts” (3.3.17). According to him, corpuscularianism has a better account of essence even
by the Aristotelian’s own standards.

Locke argues that the Aristotelian theory is inconsistent with “the frequent
Production of Monsters, in all the Species of Animals, and of Changelings [that is, the
intellectually disabled], and other strange Issues of humane Birth” (3.3.17). He justiﬁes this
assertion by appealing to the following mathematical analogy: “it is as impossible, that two
Things, partaking exactly of the same real Essence, should have different Properties, as that
two Figures partaking in the same real Essence of a Circle, should have different Properties.”
If two things have the same real essence, then they should have all the same properties.

This is Locke’s most direct criticism of the Aristotelian picture of nature, but it’s easy
to miss its force. On a modern reading of the word ‘property’, one so loose as to take in any
old accident, this argument holds two insoluble mysteries. First, why does Locke suppose
that it would convince anyone to reject the Aristotelian account of essence? Surely, no one
believes that Aristotelians believe that all members of the same species are qualitatively
identical by geometrical necessity. Second, why does Locke pick such odd and dramatic
examples of variation within species? On a loose interpretation of the word ‘property’, more pedestrian variations in hair color, height, and nationality would have done as well.

Michael Ayers has emphasized how much we need to take into account the scholastic doctrine of the predicables in reading Locke, and in particular, how much we need to take into account the fact that in seventeenth-century philosophical English ‘property’ translates ‘proprium’ as used in scholastic textbooks, a characteristic feature of a kind that may be derived with necessity from its essence (1981: 226-31, 1991: 2.18-25). Let me go further down this path.

In 1652, when he was 20, Locke began attending Oxford. He acquired a bachelor’s degree in 1656, a Master of Arts in 1658, and he began teaching undergraduates in turn from 1660 up until 1667 when he moved to London to be Shaftesbury’s physician (Woolhouse 15-77). Traditional instruction at Oxford in the middle of the seventeenth century was focused on Latin and logic, and instruction in logic relied on textbooks that digested Aristotle’s Organon (Kenney 19-21, 24).

Locke received a hodgepodge education at Oxford. Soon before he arrived, Puritan victories during the English Civil War forced the expulsion of royalists and the installation of some new professors who were sympathetic to the new science (Isler 12-15), but these were grafted onto a fundamentally medieval institution. During the same academic career in which he was taught geometry by John Wallis and astronomy by Seth Ward, he took classes on grammar, rhetoric and logic from other teachers (Bourne 1.43-50). He taught scholastic logic to students at the same time that he was carrying out physiological and botanical research and befriending Boyle.

We have a list of authors of logic books that Locke directed his students to purchase, a list that includes Robert Sanderson, Franco Burgersdijck, Christoph Scheibler, and Philip
du Trieu (Kenney 32). For our purposes, Sanderson makes for a good representative of scholasticism. Locke probably met Sanderson around 1660 (von Leyden 34), he cites Sanderson as an authoritative member of ‘the tribe of logicians’ in the Stillingfleet correspondence (Letter 4.8), and, when Locke died, his library contained Sanderson’s Logicae Artis Compendium (Library #2548a). Following Porphyry’s influential introduction to Aristotle’s logic (Isagoge, ¶56), Sanderson distinguishes four different senses of ‘proprium’:

*Proprium* is said in four senses. In the first sense, it’s what belongs only to a kind, though not to all of its members: as, for example, Healing belongs to man. In the second sense, proprium is what belongs to all of a kind, but not only to them, as *being Two-legged* belongs to Man. In the third sense, proprium is what belongs to all of a kind & only to them, but not always: as *Growing grey in old age* belongs to man. . . . With respect to the fourth sense, . . . proprium reciprocates with a species, and it is consequently inseparable with its species and can’t be shared with another . . . as *the capacity to laugh* with man (Compendium 1.5.2).

Versions of Porphyry’s four-fold division appear in other scholastic textbooks (*Monito* 40, *Manuductio* 49) and in the Port-Royal Logic (Logique 63-64=Logic 43). Locke usually uses the word ‘property’ in Sanderson’s second sense;¹² thus, for example, Locke calls ‘malleableness’ a property of gold because it depends on gold’s real constitution (3.9.17), and malleability is something that belongs to all gold, but not only to gold.

In the second or fourth sense of ‘proprium,’ Locke’s claim that two things with the same essence should have the same properties would be uncontroversial. He picks monstrous rather than more pedestrian features such as blond, short, or Danish, because Aristotle’s standard example of a human property is ‘capable of learning grammar’ and his commentators use the examples of ‘capable of laughter’ and ‘having two legs.’ Through disabilities of birth, some of us don’t have two legs and can neither laugh nor learn grammar.

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¹² Setting aside, of course, all of Locke’s references to ‘property’ in the sense of possessions in the Second Treatise of Government.
The passage presents an argument that appeals to premises that Locke’s adversaries would accept. The objection has bite because of an obscurity in Aristotle’s account of explanation, according to which unqualified scientific knowledge requires knowing the cause of a fact and knowing that the fact couldn’t have been otherwise (Post. An. 71b8-12). These requirements are elements of an ideal of inquiry and explanation: we should seek necessary, basic principles and syllogistically derive consequences from those principles (71b16-72a6).

Aristotle infers that knowledge is only of propositions that are necessary (Post. An. 1.4 73a21; Kullmann 181-83) Even so, a little later in the *Posterior Analytics*, he seems to lower his standards, and only require that the derived propositions be either “necessary or for the most part” (Post. An. 1.30 87b20-21, see also Post. An. 1.32 88b7, Post. An. 2.12 96a8-19, Met. 6.2. 1027a20-24; Kullman 273).

Franco Burgersdijck, one of the textbook authors whom Locke assigned to his students, writes this about *propria*:

Properties which flow from the essence of the subject are so necessarily in it that they cannot be separated from it by thought . . . This necessity is such that it’s contradictory if one were to say that a property is absent from its subject: for he who says, a body isn’t quantity, or that a fire isn’t hot, says as much as if he said, a body is not a body, or a fire is not a fire (Institutionum Ch. 13, Theorem 3).

Spinoza had Burgersdijck’s logic textbook in his library (Gabbey 1996: 144), which helps explain why he thought that one couldn’t think of a geometrical object without thinking of the properties that may be derived from that object: “the idea of the triangle must involve this same affirmation, namely, that its three angles equal two right angles. For which reason and conversely, this idea of the triangle can neither be nor be conceived without this affirmation” (*Ethics* 2p49).

Sanderson, on the other hand, allows for intermediate grades of demonstration, including a “universal demonstration” which is nobler than demonstrating particulars,
“though it isn’t absolute and without qualification; but ceteris paribus” (Compendium 3.14.7).

Even where scholastic accounts only aim for ceteris paribus conclusions, it’s not immediately obvious that there’s room for them in Aristotelian accounts. How can propositions derived syllogistically from necessary first principles only be true for the most part (Kullmann 269-70, Barnes 192-93)?

The derived generalizations are necessary insofar as they follow from the essence of the thing, but essences aren’t the only explanatory principles in Aristotle’s world (Kullmann 271-77). As Locke implies, for Aristotelians, essences are forms (Phys. 2.3 194b30, Met. 7.7 1032b1; Kung 361-62). The other constituent they attribute to ordinary objects is matter, and essence and matter can work at cross-purposes. So, for example, the self-motion of an animal comes from its form. Though animal self-motion is always natural for the whole matter/form composite, it can be unnatural for its body, that is to say, for its matter. A bird flies upward naturally, but when it does so its earthy body goes upward against its nature (Phys. 254b12-31). Poor eyesight and poor memory among the elderly isn’t explained by the decrepitude of form, but rather by a defect in its vehicle, the body. If the old had new eyes, they would see as well as anyone (de An. 408b18-32).

Aristotle explains deviations from perfect generalities by appealing to the variability of matter: “The matter, therefore, which is capable of being otherwise than as it for the most part is, is the cause of the accidental” (Met. 1027a9-15, see also GA 4.10 778a5-9; D. Henry 55). In the case of human generation, Aristotle thinks that the matter is provided by menstrual fluid and the form is provided by the semen (GA 716a5, 727b31, 729a29; Code 55, D. Henry 2008: 269). He explains monstrosity in general as the result of the imperfect development of menstrual fluid: “As for the origin of [monstrosity] we must look at it in this way. If the generative residue in the menstrual fluids is properly concocted, the movement
imparted by the male will make the form of the embryo in the likeness of itself” (GA 4.3 767b12-16). So this gives us Aristotle’s solution to Locke’s problem. Derived propositions give us necessary truths about how things stand with a certain kind of thing, but only if nothing goes awry with the matter. In cases of congenital mental or physical disability, something has gone wrong with the matter.

Thomas Aquinas gives a similar account of monstrosity:

many natural causes produce their effects in the same way, but not always. Sometimes, indeed, though rarely, an event occurs in a different way, either due to a defect in the power of an agent, or to the unsuitable condition of the matter, or to an agent with greater strength—as when nature gives rise to a sixth finger on a man (SCG 3.2.99.9).

As part of his project of synthesizing Christian theology with Aristotelian philosophy, Aquinas supplements natural and unnatural effects with supernatural ones. “We should keep in mind,” he writes, “that, though God at times does something apart from the order implanted in things, he does nothing contrary to nature” (SCG 3.2.100.1). Miracles aren’t monstrosities. God is the measure of how things ought to be, “so, what is implanted by God in a thing will be natural to it” (SCG 3.2.100.5). On the basis of such passages from Aquinas, Lorraine Daston and Katharine Park distinguish the medieval conception of the supernatural which were “performed directly by God without mobilizing secondary causes” from the preternatural, which violate the order of nature, but “nonetheless depended on secondary causes alone and required no suspension of God’s ordinary providence” (121). Christian miracles are supernatural. Aristotelian monsters are preternatural.

The Aristotelian account turns on a conception of matter as a variegated source of deviation from first principles. Locke on the other hand, thinks of matter as homogeneous and uniform. According to him, “we no more conceive, or speak of different Matters in the World, than we do of different Solidities; though we both conceive, and speak of different
Bodies, because Extension and Figure are capable of variation” (3.10.15). Once the Aristotelian conception of matter is abandoned, the Aristotelian account of monstrosity needs revision.

2.2  *Comprehending Alternatives to Corpuscularianism*

A natural philosophy solely based on analogies is like a science based on metaphors. Already by 1671, Locke begins to armor his preferred physical theory with remarks about the inconceivability of alternatives. The issue is tricky, however, since there is more than one sort of inconceivability at play.

We’ve examined one of these sorts. Given certain presuppositions, Locke believes that bodies with a certain mechanical structure will necessarily have a certain power so that when put in motion in a certain way, they will demonstrably bring about certain effects. Such inconceivability is multiply hypothetical: it supposes that the relevant matter will continue to cohere and be able to push other matter and it also supposes that the world works in accordance with mechanical principles, something that Locke doesn’t consider to be absolutely certain.

After arguing for limits on our possible knowledge of bodies, Locke says that his discussion has assumed the truth of corpuscularianism, and that if some other hypothesis were true, we wouldn’t be able to grasp it:

I have here instanced in the corpuscularian Hypothesis, as that which is thought to go farthest in an intelligible Explication of the Qualities of Bodies; and I fear the Weakness of humane Understanding is scarce able to substitute another, which will afford us a fuller and clearer discovery of the necessary Connexion, and *Co-existence*, of the Powers, which are to be observed united in several sorts of them. (4.3.16)
Locke thinks that we have good reasons for believing that sensible qualities depend upon mechanical qualities, but if those good reasons fall short, then the true explanation is likely to be beyond our comprehension.

Referring back to the chapter on primary and secondary qualities, Locke describes secondary qualities of bodies as “depending all (as has been shewn) upon the primary Qualities of their minute and insensible parts; or if not upon them, upon something yet more remote from our Comprehension, ‘tis impossible we should know” (4.3.11). What he takes himself to have shown is that either there is a comprehensible explanation of the colors, taste, smells, and sounds of a body, which rests on the size, figure, and motion of its parts or that these qualities have some incomprehensible explanation (Hesse 122).

Francis Bacon warned against assuming that readily available mechanical principles of explanation explain all of the phenomena: “the human intellect is also corrupted by viewing the things that are done in the mechanical arts, in which bodies are changed for the most part through composition and separation, which makes it think that something similar happens in the whole world” (NO 1.66). Locke took notes on Bacon’s works and was influenced by his praise of natural history (Anstey 2011b: 46-69). Why doesn’t Locke share Bacon’s belief that we need more sophisticated notions before the process of “true induction” can begin (NO 2.19)?

Part of the explanation lies in the form of Locke’s empiricism. According to him, we have “daily experience” of the production of motion “by impulse” (2.23.28) and we “observe” the transfer of motion from one body to another (2.21.4; Mattern 1980). It follows from his theory of ideas that he thinks that impulse interactions are conceivable.

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13 Coste adds a marginal reference in the French edition to the passage that points us to the Essay 2.8.
Locke also believes that the *only* conceivable actions of bodies are “nothing else but Modifications of Motion” (2.22.11). Counter-examples are illusory:

when a Country-man says, the Cold freezes Water, though the word Freezing seems to import some *Action*, yet truly it signifies nothing, but the effect, *viz.* that Water, that was before fluid, is become hard and consistent, without containing any *Idea* of the Action whereby it is done (ibid.). The peasant observes that it is cold and that the water is now hard, but ‘freezing’ does not refer to an activity that he has witnessed. Locke tells us that other forms of corporeal action besides modifications of motion are “as much in the dark to me as five other Senses, or as the Ideas of Colours to a blind man” (ibid.). He does not suppose that the blind perceive the impossibility of colors or that reason forces them to deny that there are colors. Rather, he believes that since they cannot see, they have no experience of colors, and thus they cannot conceive of colors. Likewise, he believes that we have no experience of bodies acting in any way other than moving.

A version of this argument occurs in Draft B of the *Essay* (§150; Downing 2001: 532-33, Walmsley 2003: 428), and it seems to mark a new direction in Locke’s thinking. Having developed a theory of ideas in Draft A, he begins to apply that theory to rule out alternatives to corpuscularianism as unintelligible (Walmsley 2003: 427-29). In Draft A (§15), Locke specifies that when he refers to causes he means *efficient causes*, modestly remarking “the other 3 sorts of causes soe cald I doe not at present so well understand their efficacy or causality”. In Draft B (§72), he goes farther and rejects one of Aristotle’s other three causes, giving an argument against the intelligibility of “secret undiscernable forme” (Walmsley 2003: 424-25)

For Locke, impulse is the form of motion by which one body acts upon another (2.8.11 1st-3rd ed.). He believes that impulse is the only conceivable way that bodies affect one another because he believes that motion is the only perceptible corporeal action, and he isn’t
willing to construct other concepts of corporeal interaction out of our ideas of motion. He therefore denies that we can conceive of corporeal interactions beyond impulse.

If impulse actions are the only conceivable ones, then the only way we can conceive of an interaction between two non-contiguous bodies with nothing visible between them is through the impulsive mediation of imperceptibly small bodies. So, on his principles, if some account besides corpuscularianism is the right explanation of such interactions, we won’t be able to comprehend it.

Without supplementation, we shouldn’t put any epistemic weight on mere psychological inconceivability. As Matthew Stuart remarks, “it is rather faint praise of corpuscularianism to say that what prevents it from being supplanted by rival theories is the weakness of our minds” (1998: 377). Since it is a mere matter of psychology that we perceive pushes upon contact but not pulls at a distance, we should treat this psychological fact as a hindrance to be overcome and not as evidence to be weighed. And Locke’s comparison of our inability to conceive of corporeal actions besides motion to the blind person’s inability to conceive of colors suggests that this was his attitude as well. He doesn’t believe that the blind ought to infer the non-existence of colors from their inability to see them, and he denies more generally that limitations of our senses constrain the structure of the world (4.3.23). He denies that the absence of ideas justifies conclusions in natural philosophy, any more “than the blindness of a Mole is an Argument against the quick-sightedness of an Eagle” (4.3.23). Still, on Locke’s account, if the true theory of nature appeals to non-impulsive corporeal interactions, our lack of the requisite ideas would keep us from grasping the theory, even if it wouldn’t justify rejecting it.

The assumptions behind Locke’s claim that we can’t conceive of alternatives to corpuscularianism are right and wrong. He is right to think that we can perceive impulse
interactions. He is wrong to think that the only conceivable interactions between bodies are perceptible or easily derivable from perceptible interactions. These points matter not just for evaluating Locke’s assertion that alternatives to corpuscularianism are beyond human understanding, but also for navigating the broad stream of thought that runs from Francis Bacon to David Hume.

Some, following Hume, will deny that we can actually observe one body pushing another body. Here a philosophical doctrine has shaped phenomenology. Only people who have read Hume will deny that they can see children making paper hats, drawing their names in the sand, or shooting basketballs (Anscombe 1981c: 137-38). Perhaps the seeds of Hume’s doctrine lie in Locke’s claim that what we really see when we look at a globe is “a Plain variously colour’d” (2.9.8). If we only saw color patches, then we wouldn’t see interactions. But we do see interactions, at least, we seem to see them.

Albert Michotte ran psychological experiments in which subjects view the motion of colored geometrical figures against a uniform background. In one experiment “the observers see object A bump into object B, and send it off (or ‘launch’ it), shove it forward, set it in motion, give it a push” (20). This result has been robustly confirmed by the experimental psychologists working in Michotte’s footsteps (Danks 448-51, see also the references at White 341).14

Even if perception is malleable in some contexts there are limits. Michotte declares that “it actually seems impossible to produce any causal impression whatever” when two figures are made to move towards one another (103, see also 218-19). Of course, we can witness an object falling. However, phenomenologically speaking, seeing a thing fall is not

14 Doubts of the sort raised by Stephen Butterfill (2009) and Lance Rips (2011) are best understood as worries about the mechanism of perception and about the external relations that are the material objects of perceptions. The question of what Lockean ideas people have is the question of what they seem to see, and people honestly report seeming to see pushes.
the same as seeing the earth pull on it. We do not see the earth pull in the way that we see billiard balls knock. The difference between attraction at a distance and impulse that makes Locke assert that only the operation of the second is conceivable is not a matter of mathematics, necessity, or reliability. It is a matter of psychology.

Psychological research hasn’t supported Locke’s thesis that we perceive only impulsive causal connections. Michotte and other researchers have generated the appearance of pulling in their subjects when one object moves away and the other follows in train. They have gotten subjects to see one object pushing another, even when the two objects are not in contact. Peter White and Alan Milne (1999) were able to provoke impressions of disintegration and bursting with computer graphics. I’m inclined to think that we can see liquids mixing, a donut being soaked in coffee, and fire burning a match.

More importantly, Locke was wrong to think that the imperceptibility of corporeal actions besides impulse entails their inconceivability. The doctrine that all our ideas are derived from experience in a straightforward way can seem beyond criticism, as if it’s a doctrine that you have to take on board in order to make any headway at all in reading Locke or Hume with philosophical understanding. But Locke’s dispute with Francis Bacon about whether future sciences will develop along mechanical lines shows that this famous piece of philosophical psychology has substantive consequences.

The verdict of the history of science came down in favor of Bacon. Mechanical explanation of the sort that Descartes, Boyle, and Locke thought would govern the whole world turn out to apply only to a restricted domain. Later natural philosophy developed concepts for actions that are not immediately copied from perception but were rather constructed slowly and in unforeseeable ways (K. Campbell 2013: 9-10).
Bacon was an empiricist in his way. He thought that we could improve our corrupt notions through systematic empirical investigation. Locke differed from Bacon in believing that all ideas could be austerely generated from simple ideas by three simple operations: abstraction, compounding, and comparing (2.12.1). That’s why he believed that if corpuscularianism were false, then the true hypothesis would be beyond human comprehension, and that’s where he was mistaken.

I would connect the austerity in Locke’s theory of ideas to the rejection of speculations about deep underlying causes that he acquired from his work with Sydenham. In Bacon’s recommended epistemology, the natural philosopher ought to move back and forth between experiment and hypothesis, using natural histories to generate intermediate axioms (NO 1.104; Anstey 2011b: 81-82) and crucial experiments to eliminate false ones (NO 1.105, 2.36). Bacon hoped to find the simple forms of things, and from there to form a deductive, exceptionless science of the world. Locke breaks with this tradition by severing the connection between experiment and finding deep causes. By giving up on our ability to find the underlying explanations of natural phenomena, he gives up on the hope of progress in the Baconian mold (Anstey 2011b: 81).

Locke’s use of ordinary analogies instead of speculative hypotheses gives the Essay a kind of timeless character. It’s less jarring for a modern reader to hear biological and chemical processes explained by comparisons to gears and watches rather than through appeals to ferments, active spirits, and archei. Much of Locke’s pessimism is justifiable, in particular about the prospects for explanation in medicine. Most seventeenth century treatments are useless or worse. The use of quinine for agues, a treatment that Sydenham recommended and Locke praises to the skies (4.12.12; Dewhurst 1966: 41-42, 53), is a rare exception, but even there there was hardly any reasonable foreseeable hope of explaining its
mechanism. As a matter of fact, even today, “the anti-malarial mechanism of action quinine is unknown” (Achan et al: 2). Nevertheless, Locke’s pessimism about finding successful explanations of the properties of bodies deprives him of a device that would have allowed his cognitive theory to capture a greater range of human thought. Explanatory theoretical terms can acquire meaning from the theories that surround them, certainly in successful theories but even in unsuccessful ones.

We can see Locke’s narrow horizons at work in his rejection of the medieval theory of the transmission of sensible species. Aristotle gave a very schematic account of light as “the activity of this, the transparent qua transparent” (de Anima 2.7 418b10-11), that is, light is the occurrence of that distinctive activity that can happen in a transparent medium (Lindberg 7-8). Locke translates this as “the Act of Perspicuous, as far forth as perspicuous” and declares that it “betrays its Uselessness and Insignificance” from the fact that it can’t be used to teach the word ‘light’ to a blind man (3.4.10).

Locke also dismisses as “learned gibberish” the “peripatetic doctrine of the species” that “material species, carrying the resemblance of things by a continual flux from the body we perceive, bring the perception of them to our senses” (Exam 9:215). Ancient atomists believed that bodies threw off images and simulacra that strike the eye (Lindberg 2-3), but Locke alludes to a doctrine that originates in Muslim natural philosophy and which can be found in Alhacen (Optics 1.49-50, 1.63-64, 1.78, Lindberg 63, A.M. Smith 2004: 183) and Averroes (Long §§76, 97; Tachau 15-16, Tellkamp 278-79).

The doctrine of species in the medium was elevated to a first principle governing the world by Roger Bacon, who declared,
this efficacy is called likeness, image, species, and by many other names” (OM 1.111=Burke 130).

The species are spread by “multiplication,” which “is either according to lines, angles, or figures. But as long as a species travels in a medium of one density, for example in pure sky, in pure fire, and pure air, or pure water, it continues in straight paths” (OM 1.111=Burke 131). He appeals to the multiplication of species to explain differences in climate (OM 1.135-37=Burke 156-58), the tides (OM 1.139-42 Burke 160-63), and the transmission of disease (OM 1.142-43=Burke 163-64) and concludes, “this multiplication is thus an amazing power, since everything happens in accordance with its laws, both hidden and manifest” (OM 1.142=Burke 163).

Colored objects produce species of colors all the time, “in every direction along every diameter,” (OM 2.31=Burke 449) according to Bacon, but these species can only affect vision in the presence of light (OM 2.54=Burke 473). When there’s an obstacle, the object isn’t seen, but when the obstacle is removed, vision occurs. He concludes from this, “vision is produced by species, but principally by species of light and color” (OM 2.31=Burke 449, see Lindberg 112-16, A.M. Smith 1981: 578-80).

Locke’s charge of gibberish seems harsh, especially since he describes the doctrine accurately enough. It’s hard to establish a paper trail to figure out whose particular version of this doctrine he intended to insult. In the Essay, he cites “whether Roger Bacon was a Mathematician, or a Magician” as an example of a question that doesn’t matter and for which evidence doesn’t compel assent in either direction (4.20.16). Locke doesn’t know whether Bacon is a serious thinker, and he doesn’t care to find out.¹⁵ We may infer that he hadn’t read the Opus Majus any time recently.

¹⁵ In a letter to Nicolas Toinard, Locke refers to Bacon as someone who had been banned from Oxford for knowing a little mathematics (LC #508 2.115).
Locke also refers dismissively to Aquinas, quoting his definition of motion, footnoting its source, and calling it “exquisite jargon” (3.4.8). Locke’s discussion doesn’t show much engagement with Aquinas’s thought and the line is just a translation of Aristotle’s definition in a commentary on the *Physics*. Still, Locke knew his way around the Thomistic corpus well enough to be able to find a relevant passage in a minor work. Aquinas’s works are within Locke’s cognizance in a way that Roger Bacon’s were not.

Aquinas also believed that sight worked through the transmission of sensible species, though he didn’t discuss the complexities of Alhacen’s optics. Like Bacon, Aquinas believed that sensible species had ‘intentional being’ in the medium, a secondary sort of existence that didn’t allow it to be directly perceived (*ST* 1.56.2 ad 3, in *DA* §418; Pasnau 1997: 39-60, Perler 37-38, Tellkamp 2006).

Most of Locke’s references to scholasticism are to the textbook authors he assigned to students when he was a tutor in Oxford (Kenney 32). Among these, Scheibler taught that points are visible by casting off visible species along straight lines (*Philosophia* Bk. 6, Ch. 1, p. 92). Scheibler also divided the visible between that which was visible *per se*, for example, light (*lux*) and color, and that which is visible *per accidens*, colors as they radiate in the medium (Bk. 6, Ch. 2, p. 92).

Whatever account of species in the medium he had in mind, Locke thought that he could dismiss it without argument. Locke attacks Scheibler by name as an example of the sort of author who shouldn’t be taught in *Some Thoughts Concerning Education* (157). He describes his own place in the intellectual age in his letter to the reader at the beginning of the *Essay*:

The Commonwealth of Learning is not at this time without Master-Builders, whose mighty Designs, in advancing the Sciences, will leave lasting Monuments to the Admiration of Posterity; But every one must not hope to be a Boyle, or a Sydenham; and in an Age that produces such Masters, as the
Great—Huygenius, and the incomparable Mr. Newton, ‘tis Ambition enough to be employed as an Under-Labourer in clearing Ground a little, and removing some of the Rubbish, that liest in the way of knowledge. (Epistle 9-10)

In his 1661 ‘Proemial Essay’ to his Certain Physiological Essays, Boyle offered a similar expression of humility:

by the way of Writing to which I have condemn’d my self, I can hope for little better among the more daring and less considerate sort of men, should you shew them these Papers, than to pass for a Drudge of greater Industry than Reason, and fit for little more than to collect Experiments for more rational and Philosophical heads to explicate and make use of. But I am content, provided Experimental Learning be really promoted, to contribute ev’n in the least plausible Way to the Advancement of it, and had rather not only be an Underbuilder, but ev’n dig in the Quarries for Materials towards so usefull a Structure, as a solid body of Natural Philosophy, than not do something towards the Erection of it. (Physiological 2.20)

The similarity in these passages suggests that Locke lifted the metaphor of an under-laborer from Boyle.

The difference in the passages tells us more. Boyle wants to assemble experimental data of the sake of future experimental philosophy. Locke wants to discredit the beliefs that stand in the way of that philosophy. He wants to refute the doctrines and practices that hinder the advancement of the sciences. Chief among these are “the language and business of the schools” (1.2.27; McCann 1994: 59). Locke offers a few substantive criticisms against pieces of scholasticism. Most of his ground clearing is indirect and consists in developing a theory of concepts that rules out a good portion of scholastic philosophy.

The renaissance humanists accused the scholastics of writing in poor Latin. By the time of Descartes and Hobbes, the charge had been raised to obscurity and gibberish. Locke’s theory of ideas gave his successors a way of systematizing such attacks. Propositions that can’t be derived from some preferred theory of ideas may be dismissed as meaningless. So Berkeley writes in his notebook, “We have learn’d from Mr. Locke, that there may be and that there are several glib, coherent, methodical Discourses wth
nevertheless amount to just nothing. This by him intimated with relation to the Scholemen” (Notebook A §492.).

Locke didn’t really show that scholasticism was vacuous. Instead, he invented a theory of ideas, believed it, and convinced others to believe it. As a result, they had their conceptual horizons limited. Theories that made sense to others seemed like nonsense to believers. In this way, what had seemed like the governing mechanism of nature to Roger Bacon came to seem like gibberish to Locke and Berkeley.

I don’t think that all of our ideas are derived by a limited number of operations from a limited number of simple ideas of sensation and reflection. Accordingly, I don’t believe Locke when he claims that various terms are meaningless. He implies that ‘substantial forms,’ ‘vegetative souls,’ and ‘abhorrance of a vacuum’ are “Gibberish,” expressions without ideas behind them (3.10.14). I think that Aristotle knew what he meant when he wrote about these things and that he was writing meaningfully if not always truly about those things. For my part, I can conceive of action at a distance, electric charge, and the principle of least action, even if there’s no possible derivation of such ideas in Locke’s system.

But it’s one thing for me to be able to form conceptions that don’t conform to Locke’s theory of ideas, and it’s another for him to do so. If a philosopher’s theory of ideas implies that something is inconceivable, then consistency will push her to say that she can’t conceive of such things and not just say it, but sincerely say it. If what a person may conceive of may vary with circumstance and belief, then we may lay it down as a rule that philosophers are less likely to be able to conceive of propositions that their cognitive theories rule out as inconceivable.
2.3 Coming to Believe the Inconceivable

It’s often tricky to say what we mean when we call something inconceivable or what the relation is between inconceivability and actuality. The main argument in Locke’s chapter on primary and secondary qualities turns on a sort of inconceivability to which Locke is willing to attribute epistemic force. He infers that the bodies involved in perception at a distance must act by impulse from the premise that it’s inconceivable that they act in any other way.

Locke changes the character of the inference in the fourth edition. In the first three editions of the Essay, he offers an argument that implies that he believes that action at a distance entails a contradiction. After reflecting on Newton’s Principia, he becomes convinced of the actuality, though not quite the conceivability of gravitational attraction at a distance. Locke’s revision in the next edition of the Essay suggests that he had come to attribute an epistemically intermediate value to his unhappiness with action at a distance, one not so strong that it guarantees falsehood yet not so weak that it’s the mere confession of conceptual impoverishment.

In the first edition, Locke argues that action at a distance is impossible because it’s “impossible to conceive, that Body should operate on what it does not touch, (which is all one as to imagine it can operate where it is not)” (2.8.11 1st ed.). The parenthetical argument against action at a distance seems fallacious. Suppose that \( x \) operates on \( y \). Locke can be denying one of two possibilities by denying that \( x \) can operate where it is not. The first is that \( x \) is operating and is not where \( x \) is. The second is that \( x \) is operating and is not where \( y \) is. On the first reading, the denial is true but does not lend support to the conclusion. On the second reading, Locke begs the question.

Whether the argument is fallacious or not, Locke intends it as a *reductio ad absurdum*. He doesn’t just think that he is psychologically incapable of understanding action at a
distance. He thinks it entails something like a contradiction. The inconceivability here is the impossibility of conceiving of the negation of a demonstrated truth.

Eventually, however, under the influence of Newton, he came to believe in the reality of action at a distance. How did Locke come to believe in something that he had dismissed as inconceivable? Part of the answer lies in his antecedent willingness to believe in empty space. Descartes had argued forcefully against the possibility of a vacuum. For him, the essence of body is extension, and everything extended is a body (PP 2.16).

Locke’s debt to Descartes is deep and wide. He adopts Descartes’s picture of ideas as modes of the mind through which we represent the world. He borrows Cartesian assumptions about physics, physiology, and epistemology. He lifts examples, arguments, and thoughts from Descartes. Locke isn’t, however, willing to adopt Descartes view that the essence of body is extension.

Locke’s friend Boyle often tries to avoid stating his views on the possibility of a true vacuum (e.g. at Spring 1.197, Continuation 6.62). Even so, he needs at least an operational notion of a vacuum to describe what is created by his air pump (Respiration 6.216) and a theoretical notion of non-obstructing space for his account of fluidity (Physiological 2.128-29). By 1671, Locke was already developing anti-Cartesian arguments to show the conceivability of extension without matter (Draft A §27). As James Axtell argues (1965: 153-54), he was ready for a general system of natural philosophy that was more amenable to empty spaces and which could replace the Cartesian one.

When Locke was in exile in in Holland, Jean Leclerc asked him to review Newton’s newly published Principia. He hadn’t been on the cutting edge of astronomy at Oxford: a line near the beginning of his Essays on the Law of Nature suggests that he thought the sun

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16 The authorship of the review was established by Rosalie Colie (1960) and James Axtell (1965)
travels around the Earth (Essays 109). In subsequent years, he educates himself to some degree. In France in 1678, he observes a total lunar eclipse with Pierre Jolley and they sent a report to the Royal Society (France 243-44, Woolhouse 2007: 147). The next year he befriends Ole Rømer, the discoverer of the speed of light; they discuss that discovery, the orbits of the satellites of Jupiter, and the measurement of time (France 263, 274; Cranston 180, Woolhouse 2007: 149, 152, 155-57). In the Essay, he sympathetically describes the thesis that the sun is a star and each of the stars suns in order to make a point about language (3.6.1). In Some Thoughts Concerning Education, he tells parents, “Astronomers no longer doubt of the Motion of the Planets about the Sun” (§180).

According to a probable story, Locke asked Christiaan Huygens whether the mathematical theorems in the book “were true, and being told he might depend upon their Certainty; he took them for granted, and carefully examined the Reasonings and Corollaries drawn from them” (I.B. Cohen 147, Woolhouse 2007: 278). I’m not sure that I believe that Huygens endorsed every proof, since some of them were defective, especially in Book II as it stood in the first edition (Westfall 1980: 703-12). Still, Huygens was in Holland when Locke was, and Locke was a member of the Royal Society and eminent enough to meet him (Woolhouse 2007: 109).

In the review, Locke for the most part summarizes the main theses of various sections of Principia. He also summarizes at length the argument at the end of Book II that Cartesian vortices are incompatible with Kepler’s laws and the observed astronomical facts (Review 367-69). He seems most interested in Principia where it touches on his pre-existing interest in the existence of the void (Axtell 1965: 156).

Descartes gives five explanations for the variable speed of the planets in the Principles of Philosophy (PP 3.141-45). For our purposes, the most important is the first, which is the
only one that lends itself to mathematical development and empirical consequences. His explanation rests on a principle which had perhaps been discovered by Benedetto Castelli and which Descartes had advanced in an earlier part of the *Principles*: in a vortex, the same quantity of matter flows through each slice of that vortex over a given time (*PP* 2.34; Bertoloni Meli 2006: 84, 157). According to Descartes, the variable speed of planets follows from the fact that the “space that rotates together with all the material of heaven in it is not a perfect sphere” (*PP* 3.141). If a vortex is thinner for part of the orbit and thicker for another, then where the space that carries a planet “is broader, so that this matter of heaven will flow more slowly than where it is narrower” (*PP* 3.141).

Newton takes this to be the vortex theorist’s best explanation for the variable speeds of planets described by Kepler’s Second Law, according to which a line from a planet to the Sun sweeps out equal areas in equal times. Newton reproduces a version of the diagram that Descartes had used to illustrate *Principles* Part 2, Section 33 (*Principia* 384=CW 789), a diagram that Locke then reproduces in turn in his review (*Review* 367). Against this explanation, Newton argues that, as a matter of observation, the orbits of Mars and Venus are closer at Mars’s aphelion than at its perihelion (that is, where Mars is farthest from the Sun rather than where it’s nearest to it). Since the Earth’s orbit lies between those of Venus and Mars, the band of vortex that carries it around the Sun should be narrower near Mars’s aphelion and thus should travel faster there. But Earth’s aphelion is close to Mars’s, and experience and Kepler’s Second Law show that the Earth moves more slowly when it’s farther from the Sun and not more quickly (*Principia* 384-85= CW 789-90; Bertoloni Meli 2006: 283, Anstey 2011b: 91-97).

Locke’s summary of the argument is extensive but defective, since he leaves out Newton’s reference to Mars (Anstey 2011b: 96). It doesn’t follow from Kepler’s Laws alone
that the aphelia of the orbits of two planets should be closer than their perihelia. There are lots of different ways to nest ellipses with the Sun at one focus. Newton was appealing to a local fact about our solar system, not simply the laws of astronomy. (I.B. Cohen, 145-47, complains about the lack of sophistication in Locke’s review.)

The two meet soon after the Glorious Revolution allows Locke to return to England. Newton writes Locke letters explaining his derivation of elliptical orbits from the law of universal gravitation (NC #353 3.71-77; Axtell 1969: 176) and tactfully inquiring into Boyle’s chemical recipes for making gold (LC #1465 4.387-88=NC #384 3.195-96, LC #1519 4.488-90=NC #391 3.217-19; Woolhouse 2007: 278, 298, 309). Newton composes an anti-Trinitarian essay entitled, “An historical account of two notable corruptions of Scripture, in a Letter to a Friend” (NC ##358-60 3.83-146). Locke is the friend, and at Newton’s request he arranges for Leclerc to publish the paper, but Newton loses his nerve and withdraws the essay (Westfall 1980: 488-93). They visit one another and write letters to each other on religion and on natural philosophy (e.g. LC #1357 4.197-98=NC #362 3.147-48, LC #1405 4.288-90=NC #365 3.152-54)

In his *Second Reply to Stillingfleet*, written after he had befriended Newton, Locke writes that *Principia* convinced him that he had been mistaken about the impossibility of action at a distance:

It is true, I say, “that bodies operate by impulse, and nothing else” [footnote: Essay, b. ii. c. 8 § 11]. And so I thought when I writ it, and can yet conceive no other way of their operation. But I am since convinced by the judicious Mr. Newton’s incomparable book, that it is too bold a presumption to limit God’s power, in this point, by my narrow conceptions. The gravitation of matter towards matter, by ways inconceivable to me, is not only a demonstration that God can, if he pleases, put into bodies powers and ways of operation above what can be derived from our idea of body, or can be explained by what we know of matter, but also an unquestionable and every where visible instance, that he has done so. (*2nd Reply* 4.467-68)
Newton had convinced him that bodies are universally attracted to one another by a mechanism that goes beyond the shape, size, number, and motion that can be derived from our ideas of body. Though he does not abandon his claim that the only way we can conceive of bodies interacting is by impulse, Locke is now convinced that God makes bodies operate in an inconceivable way. He then promises to revise Essay 2.8.11, “And therefore in the next edition of my book I shall take care to have that passage rectified” (2nd Reply 4.468).

It’s hard to get a vortex theory to entail Kepler’s laws, and Descartes didn’t engage the problem with any rigor. Newton’s objections in the first edition of Principia certainly count as prima facie difficulties, but these difficulties aren’t obviously insoluble. In his Tentamen de Motuum Coelestium, Leibniz attempted to derive both Kepler’s Second Law and his First Law (that the orbits of the planets are ellipses with the Sun at a focus) from a composition of the circular motion of a vortex, centrifugal force, and an attraction to the sun. The last attraction, according to Leibniz, should be explained impulsively in the same way as magnetism, whatever way that may be (Tentamen; Aiton Ch. 6, Bertoloni Meli 1993: Chs 1, 7). Malebranche likewise attempts a mechanistic reconstruction of Newton’s law of universal gravitation in an addition to the sixteenth clarification of the Search After Truth that he added in 1712 (Recherche 3.249-67=Search 695-706; Aiton 177-79)

Was Locke justified in believing something that he found inconceivable? The second edition of Principia appeared in 1713, almost a decade after Locke’s death. In that edition Newton argues that gravity can’t be explained by the surface textures of bodies, since on his account the internal parts of a body exert gravitational pull (Principia 530= CW 943; Janiak 2007: 129n6, 142-43). He also argues that the vortex theory can’t account for the paths of comets (Principia 527=CW 939-40). In the preface to Principia, his collaborator Roger Cotes doubts that the various intersecting vortices would keep their integrity over the centuries and
argues that such explanations are incompatible with the principle that the cause must be simpler than the effect (Principia xxvii-xxxi=CW 393-97). Many of the considerations that eventually resolved the debate in Newton’s favor were not yet on the table when Locke came to embrace action at a distance.

At one point in the Essay, Locke gives a hard normative standard for judgment that doesn’t seem to make any concession to the difficulties of gathering evidence: “the mind, if it will proceed rationally, ought to examine all the grounds of probability” before it assents or dissents (4.15.5). A little later, he softens his standards for practical reasons. “In matters of Probability, ’tis not in every case we can be sure, that we have all the Particulars before us,” he writes. Unknown evidence which we may not have “the leisure, patience, and means” to gather “may cast the Probability on the other side, and out-weigh all, that at present seems to preponderate with us” (4.16.3). In some cases, it isn’t prudent to collect all the evidence on a subject before rendering judgment. In the case of gravity, it seems to me that Locke did his epistemic duty, though it also seems likely that social, religious, and personal connections made him more sympathetic to Newton than other people would have been.

More generally, social and political factors made British thinkers more inclined to accept Newtonian doctrines than their continental counterparts were (Aiton Chs. 7-8, Merchant 1973, Bertoloni Meli 1993: Ch. 9). In 1742, near the end of the dispute, Hume makes some very knowing remarks about the epistemological value of seemingly extraneous political sympathies:

What checked the progress of the CARTESIAN philosophy, to which the FRENCH nation had shewed such a strong propensity towards the end of the last century, but the opposition made to it by the other nations of EUROPE, who soon discovered the weak sides of that philosophy? The severest scrutiny, which NEWTON’s theory has undergone, proceeded not from his own countrymen, but from foreigners; and if it can overcome the obstacles, which it meets with at present in all parts of EUROPE, it will probably go down triumphant to the latest posterity (Rée 121-22)
Kuhn makes a similar point within his framework:

> Individual variability in the application of shared values may serve functions essential to science. . . . If all members of a community responded to each anomaly as a source of crisis or embraced each new theory advanced by a colleague, science would cease. If, on the other hand, no one reacted to anomalies or to brand-new theories in high-risk ways, there would be few or no revolutions” (1970: 186; see D’Agostino 2005 for discussion).

For epistemic progress, what’s wanted are social and political divisions that are deep enough that when a new theory is proposed, thinkers line up on both sides of the issue in a lively debate, but not so deep that when a wide range of arguments are on the table, the participants are incapable of following the balance of reasons.

What lessons can we draw from the episode? First, such things can happen, that is, it’s possible for people to adopt beliefs that they had previously rejected as inconceivable. Second, people are more open to such adoptions when they are wrapped together with a position that the thinker was antecedently inclined to accept, in this case, a belief in the existence of a vacuum. Third, there are various sorts of limits to the understanding, and the ideal of a mathematically able, socially impartial judge with access to all the evidence can’t always be met. The truth may still come out with the right mix of authorities, institutions, and arguments.

2.4 Framework Incomprehensibility

Leibniz objects to Locke’s promise to revise the *Essay* so that it acknowledged action at a distance. According to Leibniz, appeals to the divine power undermine the fight against scholasticism,

> otherwise, through the favor of that which God can do, we will give too much license to bad philosophy and in admitting those centripetal powers and immediate attractions at a distance without being able to make them intelligible, I do not see what prevents our Scholastics from saying that everything happens simply through faculties, and from maintaining their intentional species which come from objects to us and find means to enter into our
souls. If that’s all right, ‘Everything will now happen that I denied could happen’ (*New Essays* 61). As Leibniz sees it, one cannot reject scholastic theories because they are unintelligible and believe at the same time that gravity works in an unintelligible way. For him, accepting action at a distance would have meant the end of sound philosophy, since it would neutralize the chief weapon in modern philosophy’s arsenal, its intelligibility.

The way that Locke revises the *Essay* shows that he does not believe that there is any inconsistency in believing in action at a distance and rejecting scholastic theories of perception on the grounds of their inconceivability. He deletes the offending section in the fourth edition and the replacement passage runs as follows: “The next thing to be consider’d, is how Bodies produce Ideas in us, and that is manifestly by impulse, the only way which we can conceive Bodies operate in” (*2.8.11 4th* ed.). We have to look twice to figure out how this counts as fulfilling his promise to Stillingfleet. Locke still argues that since the only conceivable way that bodies interact is by impulse, they interact by impulse when they produce ideas in us. His promise of making the passage consistent with his understanding of gravity is kept merely by restricting the subject under discussion to the physics of perception (Hill 2009: 90).

In both the first and the fourth editions, after asserting that we can only conceive of bodies working through impulse, Locke infers that sense perception works through the mediation of a sea of imperceptibly small particles (2.8.12-14; McCann 1994: 62, Hill 2009: 94-95). If an external object affects a sense organ through impulse, then they do so either immediately or through bodies in between the external object and the organ. Our eyes, ears, and noses sense distant objects, which can’t push on them immediately, so those objects

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17 Remnant and Bennett observe that the final quotation is from Ovid. In context it’s an expression of shocked dismay after a friend’s betrayal (*Tristia* 1.8.7).
affect our organs through intermediate bodies. There are no perceptible bodies between external objects and our eyes, ears, and noses, so Locke presumes that these intermediate bodies are imperceptibly small. By assuming that the intermediaries are small bodies, he rules out wave theories such as those advanced by Hooke and Huygens, for whom light was a pulse moving through a fluid medium (Darrigol Ch. 2). Locke’s presupposition that material substance comes in extended cohesive parcels may have kept him from seriously entertaining such hypotheses. By whatever reasoning, he is willing to base a corpuscularian theory of perception on the premise that impulse is uniquely conceivable.

In interpreting the relevant sort of inconceivability, we must avoid two extremes. On the one hand, we have to say that Locke attributes some sort of epistemic force to it, or the argument won’t make any sense. On the other hand, we can’t say that this sort of inconceivability guarantees the falsehood of whatever state of affairs we can’t conceive of, or the inconceivability of any corporeal action besides impulse will rule out Newtonian gravitational attraction.18

Insofar as this inconceivability justifies us in rejecting a proposition, it certainly does not give us knowledge that the negation of the proposition is true, at least not knowledge by Lockean standards. He believes that when we know something, we perceive a connection between two ideas (4.1.2). For universal propositions, this gives us certain knowledge, knowledge that no agent could make false (4.3.29). Thus, when we perceive this sort of agreement between ideas, we recognize the impossibility of the opposite.

The inconceivability of alternatives to impulse does not allow us to attain this level of certainty; Locke believes that God actually and unquestionably made bodies act in ways that

18 Keith Allen (2008a: §4) assumes that there’s no middle ground to be found and argues that once Locke concedes that bodies can act in inconceivable ways, his argument for a corpuscularian theory of perception becomes invalid.
go beyond impulse. For Locke, the limits of the world not only go beyond the limits of our knowledge, they go beyond the limits of our conceptions (1.1.5, 2.2.3).

Locke explicitly rejects the principle that if something is incomprehensible, then it is false. For example, he acknowledges that thinking matter can’t be explained naturally, but claims that the alternative of mind-body interaction is just as inexplicable. He protests against “an unfair way which some Men take with themselves: who, because of the unconceivableness of something they find in one, throw themselves violently into the contrary Hypothesis, though altogether as unintelligible to an unbiased Understanding” (4.3.6). On Locke’s view, there are situations in which both a hypothesis and its contrary are inconceivable; thus, he must believe that some truths are inconceivable. Since the relevant incomprehension carries is epistemically relevant, it can’t be merely the psychological incapacity that results from lacking the relevant ideas.

People think in paradigms and are likely to judge objects as better or worse instances of a concept insofar as they resemble a paradigm (Barker 434-36). If they treat a certain sort of explanation as a model of how to explain things, then they’ll be more likely to think that other phenomena can be explained in the same way and they’ll be less likely to think that phenomena can be explained in other ways. This was Kuhn’s great, deep thought. Locke treats mechanical explanations as paradigmatic ones, believes that many natural phenomena can be explained in this way, and believes that natural phenomena that can’t be explained mechanically can’t be explained by us at all.

For Locke, something can be incomprehensible in this sense even though it’s perceptible. At Essay 4.10.19, he writes,

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19 I should concede that ‘contrary’ does not mean contradictory. Rather, in traditional usage, two propositions are called contraries when they cannot both be true but may both be false (Kneale and Kneale 56). It is clear from context, however, that Locke believes that one of the two relevant contraries is true.

20 I botched this in a previous discussion of the topic (Jakovides 2002).
We cannot conceive how any thing but impulse of Body can move Body; and yet that is not a Reason sufficient to make us deny it possible, against the constant Experience, we have of it in our selves, in all our voluntary Motions, which are produced in us only by the free Action or Thought of our own Minds.

Here we see the limits of Locke commitment to the maker’s knowledge tradition. Though he thinks we can know the real essences of artifacts and can know what we intend to do, he denies that we understand how volitions move bodies. According to him, we can conceive of impulse moving bodies in a way that we cannot conceive of thought moving bodies.

Perception, which makes impulse conceivable in a way that other kinds of corporeal interaction are not, does not help us differentiate impulse from voluntary motion, since Locke emphasizes here and at Essay 2.23.28 that the production of motion by thought is a matter of experience. The way to understand the unique comprehensibility of impulse is to observe that impulse, unlike volitional action, is part of his paradigm of intelligible explanation.

Stillingfleet recognized a tension between Locke’s claim that all corporeal interactions are through impulse and the existence of mind-body interactions:

For you grant, That Bodies can operate upon one another only by Impulse and Motion (B. 2. Ch. 8. Sect. 11); that the Primary Qualities of Bodies which are inseparable from it, are Extension, Solidity, Figure and Mobility from any Body (Sect. 10.). Now how can the Idea of Liberty agree with these simple Ideas of Body? To be moved only by Impulse from another Body; and from the free Determination of our own Thoughts; are two Ideas as disagreeing with each other, as we can well imagine (Answer 73-74)

Locke paraphrases this as “how can my way of liberty agree with the idea that bodies can operate only by motion and impulse?” and replies: “By the omnipotency of God, who can make all things agree, that involve not a contradiction” (2nd Reply 4.467). Like thought and impulse, and unlike gravity and freezing, mind-body interaction is perceptible, according to Locke, so we should have some idea of it. It’s actual, so he can’t think that we perceive its
impossibility. Nevertheless, explaining it would require going far enough beyond his favored framework of explanation that he must appeal to divine omnipotence in accounting for it.

Rejecting the possibility of action at a distance is the standard view before Newton, but there are some salient exceptions. Most Greek philosophers, including Plato and Aristotle, rejected the possibility (Hesse 52-59, 67-70), but Galen, following Hippocrates, argued that organs attract juices proper to them from other parts of the body (Nat. Fac. 29-30). In defending this doctrine, he defends action at a distance more generally, arguing at length against atomist accounts of the lodestone and appealing to the capacity of dry grain to draw water through earthen vessels (Nat. Fac. 44-56; Hesse 58-59).

Most scholastics followed Aristotle in opposing action at a distance. (William of Ockham, as we shall see, was an exception.) In contrast, “Paracelsians found no difficulty in accepting” it (Debus 1978: 27). One way in which debate played out was in the controversy over whether and how wounds could be healed remotely by applying a salve to the weapon that caused the injury (ibid.). Against the view that cures that worked at a distance were unnatural and thus the work of the devil, Robert Fludd defended the existence of action at a distance (Unto Foster 29; Waddell 185-86). Van Helmont had earlier engaged in a similar dispute with the Jesuit priest Jean Roberti and was imprisoned by the Spanish Inquisition for his troubles (Debus 1978: 126-27, Pagel 1982: 8-13, Waddell 187-94).

Newton’s views on action at a distance have been a matter of controversy. Most scholars take his correspondence with Richard Bentley to show that he rejected action at a distance (e.g. Hesse 151-53, Janiak 2008: 32-41, Kochiras 2009: 268, 273-75). Newton writes,

The last clause of the second Position I like very well. Tis inconceivable that inanimate brute matter should, without the mediation of something else, which is not material, operate upon & affect other matter without mutual contact; as it must if gravitation in the sense of Epicurus be essential & inherent in it. And this is one reason why I desired you would not ascribe innate gravity to me. That gravity should be innate inherent, & essential to matter so that one
body may act upon another at a distance through a vacuum without the
mediation of anything else, by and through which their action and force may
be conveyed from one to another is to me so great an absurdity that I beleive
no man who has in philosophical matters a competent faculty of thinking can
ever fall into it. Gravity must be caused by an agent acting constantly
according to certain laws, but whether this agent be material or immaterial, I
have left to the consideration of my readers (\textit{NC} #406 3.253-54=\textit{PW} 102-03).

John Henry has persuasively argued that understanding this passage requires looking up the
clause in Bentley’s letter that Newton is praising and developing. Bentley had written “tis
unconceivable, that inanimate brute matter should (without a divine impression) operate
upon & affect other matter without mutual contact: as it must, if gravitation be essential and
inherent in it” (\textit{NC} #405 3.249; J. Henry 12-13).\footnote{I expanded a thorn.} For Bentley, it seems, the inherent and
essential features of bodies are the fundamental ones that they have independently of
circumstance and divine superaddition. If we take Bentley’s phrase as a clue to Newton’s
meaning, then Newton’s rejection of gravity as an innate and essential feature of bodies is
just a denial that inanimate brute matter can act a distance in a world without God (ibid. 12-14).

Hylarie Kochiras (2014: §4.2) suggests that Locke acquired his belief in action at a
distance by reading \textit{Principia} rather than by talking to Newton. Though, as she observes, this
fits the text of Locke’s letter to Stillingfleit, it doesn’t really fit the textual history of Locke’s
publications. In addition to reporting one of Newton’s arguments against interplanetary
vortices, his review quotes extensively from the scholium to Section 11 of Book 1, where
Newton declares that his terms ‘\textit{attractio}’ and ‘\textit{impulsus}’ are neutral with respect to how these
attractions and impulses are to be explained and with respect to whether the explanation is
corporeal or incorporeal (\textit{Review} 365-66, Axtell 1965: 156). In the first edition of the \textit{Essay}, he
praises Newton as the best of the master builders of the age (\textit{Epistle} 9-10), but it’s only after
they had became friends that Locke argues in print that bodies act in ways beyond impulse (Downing 1997: 290).

In a letter to his cousin, Peter King, Locke says of Newton, “he is a nice man to deale with, and a little too apt to raise in himself suspitions where there is no ground. Therefore when you talke to him of my papers and of his opinion of them pray doe it with all the tenderness in the world” (LC #3275 7.773). ‘Nice’ here is used in its older sense of fussy and difficult to please. Given their common interests, I find it hard to believe that they didn’t discuss the relation between God and gravity, and given Locke’s attitude toward Newton, I find it hard to believe that he would be bold enough to draw conclusions from the arguments of *Principia* differing from those that Newton was willing to draw.

Likewise with Bentley. Newton seems to have played a role in the selection of Bentley as the first Boyle lecturer (Guerlac and Jacob 316-18), and Newton’s correspondence with Bentley was for the sake of helping prepare those lectures for publication (Guerlac and Jacob 311, Westfall 1980: 504-06, J. Henry 12). If Newton thought that Bentley substantially misrepresented the theological implications of *Principia*, we would expect to find some expression of annoyance. Instead, Newton later acquiesces to an arrangement where Bentley makes at least £198 in profits from the second edition of *Principia* (NC 5.417; Westfall 1980: 750). These biographical facts suggest that by 1698, Newton, Locke, and Bentley all have the same view of action at a distance: it’s beyond the natural powers of bodies, yet possible, and indeed actual, through God’s superaddition of powers to bodies.

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22 *OED* s.v. ‘nice’ 3b.
Whether this is the right way to understand the circumstances or not,²³ scholars agree that Newton thinks that corporeal action at distance is problematic. At the very least, he thinks it’s problematic enough to require divine intervention.

Newton’s collaborator Cotes is more comfortable forthrightly calling gravitational attraction a fundamental and underived feature of bodies (Hesse 150-51, Janiak 2008: 92-94). Against those who argue that gravity is preternatural since it “does not arise from other affections of bodies and thus not from mechanical causes,” Cotes replies,

certainly there are primary affections of bodies, which, since they are primary, do not depend on others. Therefore let them consider whether it can be that all of these are equally beyond nature, and so equally to be rejected, and let them consider what philosophy will be after that (Principia xxvi=CW 392).

Everyone agrees that there are some qualities that are primary and foundational. We might as well, according to Cotes, classify gravity among those.

Samuel Clarke had given Cotes comments on a draft of the preface. In reply, Cotes clarifies what he had meant by an earlier version of the passage:

My design in that passage was not to assert Gravity to be essential to Matter, but rather to assert that we are ignorant of the Essential propertys of Matter & [t]hat in respect of our Knowledge Gravity might possibly lay as fair a claim to that Title as the other Properties which I mention’d. For I understand by Essential propertys such propertys without which no others belonging to the same substance can exist: and I would not undertake to prove that it were impossible for any of the other Properties of Bodies to exist without even Extension (NC #1001 5.412-13)

Cotes abandons the project of finding the essential properties of bodies. Instead, he recommends that we inquire as far as we can into the fundamental explanatory features of bodies and then move from there to explain derivative qualities.

Cotes’s reference to ‘primary affections’ isn’t best understood as a reference to Locke’s distinction between primary and secondary qualities, but rather to an older

²³ An unusual number of papers on the topic have come out in recent years, especially in Studies in History and Philosophy of Science. Kochiras (2009) and J. Henry (2011) are good places to start.
distinction that lies behind that one, a distinction between qualities that are fundamental in explaining the characteristics of matter and those that are derivative. In the disciplines that gave rise to chemistry, there’s a long tradition of calling the fundamental explanatory qualities or principles ‘firsts’ (Baeumker, Maier 1968: 17-18, Anstey 2000: 20-30, Pasnau 2011a: 459-68, 485-90). Aristotle’s ‘first qualities’ are hot, cold, dry, and wet; Paracelsus’s tria prima (‘three firsts’) are salt, sulfur, and mercury. Boyle was willing to follow Aristotelian usage in calling hot, cold, dry, and wet ‘first qualities’; he called what he considered to be the more fundamental attributes of size, shape, motion, and rest “Primary Modes of the parts of Matter; since from these simple Attributes, or Primordiall Affections, all the Qualities are deriv’d” (Cosmi call 6.267=SPP 97).

Cotes’s point is that there have to be some qualities that are fundamental in the order of explanation, and that gravity is a good candidate to count as a fundamental feature. Notice that this view is a defense of the unproblematic character of gravity. Unlike Bentley and Locke’s position, it can’t be developed into a proof for the existence of God.

How can we explain Cotes’s comfort and Locke’s, Newton’s, and Bentley’s discomfort with gravitational attraction as a foundational feature of bodies? For one thing, Cotes was twenty years younger than Bentley, forty years younger than Newton, and fifty years younger than Locke. Cotes grew up reading Principia. Locke, Newton, and Bentley had not. Kuhn remarks,

unable either to practice science without the Principia or to make that work conform to the corpuscular standards of the seventeenth century, scientists gradually accepted the view that gravity was indeed innate. By the mid-eighteenth century that interpretation had been almost universally accepted (1970: 105).

Cotes is an eighteenth-century thinker. Locke, Newton, and Bentley belong to the seventeenth.
Locke was exposed to corpuscularianism in his twenties. He didn’t read
Principia until he was in his fifties. If you treat certain explanations as exemplars of intelligibility for
decades, then explanations that are far from those exemplars will seem mysterious.

Such incomprehension justifies us in rejecting a hypothesis insofar as we have reason
to think that the exemplars that we have suffice for explaining the relevant phenomena. So,
if our favored sorts of explanation are broad in scope, fruitful in their consequences, and
conform to the evidence, then we ought to doubt explanations of a radically different sort.
Of course, such justifications are parasitic on the justifiability of believing that one’s
preferred paradigm can explain the relevant phenomena.
Chapter 3    Corporeal Substances and the Foundations of Corpuscularianism

3.1    Substances as Ordinary Objects

Locke’s worries about substance and inherence are tied up with his worries about his preferred theory of matter. He believes that getting a clear answer to the ancient question concerning the relation between primary beings and the qualities that inhere in them requires getting clear on certain intractable questions about cohesion and impulse. His specific complaints about the obscurity of our idea of substance in general aren’t ones that could be reasonably raised by any philosopher in any scientific context. Instead, they are puzzles concerning the foundations of corpuscularianism.

On one traditional reading, Locke’s idea of substance in general is the idea of a bare particular. In discussing the doctrine, G. E. M. Anscombe writes,

One of the considerations brought forward in erecting this notion (for it is not a straw man, real humans have gone in for it) seems so idiotic as to be almost incredible, namely that the substance is the entity that has the properties, and so it itself has not properties (1981b: 38).

Jonathan Bennett attributes this doctrine to Locke and writes, “The fact is that the substratum idea does involve a trouble that could be put in terms of the upholder of properties not itself having properties; yet it is not idiotic” (2001: 2.110-11). I don’t want to engage in the philosophical dispute between Anscombe and Bennett about whether the notion of a thing without properties having properties is idiotic or merely false. I do want to engage in the exegetical dispute between Bennett and Ayers about whether Locke believes that the idea of substance represents bare particulars out in the world.

As I understand Locke, he supposes that the idea of substance in general is, in Ayers’s phrase (1975: 4), “a sort of a dummy concept,” something standing in for both an absent, informative idea of the substance of body and the different, absent, informative idea
of the substance of spirit (Ayers 1975: 14-15). On the alternative interpretation, according to which Locke believes in bare particulars, our present idea of substance in general couldn’t be improved upon. It would represent a funny kind of logical object that existed uniformly in both bodies and spirits.

If Lockean substance were a kind of featureless substratum, then it would all be the same. He argues, however, that it can’t all be the same, in his consideration of the question of whether ‘substance’ is used in the same sense when applied to God, finite spirits, and body:

If so, whether it will not thence follow, That God, Spirits, and Body, agreeing in the same common nature of Substance, differ not any otherwise than in a bare different modification of that Substance; as a Tree and a Pebble, being in the same sense Body, and agreeing in the common nature of Body, differ only in a bare modification of that common matter; which will be a very harsh Doctrine (2.13.18).

The passage implies that Locke believes our idea of substance in general has to correspond to radically different kinds of substrata in God, finite spirits, and bodies (Ayers 1975: 14-15n32). Otherwise, we would be stuck with the absurd consequence that they could be transformed into one another.

Moreover, if by ‘substance’, Locke meant bare particular he wouldn’t have asserted that a clear idea of substance would be useful (1.4.18), make our complex ideas of substance more adequate (2.31.13), and take us part of the way towards natural science (4.3.23). At 2.23.1, Locke writes, “we accustom our selves, to suppose some Substratum, wherein they [scil. recurring collections of ideas] do subsist, and from which they do result, which therefore we call Substance;” which suggests that the relation between substance and quality is

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24 I think of myself as following Ayers in various respects, but I abjure the implications there seem to be in his 1975: §1 that Locke identifies substances and real essences and that he identifies ignorance of substance with ignorance of real essence.

25 Locke goes on to argue that that Cartesians don’t have clear and distinct ideas of different sorts of substance by challenging them to specify the relevant ideas (2.13.18). I’ll explain his reasons for denying that we have clear ideas of corporeal substance or spiritual substance in the next section.
explanatory, since the ideas are supposed to result from the substance (as Bennett concedes 2001: 2.122-23, see also Stuart 2013: 214-5).

Excellent evidence that Locke doesn’t believe in the existence of general substances in rerum natura may be found where he chides Edward Stillingfleet for referring to ‘general substance’ and writes, “I must take the liberty to deny there is any such thing in rerum natura, as a general substance that exists itself, or makes any thing” (Letter 4.27; Pasnau 2011a: 162-63n4). For Locke, there aren't substances-in-general out in the world in addition to all the particular substances. More generally, I want to say, the exchange is evidence that his idea of substance in general doesn’t correspond to any entity in the world distinct from ordinary objects. It’s only a mark of obscurity and confusion in our conception of ordinary objects.

Instead, Lockean substances are ordinary objects that have the qualities that inhere in them. The best evidence for this occurs in his reply to Stillingfleet’s charge that he had “almost discarded Substance out of the reasonable part of the World” (Trinity 234). Locke writes,

> as long as there is any simple idea or sensible quality left, according to my way of arguing, substance cannot be discarded; because all simple ideas, all sensible qualities, carry with them a supposition of a substratum to exist in, and of a substance wherein they inhere: and of this that whole chapter is so full, that I challenge any one who reads it to think I have almost, or one jot discarded substance out of the reasonable part of the world. And of this, man, horse, sun, water, iron, diamond, &c. which I have mentioned of distinct sorts of substances, will be my witnesses as long as any such thing remains in being (Letter 4.7).

The defense in the final sentence only makes sense if he considers horses, water, and diamonds to be examples of substances (Pasnau 2011a: 165-66). Nor should we look at Locke’s term ‘substratum’ as a special term for a peculiar and distinct entity underlying the substances that are ordinary objects and stuffs (Korman §5). According to him, the

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26 The texts that Peter Alexander quotes (210-211) to show that Locke believes in substance-in-general out in the world just show that he believes in the existence of substances.

27 In Essay 2.27, ‘substance’ is used somewhat more narrowly, but let me set that aside.
substratum is that which ‘we call Substance’ (2.23.1); in his first letter to Stillingfleet, he implies that he’s using the word ‘substance’ to mean “the substratum of accidents” (Letter 4.23).

Locke believes that we know that qualities can’t exist without a bearer of qualities: “the ideas of these qualities and actions, or powers, are perceived by the mind to be by themselves inconsistent with existence . . . . Hence the mind perceives their necessary connexion with inherence or being supported” (Letter 4.21, see also 2.23.2). He considers the definitive marks of substance to be supporting qualities (2.23.6) and not being supported by anything in turn (2.12.6). He assumes that clear ideas of the substance of body and the substance of spirit would not raise the further question of what those substances depend upon. On this picture of substance, it can’t be turtles all the way down.

The idea of substance in general is the idea of a thing that stands on its own and in which qualities inhere; for Locke these are just ordinary objects. We add ideas of particular qualities to the idea of substance in general to get the ideas of particular substances and of the sorts they fall under. Again, these are ideas of ordinary objects and of their sorts. Thus understood, substances are distinct from the sum of their qualities (Korman 78). Instead, they are the things that have the qualities, the things in which the qualities inhere. So, e.g., Fido is not his friendliness and brownness, but rather that thing which is friendly and brown. Which is not to say that dogs or other substances lack qualities.

These are all good Aristotelian theses (Cat. 2a11-12, 2b15-17), and Locke appeals to the authority of “Burgersdicius, Sanderson, and the whole tribe of logicians” to back him up (Letter 4.8). Locke’s definition of substance

is the best I can hitherto find, either in my own thoughts, or in the books of logicians: for their account or idea of it is “Ens,” or “res per se subsistens et substans accidentibus;” which in effect is no more, but that substance is a being or thing; or, in short, something they know not what, or of which they have no clearer idea, than
that it is something which supports accidents, or other simple ideas or modes, and is not supported itself as a mode or an accident (ibid., see also 2nd Reply 4.449-50; McCann 2001: 96-97, Lowe 503).

We should take his avowals of Aristotelian orthodoxy seriously.

In his survey of the literature, Stuart (2013: 213-23) comes up with five entities or stuffs other than ordinary objects that the obscure idea of substance in general might correspond to: bare particulars, real essences, matter, featureless stuff, mysterious stuff, and quantity of stuff. I don’t think that these readings fit with Locke’s avowals of orthodoxy, the ordinary examples that he gives to Stillingfleet, or his implication that the idea of substance in general is an idea that doesn’t correspond to a funny object.

Having noted this, we should find the source of Locke’s unhappiness with the orthodox position that he finds himself advocating along with Aristotle and his followers. Why does Locke assert that when we describe the “Supposition of he knows not what support of such Qualities, which are capable of producing simple Ideas in us . . . we talk like Children; who, being questioned, what such a thing is, which they know not, readily give this satisfactory answer, That it is something” (2.23.2)? How can his orthodox definition of substance be compatible with his argument that “Substance and Accidents [are] of little use in Philosophy” (2.13.19-20 marg.)? What’s the point of the analogy between “a philosopher that says, that which supports accidents is something he knows not what; and a countryman that says, the foundation of the church at Harlem is supported by something he-knows-not-what” (Letter 4.10)?

With respect to his comparison of philosophers to children, let us note that Locke argues that we are like them in being ignorant, not in being mistaken (2.23.2, Letter 4.10). With respect to his argument that substance and accident are of little use in philosophy, let us note that the relevant kind of philosophy is natural philosophy—physics, in particular.
Locke is arguing against a certain Cartesian argument against the vacuum. With respect to
the analogy of the countryman, consider the possibility of knowledge that Locke sketches
immediately afterward:

if the countryman knows that the foundation of the church at Harlem is supported
by rock, as the houses about Bristol are; or by gravel, as the houses about London
are; or by wooden piles, as the houses in Amsterdam are; it is plain, that then, having
a clear and distinct idea of the thing that supports the church, he does not talk of this
matter as a child; nor will he of the support of accidents, when he has a clearer and
more distinct idea of it, than that it is barely something (Letter 4.10, see also 2nd Reply
4.446).

The ignorant farmer is like the philosopher who knows that substances support accidents,
without knowing any details. The knowledgeable farmer has a clear idea of what lies under
the foundations of the houses and thus knows how the foundations are supported. The
problem with philosophical orthodoxy about the nature of substance is not that it is in error,
but rather that it doesn’t fill in the details. If we had clear ideas of substance, we would
know not only that qualities inhere in substances, but also how they inhere in substances
(Ayers 1991: 2.37). This knowledge, Locke supposes, is like a piece of civil engineering.

Stuart denies that Lockean substrata are ordinary substances, since “If it were his
position, then he should not say that the idea of substance in general is obscure or confused”
(2013: 210). This inference implausibly assumes that Locke believes that there aren’t any
deep mysteries pertaining to ordinary substances. But there are such difficulties, and they are
developed at great length §§15-27

The obscurity of the idea of substance will turn out to come in two flavors. First, the
obscurity of our idea of spiritual substance and second the obscurity of our idea of corporeal
substance. Considered as an abstract idea, separated from its surroundings, it’s the same
obscure and relative idea in both cases; each is the mark of our ignorance at the foundations
of our understanding of substance. The same idea, however, signifies different puzzles when
surrounded by ideas of corporeal qualities than it does when surround by ideas of mental operations. The obscurity of our idea of the substance of spirit is a matter of not knowing how it can think or will. The obscurity of the idea of the substance of body is a matter of not knowing how they cohere or move other bodies.

In arguing for the inevitability of a general idea of substance in addition to all the particular ideas of qualities, Locke writes, “when we speak of any sort of Substance, we say it is a *thing* having such or such Qualities, as Body is a *thing* that is extended, figured, and capable of Motion a Spirit a *thing* capable of thinking” (2.23.3). According to him, “These, and the like fashions of speaking intimate, that the Substance is supposed always *something* besides the Extension, Figure, Solidity, Motion, Thinking, or other observable *Ideas*, though we know not what it is” (ibid.). In the next two sections, he subdivides the problem of the obscurity of our idea of substance between bodies and spirits. First, “when we talk or think of any particular sort of corporeal Substances, . . .” for which we must posit in each “some common subject; *which Support we denote by the name Substance*, though it be certain, we have no clear, or distinct *Idea* of that *thing* we suppose a Support” (2.23.4). He then moves on the spiritual substances:

The same thing happens concerning the Operations of the Mind, *viz.* thinking, Reasoning, Fearing, *etc.* which we concluding not to subsist of themselves, nor apprehending how they can belong to Body, or be produced by it, we are apt to think these the Actions of some other *Substance*, which we call *Spirit* (2.23.5).

The upshot of all of this is, “We have as clear a notion of the Substance of Spirit, as we have of Body” (ibid.). We have no “clear and distinct *Idea*” of either (ibid.). That comparison is developed at great length in the middle of the chapter, where Locke makes it plain wherein the relevant obscurities lie.
The problem of the obscurity of our idea of substance is bifurcated in sections four and five and explained at great length in sections fifteen through thirty-two. So, if we want to understand Locke on the obscurity of our idea of substance, we should look carefully at his argument that our idea of spirit is no more obscure than our idea of body.

3.2 What a Clear Idea of Substance Would Teach

Locke argues against Hobbes that our idea of corporeal substance is as “clear and distinct” as our idea of thinking substance, by arguing that they are both obscure (2.23.15). He argues that the idea of body is obscure by arguing that we can’t explain cohesion or impulse. The form of his argument implies that he believes that a clear idea of corporeal substance would allow us to explain the coherence of bodies and the capacity of bodies to make other bodies move through impulse. Otherwise, the skeptical arguments developed with such loving care would be irrelevant to the wider anti-Hobbesian point.

Locke has a tangled relationship with Hobbes. In his 1660 First Tract of Government, he asserts the Hobbesian doctrine that “it is yet the unalterable condition of society and government that every particular man must unavoidably part with this right to his liberty and entrust the magistrate with as full a power over all his actions as he himself hath” (1st Tract 11). In that work, he also echoes Hobbes by asserting that, in the absence of government, there is “no peace, no security, no enjoyments, enmity with all men and safe possession of nothing, and those stinging swarms of miseries that attend anarchy and rebellion” (1st Tract 37; Cranston 61-63).

In 1673, Hobbes’s biographer John Aubrey wrote to Locke and suggested that he visit the elderly Hobbes: “The old gent is still strangely vigorous if you see him (which he would take kindly) pray my service to him” (LC #268 1.376; Cranston 151-53). We might
reasonably take Aubrey’s informal tone to imply that he wasn’t setting up a first meeting between Hobbes and Locke, but rather suggesting another visit between acquaintances. If Hobbes hadn’t met Locke, it’s not clear why he would have wanted Locke to come visit. Locke wasn’t famous in his own right at the time, and if Hobbes’s goal was merely to curry favor with Locke’s patron Shaftesbury, it would be odd for him to sit back and hope for a visit from Locke (Rogers 1998b: 61-62).

Even in Locke’s mature views in his published works, important similarities remain with Hobbes’s opinions. Locke defines good as that which causes pleasure (2.20.2). Hobbes defines good as the object of appetite and pleasure as the appearance of good (Leviathan Ch. 6, pp. 120-22; Rogers 1998b: 76-77). Locke, like Hobbes, argues that belief that Jesus is the messiah suffices for salvation (Leviathan Ch. 43, p. 615, Reasonableness Chs. 4-6, 9-13; Higgins-Biddle lxxv-lxxvii). In the Second Treatise of Government, Locke argues, as Hobbes had in Leviathan, that considering the conditions under which it’s rational to leave the state of nature can tell us something important about the proper scope and function of government.

Notwithstanding these enduring similarities, Locke’s political views moved away from absolutism and thus, in effect, away from Hobbes. A few years before Aubrey’s solicitous message, Locke writes an annotation in a work by Samuel Parker in which he compares Parker’s view to Hobbes’s and treated the similarity as a reductio ad absurdum (Cranston 133, Rogers 1988b: 73-74). Samuel Mintz describes Hobbes as “the bête noire of his age” (vii). By the time he wrote the Essay, Locke was willing to add his voice to the general hostility. At one point, he distinguishes the Christian, ‘Hobbist,’ and heathen justification for why agreements ought to be kept (1.3.5), a division that excludes Hobbes and his followers from the ranks of Christians.

Hobbes argues that empiricism entails the inconceivability of immaterial objects,
because whatsoever (as I said before,) we conceive, has been perceived first by sense, either all at once, or by parts; a man can have no thought, representing any thing. . . . but he must conceive it in some place; and indued with some determinate magnitude; and which may be divided into parts (Leviathan Ch. 3, p. 99).

Since everything we perceive has divisible magnitude, everything we can conceive of has divisible magnitude. He eventually concludes, “Substance incorporeal are words, which when they are joined together, destroy one another, as if a man should say, an Incorporeal Body” (Pt. 3, Ch. 34, p. 429).

Locke argues against “People, whose Thoughts are immersed in Matter, and have so subjected their Minds to their Senses, that they seldom reflect on any thing beyond them” (2.23.22). Hobbes, who denies that we can conceive something if we haven’t sensed its parts, is no doubt the farthest sunk of the submerged (Downing 2001: 529-30). Such people “are apt to say, they cannot comprehend a thinking thing, which, perhaps, is true: But,” Locke adds, “when they consider it well, they can no more comprehend an extended thing” (2.23.22). That is, materialists deny that they understand what people mean by spirits, but if they think about it, they’ll see that they don’t really understand bodies either.

The arguments are anticipated in 2.23.5, but they run in earnest from §§15-32 of the chapter. In them, Locke tries to show that people do not have “any more, or clearer, primary Ideas belonging to Body, than they have belonging to immaterial Spirit” (2.23.16). The quoted passage anticipates arguments for two conclusions, one about the quantity of our primary ideas and the other about their clarity. I’ll call the first argument (which I’ll return to in the next chapter) the enumeration argument and the second one the difficulty argument, because Locke infers from the difficulty of explaining the fundamental principles of corpuscularianism that we do not have clear ideas of body. Understanding the difficulty
argument tells us what he thinks we would know if we had a clear idea of corporeal substance.

Both arguments turn on Locke making trouble for the incautious and unworried materialist. He tries to show that there are two fundamental properties, cohesion and the ability to make other bodies move by impulse, which we can’t explain.

When Galileo made the study of the strength of materials one of his Two New Sciences he put the problem of cohesion at the center of natural philosophy (Millington 254). He gives two initial explanations for the cohesion of bodies: first, “that much-talked-of repugnance which nature exhibits towards a vacuum” and second, “a gluey or viscous substance which binds firmly together the component parts of the body” (Discorsi 11). In arguing that the abhorrence of vacuum explains at least some forms of cohesion, Galileo cites the phenomenon that it’s very difficult to pull “two highly polished and smooth plates of marble, metal, or glass” apart, even though they can easily be moved laterally with respect to one another (Discorsi 11-12.). He supplements this account with the tentative hypothesis that microphysical vacua inside solid bodies hold them together (Discorsi 19-20). He also argues that the surface tension holding water droplets together can’t have an internal source and must thus have an external cause (Discorsi 70).

As we’ve seen, Locke was interested in cohesion from at least the time when he composed Draft A in 1671. There he suggests that cohesion is explained by something like carpenter’s joints. James Hill (2004: 612-13) calls these ‘hook and eye’ accounts. Lucretius had given one in de Rerum Natura:

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28 Zvi Biener (2004) has argued that Galileo’s first new science is “the science of matter,” but that doesn’t do justice to the focused character of Galileo’s discussion. Biener more accurately writes, “although the moniker ‘strength of materials’ accurately represents the contents of Galileo’s new science, it fails to capture the significance of his approach to it” (256), which seems fair enough, but it isn’t a reason to use a different term for the science.
What seems to us the hardened and condensed
Must be of atoms among themselves more hooked,
Be held compacted deep within, as 'twere
By branch-like atoms- of which sort the chief
Are diamond stones, despisers of all blows,
And stalwart flint and strength of solid iron,
And brazen bars, which, budging hard in locks,
Do grate and scream. But what are liquid, formed
Of fluid body, they indeed must be
Of elements more smooth and round- because
Their globules severally will not cohere (DRN 2.444-452)²⁹

On such accounts, both fluids and solids are composed of rigid corpuscles, and differences in cohesion are determined by the shapes of the corpuscles and their arrangement.

In the published version of the Essay, Locke reaches a more pessimistic position. He writes of body, “wherein consists the union and cohesion of its parts seems to me as incomprehensible, as the manner of Thinking, and how it is performed” (2.23.24). He argues that we’ll never have an explanation for cohesion by arguing against potential internal and external explanations. All of Locke’s arguments are against particular accounts of cohesion, but we should attend to the form of most of these arguments. He argues that contemporary theories of cohesion, even if true, would not completely explain cohesion. According to him, they all explain the cohesion of bodies by appealing to other coherent bodies, but they can’t explain the cohesion of those explanatory bodies.

In the English draft of the abstract of the Essay, Locke attributes the theory that bodies are held together by ethereal pressure to Jacob Bernoulli (Abstract 375, Rogers 1998a: 30, Hill 2004: 614). Malebranche also advocated such a view (Recherche 2.392-402=Search 520-26; Millington 264-67, Hill 2004: 613-14). In the Essay proper, Locke offers three arguments against such theories.

²⁹ I owe the reference to Antonia LoLordo
First, he points out that explaining cohesion by appealing to the evenly distributed pounding of air corpuscles would not explain the coherence of the air corpuscles (2.23.23). He argues that we cannot completely fill in the explanatory gap by supposing that the pressure of the ether holds the corpuscles together, since the coherence of ether particles would remain unexplained (ibid.; Hill 2004: 626-27).

Locke’s second argument draws lessons from Boyle’s account of why two polished pieces of marble are hard to pull apart. If Locke knows Galileo’s account of the phenomenon, he doesn’t take it seriously. For Locke, the “abhorrence of a Vacuum” is something that people only believe in because they’ve been taught the expression for it (3.10.14). Instead, he assumes the truth of Boyle’s account, for whom the phenomenon is explained by “the unequall pressure of the Air upon the undermost stone; For the lower superficies of that stone being freely expos’d to the Air is press’d upon by it, whereas the uppermost surface, being contiguous to the superiour stone, is thereby defended from the pressure of the Air” (Spring 1.238; Millington 261, Shapin and Schaffer 47-48). Locke grants that pressure from an ambient fluid “may hinder the avulsion of two polished Superficies, one from another in a Line perpendicular to them, as in the Experiment of two polished Marbles” (2.23.24), but he argues, the very same case shows us what happens when there is ordinary, symmetric ambient pressure.

Though the two polished marbles can only be pulled apart with difficulty, they can be easily moved laterally relative to one another; such pressure doesn’t “hinder the separation by a Motion, in a Line parallel to those surfaces” (ibid.). Since symmetric ambient pressure doesn’t constrain two polished pieces of marble from moving laterally, it can’t give a general explanation of cohesion. If ambient pressure were the only source of cohesion, then “in every imaginary plain, intersecting any mass of Matter, there could be no more
cohesion, than of two polished Surfaces, which will always, notwithstanding any imaginable pressure of a Fluid, easily slide one from another” (ibid.). Because ordinary ambient pressure doesn’t keep two pieces of marble from sliding relative to each other, Locke concludes that it can’t be the only thing holding bodies together.

In his third argument Locke appeals to cosmological considerations to show that cohesion can’t be explained though external pressures. Either the material world is finite in extent or infinite. If the material world is finite, we couldn’t explain why the universe coheres. If we suppose infinite matter, then we replace a difficult hypothesis, a coherent finite universe, with “the most absurd and most incomprehensible” supposition of all, an infinite material world (2.23.27).

Locke has oddly asymmetrical attitudes to the possibilities of infinite space and infinite matter. He assumes space extends infinitely in all directions (e.g. at 2.15.8), but he considers infinite matter repugnant to reason. Aquinas rejected the possibility of an infinite natural body on the grounds that “every natural body is determined by some substantial form” (ST 1.7.3). Locke can’t be thinking exactly that thought, since he rejects the intelligibility of substantial form (2.23.6, 3.10.14), but perhaps the scholastic pattern of thought that treated infinite bodies as inconceivable crept its way into his mind.

Besides arguing against explanations of cohesion from external causes, Locke also argues against being able to fully explain the phenomenon through internal bonds. He grants his opponent that these might supply intermediate explanations of cohesion, but claims that these explanations would need to appeal to coherent bodies. He admits that it would be a great discovery if someone determined the cement that holds ice together, but this would not make cohesion “intelligible, till he could shew wherein consisted the union, or consolidation of the parts of those Bonds, or of that Cement, or of the least Particle of
Matter that exists” (2.23.26). (Malebranche makes a similar point, *Recherche* 2.379—Search 512-13.) According to Locke, we can give no ultimate account of the cohesion of the bodies that explain the cohesion of other bodies (Hill 2004: 624-25).

These sorts of regress argument will not work against any possible explanation of cohesion. One might explain it without appealing to objects that themselves cohere. For example, one could think of the ether not as composed of cohesive particles but as a perfect fluid. Along these lines, Leibniz believes that matter at rest is such a fluid and, following Hobbes (*Seven Ch. 5*), that the intersecting motions of that fluid produce firmness (*Thoughts*; Millington 262-64). Someone who explains the cohesion of bodies through the behavior of a fluid does not move in a circle, nor does she use the kind of explanation that artisans apply to machinery.

Locke’s pessimism about our prospects for explaining cohesion is a sign of his refusal to countenance alternatives to corpuscularianism. Natural philosophers who restrict themselves to mechanical principles cannot explain cohesion completely. A regress argument will work against any account of cohesion that appeals to the mechanical affections of bodies in the way that a watchmaker or a smith appeals to them. If the extension of solid bodies depends on cohesion, there is no hope of offering a mechanical explanation of cohesion without falling into a vicious circle. Extension is too fundamental to this kind of explanation to get around. Cohesion explains the mechanical features of bodies, and these features cannot explain cohesion in turn.

Besides being pessimistic about explaining cohesion, Locke also has little hope for explaining “the power of communication of Motion by impulse” (2.23.28). He can’t help thinking that collisions involve the passing of an accident, motion, from one body to another. According to him, in the ordinary case in which the quantity of motion is conserved in a
collision, “we can have no other conception, but of the passing of Motion out of one Body into another; which, I think, is as obscure and inconceivable, as how our Minds move or stop our Bodies by Thought” (ibid.). There’s only one way to conceive of collisions, but Locke doesn’t like it. He dislikes it so much that he’s willing to contradict himself and call that one way inconceivable.

According to Locke, when we see a second body moving after being struck by a first, “we observe it only to transfer, but not produce any motion” (2.21.4). We see a certain motion hopping from body to body, but we don’t perceive the initial generation of that motion (Mattern 41). Looked at coldly, it’s hard to see the scandal here. We might think of this as a reasonable way to conceive of momentum, that is, as a determined, non-spontaneous, dependent, conserved entity passed from body to body in collisions.

Locke finds the testimony of his senses problematic because it strays too close for his comfort to the scholastic conception of a real quality, which early modern philosophers treated as paradigms of scholastic nonsense. Boyle cites Aristotle’s definition of be in a subject and cites its three conditions: “(1) be in another thing, (2) is not in it as a part, and (3) cannot exist separately from the thing or subject, wherein it is” (OFQ 5.308=SPP 21, Cat. 1a22-24). In light of that account of inherence, he complains, the doctrine of real qualities “appear to me to be either unintelligible, or manifestly contradictory” (OFQ 5.308=SPP 22; Pasnau 2011a: 180). Since the Catholic doctrine of transubstantiation appealed to real qualities (Pasnau 2011a: 185-90), Descartes had reason to be more tactful, but he argues along the same lines as Boyle: “It’s completely contradictory for there to be real accidents, since whatever is real can exist separately from any other subject, but whatever can exist separately is a substance and not an accident” (AT 7.434=CSM 2.293; Menn 188-89).
Such considerations had occurred to the scholastics, who thought that a miracle was required to separate an accident from its underlying substance. To the objection that the accidents of the bread and wine can’t exist without the corresponding substances, Aquinas cites the pseudo-Aristotelian Book of Causes, according to which “the effect depends more on a first cause then on a second.” “And so,” he continues, “God, who is the first cause of everything, can make things that are posterior remain, while taking away things that are prior” (ST 3.75.5 ad 1). God can overrule the ordinary dependence of accidents on their substances and does so during the Eucharist.

Aquinas doesn’t believe that such independence occurs in the ordinary course of nature, however. In reply to an argument for occasionalism from “exponents of the Moorish law” (SCG 3.69.11), he replies that “it’s ridiculous to say that a body doesn’t act because an accident doesn’t pass from subject to subject” since people don’t explain natural phenomena in that way: “For it isn’t said that a hot body heats because numerically the same heat that’s in the heating body passes to the heated body: instead a numerically distinct heat becomes actual in the heated body because of the power of the heat in the heating body” (SCG 3.69.28; O’Neill 1993: 38). Qualities work through the multiplication of species and not through their transfer. As evidence that this was the standard scholastic view, we may consider Leibniz’s remark that Paolo Casati thought of the transfer of motion as the transfer of a real accident “despite the entire school” (New Essays 171-72).

Viewed from the point of view of eternity, it may seem that there’s nothing more natural about the multiplication of species than there is about the transfer of species, but

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30 According to the apparatus of the Leonine edition of SCG, Aquinas has in mind the views described by Maimonides in Part I, Chapter 73 of the Guide for the Perplexed. He attributes to the Mutakalleminim the view “that this white cloth, which is coloured when put into the vessel filled with indigo, has not been blackened by the indigo; for blackness being an attribute of indigo, does not pass from one object to another” (Guide 125). Walter Ott pointed me to the passage in Aquinas, and Jeff Brower and Dan Frank helped me find its antecedents.
judgments of conceivability aren’t made from a standpoint of eternity. Instead, they’re made in a certain time and place. The claim that accidents depend on the substances in which they inhere isn’t a merely verbal definition, but rather part of Aristotle’s attempt to completely describe the constituents of reality, an attempt that governed the range of what philosophers thought naturally possible for a long time to come.

One might think that Descartes commits himself to the transfer of accidents across substances in his formulation of his third law of nature, the second clause of which tells us that when a body “meets a weaker one, it loses as much [motion] as it transfers to the other” (PP 2.40, see also PP 2.42, 2.48, 2.50). Henry More presses him on how such transfer is possible, since “my imagination doesn’t entirely grasp, how anything that can’t exist outside of a subject (as are all modes of whatever kind), might migrate into another subject” (AT 5.382). Descartes replies,

> You observe correctly that ‘motion, since it is a mode of body, cannot pass from one body to another’. But that is not what I wrote . . . When I said that the same amount of motion always remains in matter, I understood this as regarding the force which impels its parts, which applies itself at one moment to one part of matter and at another to another in accordance with the laws set out in articles 45 and following of Part Two. So there is no need for you to worry about the transmigration of rest from one object to another, since not even motion, as a mode which is opposed to rest, transmigrates in that way (AT 5.404-05=CSMK 3.382).

This is an important, yet enigmatic remark, and one that does not satisfy all subsequent thinkers. Louis de la Forge (Traité 237-38=THM 145) denies that bodies have causal power in order to avoid having motions hop from one body to another (Anstey 1999: 64, Sangiacomo 2014). Even Boyle suggests that this is a good argument for occasionalism (Anstey 1999: 60, 64). The problem pushes Margaret Cavendish (Phil. Letters 97-99=W P 24-26) to assimilate the collisions of bodies to the control of the mind over the body and also pushes her to the conclusion that all matter is animated (O’Neill 2001: xxix-xxxv).
Huygens is an interesting exception to the general anxiety about the transfer of motion. In a letter to Henry Oldenburg, he writes,

As for Mr [William] Neile’s request for the reason why one body gives movement to another, I don’t believe that this can be found through better known principles. And I think that I have done something by having demonstrated the rules of communication of motion which nature observes, even though I only showed to both [‘the that,’ as opposed to the why] (OC #1307 6.290/292)

For Huygens, we should be content with learning that bodies communicate motion in accordance with certain rules, and not worry too much about why or how this occurs.

Leibniz expresses surprise at Locke’s sympathy for the view that motion is a real quality that can move from body to body. He has Theophilus tell Philalethes, “I doubt that this is your view, or that of your able friends, who usually stay well clear of such fantasies” (New Essays 172). Remnant and Bennett suggest that such considerations may have pushed Leibniz towards the doctrine of pre-established harmony, (New Essays lxiv-lxv, s.v. ‘Pre-established harmony’). It’s in this context that Locke calls the transfer of motion in collisions “obscure and inconceivable.”

Since he describes difficulties in explaining the communication of motion and cohesion as evidence for the obscurity of our idea of body, we may infer that a clear idea of the substance of body would resolve those difficulties. Nor would such a self-explanatory idea leave open new puzzles of dependence. It would tell us how bodies manage to exist without inhering in anything else. It’s also a good bet that Locke assumes that any such knowledge would conform to his account of knowledge. That is, it would consist in the direct or indirect perception of the agreement between some clear idea of the substance of body and the ideas of impulse or the idea of solid, coherent parts. This chain of ideas would explain to its perceiver how bodies cohere and communicate impulse.

31 For a very useful discussion see Eileen O’Neill (1993).
A corresponding clear idea of the substance of spirit would tell us how spirits manage to exist without inhering in anything else and explain how volition and understanding work. Given the right idea of substance, we could solve the puzzles associated with the foundations of bodies or those associated with spirits.

3.3 Corpuscularianism with Obscure Foundations

How are Locke’s worries about the foundations of corpuscularianism compatible with his praise of the doctrine? As we’ve seen, he takes impulse to be the only conceivable mode of corporeal action. How can his conclusion in Essay 2.23.28 that we do not comprehend “the manner how” motion is produced by impulse be compatible with his assertion in 2.8.11 that we can only conceive of bodies operating through impulse?

We can reconcile these passages by recognizing that Locke believes that we can explain phenomena through principles that we cannot explain in turn. At 2.23.28 impulse is a phenomenon to be explained, and, since it seems to involve the transfer of real accidents from one body to another, he concludes that we have no explanation for it or any prospect of acquiring one. At 2.8.11, the phenomenon to be explained is the motion of bodies, something distinct from impulse. In the first search for explanation, we cannot appeal to impulse on pain of circularity. In the second search, Locke assumes that an appeal to impulse will be intelligible and helpful.

Some might say we should not use impulse explanations to explain phenomena until we understand impulse all the way down, but this seems excessively scrupulous. We should follow Boyle in accepting intermediate explanations. Difficulties in conceptualizing the transfer of motion don’t show that locksmiths cannot explain how a key opens a lock. If Locke’s worries about the conceptualization of impulse do not imperil the locksmith’s actual
explanations of how a key opens a lock, they do not imperil the corpuscularian chemist’s potential explanation of how *aqua regia* dissolves gold. If a pharmacist somehow learns the minute mechanical affections of opium and the human body, and thereby derives the soporific effects of opium, we will not complain if he fails to give an ultimate explanation of cohesion of poppy seeds.

None of Locke’s skeptical reflections contradicts his belief that watchmakers understand their watches well by using deductive reasoning, since he believes in deductive explanations that are not ultimate and complete explanations. He believes that the watchmaker has an explanation for the rotation of the second gear, although he also believes that she does not understand why the gears do not melt. That’s the commonsensical view. The watchmaker has a superior understanding of watches, and this superior understanding consists in the fact that she can offer better deductions of how watches work than most people can. This is true even if she cannot go further down the chain of explanations and explain why copper or any other solid material does not melt upon contact.

Locke tells us that we perceive the transfer of motion from one body to another and in the same breath he asserts that “the manner how, hardly comes within our comprehension” (2.23.28). We perceive the phenomenon without having any explanation for it. To take an example from Locke’s “Discourse on Miracles”, the disciples may perceive Jesus’ walking on water without comprehending the manner in which it is done (*Miracles* 9.259). In natural cases as well (the northern lights, the flight of a butterfly), a person may perceive what he cannot explain.

Arnauld and Nicole’s axles and Locke’s interlocking gears and his keys and wards are idealized in certain respects. When we attempt to apply conclusions about ideal gears to particular material gears—made of copper, greased with oil—we will do it by judging that
the actual gears behave in the same way. Because he has high standards for knowledge, Locke is committed to denying that such applied inferences provide us with knowledge, strictly so-called. As Lisa Downing remarks, “we cannot deduce the key’s ability to open the lock from the shape of the key and the shape of the lock if the key might crumble or the pressure from the key might fail to move the lock” (1998: 409). Since we have no explanation of the foundations of cohesion, our only reason for believing that an actual gear will continue to cohere and communicate motion is past experience.

Locke would probably classify the assumption that particular gears will cohere throughout their turning as ‘assurance’, the highest degree of certainty that does not count as knowledge. He declares that everyone agrees as a matter of experience, “Fire warmed a man, made Lead fluid, and changed the colour or consistency in Wood or Charcoal; that Iron sunk in Water, and swam in Quicksilver” (4.16.6). From this universal agreement, “we are put past doubt, that a relation affirming any such thing to have been, or any predication that it will happen again in the same manner, is very true” (ibid.). As a practical matter, he tells us,

> these Probabilities rise so near to Certainty, that they govern our Thoughts as absolutely, and influence all our Actions as fully, as the most evident demonstration: and in what concerns us, we make little or no difference between them and certain Knowledge: our belief thus grounded, rises to Assurance (ibid.).

Locke emphasizes that, practically speaking, judgments such as *iron will sink in water* are as good as knowledge. I emphasize that, theoretically speaking, he refuses to call such judgments certain knowledge. He withholds this compliment because, as I said, he has very high standards for knowledge. According to him, “we are only capable of certain and universal knowledge” for propositions that can’t be made false by “any Power whatsoever” (4.3.29). This means that a prediction only will count as certain and universal knowledge if
we cannot conceive that any agent, natural or supernatural, might make the prediction false. We can conceive of God’s frustrating the prediction that iron will sink in water. Thus, the generalization that iron will sink in water cannot count as knowledge by Locke’s standards.

The watchmaker’s confidence that a copper gear will not melt when spun has the same epistemic status as the prediction that iron will sink when placed in water. Locke must believe that we can conceive of God’s frustrating the prediction that a gear will cohere while a gear next to it is turned, especially since he sometimes argues that we must attribute the coherence of matter to God’s will. He must therefore deny that applied gear inferences provide us with knowledge in the strict and philosophical sense, even if he counts the idealized version of the inference as providing us with deductive knowledge.

Locke implies that we cannot perceive a necessary connection between the motion of one gear and the motion of another. It is true, as we have seen, that he believes that we can see causal interactions. Nevertheless, this is not the same thing as saying that we perceive that if one copper gear moves clockwise, an interlocked one must move counterclockwise. If we put a loud and philosophical emphasis on the ‘must’ and take seriously the possibility of melting, we will see that we perceive no such thing. If we concede that, for all we know, the gears could melt, then it does not make much sense to say that we perceive that the second gear absolutely must move in the opposite direction from the first.

So, to sum up, substances are substrata, which are souls and ordinary bodies. In corporeal substances, the obscurity of our idea of substance consists in our not having explanations for cohesion and impulse. In spiritual substances, the obscurity of our idea of substance consists in our not having explanations for our abilities to think and to move our bodies. These beliefs about the obscurity of our idea of corporeal substance are consistent
with Locke’s beliefs that artisans understand their artifacts especially well and that we would have a similar understanding of plants and animals if we could see much better.

Chapter 4  Locke’s Theory of Inherence

4.1  An Imperfect Definition of Body

Locke implies that there’s a tight connection between the problem of substance and the problem of inherence. In the course of complaining that the definition of substance as that which supports accidents is uninformative, he writes, “we take it for a sufficient Answer, and good Doctrine, from our European Philosophers, That Substance without knowing what it is, is that which supports Accidents. So that of Substance, we have no Idea of what it is, but only a confused obscure one of what it does” (2.13.19). The element of irony here is that Locke doesn’t really think that this is a sufficient answer. He does believe that we have an obscure idea of what it does, namely, support accidents. He would much prefer to have a clear idea of what substance is in itself, which would tell us how qualities inhere in bodies.

The relevant notion of support is that of inherence, but Locke believes that this is merely a fancy piece of terminology, and not a sign of illumination: “were the Latin words Inherentia and Substantia, put into the plain English ones that answer them, and were called Sticking on, and Under-propping, they would better discover the very great clearness there is in the Doctrine of Substance and Accidents” (2.13.20). So, if we knew how substances support qualities, then we would know how qualities inhere in substances.

We can’t really get into all the details, because Locke’s fundamental point is skeptical, and because he thinks that there are other gaps in our knowledge that keep from having a full deductive understanding of how accidents inhere in substances. Still, we can say what he thinks we would know if those gaps were filled. This is especially true for ideas of corporeal
substance, since he advances various claims about how primary qualities hang together and about how secondary qualities and other powers depend on determinate structures of primary qualities.

In what I earlier called the enumeration argument, Locke argues that we don’t have more ‘primary ideas’ of body than of spirit in §§16-21, and he repeats his argument in §30. According to him, our inquiries into body and spirit have bogged down at the same point. We have acquired clear ideas of two properties in each case and have not been able to figure out the substance that underlies any of these properties:

in short, the Idea we have of Spirit, compared with the Idea we have of Body, stands thus: The substance of Spirit is unknown to us; and so is the substance of Body, equally unknown to us: Two primary Qualities, or Properties of Body, viz. solid coherent parts, and impulse, we have distinct clear Ideas of: So likewise we know, and have distinct clear Ideas of two primary Qualities, or Properties of Spirit, viz. Thinking, and a power of Action (2.23.30).

These are not, of course, the only qualities that he attributes to bodies and spirits. Of corporeal qualities, he adds, “we have also the Ideas of several Qualities inherent in Bodies, and have the clear distinct Ideas of them: which Qualities, are but the modifications of the Extension of cohering solid Parts, and their motion.” For him, these other qualities are implications and determinations of being able to communicate impulse and having cohesive, solid parts. He counts two of each, and, in light of the fact that we don’t have clear ideas of either the substance of body or the substance of spirit, he concludes that our cognitive grasp of each is on a par.

Downing (2001: 524-31) observes that a version of the argument occurs in Draft B (§94) and that the argument shows interesting similarities to one that Henry More offered in *The Immortality of the Soul* (1.3.1-2). In spite of the argument’s antecedent in More, the best way to understand it is to look at the scholastic logic textbooks from which Locke taught.
his students at Oxford. Locke is applying scholastic principles of inquiry to corpuscularian problems of inheritance.

Locke’s implicit contrast between properties and qualities confirms what we saw in his treatment of monstrosity: he’s using the word ‘property’ in a technical sense. His lists of properties of body and spirit are limited by two constraints. The first is that he only includes features that are “proper and peculiar” (2.23.17) to either spirit or body. After offering lists of proper and peculiar ideas of body and of spirit, Locke remarks, “The Ideas of Existence, Duration, and Mobility, are common to them both” (2.23.18). For those who doubt that mobility belongs to spirit, Locke argues that “spirits are capable of motion” in the next three sections (2.23.18 marg.). Those arguments that the mind moves aren’t irrelevant but interesting digressions from the main anti-Hobbesian argument of §§15-32. Instead, they are justifications for omitting mobility from his list of the properties of body. Locke is working with a technical notion of property, according to which this justification makes sense. He only counts a feature as a property if it belongs to all and only the members of a class, which means that he’s using ‘property’ in the fourth sense of prorprium from seventeenth century textbooks.

Locke’s classification of “Thinking” as one of the two properties or primary qualities of spirit in 2.23.30 seems imprecise to me, since he argues at length against Descartes’s doctrine that the mind always thinks (2.1.10-19). Locke is probably being careless. At the end of his chapter Of Power, he appends a list of primary and original causes of ideas that roughly corresponds to the lists of prorpria in 2.23.30. In the first edition, “Thinking” is listed as a cause “which by reflection we receive from our Minds” (2.21.47 1st ed.). In the second edition, he replaces that word with ‘Perceptivity,’ a word of his own invention, which he defines as “the Power of perception, or thinking” (2.21.73 2nd ed.). It seems to me that
Locke’s only reason for making the switch from ‘thinking’ to ‘perceptivity’ is to conform to the strictest notion of proprium. The capacity to perceive, unlike thinking, is always present to the mind. Thus we ought to treat perceptivity as his considered choice for his list of propria of spirit.

I would fuss with other items on the lists in 2.23.30. ‘Impulse’ is not a feature of bodies; plainly, Locke is using shorthand for what he earlier calls “the power of communication of Motion by impulse” (2.23.28). ‘Solid coherent parts’ doesn’t seem to have the right verbal form to name a property, either. He means, I suppose, what he earlier calls “the cohesion of solid, and consequently separable parts” (2.23.17).

The second constraint on Locke’s application of the term ‘property’ is that candidate properties are excluded for being derivative. He writes,

*The primary Ideas we have peculiar to Body, as contradistinguished to Spirit, are the cohesion of solid, and consequently separable parts, and a power of communicating Motion by impulse. These, I think, are the original ideas proper and peculiar to Body: for figure is but the consequence of finite Extension* (2.23.17).

Figure is excluded for not being ‘original’. That is, it isn’t foundational enough. Locke judges figure to be a consequence of extension of a body, which is, he tells us, “nothing but the cohesion of solid parts” (2.23.24).

The four scholastic definitions of proprium don’t explain Locke’s exclusion of figure from his list of the relevant properties of body. The reason he offers, that “Figure is but the consequence of finite Extension,” (2.23.17), is somewhat puzzling on reflection. So long as figure otherwise meets the criteria for being a proprium, why should the presence of a discoverable, intelligible connection to another proprium disqualify it? Indeed, if our goal is to measure our relative cognitive grasps of body and spirit, shouldn’t the presence of “necessary dependence, and visible connexion one with another” (4.3.14) between the
cohesion of solid parts, extension, and figure count for more than whether scholastic
definitions of ‘property’ are satisfied?

Locke is borrowing more from the scholastics here than terminology; he is
borrowing an epistemic framework. In this framework, accumulated *propria* are clues to the
nature that underlies and explains them. If one *proprium* flows from another, and the
derivative *proprium* gives no new information about the underlying nature, then the derivative
feature may be omitted from an epistemic progress report.

A common thesis of scholastic epistemology is that we move from an obscure grasp
of the effects to knowledge of the causes and back to a clear knowledge of the effects.
Following tradition (Randall 42-65, Jardine 686-93, Sgarbi 70-75), Sanderson calls this
method ‘regressus’. He writes,

Regressus is a *Going back and forth between cause and effect through Demonstration*; by it, we
reciprocally demonstrate an effect through a cause, through which the effect itself
was earlier demonstrated. This capacity is called *regressus*, because from a kind of
confused and experimental cognition of an effect, as something very close to sense,
our intellect will have advanced toward a similar, confused cognition of the cause; and
then, through varied and careful study and through comparing cause to effect, our
intellect will ripen this cognition so that something distinct might be made from
something confused: then from that distinct cognition of the cause the intellect goes
back (*regreditur*) to a similar and distinct cognition of the effect (*Compendium* 3.16.4).

Through a combination of conjecture, intuition, and the proper use of the method of
division, we move from derived features to a conception of the simple essence behind the
sort. With that essence in hand, we may deduce effects from it. This returns us to where we
started, but our cognition is now distinct rather than confused (Sgarbi 154-55). These
consequences are often called *propria*. According to Sanderson, in strictest usage, “A
proprium flows from the essential principles of a species: *as, for example, the ability to laugh flows
from rationality*. In this sense, a proprium is said to pertain to a thing’s essence: not as a
*constituent*, but as *consequence of the essence*” (*Compendium* 1.5.2).
Given the Aristotelian method of inquiry, it is possible to be stuck at a preliminary position: we have assembled what seem to us to be *propria* of a certain kind of thing, but we have not yet been able to determine the essence from which these *propria* may be deduced (Lennox 40-41). Because of this possibility of getting stuck on the way to a real definition, Scheibler divides definitions between perfect and imperfect:

A perfect one explains a thing through its essential causes or the signs of those causes, that is, through its genus and its substantial differentia, for example, *man is rational animal*. An imperfect one is from an accumulation of attributes or otherwise from non-essentials, for example, *man is animal capable of instruction, capable of laughter, and mortal.* (*Philosophia* Bk. 1, Sec. 1, Ch. 13, p. 23).

The best account of a thing is through genus and differentia. But sometimes, Scheibler implicitly concedes, we can't make the jump from accumulated attributes to a canonical definition. Failing that, we have to settle for a listing of attributes, where these are either coextensive with the essence (as in the capacity to laugh) or are presumed to be entailed by the essence (as with mortality or the capacity for instruction). Such a list, Scheibler tells us, provides us with an imperfect definition.

Locke offers his lists of primary ideas in 2.23.17-18 and his lists of properties in 2.23.30 as imperfect definitions of body and spirit. He believes that if we had clear ideas of these underlying substances, then we would be able to derive the *propria* on these lists. According to Locke, we are stuck near the beginning of the process of regressus. We know the inseparable features of bodies, but we can’t get to the first principle that would allow us deductive knowledge of the source of those *propria*. In the place of an idea that would give us that sort of knowledge, all that we have is a dimly grasped relative idea of substance.

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32 Compare Sanderson, “One must look for the proximate genus (whether it is to be defined as substance or as accident) from the table of the appropriate category. The table of substance, indeed, will supply the differentia of substances. If names for these are lacking, as is often the case, *propria* should be supplied in their place, for example, A horse is a four-footed animal capable of whinnying” (*Compendium* 1.17.5). And, “an imperfect definition is that which is described and defined through terms that don’t explain what’s essential” (1.17.6). (Because of a typo the seventeenth chapter of the first book begins ‘Cap. 7.’)
According to Locke, the substance of body is unknown to us, and we have to settle for an imperfect definition composed of two fundamental *propria*. He treats the number of fundamental properties in an imperfect definition as a measure of the quality of our cognitive grip. Since we also know two fundamental properties of spirit, “Thinking, and a power of Action” (2.23.30), our understanding of spirit is as good as our understanding of body.

Here are some of the virtues of interpreting 2.23.30 as lists of *propria* composing imperfect definitions of body and spirit. First, taking ‘properties’ in the technical sense allows us to understand why Locke thinks that his argument that the soul moves shows that mobility shouldn’t count as a property of body. Second, seeing *propria* as evidence towards an unknown *explanans* lets us understand why he denies that the derivative property of figure adds anything to his list. Third, interpreting the lists as imperfect definitions gives us a pointed account of the form of the section. That is, it explains what would otherwise be inexplicable, Locke’s reasons for writing that the substance of such and such is unknown to us, but we know two of its properties.

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33 Walmsley discusses the ancestral passage of 2.23.30 in Draft B (§94) and comes up with an alternative reading of Locke’s earlier expression “primary qualities or propertys of body.” Acknowledging that Locke uses the word ‘property’ in its traditional sense, Walmsley (2003: 436) takes the adjective ‘primary’ to modify both ‘qualities’ and ‘propertys’ severally and suggests, “that the ‘or’ here was not meant to imply synonymy”. Instead he supposes that it disjoins two exclusive possibilities. According to him, Locke’s point in using the disjunction is just that “we cannot say whether the extension of bodies and the cohesion of their parts are mere qualities of material substances or are properties of it. By using the phrasing ‘qualities or propertys’ he may have been highlighting how little we know of the constitution of natural bodies and pointing to the difficulties he found in the idea we have of material substance” (2003: 437). Two additions in the published version of the Essay disambiguate Locke’s expression and show, I think, that Walmsley’s suggestion is mistaken. Locke did intend to equate the primary qualities of body with its *propria*. First, Locke adds a comma to the published version of the Essay, so the final text reads “Two primary Qualities, or Properties of Body”. He was unusually fussy about punctuation, a characteristic that led to battles with printers who were “unable to satisfy such meticulousness” (Laslett 10). Since he wasn’t bound by our own, less flexible rules of punctuation, he could use a comma to resolve the ambiguity between Walmsley’s interpretation of his words and mine. Second, in 2.8.9, Locke defines primary qualities as inseparable features. This definition is akin to traditional definitions of *propria* and one which makes it reasonable to suppose that he considered the expression ‘primary quality’ to be a synonym for ‘property’ in the context of 2.23.30.
As I’ve construed it, there are two aspects to Locke’s enumeration argument: first that our grasp of mind and body are of the same kind, namely, imperfect definitions; and second, that the quantities of *propria* in these definitions are the same number, namely, two. I believe that the first aspect is crucial to understanding Locke’s metaphysics. The second aspect, his enumerations of the *propria* of body and spirit, is somewhat arbitrary.

I don’t think that *having solid coherent parts* is a single, simple property. Elsewhere, Locke offers *extension* and *solidity* as fundamental features of body (e.g. 2.21.73 and 3.6.21), and those seem to me to be at least as good candidates as the properties that he offers in the enumeration argument and they’re more obviously simple.

Locke also claims that “receiving and communicating Motion by impulse, supposes Solidity” (4.3.14), which suggests that he believes that solidity is more fundamental than the capacity to move other bodies through impulse. The cohesion of solid parts presupposes solidity even more obviously. More offered a different list, thinking the fundamental properties of body are being impenetrable and discernible, that is, divisible (*Immortality* 1.3.1; Downing 2001: 530). It’s hard to avoid the conclusion that Locke hasn’t managed to find an objective list of the basic features of body, even by the lights of the science of his time. It’s also hard to avoid the conclusion that his argumentative goal of showing that our understanding of spirit is as good as our understanding of body affects the formulation of his lists in *Essay* 2.23.30.

Though I don’t think that the enumeration argument allows us to discover the objectively fundamental properties of bodies, I do think that it helps us understand Locke’s claim that we know the sensible qualities of things while their substratum is unknown. E.J. Lowe denies that Locke identifies substrata with ordinary objects “not least because he says that *substrata* are completely *unknown* entities, whereas many of the property-possessing
objects which (in his looser way of talking) he calls ‘particular substances,’ such trees and rocks, are far from being completely unknown to us” (508). Locke doesn’t exactly say that substrata are completely unknown to us, but he comes close. According to him, we “signify nothing by the word Substance, but only an uncertain supposition of we know not what; (i.e. of something whereof we have no particular distinct positive) Idea, which we take to be the substratum, or support, of those Ideas we do know.” (1.4.18). He also claims that our complex ideas of substances “are Collections of such Qualities, as have been observed to co-exist in an unknown Substratum which we call Substance (4.6.7).

To say that an ordinary object is unknown to us even though we know some of its sensible qualities seems like a strange way of talking. We can dispel some of this strangeness by taking into account the scholastic background to his treatment of substance and property. He is asserting that we only have an imperfect grasp of corporeal substances, one that allows us to recognize that they cohere and can propel bodies through impulse, but not one that allows us why they cohere or how they propel bodies. Corporeal substance gives rise to two fundamental properties, cohesion and the capacity to move other bodies. These constitute an imperfect definition of body, not as good as what we would have if we had a clear idea of corporeal substance itself but second best. It’s the imperfection of this definition that leads Locke to say that we know the qualities of the substratum, but not the substratum itself.

In the General Scholium to Principia, Newton makes similar claims about substance:

We have ideas of [God’s] attributes, but we don’t know in the least what the substance of any thing is. We see only the shapes and colors of bodies, we hear only sounds, we touch only external surfaces, we smell solely odors, and we taste flavors. We know innermost substances by no sense and by no reflecting act; much less do we have an idea of the substance of God (Principia 529= CW 942).

I take Newton’s point to be the Lockean one that we can’t know the ultimately fundamental features of bodies through sensation or reflection.
Kochiras (2014: §4.1) suggests Newton that wasn’t influenced by Locke since the assertion that we don’t know innermost substance is anticipated in *de Gravitatione*, where Newton asserts that we don’t have “clear and distinct perception’ of what bodies are “in essential and metaphysical constitution” (*PW* 27). Let me add two caveats. First, Newton’s claim that we don’t know substances by a reflecting act (*actione reflexa*) seems like an allusion to Locke’s denial that have a clear and distinct idea of spiritual substance through reflection. Second, Newton’s purposes in the two passages are quite different. In *de Gravitatione*, he’s arguing that whether something counts as a body doesn’t depend on its underlying constitution. In *Principia*, he’s trying to illustrate his claim that we know God through his acts and not through his substance.  

4.2  *Inseparable Qualities*

The doctrine that inquiry into objects begins by finding their inseparable features lasts into the modern period. Early modern philosophers are interested in all sorts of inseparable features, but especially in the inseparable features of bodies. Francis Bacon recommends that natural histories for “the investigation of forms” begin by drawing up a table of “all the instances that are known which come together in the same nature” (NO 2.11). Descartes can’t take away extension, flexibility, and changability from a piece of wax and concludes that those features are distinctly understood and belong to the wax itself (*AT* 7.30-31=CSM 2.20-21, see also *PP* 2.4 *PP* 2.11; Garber 1992: 77-80, 330n43).

Some early modern thinkers think that lists of inseparable features of sorts might be useful even if they aren’t clues to the underlying essences that explain the inseparable features. When Galileo considers a corporeal substance he thinks of it as necessarily as

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34 Newton doesn’t seem to be interested in drawing distinctions between substance and essence (McGuire 253). The theological point that in this life we know God through his acts and not through his essence was a standard one. See Aquinas (*ST* 1.12) in particular.
“bounded, and as having this or that shape; as being large or small in relation to other things, and in some specific place at any given time; as being in motion or at rest; as touching or not touching some other body; and as being one in number, or few, or many.” He can’t separate a corporeal substance from such conditions “by any stretch of my imagination,” and he concludes that this unimaginability is evidence of the mind-independence of these qualities (Assayer 274). Sydenham urges that “in what is to be described of any disease, what is peculiar and perpetual be expounded apart from what is accidental and extraneous” (Preface ¶10). He emphasizes this point even though, as we have seen, he denies that we can use such descriptions to find the ultimate causes of diseases (Preface ¶20).

After positing homogeneous matter and motion as fundamental and universal principles of bodies, Boyle argues that different motions will lead to the actual divisions of matter into parts “and that each of the primitive Fragments, or other distinct and entire Masses of Matter, must have two Attributes—its own Magnitude, or rather Size, and its own Figure or Shape” (OFQ 5.307=SPP 20). Each of these fragments of matter are finite, he supposes. That is has some size follows from its “being a finite Body, its Dimensions must be terminated and measureable.” Likewise, “though it may change its Figure, yet for the same reason it must have some Figure or other” (ibid.). Thus, Boyle concludes,

now we have found out and must admit three Essential Properties of each entire or undivided, though insensible, part of Matter: namely Magnitude (by which I mean not quantity in general, but a determined quantity, which we in English oftentimes call the size of a bodie), Shape, and either Motion or Rest (for betwixt them two there is no mean) (ibid.)

Size and shape (but not motion or rest) “may be called inseparable Accidents of each distinct part of Matter: inseparable because, being extended and yet finite, it is Physically impossible, that it should be devoid of some Bulk or other and som determinate Shape or other” (ibid.).
Boyle often links claims that ‘primary’ affections are explanatory with claims that they are universal or ‘catholic.’ Boyle believed that bulk and figure were both ‘more Catholick’ and more “Fruitfull” than the rival Aristotelian first qualities (Chymist 2.232; Mandelbaum 97-98). Along the way to that conclusion, Boyle argues that experience (and “especially that which is afforded us by chemical operations”) shows us that matter can be divided into imperceptible parts. Since all matter has shape and size, Boyle concludes “the minutest fragments, as well as the biggest masses, of the universal matter are likewise endowed each with its peculiar bulk and shape” (ibid.). Thus, according to Boyle, we know from reason that shape and size are possessed by any finite fragment of matter, we know from mechanical practice that they and motion are explanatory features, and we know from chemical experiments and other experiences that matter is sometimes divided into imperceptibly small parts. Together, these remarks constitute an argument for the existence of corpuscles and their explanatory power. However the proper list of inseparable qualities of bodies runs, if we knew that every material substance has those qualities, then we would know that they are all governed by the principles that govern those qualities.

Locke’s interest in the inseparable features of bodies occurs not only in the enumeration argument but also in his definition of primary qualities, in which he denies that bodies can lose such qualities through natural transformations. He defends the inseparability of primary qualities by arguing,

division (which is all that a Mill, or pestel, or any other Body, does upon another, in reducing it to insensible parts) can never take away either Solidity, Extension, figure, or mobility from any Body, but only makes two, or more distinct separate masses of Matter, of that which was but one before (2.8.9).

The modal expression ‘can never’ suggests that Locke has a rational, deductive inference in mind (McCann 1994: 61-62, 65). He confidently asserts that the only thing that a mill or

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pebble can do to a grain of wheat is divide it, even when the divided parts are too small to be perceived (Winkler 153). This reasoning is something like the demonstrations that he implies watchmakers and locksmiths use. His point isn’t the merely hypothetical de dicto point that if the result of smashing a grain of wheat is a body, then it will have primary qualities. For Locke, matter can’t be destroyed naturally, it can only be rearranged or split apart (2.2.2). The results of such transformations will also be bodies, and they’ll also have primary qualities.

In addition to the a priori connections that Locke explicitly or implicitly draws between primary qualities and corporeal substance, he also offers a merely empirical measure of the inseparability of primary qualities from bodies. He declares primary qualities to be “such as Sense constantly finds in every particle of Matter, which has bulk enough to be perceived” (2.8.9), as if we might go around with a tape measure checking, yes, this one’s extended and that one, too.

Newton elevates the principle behind Locke’s empirical generalization to the status of his Third Rule of Philosophizing: “Qualities of bodies that cannot be intensified and remitted and which belong to all bodies for which experiments36 may be set up, ought to be considered universal qualities of bodies” (Principia 387=CW 795). He offers the following illustration, “The extension of bodies is not known except through our senses, and it isn’t sensed in all of them; but because extension is met in all sensible bodies, it is asserted of all of them” (Principia 388=CW 795). Mandelbaum (87) suggests that if the third rule had been published before the Essay, we might suppose that Locke was influenced by it.

A more direct suggestion would be to say that Newton is influenced by Locke. James Axtell (1969: 176) judges that Locke and Newton meet soon after Locke comes back to

36 Experimenta, which may also be translated as ‘experiences’.
England in February 1689; the first copies of the *Essay* are printed in December 1689 (Woolhouse 2007: 276); and one of Newton’s earliest revisions of Rule 3 is written in April 1690 at the latest (McGuire 238); the earliest dateable evidence we have of contact between the two comes from a month earlier (Westfall 1980: 488).37 Sometime in the 1691, Newton offers Locke a copy of *Principia* with many emendations, including a revised version of Rule 3 (Axtell 1969: 176, I.B. Cohen 24-26, Anstey 2011b: 157-58).

In the first edition of *Principia* the place of the third rule of philosophizing is taken by ‘hypothesis 3,’ which ran “Every body can be transformed into any other kind of body whatsoever and successively take on all the intermediate degrees of qualities” (*Principia* 1st 402=CW 795n.bb). Newton comes to see that he didn’t need to commit himself to the underlying homogeneity of matter. For his purposes, it suffices to draw generalizations on discoverable qualities of bodies lying closer to the surface. Locke’s empirical justification of the inseparability of primary qualities, which he intends as a way of justifying corpuscularianism, ends up as a way to bypass it.

Locke defines primary qualities as those that “are utterly inseparable from the Body, in what estate soever it be” (2.8.9). This definition makes them the *propria* of body, where *proprium* is taken in something like Sanderson’s second sense: a property of A is a feature that all As have at all times. Thus, in both the chapter on primary and secondary qualities and the chapter on our ideas of substances, Locke treats primary qualities as *propria* of body, though he uses slightly different criteria.

The criterion in the definition differs from the one that Locke uses at 2.23.30 for fixing the “primary Qualities, or Properties of Body” in two respects. First, the definition of

37 J.E. McGuire suggests that a later version of the rule is “the result of the philosophical stimulation of Newton’s association with Locke” but he doesn’t want to say “Newton was in any way indebted to Locke for his method of introducing and defending this distinction in qualities” (240). This is a rather delicate position that McGuire doesn’t fully justify.
primary qualities in 2.8.9 doesn’t exclude qualities that are derivative. As we’ve seen, in the chapter on our ideas of substance, he excludes \textit{figure} from his list of primary qualities since it “is but the consequence of finite Extension” (2.23.17). He is happy to list \textit{figure} as a primary quality throughout his chapter on primary and secondary qualities, however. Second, the looser definition doesn’t exclude qualities that are possessed by things other than bodies. \textit{Mobility} and \textit{Number} are listed as primary qualities in 2.8.9, even though he believes that spirits can move and that everything can be numbered. In what follows, I’ll call the \textit{cohesion of solid parts} and \textit{the capacity to move other bodies by impulse} the ‘deep propria’ of bodies.

The tacit complementary thesis to Locke’s definition of primary qualities is that determinable secondary qualities are separable from bodies. It isn’t puzzling to be told that taste, sound, and smell can be separated from bodies. According to Locke, ‘insipid’ and ‘silence’ don’t signify a taste or a sound but rather their absence (2.8.5, Woolhouse 1983: 150), and it’s not hard to imagine things as insipid, silent, or odorless (Rickless 303, Downing 1998: 402-03n46).

It’s a little trickier to conceive of bodies losing their colors, but seventeenth century improvements in the microscope made it easier. According to Boyle, “multitudes of Bodies, there are, whose Fragments seem Opacous to the naked Eye, which yet, when I have included them in good \textit{Microscopes, appear’d Transparent}” (\textit{Colours} 4.52), and tentatively suggested that this might the true for all composites (\textit{Colours} 4.50, C. Wilson 231). Locke is familiar with microscopes and their tendency to turn materials, especially biological materials, transparent. In 1686, he goes to Delft to visit Antonie van Leeuwenhoek, the discoverer of bacteria and spermatozoa, and observes blood, teeth, and canine spermatozoa with Leeuwenhoek’s second best instruments (\textit{Medical Notes} 272-73; C. Wilson 237).
Locke follows Boyle in his suspicion that everything would be transparent if our vision were good enough. In discussing the possibility of microscopical eyes, Locke supposes that if we could see much better the colors that we see would “disappear” and be replaced with “an admirable Texture of parts of a certain Size and Figure” (2.23.11). The examples from the microscope intended to illustrate his thesis (sand, pounded glass, hair, and blood) are all cases in which an object that looks entirely colored under ordinary conditions turns out to be either entirely or mostly transparent when viewed under a microscope (Maier 1968: 66-67). In discussing the role of analogy in natural philosophy, he offers as examples the production of colors by “the different refraction of pellucid Bodies” (he has in mind prisms and the like) and the production of color by different arrangement of “watered Silk.” (The latter phenomenon is actually produced by diffraction, though Locke couldn’t have known that.) He concludes “that the Colour and shining of Bodies, is in them nothing but the different Arrangement and Refraction of their minute and insensible parts” (4.16.12), that is to say, in something like the way different arrangements of prisms produce colors (C. Wilson 230). 38

Locke chooses the example of wheat with imperceptible particles in mind. Ground wheat is flour, of course, and since flour is a powder, it is difficult to see the features of its smallest constituents. If a perceiver’s vision is weak enough or the flour is very well ground, then the each of the smallest particles in the flour is “less than to make it self singly be perceived by our Senses” (2.8.9). Though we cannot perceive these particles with the naked eye, Locke believes that reason tells us that these small particles exist and, no matter how

38 Soon afterwards, Newton follows Locke and Boyle in this supposition: “The least parts of almost all natural Bodies are in some measure transparent: And the Opacity of those Bodies ariseth from the multitude of Reflexions caused in their internal Parts. That this is so has been observed by others and will easily be granted by them that have been conversant with Microscopes” (Opticks 248). Because things tend to look transparent through the microscope, Newton argues that matter is much more tenuous than one might have otherwise thought (Thackray 1968).
small, they possess primary qualities (Maier 1968: 64). Here Locke follows Democritus (A37), Descartes (PP 4.200-02), and Boyle (OFQ 5.307=SPP 20; Aaron 1971: 121-122, Anstey 2000: 45-47).

Locke’s concern to show that imperceptible particles possess primary qualities should be seen as part of a tacit argument for the thesis that primary qualities are not dispositions to produce ideas in us. If all imperceptible bodies possess primary qualities then those primary qualities are not dispositions to produce ideas in us, since imperceptible bodies have no such dispositions (Cummins 409-10, Stuart 2003: 70). For his purposes, Locke tells us, he needs to

distinguish the primary, and real Qualities of Bodies, which are always in them, (viz. Solidity, Extension, Figure, Number, and Motion or Rest; and are sometimes perceived by us, viz when the Bodies they are in, are big enough singly to be discerned) from those secondary and imputed Qualities, which are but the Powers of several Combinations of those primary ones, when they operate, without being distinctly discerned (2.8.22).

The contrast that he wants us to heed is between qualities that are possessed by every material body, including imperceptible ones, and qualities that are not possessed by imperceptible bodies, since those qualities are dispositions to produce ideas in us.

Divide the primary qualities into three groups. Begin with those qualities that are determinate and inseparable: solidity and mobility. If imperceptible bodies without any dispositions to produce ideas in us possess these qualities, then these qualities are not dispositions to produce ideas in us. In a second group, include determinate primary qualities that can be possessed by both imperceptibly small bodies and ones that are visibly large. Sphericity, single, convex everywhere, and traveling at 10 meters per second may be possessed by a corpuscle or by a baseball. If a corpuscle does not have any power to produce ideas in us, then none of its qualities is a power to produce ideas in us, no matter where these qualities are instantiated. The remainder are varieties of extension and bulk. Those bodies that are
too small to be seen possess different determinate qualities in this group than bodies of perceptible size. However, it would be incredible if being one meter long were a bare power to produce ideas in us while being ten microns long were not. Lengths and volumes are too homogenous for that to be a serious possibility. Therefore, we may conclude that primary qualities are not essentially dispositions to produce ideas in us.

Because Locke thinks that primary qualities are inseparable from bodies, he infers that primary qualities aren’t powers to produce ideas in us. Portions of matter continue to possess primary qualities, even after they have been pulverized to imperceptible pieces (2.8.9). In contrast, secondary qualities are dispositions to produce ideas in us, and imperceptible bodies are imperceptible because they lack such dispositions (Bolton 2001: 111).
4.3 How Qualities Inhere

Various remarks scattered through the Essay tell us how Locke thinks derivative primary qualities arise from cohesion of solid parts and thus gives us an outline of how qualities arise from the underlying substance. He thinks extension, figure, bulk, and texture are derivable from the deep propria of body. The relevant deep proprium in this context is having coherent solid parts. The capacity to move other bodies through impulse only plays a role in fixing the powers that a body has to affect other bodies.

The first step from the deep propria of Essay 2.23.30 to the primary qualities of 2.8.9 is Locke’s identification of extension with the cohesion of solid parts (2.23.24). On reflection, we might be mystified by this identification. Leibniz criticizes Locke’s analysis: “this cohesion of parts appears not to be necessary to make an extended whole, since we may say that perfectly subtle and fluid matter composes an extended thing” (New Essays 222).

Elsewhere, Locke distinguishes extension strictly so-called, which only matter possesses, from ‘expansion’ which applies “to Space in general, with or without solid Matter possessing it” (2.13.26). This doesn’t count as a full reply to Leibniz, since the reasons for the distinction aren’t obvious. Right before drawing the it, he tells us we get the same “uniform simple Idea of Space” when “we consider in Matter it self, the distance of its coherent solid parts” or through “considering it as lying between any two Bodies, or positive Beings, without any consideration, whether there be any Matter or no between” (2.13.26). Since the idea of space is the same for both material things and for any arbitrary stretch of distance, his point can’t be a psychological one.

Locke is laying the foundation for a metaphysical and physical inquiries into the physical underpinings of geometrical features. Why does this corporeal substance have the extension that it has. In virtue of what is this piece of paper 8 ½ inches wide or this tree 40
feet tall? His general answer to such questions is: in virtue of their coherent, solid parts. As Hill (2004: 620) puts it, Locke is interested in the question, “How is body extended?”

Locke argues from the constant motion of water to the conclusion that it is composed of particles that don’t stick to one another at all: “the Particles of Water are also so perfectly loose one from another, that the least force sensibly separates them. Nay, if we consider their perpetual motion, we must allow them to have no cohesion one with another” (2.23.26, cf. Boyle *Physiological* 2.138-39, Descartes *PP* 2.56-57). He implies that he believes that water particles move only through inertia and that if they cohered to any degree, the frictional force would always, inevitably, bring them to a perfect standstill.39

“Yet,” Locke continues, “let but a sharp cold come, and they unite, they consolidate, these little Atoms cohere, and are not, without great force, separable” (2.23.26). He is prepared to hold this picture in the face of contrary empirical evidence or at least in the absence of confirmation. He writes,

> the little Bodies that compose the Fluid, we call *Water*, are so extremely small, that I have never heard of any one, who by a Microscope, (and yet I have heard of some, that have magnified to 10000; nay, to much above 100,000 times,) pretended to perceive their distinct Bulk, Figure, or Motion. (ibid.)

Nevertheless, he is sure that the particles are in there.

Locke’s discussion of the fluidity of water confirms what would have been probable in any case, namely, that he adopted Boyle’s account of fluidity. According to Boyle,

> A Body then seems to be Fluid, chiefly upon this account, That it consists of Corpuscles that touching one another in some parts only of their Surfaces (and so being incontiguous in the rest), and separately Agitated to and fro, can by reason of the numerous pores or spaces necessarily left betwixt their incontiguous parts, easily glide along each others superficies, and by reason of their motion diffuse themselves, till they meet with some hard or resisting Body (*Physiological* 2.120; Hill 2004: 617).

39 This doesn’t necessarily contract his assertion, “Water . . . left to it self, would cease to be fluid” (4.6.11). Perhaps Locke thinks that fluids constantly move because of collisions from ambient particles and that, without that motion, a portion of matter would lack some of the characteristic features of fluids.
Notice that on this account fluids are not necessarily scattered objects. Their constituent corpuscles do touch one another in places, but leave gaps in others. The corpuscles aren’t rigidly bound to one another, and the gaps allow them to easily move relatively to one another.

We may surmise that Locke would reply to Leibniz’s objection with a substantial corpuscularian account of the way the world is. Locke doesn’t believe in perfectly subtle and fluid matter but rather thinks of fluids as agglomerations of solid, cohesive particles. Macroscopic fluids are composed of hard, inelastic corpuscles, and the extension of those corpuscles consists in the cohesion of their solid parts. The arrangements of those particles underlie the expansion of fluids in turn. On his treatment, the cohesion of solid parts is foundational and underlies the different kind of extension that fluids posses.

After extension comes figure. As we’ve seen, Locke believes, “Figure is but the consequence of finite Extension” (2.23.17). His rejection of limitless matter entails that any portion of extension will be finite. So, solid substance will invariably be bounded by extension and figure.

Locke’s analysis of matter and body makes this implication clear. According to him, “Matter and Body be not really distinct, but where-ever there is the one, there is the other” (3.10.15). As Locke’s gloss on the phrase makes clear, ‘really distinct’ ought to be taken in the Cartesian-Scholastic sense of its not being possible for one to exist without the other. The abstract idea of body is “solid extended figured Substance, whereof Matter is but a partial and more confused Conception, . . . used for the Substance and Solidity of Body, without taking in its Extension and Figure.” His implication is the presence of solidity in a substance inseparably entails the presence of extension and figure. Let me suggest that he that this solid substance will also be cohesive.
By ‘texture,’ Locke seems to mean the internal arrangement of parts of within a single body, which is what Boyle meant when he defined the word as a technical term (OFQ 5.316=SPP 30; Anstey 2000: 48). The texture of a body arises out of the figures and interrelations of its parts. Insofar as he genuinely thinks of textures as inseparable from matter, perhaps he considers the textures of atomic corpuscles to be their shapes.

Locke counts *mobility* and *number* as primary qualities of bodies and he also thinks that they are possessed by spirit. The term ‘mobility’ only occurs in the chapter on primary and secondary qualities in the section where he defines primary qualities as those that are inseparable from bodies. Elsewhere, he uses ‘motion’ or ‘motion or rest.’ Motion, however, seems to be separable from bodies and thus doesn’t fall under his official definition. *Motion or rest* seems like a gerrymandered quality (R. Wilson: 223), which seems like cheating. If that gerrymandered quality is legitimate, then so are *transparent or colored* and *tasty or insipid*. To be fair, with the rise of Galilean relativity, it was a genuine question whether rest was metaphysically different from motion or just one speed among many. If rest is the same sort of thing as a positive degree of motion, then ‘motion or rest’ will only be grammatically disjunctive and not metaphysically disjunctive. Locke inconclusively raises the related question of whether rest is a privation at *Essay* 2.8.6.

Number is a funny property, if it is a property at all. The most important passage for understand what Locke is thinking here is his discussion of smashing of a grain of wheat. Keith Campbell offers one suggestion for what Locke might be counting. He observes that in atomism

> every basic particular is a strict unity, and every derivative particular comprises a definite number of atoms. . . . By including number among the primary characteristics of all things Locke was showing, although not explicitly, his allegiance to an atomistic philosophy of matter (1976: 50).

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40 I owe this point to Antonia LoLordo.
This would make number into an explanatory and objective feature of portions of matter, so it seems like the right sort of reading. Against this reading, we may observe that Locke applies ‘two’ as a predicate to the divided grain, when he instructs us to “Take a grain of Wheat, divide it into two parts” (2.8.9). Since Locke’s sentence occurs immediately before his listing of number as a primary quality meeting the inseparability criterion, it should probably control what he means to be counting, which seems to be distinct masses of matter, divided out of an initial portion. When it comes to the initial divisions of the grain of wheat, the numbers that he has in mind aren’t on the order of Avogadro’s number but homelier, and smaller, such as two.

Locke contemplates the division of the grain of wheat into insensible parts. He also has insensible parts in mind in other passages in Book 2, Chapter 8. In §13, he refers to the number of the light and odor particles involved in the perception of color and smell. In §16, number makes a list of primary qualities as the number of the “solid parts” of snow; in §17, the relevant number is the number “of the parts of Fire, or Snow”; in §18, what is enumerated is the “parts” of a digested laxative. These last passages are all consistent with Campbell’s interpretation, but in §12, Locke predicates number along with other primary qualities “of Bodies of an observable bigness.”

We can make the passages compatible by taking him seriously when he tells us that he is counting “distinct separate masses of matter” (2.8.9). When a piece of grain is pulverized, the number of the portion of matter that constitutes it does not go to zero; rather, its number counts the discrete pieces of matter that once made up the grain of wheat. His thesis is that number is inseparable from portions of matter. No amount of pounding can keep a portion of matter from being composed by some determinate number of discrete parcels of matter. A parcel of matter is discrete if it’s continuous and marked off by a closed
three-dimensional surface. The relevant continuity here is cohesion, either the strong sort that holds a single atom together or the less tenacious hook-and-eye connections that corpuscularians believe bind corpuscles into macroscopic solids.

Locke counts bodies by counting the number of pieces into which the original piece of matter has now been actually divided. The parts he has in mind must be actual parts that don’t cohere with the rest of the portion of matter, or he wouldn’t have said that division makes two out of what had been one before. If such a division is an objective physical fact, then the enumeration will be objective, intrinsic, and independent of perceivers. If this interpretation is correct, then the number of a Lockean liquid will be the number of its unattached corpuscular parts. Notice that what is numbered in these examples is a portion of matter. Insofar as a single body has a number by this way of counting, that number is one.

Other things beside lumps of matter may be counted, Locke knows: “Number applies it self to Men, Angels, Actions, Thoughts, every thing that either doth exist, or can be imagined” (2.16.1). The number of separate bodies in a portion of matter, however, has a special status in his system because he thinks it’s an important explanatory quality. The central phenomenon to be explained in Book 2, Chapter 8, for example, is the production of sensation by external objects, and elsewhere Locke tells us that he “is certain, that the more Particles of light are reflected from a Body, fitted to give them that peculiar Motion, which produces the Sensation of Whiteness in us . . . the whiter does the Body appear” (4.2.12). Numbers of such particles are what he has in mind when he classifies number as a primary quality.

Let us shift our attention from determinable inseparable qualities such as bulk and shape to determinations of those qualities such as two gallons and cubical. A determination of a determinable is a fixed variety of a more general quality. Figure is determinable, circular
is determinate; extension is determinable, seven feet long is determinate. The determinable qualities *extension, bulk, figure,* and *motion or rest* may be inseparable from a piece of wax, but *one inch in diameter, sphericity,* and *travelling a foot per second* are not. Only solidity and mobility are both determinate and inseparable.

Many explanatory qualities of matter won’t count as primary on Locke’s definition, even if we assume the truth of the corpuscularian hypothesis. Particular shapes, motions, and sizes are explanatory, but they don’t meet Locke’s official definition, since bodies can continue to exist without having those particular shapes, motions, and sizes.

When Locke is careful he uses the expression ‘modifications of primary qualities’ to refer to the determinate explanatory qualities. For example, at *Essay* 2.8.23 he says that secondary qualities and other powers of bodies “result from the different Modifications of those primary Qualities,” and in the next section he describes such powers as “resulting from the different Modifications of the Original Qualities.” Boyle had earlier distinguished “determinate *Motion, Figure, Size, Posture, Rest, Order,* or *Texture*” from those qualities considered as “fertile Catholick Principles” (*Excellency* 8.106=*SPP* 141-42).

Often Locke isn’t that careful, and he treats primary qualities as the observer-independent, intrinsic qualities that explain the powers of a body (R. Jackson 62-67). Qualities such as Locke’s examples of “Circle” and “Square” (2.8.18) don’t count as primary unless we assume that Locke tacitly intends to include determinate qualities falling under inseparable determinable qualities.

The distinction between having some texture or other, and having the definite and particular texture that explains all of a substance’s sensible qualities is an instance of a more general distinction between determinable qualities and determinate ones. The determinate
texture is Locke best hypothesis for the “real Essence, or internal Constitution” from which the sensible qualities of bodies flow (2.31.6).

Determinable primary qualities may flow with necessity from a corporeal substance, but determinations of those primary qualities do not. Locke himself makes this point in rejecting Stillingfleet’s assertion that internal constitutions flow from substances. According to the bishop,

although we cannot comprehend the internal Frame, or Constitution of things, nor in what manner they do flow from the Substance; yet by them we certainly know that there are such Essences, and that they are distinguished from each other by their Powers and Properties (Trinity 257).

In reply, Locke demurs:

I do not take [these essences] to flow from the substance in any created being, but to be in every thing that internal constitution, or frame, or modification of the substance, which God in his wisdom and good pleasure thinks fit to give every particular creature, when he gives a being (Letter 4.82; Ayers 1981: 225-26n38).

Only the fundamental properties in the imperfect definition of body flow from the substance. A clear idea of substance of body, for example, would explain why bodies have extended solid parts and why they can communicate motion. It wouldn’t explain the microphysical texture that any particular body has (Ayers 1975: 16). Locke attributes the particular real essences of creatures to God’s providential plan.

The idea of a primary quality is, Locke argues, “an Idea of the thing, as it is in it self, as is plain in artificial things” (2.8.23). Why should thinking about artifacts (as opposed to animals, plants, or minerals) make it plain that primary qualities belong to things as they are in themselves? What’s important about primary qualities in the artifacts that he has in mind, such as clocks and locks, is that they explain how the artifacts work. The implicit principle that he relies upon in his justification is that if a quality is explanatory in a relatively deep way, then it belongs to a thing as it is in itself.
This can seem like the deepest way at getting at the distinction between primary and secondary qualities. Primary qualities belong to the bodies intrinsically, independently of how they are perceived and, indeed, independently of how things stand with respect to everything aside from the bodies in which they inhere. Our grasp of primary qualities gives us an objective God’s eye view of things, whereas our representations of colors, tastes, and smells are subjective and perspectival.

The principle behind Locke’s inference seems shaky since some relational qualities are explanatory. *Motion* is an explanatory quality, but it’s not obvious that it belongs to bodies as they are in themselves. *Being 93 million miles from the sun* is a relational feature of the Earth that explains various facts about it. The *price* of an object doesn’t belong to a thing as it is in itself, but it’s an explanatory quality if any quality from economics is.

Even so, Locke’s account of substance gives him good reason to believe that primary qualities belong to things as they are in themselves. Being a corporeal substance gives rise to the foundational inseparable qualities of *having solid, cohesive parts* and *being able to move other bodies through impulse*. These qualities in turn give rise to extension, to figure, bulk, texture, and number. These are determinable features of body that will arise from a solitary corporeal substance, so they belong to the substance as it is in itself.

My story leaves our mobility, motion, and number. They are primary qualities, and so Locke is in principle committed to their belonging to bodies as they are in themselves. On the other hand, he doesn’t say or imply that their presence would be derivable from a clear idea of corporeal substance. Number is supposed to belong to a portion of matter to the extent that it’s divided into discrete parts. Insofar as a single corporeal substance has a number, that number will be one. Locke does say that *unity* is inseparable from each thing.
and that “there is not any Object of Sensation or Reflection, which does not carry with it the Idea of one” (2.13.25).

If a determinable quality, such as figure, inheres in a substance, then so do its determinations, such as spherical. If that’s right, then that both primary qualities and their determinations belong to bodies as they are in themselves.

Locke’s story of inherence begins with an unknown substratum and ends with ideas being produced in us. If someone inquires into the “Notion of pure Substance in general,” Locke writes, “he will find he has no other Idea of it at all, but only a Supposition of he knows not what support of such Qualities, which are capable of producing simple Ideas in us.” By way of explaining the relevant notion of support, Locke describes two attempts to inquire into the substance of a body:

If any one should be asked, what is the subject wherein Colour or Weight inheres, he would have nothing to say, but the solid extended parts: and if he were demanded, what is it, that the Solidity and Extension inheres in, he would not be in a much better case, than the Indian before mentioned . . . (2.23.2)

For Locke, “Colour and Weight . . . if duly considered, are also nothing but different Powers” (2.23.10). Color, of course, is his paradigmatic example of a secondary quality, a power to produce ideas in us (2.8.10). I’ll explain what he means by this and why he believes it later in the book, but for now it’s enough to say that it’s so.

Locke must be thinking of weight as a tertiary quality, something like the disposition to push down towards the earth. He defines a “third sort” of quality (2.8.10) that comprises powers “to make such a change in the Bulk, Figure, Texture, and Motion of another Body, as to make it operate on our Senses, differently from what it did before” (2.8.23). He believes that color and weight of a body arise from “the Figure, Size, and Connexion of its solid Parts” (2.31.6). Color and weight inhere in these qualities because these qualities explain them.
Here we have Locke’s metaphysics of body in a nutshell. With some details filled in, it runs as follows. Most qualities, for example yellowness, heaviness, ductility, and solubility in a mixture of hydrochloric and nitric acid are mere capacities to act upon and be operated upon by other substances. These capacities arise out of the internal constitutions of bodies, which Locke supposes are determinations of their primary qualities. The determinable primary qualities such as shape, bulk, and motion or rest arise from an unknown substratum. If we had a clear idea of that substratum, then we’d know how bodies cohere and how one body in motion can knock another body into motion.

Our ignorance of the particular textures that explain the particular sensible qualities that a body possesses is for Locke the second great obstacle to a full and enlightening account of inherence. Seth Pringle-Pattison (233n1) observes that Locke “teaches a twofold mystery”: our ignorance of substance and our ignorance of real essence. Having a clear and distinct idea of corporeal substance would allow us to understand why such things cohere, and thus why they have some texture or other. But knowing the particular texture of a thing is a step beyond that. Considered as determinable qualities, primary qualities are the properties that flow from the substance. Considered as determinate qualities in a particular body, they constitute its real essence, and secondary qualities flow from them. The interactions between ambient corpuscles and a body’s microphysical primary qualities explain why that body has a power to produce the idea of a color in the mind of an observer and explains why it has a tendency to push down towards the center of the earth. When Locke answers the question “what is the subject wherein Colour or Weight inheres” with “the solid extended parts” (2.23.2), he implies that the explanatory relation between the microphysical texture of a body and its derivative capacities suffices for inherence.
On Locke's considered view, most qualities depend not only on the textures of bodies, but also on “those invisible Fluids, they are encompassed with” (4.6.11). He predicts that if you “put a piece of Gold any where by it self, separate from the reach and influence of all other bodies, it will immediately lose all its Colour and Weight” (ibid.). Color and weight don’t belong to bodies as they are in themselves, but only as they are influenced by other bodies.

Locke has borrowed the method of regressus from his scholastic textbooks. Within his physical worldview, he thinks that we can make two applications of the method. In the first application, we look for “that real constitution of any Thing, which is the foundation of all those Properties, that are combined in, and are constantly found to co-exist with the nominal essence” (3.6.6). We surmise that those properties “spring from” some determinate combination of “size, figure, and texture of parts” (4.3.11). In the second application, we consider the inseparable features of body qua and don’t manage to come up with anything besides “an obscure and relative Idea of Substance in general” (2.23.3). Thus, the inseparable qualities of bodies are the deepest level Locke thinks we can reach in the application of regressus to bodies.

It follows that Locke’s next question, “what is it, that that Solidity and Extension inhere in,” is also a question looking for an explanation. What explains the solidity and extension of bodies? The ultimate answer, for us, as for the Indian Cosmologist, is “something, he knew not what” (ibid.; see Ayers 1975, 12-14; 1991, 2.37). Solidity and extension flow from the corporeal substance as color and weight flow from its microphysical texture.

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41 Locke makes a precise revision here in the fourth edition to make the passage compatible with his new embrace of gravitation attraction at a distance. In the third edition, the weight of a piece of gold vanishes if it is “separate from all other bodies”; in the fourth edition, it has to be “separate from the reach and influence of all other bodies”.
At this point, we can reconstruct general Lockean account of inherence. At the bottom are the propría that flow from the obscurely grasped substance. Suppose that we had a clear idea of corporeal substance. Then we could know, according to Locke, why this horse and this stone cohere and how they can move bodies through impulse. That kind of knowledge is enough to make predications such as this stone coheres demonstrable and deeply intelligible. Given that knowledge, we could demonstrate that the stone has some shape, some bulk, and some extension. If we knew the microphysical texture of the stone and horse, the textures of surrounding bodies, the character of the corpuscles surrounding the bodies, and the principles of divine superaddition, we could derive all the sensible qualities of the stone and horse. For the reasons that Dan Kaufman (2007) raises, it’s tricky to work different principles of identity into this account of inherence. Obviously, those lacunae are big ones, but that’s Locke’s best picture of how the world hangs together, and it gives us an idea of what he’s hoping for in a theory of substance and inherence.

For Locke, inherence is a substantive relation. If we knew much more, it would be understood with explanatory relations between substance, real essence, and derivative powers. Someone might complain that the resulting account is too robust and that a complete account of inherence ought not depend on physical considerations of cohesion and impulse. Some might prefer that inherence be counted as an unanalyzable and primitive relation that obtains between unsaturated qualities and free-standing substances—a logical and metaphysical relation, unstained by physical or psychological considerations.

In my opinion, there’s no reason to posit a sharp line between metaphysics and the sciences. Nor is there any reason to deny that qualities can inhere in different ways. Locke’s treatment of the relations between substance, propría, and derivative powers is a worldly account of inherence, but it’s none the worse for that.
Chapter 5    The Rise and Fall of the Medieval Theory of Perception

5.1    The Roots of the Theory

Perhaps the most important way that the scientific revolution affects early modern philosophy is by overthrowing the medieval theory of perception. The medieval theory of perception was not just an account of the communication of sensible qualities across a medium, but an integrated theory with branches in anatomy, psychology, and semantics. Once the theory is overthrown, new theories of cognition are invented as replacements.

The medieval theory is complicated and there isn’t any canonical source that Locke might be thought to be targeting. He treats the view that he’s attacking as a common one. According to him, most people think that our ideas of sensible qualities are “the perfect resemblance” of something in the thing “and it would by most Men be judged very extravagant, if one should say otherwise” (2.8.16). I’ll describe how the theory acquired some of its complexities and cite some literary figures to show that a version of the theory was alive and kicking in the sixteenth and seventeenth centuries.

I want to avoid two extremes in my interpretation. On the one hand, I want to avoid analyses of resemblance so that talk of a cognizer’s possessing a resemblance of something in the world is just a jargon filled way of saying that the cognizer knows about the thing, so that the scholastic slogan that knowledge is through similitudes is a puffed up way of saying that knowledge is knowledge. On the other hand, I want to avoid saying that parts of the scholastic theory of perception are obviously impossible or nonsensical. I’d rather present the theory as an alien and powerful view, a view that’s partly retained by Locke when other parts become untenable.
Let us begin at the beginning. Aristotle begins his major work on the soul by giving an opinionated history of the views of his predecessors. “With one exception,” he tells us, all those who define the soul by its power of knowing make it either an element or constructed out of the elements. The language they all use is similar; like, they say, is known by like; as the soul knows everything, they construct it out of all the principles. Hence all those who admit but one cause or element, make the soul also one (e.g. fire or air), while those who admit a multiplicity of principles make the soul also multiple (de Anima 1.2 405b13-20).

He criticizes Anaxagoras for violating this pattern: “The exception is Anaxagoras; he alone says that mind is impassible and has nothing in common with anything else. But, if this is so, how or in virtue of what cause can it know? This Anaxagoras has not explained, nor can any answer be inferred from his words” (405b20-23). Aristotle’s rhetorical question and his follow up complaint show that he believes that resemblance is an adequate basis for knowledge and that substitutes are hard to come by. He asserts in his own voice,

in general, with regard to all sense perception, we must take it that the sense is that which can receive perceptible forms without their matter, as it receives the imprint of the ring without the iron or gold, and it takes the imprint which is of gold or bronze, but not qua gold or bronze. Similarly too in each case the sense is affected by that which has color or flavor or sound, but by these not in so far as they are what each of them is spoken of as being, but in so far as they are things of a certain kind and in accordance with their principle (de Anima 2.12 424a17-22).

So, when we see a red wagon, we receive the form red without any metallic matter and our eyes are affected by it, not qua wagon, but qua red thing (S.M. Cohen 65-66).

Why would anyone think that like is known by like? Perhaps Aristotle and his predecessors reasoned as follows. External sensible objects affect us. Distant objects of knowledge can’t immediately affect us, since nothing at a distance immediately affects us. When the thing known isn’t spatially present to the knower, there has to be an inner proxy

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42 Later in de Anima, Aristotle expresses more sympathy for Anaxagoras’ treatment of mind as unique and unmixed with matter (3.4 429a18-24), but this sympathy is restricted to the intellect as opposed to sensory perception.
for that external thing. The inner proxy has to carry information about the external thing somehow, and the most straightforward way to carry that information is by resembling the external thing. So, probably, like is known by like.\textsuperscript{43}

Aristotle thought that living things and their organs had natures distinct from their matter and that these natures were among the fundamental explanatory principles in the world (\textit{Phys.} 2.1; Burnyeat 1992: 22-23, S.M. Cohen: 61), but he also puts material preconditions on having capacities for sensation (\textit{de Anima} 1.3 407b17-26; Burnyeat 1992: 23, Nussbaum and Putnam 55). He works out some of the physiological conditions for having cognitive resemblances in \textit{Parts of Animals}. There he describes a hypothetical sort of necessity that occurs in nature and in art: if a kind of thing exists, then it must have the right kind of matter (\textit{Part. An.} 1.1 639b34-640a8). So, for example, if wood is to be split by an axe, the axe must be hard, and if hard it must be made of bronze or iron (642a9-12; Everson 79-80).

As an instance of this sort of necessity, Aristotle argues that sense organs have to be composed of homogeneous matter in order to take on resemblances. The sense organs have to be composed of matter that can temporarily resemble some external thing with respect to the qualities they perceive, since sense organ “is potentially such as its object is actually” (\textit{de An.} 2.11 424a1; S.M. Cohen 66, Sorabji 1992: 211-12). Each sense organ allows us to perceive simple qualities, so the matter of our sense organs must be able to potentially possess these simple qualities. Since heterogeneous matter can’t compose a simple homogeneous body (\textit{Part. An.} 2.1 646b30-35). Aristotle concludes, “sensation is confined to the simple or homogeneous parts” (647a14). That is, sense organs have to be composed of relatively homogeneous stuff or they couldn’t take on simple qualities (Johansen 195-96).

\textsuperscript{43} Aristotle also seems to appeal to these inner resemblances in order to explain introspection and self-knowledge (\textit{de Anima} 3.2 425b19-24; Sorabji 1974: 71-72, S.M. Cohen 66-67).
According to Aristotle, if the eye were colored independently of perception, we couldn’t perceive color: “what is to perceive white and black, must, to begin with, be actually neither but potentially either (and so with all the other sense organs)” (de An. 427a7-10; Sorabji 1992: 214-15). His explanation of why the eye is composed of water is that water is transparent, and easily confined and condensed (Sens. 2 438a13-16). Here and elsewhere in his biological writings, the thesis that knowledge is through resemblances is a physiological claim, intended to explain how a living thing can be aware of the features of external bodies (Everson 80-84, Johansen 87-95).

This is controverted terrain. The dispute in Aristotle scholarship ranges over multiple issues, but it will be useful to bring out and distinguish two of them for the light they cast on the Aristotelian thesis that perception is the reception of form without matter and indirect light they cast on the Lockean thesis that ideas of primary qualities resemble something in bodies.

The first question is whether the received form inheres in the same manner in the perceiver as it does in external bodies (Caston 248-53). It’s plain at least that most of Aristotle’s successors thought that sensible species inhere in perceivers in a different way than they inhere in natural objects and many of them thought that being F in this other way wasn’t enough to be F without qualification.

A distinct, second question is the central one for my project: whether Aristotle and his successors really mean it when they say that knowledge is through likenesses. This is a different question from whether they believe that sensible species inhere in perceivers in the same way that they inhere in the perceived object. There’s more than one way to skin a cat, but the grisly results pretty much resemble each another. Likewise, the fact that one thing is F in one way and another is F in another way doesn’t show that the two things don’t
resemble each other with respect to F. Absent some special reason to think otherwise, they do. Of course, if one thing is ‘F’ is one sense and another in another, they may not resemble each other at all. The lesson is that senses ought to be distinguished from ways (G.B. Matthews 1972).

When I attribute a belief in literal resemblance to philosophers, I mean that they assert that a form inheres in the external object and that a similar one inheres (in one way or another) in the perceiver. The alternative is to say that such claims are to be paraphrased away. According to Myles Burnyeat, for example, Aristotle believes “receiving the warmth of a warm thing without its matter means becoming warm without really becoming warm; it means registering, noticing, or perceiving the warmth without actually becoming warm” (1992: 24). On such interpretations, resemblance claims aren’t part of an explanation of cognition. They’re just roundabout ways of describing cognition.

Aristotle’s cognitive theory came to be supplemented by the discovery of a system of cavities in the brain. There are four ventricles in the brain, which contain clear cerebrospinal fluid. Two of these ventricles are bigger and to the side; today these are called the lateral ventricles. They are in front of two others, a central ventricle which is today called the third ventricle, and a ventricle behind and below that which is today called the fourth ventricle. Following ancient and medieval practice, I’ll call the lateral ventricles ‘anterior’ or ‘front,’ the third ventricle the ‘middle ventricle’ and the fourth ventricle ‘posterior’ or ‘rear.’

Aristotle himself had observed that the great majority of animals have ‘a small hollow’ in their brains (H.A 1.16 495a5; Sudhoff 153, Clarke 1962: 85), but he didn’t attribute a cognitive role to the brain or its recesses (Clarke 1963). Herophilus of Chalcedon, who was born around the time of Aristotle’s death, carried out a program of systematic dissection for the sake of developing a scientific biology (von Staden 115-24). He provided more detailed
descriptions of the ventricles in the brain and decided that the posterior ventricle was the control center of the body (von Staden 158, 315-16, Sudhoff 153-54, Rocca 36-42).

Four and a half centuries later, Galen improved on earlier anatomical descriptions, attributed thought and memory to the substance of the brain, and argued that the ventricles were the soul’s instruments of volition and sensation (De Placitis 7.3.14-22; Rocca 172-99). The anterior ventricles receive smells and generate pneuma which are passed on to the eye and make vision possible by being sprayed out to the air (De Placitis 7.5.5-7.7.19; Lindberg 10, A.M. Smith 1981: 572-73, Rocca 135).

Psychological theories from late antiquity and the middle ages continued and elaborated the project of localizing psychic capacities to the ventricles. Augustine merges the two anterior ventricles that Galen had observed into one, and asserts that the front ventricle receives sensation, the middle is the site of memory, and the rear is the source of motion (de Genesi 7.18; Sudhoff 158, Pagel 1958: 100, Clarke 1962: 87-88). At about the same time in the east, Nemesius of Emsea placed imagination in the front ventricle, intelligence in the middle, and memory in the back (Nature §13; Pagel 1958: 98-99, Clarke 1962: 86-87). Avicenna supplements and subdivided these inner faculties and wedged five faculties into three ventricles, with the anterior ventricle divided into two parts (Deliverance 31; Sudhoff 164-65, Wolfson 96-100, Black 59-62).

Roger Bacon combined Aristotle’s account of cognition, Galen’s description of the ventricles of the brain, and Avicenna’s account of the role of the ventricles with Alhacen’s optics (Sudhoff 174, Lindberg 107-15, Tachau 4-8). The sensible species are received by the senses, integrated into images in the front ventricle, supplemented and recombined in the middle, and stored and recollected in the rear (Wolfson 107-110). David Lindberg calls this combination of views ‘The Baconian synthesis’ (116).
Bacon’s contemporary Aquinas also believed in the localization of the psychological capacities to the ventricles, asserting that “the principle of vision is interior, next to the brain, where the two nerves proceeding from the eyes unite” (In DSS 1.5.6) and that the capacity to compare individual forms is located “in the middle chamber of the brain” (QDV 15.1). Aquinas reduced Avicenna’s five inner faculties to four (ST 1.78.4; Sudhoff 172-73, Wolfson 120-22, Black 66-68), and different thinkers had different lists.

Anatomical orthodoxy up through the sixteenth century was that sensible species from various sense organs were received and collated into phantasms in the anterior ventricle, intelligible species were extracted from those phantasms in the middle ventricle, and phantasms were stored and recalled through the rear ventricle (Sudhoff 164-204, Clarke and Dewhurst Ch. 3, A.M. Smith 1981: 571-75, Park 470-72). The Baconian synthesis allows for a deep continuity between the quality that’s seen and the perception in the perceiver. According to Aquinas, “the interior of the eye must be transparent . . . so that there may be a uniform process of alteration from the thing seen to the principle of vision” (In DSS 1.5.6). That is, the vitreous humor in the eye is transparent in order to allow for the continuous transfer of a sensible species from the seen object to the ventricles. Sensible qualities multiply across a transparent medium and into the fluid in the ventricles. The substratum and the manner of inherence vary during the process of perception, but the form remains the same (A.M. Smith 2004: 187-89).

Some of the epistemologists and logicians of the later middle ages rejected or modified some or part of Bacon’s synthesis of multiplying species in the medium, Alhacen’s optics, and the localization of psychological capacities in the ventricles. Ockham endorsed action at a distance, denied that there were species in the medium, and argued that species distinct from acts of perception don’t inhere in our sensitive capacities (Rep. 2 q. 13, Rep. 3
Robert Holcot thought that the Aristotelian thesis that knowledge takes place by the reception of forms should be paraphrased away into the claim that learning is the acquisition of a certain disposition (Tachau 249).

There were fourteenth century defenders of more metaphysically laden conceptions of the reception of forms, with William Crathorn defending an especially pure version of the doctrine (Tachau 255-74, Pasnau 1997: 89-93). Jean Buridan pushed back against Ockham’s rejection of species in the medium. He also argued that since someone in a warm bath becomes accustomed to the temperature and someone who eats garlic can no longer smell it on the breath of his neighbor, we should infer that the material presence of a sensory quality gets in the way of the perception of it and that we must posit a second form of causality beyond the ordinary workings of these qualities (Maier 1967: 446-48)

5.2 Two Kinds of Inherence

Aristotle’s eminence among his medieval followers ensured that they took seriously his analysis of perception as the reception of a form without matter. Whatever exactly he meant by the doctrine, hardly anyone in the middle ages thought that the form was present in the very same way as it is in the medium and in the perceived objects. Averroes argues that colors can’t be in the transparent medium in the same way that they’re in bodies or the medium wouldn’t be transparent (Long §71), and I don’t think that anyone disagreed (Knuuttila 13-15). Bacon puts the point by saying that colors in the air can’t be seen except indirectly and incidentally (OM 2.44-45=Burke 463; Tachau 22-23).

The second sort of inherence demanded by their optics offered medieval thinkers another way of understanding how subjective appearance might inhere in perceivers.
According to Aquinas, sensible species have intentional existence in both the medium and in
the perceiver, as opposed to the natural existence that these qualities have in external objects
(ST 1.56.2 ad 3, In DA §418; Pasnau 1997: 39-60, Perler 37-38, Tellkamp 2006). As an
element of philosophical psychology, ‘intentional inherence’ was embedded in a wider
natural philosophical theory, the parts of which fit together nicely and which included
Alhacen’s geometrical optics, one of the great intellectual achievements of the middle ages.
Psychological applications of the concept of intentional inherence borrowed intelligibility
and legitimacy from that wider theory.

Some distinction between air and animal must still be drawn. Sensible species don’t
produce sensation in the medium, according to Aquinas, because the medium doesn’t have
the capacity to sense (In DA §563; Burnycat 2001: 150, Perler 39, Tellkamp 276-77). Bacon
explains why sensible species travelling up the optic nerves seem to violate the laws of
external optics by declaring that different rules apply “in an animated medium,” where the
soul has a power “to direct species according to the needs of its operations” (OM
2.463=Burke 467-68; G.B. Matthews 1978: 197).

Aquinas distinguishes the various sensory capacities by whether and how the sensed
object is changed and by whether and how the sense organ is changed. In sight, hearing, and
smell, the organ only receives the perceived species in a spiritual way, so that receiving the
form of F doesn’t make the organ F without qualification, “as the form of color is received
by the pupil, which isn’t made colored by this” (ST 1.78.3; Perler 43-44, Brower and Brower-
Toland 204n24). Sound requires a motion in the air and smell requires that its object be

44 Robert Pasnau (1997: Ch. 1 §3; 2002) denies this because in three passages, Aquinas seems to define
cognizant beings as those that can have forms besides their own. Peter King (2007a: 84) reaches the same
conclusion because Aquinas seems to say that air and water can perceive colors (In DA §570), but, as Pasnau
observes (1997: 51), the relevant word (perceptiva) may be naturally translated as ‘receptive’. It wouldn’t be
unprecedented to think that the air acquires something like consciousness during sight. Galen thought that this
happens when the eye emits pneuma (Lindberg 10-11). It likewise wouldn’t be unprecedented for a philosopher
to contradict himself, as Martin Tweedale (1992) argues that Aquinas does on this point.
warmed. In taste and touch the organ becomes “naturally altered”; “the hand that touches something warm is warmed, and the tongue is moistened by the moisture of the tasty thing’’ (ibid.). For Aquinas, salivation is only a prerequisite for the spiritual reception of sweetness and bitterness (ST 1.78.3 ad 4). Thus, for him warmth is the only exception to the principle that perceptible qualities inhere in the sense organs not without qualification, but only spiritually. This form of inherence allows for cognitive presence without all of the metaphysical entanglements of having the quality in the ordinary way.

He applies a similar division of kinds of inherence in accounting for the presence of forms in the intellect: “an intelligible species is a likeness of the very essence of a thing, and it is in a certain manner the very quiddity and nature of the thing in accordance with intelligible being, not in accordance with natural being exactly as it is in things” (Quod. 8.2.2).45 The very same essence exists in the world and in the intellect. In the world it has natural being and in the intellect it has intelligible being.

Aquinas is ultimately more interested in theology than he is in philosophical biology. Some subtleties in his treatment of the role of resemblance in cognition come out in his treatment of divine knowledge. He considers the objection that God’s knowledge of other

45 In arguing that Aquinas doesn’t really mean what he seems to say in this passage, Claude Panaccio (192-93) cites a text where Aquinas says that almost all intelligible species in the intellect have accidental being (SCG 1.46.4). But Aquinas’s point is just the modal one that knowers don’t have intelligible species such as bovinity in their intellects by necessity. It doesn’t show anything about the category to which our intelligible species belong, nor does it show that the bovinity in our mind can’t be the same (in some sense of same) as bovinities in the field, which constitute the essences of various cows. Jeff Brower and Susan Brower-Toland argue that since Aquinas counts intellectual species as qualities, he can’t think that they are formally identical with species in external substances (216-18), but the passages that they cite (197n7: ST 1-2.53.1, SCG 1.46, QDP 9.5) don’t seem decisive to me. I think the passage that addresses the question most directly is a bit twisty. In arguing that we can’t understand many things at once, Aquinas argues that intelligible species will drive each other out of the intellect because, in a way, they all belong to the same genus. According to him, “all intelligible species belong to one genus, since they are perfections of one passive intellect; even though the things of which they are species belong to diverse genera” (ST 1.85.4). Out in the world, things in distinct genera fall under distinct intellectual species, even though these species all fall under the genus modification of the passive intellect. I think Aquinas believes that intellectual species resemble species out in the world and these species fall under distinct genera, and also that he believes that the intellectual species, considered as they are in the soul, are all modifications of the passive intellect. This allows us to read this passage so that it’s compatible with his assertion in Quod 8.2.2 that the very same form inhere in different ways in the intellect and in the world.
things can’t be consistently combined with both the Aristotelian doctrine that knowledge is
the assimilation of knower and the thing known and also the radical dissimilarity between
God and his creation (QDV 2.3 obj. 9). Aquinas replies by claiming that ‘similitudo’ can be
considered in two ways. The first is resemblance, ordinarily so called:

   One way is by agreement in nature. Such a resemblance isn’t required
   between knower and thing known. Indeed, we sometimes see that the less
   the resemblance, the more perspicuous the cognition. For example, there is
   less resemblance between a stone and its likeness in the intellect than there is
   between it and its likeness in the senses, since the likeness in the intellect is
   more removed from matter, but the intellect knows more perspicuously than
   the senses.

   The second way

   is by representation, and this resemblance is required between knower and
   the thing known. Though there is the least resemblance between God and a
   creature with respect to agreement in nature, there is still the maximum
   resemblance in that the divine essence most expressly represents the creature,
   and thus the divine intellect knows each thing best (QDV 2.3 ad. 9)

   The second sort of similitude is just a roundabout way of saying that the knower knows
   about the thing known (see O’Callaghan 462-69 and compare Pasnau 1997: 105-13 and
   Brower and Brower-Toland §3).

   This second sort of similitude isn’t an explanatory part of his account of how God
   knows about creatures. Aquinas’s positive account of divine knowledge is that God made
   creatures and immaterial intellectual agents know what they’ve done (QDV 2.3, ST 1-2.2.3,
   SCG 1.50.3; Kretzmann §4).46 His account of God’s knowledge is really the primordial case
   of maker’s knowledge.

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46 Aquinas defends the imago dei doctrine and the possibility of resemblance between God and his creatures by
distinguishing three ways in which one thing may resemble another, the third of which is an analogical mode
that holds between a cause and an effect that may not share a genus (ST 1.4.3; O’Callaghan 466-67; Perler, 55-
56, reads this somewhat differently, neglecting remarks at the end of the passage.). God’s resemblance with his
creatures in the third analogical sense from the Summa (which holds between cause and effect) thus explains
God’s resemblance with his creatures in the second extended sense from the Disputed Questions on Truth (which
holds between a knower and thing known).
Someone who is cynical about Aquinas's project of combining Aristotelian philosophy with Christian doctrine might suppose that his second sense of resemblance was merely a Pickwickian stipulation that allows him to square the Aristotelian principle with a simple, non-Aristotelian God who thinks about things other than himself. Insofar as Aquinas appeals to resemblance to explain human cognition, he appeals to the first, ordinary, notion of resemblance, and here the relationship to knowledge isn't always direct. The incorporeal likeness of a stone in the intellect resembles the stone less than the corporeal likeness in the sense organs, but the intellect still gives deeper insight. It matters a great deal what aspects of a stone are resembled and which faculty considers those resemblances.

In order to explain this distinctive form of inherence, some medieval and renaissance philosophers compared it to the way appearances inhere in a mirror (Shuger 31-34, Clark 17-19). For Avicenna,

> the eye is like a mirror, and the visible object is like the thing reflected in the mirror by the mediation of air or another transparent body: and when light falls on the visible object, it projects the image of the object onto the eye . . . If a mirror should possess a soul, it would see the image that is formed on it (quoted in Lindberg 49, see also Psychology 27).

Averroes argues that the predominant element in the eye is water, “in order that the forms of the sense-objects may be imprinted upon it just as forms are imprinted upon a mirror” (EPN 6; Lindberg 55, Clark 17). In the fourteenth century, Richard FitzRalph, eventually Archbishop of Armagh, suggested that in cognition, “the species is impressed in its subject just as, perhaps, the image is in a mirror” (Tachau 239). For Juan Luis Vives, a sixteenth century humanist, “knowledge is like the image of certain things, expressed in the soul as if in a mirror” (Soul and Life 407; Shuger 33-34).

Any simile is limited, and everyone would reject some comparisons between mirror imagery and phantasms. According to Democritus, we see through reflections in the eye.
Aristotle argues that this gives the wrong picture of the reflection that we see in the eyes of others, and it can’t account for why not every reflecting object can see (Sens. 2 438a5-12, Johansen 46). Boethius criticizes the Stoics for comparing perception to a mirror, since mirrors are entirely passive, and the mind exercises judgment in perception (Consolation Bk. 5, Poem 4; Pasnau 1997: 125). Right after Vives says that mirrors are like souls, he contrasts mirrors and souls with respect to spirituality and immortality (Soul and Life 407).

Presumably, no one comparing phantasms to mirror images would want to say that mirrors are conscious, active, spiritual, or immortal. That isn’t the point of the comparison. The point is to find an illuminating example which can help explain how the perceiver might take on the form of a perceived object without taking on its matter, an object which, in Richard Rorty’s phrase (43), “takes on new forms without being changed.” For all that, it’s a simile, not an analysis.

Locke’s targets are those who believe that secondary qualities are “the same in those Bodies, that those Ideas are in us, the one the perfect resemblance of the other, as they are in a Mirror”; according to him, this is “most Men” (2.8.16). According to Robert Pasnau, Locke is attacking the doctrine that “the world really does possess the various phenomenal characteristics of our sensory experiences,” (2011b: 52). Pasnau calls this doctrine ‘Veridical Projection’ and argues that any such criticism must, in principle, be attacking a straw man:

There is, however, more than just a lack of evidence here; there is also a kind of pragmatic impossibility. We could justly ascribe the thesis of exact likeness—that is, Veridical Projection—to the Scholastics only if we could find an author who sets the thesis out in reasonably explicit terms. But Veridical Projection is a thesis that, as soon as it is set out in explicit terms, shows itself to be incoherent. Anyone who gets far enough along to distinguish phenomenal experiences from things in the world, and then considers whether the latter might be exactly like the former, has to see immediately that the thesis is impossible. . . . Inanimate objects cannot be

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47 Rorty mars the point a little by restricting it to intellectual, as opposed to sensible forms. The simile of the mirror is the starting point and the eponym of his Philosophy and the Mirror of Nature.
characterized in terms of phenomenal experiences—that follows directly from their being inanimate (2011b: 54, see also 2011a: 494-95).

Pasnau is so convinced that phenomenal experiences can’t resemble external things that he thinks that the principles of interpretive charity require us to not attribute the view to anyone.

I’m not sure how well the term ‘phenomenal characteristics’ travels across the ages, but in this context it means colors as they seem to us and sensations as they feel to us. If Pasnau means that no one could possibly believe that colors as they appear resemble colors as they are in external bodies or that sensations couldn’t possibly resemble their stimuli, then I think he’s mistaken. Is it really incoherent that a bit of color might inhere in an ordinary way in an external body and that another resembling bit of color might inhere in a different way (say, spiritually or intentionally) in a perceiver? I feel as though Pasnau has understood and explained much subtler views than that.

Stuart Clark has emphasized how hard it is to square non-literal interpretations of cognitive resemblance with all the things that pre-Cartesian authors write about it (15-16). My favorite example of his occurs in the context of a counter-reformation defense of religious art (Clark 168-72). Nicholas Sanders, a sixteenth century English Catholic exile, argued that the commandment against graven images was only a commandment against idolatry and couldn’t have been intended as a general prohibition of representational pictures and statuary. God has made it impossible for us to think without imagery, so he couldn’t have intended us not to make any images at all:

it is utterly impossible, that the making of an Image (onely as it is the similitude of an other thing) should be forbidden. Otherwise God should be contrary to himself. For he hath so made us, that we can not learne, know, or understand any thing, without conceiving the same in some corporeal Image or likeness. Our knowledge commeth by our senses, of which our eies are the chefe. They see visible Creatures, and heare soundes or noices, whereby the common sense being informed with such images as it is able to conceive,
offereth the same to our phantasie or imagination, whence the mind beginneth to gather knowledge and to print (as it were) or to grave in it self that, which is pawred into it by the senses (Images 43r-44v).

The Anglicans who pulled down statues in English churches

were more foolish then the stoanes which they pulled doune . . ., as though the handy worke it selfe were unlaulful . . . whereas if al Images to bee rooted uppe, they shoulde not have spared theyr owne braines, which are more full of Images (that I may not say of Idols) then al the Churches in Christendome are (Images 44r-45v).

Imagery begins at home, and it’s hypocrisy to pull down the statue in your church while ignoring the images in your own skull.

No one could offer such an argument without believing that mental images literally resemble in certain respects images carved in stones and painted on canvasses. Nor is the thought that an interpretation of the commandment against graven images should apply to mental imagery idiosyncratic to Catholics. English Protestant divines worried throughout the sixteenth century that mental images might constitute forbidden idols (Aston 452-66).

If the reader can’t conceive of any resemblance between mental and physical imagery, one option is to claim that charity requires that we deny attributing a belief in such resemblances to Locke or his predecessors. Instead, let me suggest that the lesson we should draw is that the boundaries of conceivability can be relative to social circumstances, and that through sympathetic historical understanding, those boundaries can be overcome.

As Mark Smith argues (2004: 191-94), the medieval theory of optics attempts to capture the way things appear from a subjective point of view. The phantasms in the ventricles weren’t optical images such as those that Kepler discovered on the retinas but rather the inner aspects of appearances. On the standard medieval view, an anatomist who cut a ventricle open wouldn’t be able to see mental images any more than we can see species
inhering in the medium. If the medieval theory had turned out to be true and the forms in the ventricles were similar to the forms in the world, then it would have been perfectly reasonable to say that internal appearances resembled external bodies, or, if you please, that phenomenal characteristics were also present in inanimate objects.

You don’t have to believe the Baconian synthesis in order to believe that subjective states resemble physical objects. After all, Locke believes that ideas of primary qualities resemble something in bodies without believing in the multiplication of species. But if you believe in the Baconian synthesis, then you believe that subjective states can resemble physical states, and if you can understand how someone might believe the Baconian synthesis, then you can understand how someone could believe that subjective states resemble physical states.

5.3 The Downfall of the Medieval Theory of Perception

Parts of the Baconian synthesis were true and parts weren’t. Alhacen’s geometrical account of the scattering of light was one of the great achievements of medieval science. His account of the optics of the eye and Avicenna’s account of the localization of the internal psychological functions were mistaken, but they weren’t incoherent. They were rejected for empirical reasons. Once rejected, a new account of how physical stimuli give rise to sensations and appearances was needed.

As I understand it, the mind-body problem has two parts. First, how can sensation and subjective appearances be present in a corporeal perceiver? Second, how can physical stimuli give rise to sensations and appearances? One of early modern philosophy’s distinctive features is its profusion of answers to these problems—materialism, interactionism, parallelism, dual aspect theory, occasionalism, pre-established harmony, and idealism.

48 William Crathorn may be an exception here (Pasnau 1997: 89-95; King 2007a: 88-90)
This multiplicity of answers arose out of the breakdown of the medieval theory of perception. In the sixteenth and seventeenth centuries, the theory came under pressure from three sources. First, discoveries in brain anatomy suggested that the ventricles didn’t play an important role in cognition. Second, Kepler discovered optic images that didn’t inhere in the lens or the aqueous fluid of the eye but were rather cast upside down and backwards onto the curved back surfaces of our eyes. Finally, new theories of matter fit poorly with the medieval theory of light and with scholastic accounts of the biological bases of cognition. The breakdown of the medieval theory of perception led to new accounts of how sensations were produced in perceivers and of the substrata in which they inhere.

In the beginning of the fourteenth century in Bologna, Mondino de Luiizzi revived observational anatomy by carrying out public dissections and writing a guide for dissection (Lindberg 169). This revival didn’t immediately improve Italian knowledge of brain anatomy. Leonardo da Vinci’s early drawings of the anatomy of the brain in the 1490s showed a simple chain of circular chambers coming out of the optic nerve. About ten years later, he had the idea of injecting wax into the ventricles and as a result was able to draw much more accurate representations of the ventricular system (Clarke and Dewhurst 32-33, 51; Gross 99-104).

Leonardo didn’t publish his work. It was Andreas Vesalius’s publication of The Fabric of the Human Body in 1543 that heralded a new age in the history of anatomy. Printing presses with their wood cut images could reproduce anatomical diagrams in a way that monks in their scriptoria couldn’t (Lindberg 168, Eisenstein 194-95). With reproducible illustrations, cumulative progress was possible in anatomy in a way that it hadn’t been before.

Vesalius rejected the traditional attribution of psychological capacities to the ventricles because irrational animals have the same ventricular structure (Fabrica 624,
This wouldn’t have surprised the defenders of the ventricular theory. They almost all denied that the intellect had a corporeal organ. When Aquinas criticized Avicenna’s division of the inner senses, he did so on the grounds that capacity to combine and divide mental imagery is particular to human beings, and thus doesn’t need a corporeal foundation (ST 1.78.4; Black 66-67). Only the psychological capacities that we have in common with the animals needed to be grounded in the sense organs or the ventricles. Vesalius himself asserts (possibly insincerely) that we have an immaterial rational soul (Fabrica 636=Brain 40), which seems compatible with asserting that it interacts with the body through the ventricles.

Vesalius seems to have believed that the difference in rational capacity between humans and lower animals should show up anatomically (Singer 80n57, Bynum 454). Though he denied that lower animals have significantly different cerebral parts than humans, he asserts, “we know for certain that the brains of animals vary by size to the extent that they to see by reason they’ve been given. For the largest brain occurs in man; after that in ape, dog, and so forth, in the same order we gather by arguments that the power of reason in an animal gets closer to those” (Fabrica 624=Brain 7). If Vesalius had thought that the difference in rational capacities between humans and other animals lay in the sizes of their brains, we can understand his cagey remark that he would have explained the most likely hypothesis about the brain if he “could do so without disgracing most holy faith” (Fabrica 623=Brain 4). He was writing not long after the Fifth Lateran Council had decreed the immortality of individual soul to be philosophically demonstrable, and there were new pressures in Italy towards orthodoxy (Monfasani 264). If humans differ in their rational capacities from other animals only by having larger brains, the usual arguments for immortality won’t work.
Vesalius’s skeptical remarks didn’t immediately kill the assumption that psychological faculties were localized in the ventricles. A half a century later, Shakespeare has a character give an anatomical account of his capacity for wordplay:

This is a gift that I have--simple, simple; a foolish extravagant spirit, full of forms, figures, shapes, objects, ideas, apprehensions, motions, revolutions. These are begot in the ventricle of memory, nourished in the womb of \textit{pia mater} and delivered upon the mellowing of occasion (\textit{Love's Labour's Lost} 4.2.67-72).

The ventricle of memory is the posterior ventricle. The ‘womb of the pia mater’ is the middle ventricle, which is surrounded by that membrane. In \textit{Twelfth Night} (1.5.111-112), a character insults another’s intelligence by saying that he has ‘a most weak \textit{pia mater}’.

In Edmund Spencer’s \textit{Fairie Queene}, also written in the 1590s, Alma gives Guyon and Arthur an extended tour of her castle, which is an extended metaphor for the human body. Three counselors reside in the turret, each in his own chamber. The chambers correspond to the ventricles: the first painted with scenes “Such as in idle fantasies doe flit:/Infernall Hags, \textit{Centaurs}, feendes, \textit{Hippodames,}/Apes, Lions, \textit{Ægles}, Owles, fooles, louers, children, Dames” (Bk. 2 Canto 9 verse 50) the second painted with images of “all artes, all science, all Philosophy” (2.9.53) and the last “Hangd about with rolles,/And old records from auncient times deriv’d” (2.9.57, Harvey 1-2). In \textit{The Anatomy of Melancholy}, published in 1621, Robert Burton recapitulates the traditional account, placing common sense “in the fore-part of the brain,” phantasy in “the middle cell of the brain,” and memory in “the back part of the brain” (1.1.2.4, see also 1.1.2.7). Shakespeare followed Avicenna in counting five inner wits (\textit{Much Ado} 1.1.62-68, \textit{Twelfth Night} 4.2.63) Burton follows Nemesius in counting three, one for each ventricle (1.1.2.7)

Descartes and his followers were the last to defend a version of the ventricular theory (Clarke and Dewhurst 68). The pineal gland is embedded in the \textit{pia mater} over the
middle ventricle, near the entrance to the rear ventricle. Descartes thought that it dangled freely and was subject to currents of animal spirits, that is, rarified fluids in the brain (Passions §§31, 34). According to him, external objects cast images on the retinas, which in turn open certain tubes in the brain, which then differentially push on the surface of the pineal gland, which makes the soul see shape (AT 11.176-77=CSM 1.106, Passions §35). When the images depend on the presence of objects, they are attributed to the common sense. When they have other causes, they are attributed to the imagination (AT 11.175-76=CSM 1.105-06, AT 5.162-63=CSMK 3.345). Differential motions also cause sensations of movement, size, distance, colors, sounds, and smells and pleasure, pain, hunger, thirst, joy, and other passions (AT 11.176=CSM 1.106).

Descartes thus believed what Avicenna and Aquinas believed centuries earlier: an immaterial rational mind casually interacts with the body through the middle ventricle. They all believed in resemblances in the eyes and in the brain, but for Descartes the resemblances are only partial and resemble in the way that engravings resemble their subjects (AT 6.112-17=CSM 1.165-67). The main difference between his philosophy of mind and that of his medieval predecessors is that instead of thinking that sensations of color, sound, and taste inhere in the sense organs and in the ventricles, Descartes thought that they inhere in an incorporeal soul.

Locke’s teacher Willis is primarily known to history as an anatomist of the brain. The arterial circle at its base is named after him. He struck late blows against the importance of the ventricles, offering two arguments against the “opinion of the ancients” that the ventricles are “a factory of animal spirits, where they both themselves are generated and where the works of the chief animal functions are roused” (Anatome 104=Anatomy 96). First, the ventricles are too big: “the animal spirits, being very subtle and apt to fly away, don’t
require such large and open spaces, as much as narrower passages pores, such as are cultivated in the substance of the brain” (Anatome 105=Anatomy 96). Second, the intricate structure of brain shows “that these ventricles are not formed out of the primary intention of nature, but result only secondarily and accidentally from the complication of the brain” (Anatome 105=Anatomy 97). For Willis, the complexity of the brain shows that it’s the important organ and that the surrounding ventricles are merely byproducts or spandrels.

Johannes Kepler’s critique of Alhacen’s account of the optics of the eye was a second blow against the Baconian synthesis. In 1590 Tycho Brahe used a pinhole camera to observe a partial solar eclipse and found that the image of the shadow of the moon was smaller than expected. In 1598, his students got the same result with a different eclipse (Straker 276-82). Kepler rightly surmised that the difficulty was an artifact of the pinhole camera (Paralipomena 2.8-12; Lindberg 186, Straker 282-93) and resolved to investigate.

Alhacen had argued that each point on an illuminated body radiates light and color in all directions. He realized that visual information would all be lost if these rays weren’t reduced somehow, and multiple rays from different parts of the visible body struck every point of the surface of the eye (Optics 1.6.7-13, Lindberg 71-74). His solution was to suppose that only those rays that struck the cornea at right angles are perceived at the glacial humor (the lens, more or less),

49 which is the initial location of visual sensation (Optics 1.6.14-44, Lindberg 73-83, A.M. Smith 2004: 185-87).

Kepler saw that we don’t have to assume that slightly refracted rays are imperceptible. He showed that the rays of light travelling from a body are initially winnowed by the smallness of the pupil in the way that the pinhole in a pinhole camera winnows them and that the remaining rays of light that make it to the lens are refracted so that they

49 For more precision on Alhacen’s anatomy of the eye, see A.M. Smith 2004: 183-84
reassemble as focused, upside-down, and backwards images on the retina (Paralipomena Ch. 5; Lindberg 188-208).

Mark Smith (1981, 2004) has given judicious and wide-ranging histories of the medieval theory of perception, and I’ve mostly stayed with their outlines. He rightly traces the mind-body problem to the breakdown of the Baconian synthesis. Insofar as I disagree with him, it’s only about where he places the moment of crisis.

In the course of discussing mirror images, Kepler defines an image (imago) as an object as seen as being in a place other than its own, and sometimes with a different quantity and proportion of parts: “in brief, an image is a vision of a thing, with an error of the faculties conjoined concurrently to the vision.” An image, on this definition, “is composed out of real species of color and light and out of intentional species of quantity” (Paralipomena Ch. 3 Def. 1). Such an image is, he tells us, a mere being of reason (ens rationale). He defines pictures (picturae) by contrast, as “the figures that really exist on paper, or on another surface (Ch. 5, Def. following Prop. 18). On Smith’s account, Kepler’s discovery of the retinal image was the crucial moment because he transformed what had been traditionally thought of as a merely subjective appearance into an objectively visible optical picture (2004: 192-94, see also Gaukroger 77).

I grant that Alhacen’s account of how light strikes the eye was crucial to the development of a plausible intromissionist theory of light and to the development of the Baconian synthesis, and I grant that Kepler showed the falsity of some parts of Alhacen’s account. Kepler’s discovery did not, however, show that the medieval theory of perception as a whole was untenable.

Indeed, we might think of the discovery of the retinal image as a picture on the back of the eye as evidence for a simplified version of the traditional theory. In a note on
controversies surrounding Aristotle’s theory of perception, Christopher Shields (2011) suggests that commentators would rather not “saddle Aristotle with the dubious empirical claim that all organs, in all instances of perception, always come to exemplify the sensible qualities they perceive. (Do my eyes really become pinstriped when I see a dapper man’s suit?)” Kepler showed that part of your eye becomes pinstriped when you see a dapper man’s suit. It’s the damnedest thing.

The discovery that there are pictures inside the skull can hardly undermine the hypothesis that cognition works by processing images in the ventricles. As Clark writes, “Post-retinal transmission in Kepler was consistent with a traditional physiology in allowing ‘visual spirit’ to carry the retinal picture (or ‘immaterial image’) onwards to the ‘common sense’, where visual judgements based on the principle of the simulacrum still occurred” (343). A believer in the medieval theory of perception could have readily accepted Kepler’s discoveries as friendly amendments. The displacement of the initial visual image from lens to retina and the transformation of subjective imagery into publically visible pictures doesn’t seem like a Kuhnian crisis that required the abandonment of the theory.

The third blow to the medieval theory of perception is the rise of new accounts of matter. In my opinion, this is the most important source of the mind-body problem.

Once Copernicans had set the earth in motion, natural philosophers could no longer adopt Aristotle’s classification of matter by their relative tendencies to travel to the center of the earth (DC 4.4; Kuhn 1957: 84-87). Seventeenth century discoveries in mechanics overturned some of the principles of motion that Aristotle had attached to this dynamical conception of matter, including his analysis of projectile motion and his thesis that the heavier a body is, the faster it falls (Bertoloni Meli 2006: 47-49, 61-63, 229).
Alchemy is an ancient art that turned into chemistry. During the seventeenth century the terms ‘alchemy’ and ‘chemistry’ were used interchangeably (Newman and Principe 1998). In the sixteenth and seventeenth centuries, alchemists became interested in topics beyond the transmutation of metals, including assaying, refining, brewing, and making dyes, explosives, and medicine. Hopes were attached to these new technologies, especially medicine, and some renaissance philosophers came to see alchemical concepts as cosmologically significant (Newman 2006b: 498-509). As a result, there was what Lawrence Principe (2013: 107) calls a “golden age” of the discipline and an “explosive growth” in the number of its practitioners. Techniques of chemical synthesis and analysis became increasingly sophisticated, and Boyle was able to turn those techniques into arguments that substantial forms don’t play a role in the generation and destruction of chemical compounds (OFQ 395-98, 451-52, 460-61, 471-72; Newman 2006a: 208-15).

Because these attacks on Aristotelian theories of matter don’t have much in common, the theories of matter that they advocated as replacements aren’t all the same. In particular, not all of the new theories of matter are corpuscularian. Before considering the difficulties that Locke has in finding a place for mind in his corpuscularian world, let me consider one of these alternative approaches to matter and how it handles the mind-body problem.

Because Locke attended his lectures, Willis’s chemical theory of matter is a good and salient example of one of these alternative approaches. The decomposition of stuffs through the application of fire suggests to him that the chemists have the best account of matter. On his version of the doctrine, bodies are composed of particles of spirit, sulfur, salt, water, and earth (de Ferm. 3-4= Fermentation 2; Isler 47). This list takes Paracelsus’s tria prima, replaces mercury with spirit, and supplements these with the traditional elements of water and earth.
(Frank 1990: 116). If the corpuscularian replies that such chemical elements arise from corpuscularian principles, then Willis requests a demonstration. He himself “doesn’t want to profess a hammering or dreaming philosophy” (*de Ferm.* 4=*Fermentation* 2; Isler 48, Debus 2001: 66-70).\(^{50}\)

Though Willis rejects the Aristotelian theory of matter, he preserves the continuity between light and sensation that was also a central feature of the medieval picture by making spirit into a chemical element. He doesn’t think that the animal spirits flowing through the nerves and brain are like spirits of wine, turpentine, or sal volatile, since those spirits “neither represent simulacra of objects nor do they have any elastic power”; they are also less subtle and less volatile than animal spirits. Instead, according to him, animal spirits are like rays of light, since they are both configured to carry impressions (*de An. Brut.* 41=*Brutes* 23-24; C.U.M. Smith et al. 137).

According to Willis, animal life has “twin roots or fountains” (*Anatome* 134=*Anatomy* 95), vital spirits produced in the blood and animal spirits produced in the cerebrum and cerebellum. He identifies sensations with the motions of animal spirit:

The formal cause of the senses consists in the *retraction* of the spirits, or a *flowing back* to their fountains. For wherever the impression of a sensible object is carried into this radiant framework, immediately either the whole structure, or some portion of it by which it admits species, is forced to waver, driven backward, as if it springs back into itself, recedes (*Anatome* 135=*Anatomy* 95).

Animal spirits, like other Willisian elements, come in particles (Frank 1990: 116), so we should think of these impressions as waves in a particulate fluid. When the eyes are struck, the concussion creates a wave, which can be thought of as an optical species: “whenever the

\(^{50}\) This reply to the corpuscularian occurs in the 3rd edition but not in the 1st. According to Antonio Clericuzio (1994: 85), it’s a reply to Boyle’s *Sceptical Chymist*.\footnote{This reply to the corpuscularian occurs in the 3\(^{rd}\) edition but not in the 1\(^{st}\). According to Antonio Clericuzio (1994: 85), it’s a reply to Boyle’s *Sceptical Chymist*.}
exterior part of the soul is struck, a sensible impression, as an optical species, or as an waving of waters, is carried inwards, bending to the corpus striatum” (*Anatome* 136=PA 95-96).

There “a perception or internal sensing of the character of the external sensation arises.” If the impression makes it to the corpus callosum, “imagination follows.” And finally, “if the same fluctuation of spirits is dashed against the cerebral cortex, as its utmost banks, it imprints on it the image or character of the sensible object, which, when that place is later reflected, raises up the memory of the same thing” (*Anatome* 136=PA 96, Clarke and Dewhurst 70, Frank 1990: 134-35). In addition to these waving patterns in spirit, Willis believes that humans have a rational soul which governs the sensitive soul, and “considers the images and impressions displayed by the sensitive soul as in a mirror, and according to the conceptions and notions drawn from that, exercises acts of reason, judgment, and will” (*de An. Brut.* 95-96=Brutes 32, Frank 1990: 130-31).

For Willis, the mentality of the sensitive soul flows through the brain as water might flow through gravel (Frank 1990: 133). He maps the functions of the mind onto the anatomy of the brain (*de An. Brut.* 81-82=Brutes 27; Bynum 450-53). In effect, he takes the standard Aristotelian psychological theory, according to which sense impressions are combined into phantasms and then stored in memory, and modifies that theory in accordance with his deeper understanding of the anatomy of the brain. He replaced the front ventricles with the corpus striatum, the middle with the corpus callosum, and the rear with the cerebral cortex. His predecessors who localized psychological faculties onto the ventricles carried out the same mapping project with less sophisticated anatomical theories, but with more flexible theories of inherence.

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51 Willis included more of the brain within the corpus callosum than anatomists do today (Clarke and Dewhurst 70).
6.1 Corpuscularianism and Thinking

The historian of philosophy Peter King (2007b) places the blame for the mind-body problem on the rise of corpuscularianism. That can’t be the complete answer since not everyone in the early modern period believes that the fundamental explanatory properties of body are shape, size, number, and motion. The mind-body problem, moreover, outlasts the heyday of corpuscularianism. Still, corpuscularianism was a popular physical doctrine in the middle of the seventeenth century that provides a useful model for thinking of the relation between an austere physics and the philosophy of mind.

King presents the problem as a matter of accounting of how corpuscularian bodies can possess secondary qualities (2007b: 204). I would emphasize rather the difficulties in accounting for how mentality could inhere in bodies made out of thoughtless corpuscles and in explaining how corpuscles coming from external bodies can cause mentality. For Locke, the mind-body problem is in the perceiver and not in the perceived object.

Suppose your model of corporeal inherence is that a corporeal substratum gives rise to shape, size, solidity, and mobility, with circumstances determining the particular shapes, sizes, and degrees of motion of a body and these determinate qualities in turn giving rise to various capacities and dispositions. On such a picture, it’s hard to see how sensations can naturally inhere in corporeal substances. Likewise, if your ideal of intelligible causation is one gear moving clockwise and an interlocked gear moving counterclockwise, and you can only conceive of light as composed of rapidly moving tiny particles, then it’s be hard to see how these bodies in motion could bring about visual appearances. The scholastic theory of matter
isn’t austere in the same way. It allows for multiple ways in which forms may inhere in matter and for the multiplication of forms across different sorts of matter.

Let me treat these problems in a bit more detail, beginning with the problem of how perceptions can inhere in embodied creatures. Those who believe that we are fundamentally corporeal perceivers have two basic options. One option is to have a sufficiently flexible theory of inherence that allows perceptions to be naturally present in material substance. The second option is to believe that thought and sensation are somehow present to matter at the ground level.

Aquinas influentially describes the prime matter underlying all corporeal substances as ‘pure potentiality’ ([SCG 1.17.7, ST 1.115.1 ad 2; Wippel 313-320, Pasnau 2011: 35-40]. That doesn’t mean that prime matter can underlie absolutely anything; he denies that it can be the substratum of purely spiritual beings ([QDSC art. 1; Wippel 305). Still, on his theory a vast array of substantial forms can be instantiated in prime matter, and the resulting substances can have a vast array of properties, capacities, and accidents.

As an alternative to having a flexible theory of inherence that allows mental states and capacities to inhere in unthinking matter, we might say that some kinds of mentality possess mentality by their own nature. In effect, this is what Willis does when he makes spirit into one of his fundamental chemical stuffs. By way of contrast, Boyle complained, “as for what the Chymists call Spirit, they apply the Name to so many differing things, that this various and ambiguous Use of the Word seems to me no meane proof, that they have no cleare and settled Notion of the Thing” ([Producibleness 9.52; Clericuzio 87). In this dispute, Locke follows Boyle rather than Willis.

Boyle and Locke believe in the value and interest of chemical experiments, but they believe that chemical principles are ultimately explained by the number, size, shape and
motion of solid parts, which is the position Willis criticized as hammering and dreaming. Throughout his adult life, Boyle was “a great Lover of Chymical Experiments” (*Chymist* 2.208; Principe 1998). His interest reached its climax towards the end of his life when he used his influence with Parliament to have the law against making gold repealed because, it seems, he thought that he had figured out how to do it (Principe 1998: 11). Though he believed in the transmutation of metals and chemical explanatory principles, he thought that these could, in principle be explained by the shape, motion, and configuration of corpuscles and the solid parts of bodies (*Chymist* 2.255, 2.270-75, *OFQ* 5.332-*SFP* 49-50; Kuhn 1952: 21-24, Newman and Principe 2002: 289-96).52

Locke likewise has a lifelong interest in the theory and practice of chemistry, partly under the influence of Boyle. Our first knowledge of contact between the two is a letter in which Locke describes loaning someone a chemistry book from Boyle’s library (LC #101 1.151, Stewart 1981: 21, 30-31, Anstey 2011b: 171). In his physiological research in the mid-1660s, he develops what Robert Frank (1980: 219) calls a “consuming love of chemistry.” When he goes on a diplomatic mission to the Duchy of Cleves in 1665, Locke visits Johann Schard, with whom he corresponds afterwards and from whom he records chemical instructions (Meynell 1995: 188, Walmsley and Milton: 90-91, Anstey 2011b: 173-74). Over the course of his life, he spent a great deal of money on experiments (Meynell 1995: 188).

His interest in chemistry extends into the 1690s (Anstey 2011b: 175-77). Boyle’s will gave Locke a role in the administration of his chemical and medical papers (Stewart 1981: 38-43, Anstey 2011b: 53-59). A letter from Newton in 1692 implies that Locke believes in

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the chemical possibility of multiplying the quantities of metals (NC #391 3.218=LC #1519 4.490; Stewart 1981: 43, Anstey 2011b: 176).

Let us me draw a distinction between, on the one hand, ‘chemical practice’ by which I mean the manipulation of stuffs through grinding, mixture, burning, melting, heating, distillation, sublimation,\textsuperscript{53} and the like and, on the other hand, a ‘chemical theory of matter,’ by which I mean the view there are fundamentally different sorts of matter which are differentiated by more than their varying shapes, sizes, and motions.\textsuperscript{54} Locke and Boyle engage in chemical practice, but, at least in their mature views, they don’t accept chemical theories of matter.

Many examples in the Essay appeal to chemical elements and operations, including 169 references to gold. At Essay 2.18.7, he cites ‘cohobation’ (repeated distillation) as an example as an example of a specialist’s term for a mixed mode. At 3.6.8, Locke argues that the inconsistency of chemical experiments shows that chemical kinds aren’t natural kinds (Anstey 2011b: 187). At 4.3.16, he argues that alchemists ought to be more honest and less secretive in publishing their results (Alexander 281).

None of Locke’s experiences with chemical experiments convinces him that matter is composed of fundamentally heterogeneous stuffs. Often his point is that the properties of chemicals can be explained by the shape, size, number, and solidity of their solid parts (e.g. 2.31.6, 4.3.25, 4.6.10; Anstey 2011b: 186-87).

Looking in the Essay’s chapter on our knowledge of the existence of God, we can see that Locke takes neither of these options for thinking about how thinking might inhere in matter. First, he argues that thinking can’t be a necessary feature of matter \textit{qua} matter. He

\textsuperscript{53} The list of techniques here is derived from Principe’s accounts (2013: Chapter 6) of his impressive laboratory reproductions of alchemical recipes.

\textsuperscript{54} Newman and Principe (1998) recommend the term ‘chymistry’ for seventeenth century alchemy and chemistry, but for present purposes I’d rather emphasize continuities with modern views and practices.
then offers reasons for that thinking can’t arise out of contingent arrangements of thoughtless matter. Against the possibility that matter has “originally in and from it self Sense, Perception, and Knowledge,” Locke argues that that would entail that “Sense, Perception, and Knowledge must be a property eternally inseparable from Matter and every Particle of it” (4.10.10). If we don’t posit a powerful and infinite God beyond these particles of matter, then we couldn’t account for the phenomena. There would be “an infinite number of eternal finite cogitative Beings, independent one of another, of limited force, and distinct thoughts, which could never produce that order, harmony, and beauty which is to be found in Nature” (ibid.). On this hypothesis, “there would be as many eternal thinking Beings, as there are Particles of Matter, and so an infinity of Gods” (4.10.14). He treats this as a reductio ad absurdum, though philosophers have believed stranger things.

I think that for Locke this flight into panpsychism is just a case of coming up with an argument for argument’s sake. Elsewhere, he asserts, “matter . . . is evidently in its own nature void of sense and thought” (4.3.6). Here he follows Descartes, who doesn’t think that we can mean anything intelligible when we say that something like a sensation of color exists in a body (PP 1.70; Downing 2011: 119-28).

Locke also tries to show that thinking can’t arise out of an arrangement of unthinking matter and that it’s “impossible, that Things wholly void of Knowledge, and operating blindly, and without any Perception, should produce a knowing Being” (4.10.4). He thinks that we know enough about matter to know that bodies, left to their own natural capacities, “knock, impel, and resist one another . . . and that is all that they can do” (4.10.10). If that constraint on the causal powers of bodies is taken seriously and restrictively, then bodies can’t give rise to sensation or knowledge.
According to Locke, “we are apt to imagine” division into tiny parts as “a sort of spiritualizing, or making a thinking thing of it.” (4.10.10). He may be thinking of Lucretius who offers two reasons for thinking that mind is matter composed of especially fine particles. First, mind is especially swift, and what is especially swift is composed of especially fine particles (DRN 3.179-185). Second, the difference between a living human and a dead one without mind or spirit is too small to be weighed, so the particles that compose mind and spirit must be too small to be weighed (DRN 3.208-228).

Against such arguments, Locke replies that the principle that bodies in motion don’t naturally produce thought works at any scale:

Divide Matter into as minute parts as you will . . . vary the Figure and Motion of it, as much as you please, a Glove, Cube, Cone, Prism, Cylinder, etc. whose Diameters are but 1000000th part of a Gry will operate no otherwise upon other Bodies of proportionable Bulk, than those of an inch or foot Diameter; and you may as rationally expect to produce Sense, Thought, and Knowledge, by putting together in a certain Figure and Motion, gross Particles of Matter, as by those that are the very minutest, that do anywhere exist. (4.10.10)

The passage is Locke’s occasion for offering a system of measurement to the commonwealth of letters. A footnote tells us that a ‘gry’ is one tenth of a ‘line,’ which is one tenth of an ‘inch,’ which is one tenth of a ‘philosophical foot,’ which is one third of the length of a pendulum with a period of one second at 45 degrees latitude. The pendulum length should be about 24.8 centimeters. A gry is one three thousandth of that, or 83 micrometers. If macroscopic bodies can’t naturally produce thought through their arrangements and motions alone, then no body, even one measured in picometers, can produce thought without divine assistance.

Locke’s analysis of matter as solid substance is meant to be an alternative to “those obscure and unintelligible Discourses, and Disputes, which have filled the Heads and Books of Philosophers concerning Materia prima” (3.10.15). Compared to Aquinas, Locke has a
much more constrained theory of the ways that the features of corporeal substances may
naturally inhere in bodies. According to him, a body have certain inseparable qualities that
flow from an unknown nature, and the determinations of those inseparable qualities give it
many of its powers and operations. Those are all the qualities, he believes that bodies can
naturally possess. He doesn’t think that sensations of secondary qualities can flow on their
own from the textures of bodies.

Beyond the puzzle of inherence, there’s also a puzzle in Locke’s system about
interaction, that is, about how external bodies in motion can cause sensations. The medieval
theory of perception solved the first problem through the multiplication of species. The
same sensible species are present in the ventricles of the brain in something like the same
way that they are present in the medium.

According to the medieval theory of optics species of light and color inhere in
transparent media in a distinctive way that doesn’t stain the air so that they can be directly
seen. This second sort of inherence gave medieval thinkers the conceptual resources to
assert that sensible species might inhere in this distinctive way in the transparent fluids in the
eye and in the ventricles of the brain. They could thus tell themselves an intelligible story
about how mentality might inhere in animals. For corpuscularians, there are no sensible
species of color and light is merely a collection of little bodies bouncing off objects. What’s
more, they had abandoned the rich scholastic hylomorphic picture with its varietis of matter
and inherence for an austere conception of matter in which a body’s natural properties are
supposed to flow from the shape, size, motion and number of the body’s solid parts. It’s
hard to explain how mentality might naturally inhere in corporeal beings on such an account
or to explain how external stimuli might cause sensations.
Optical and anatomical discoveries don’t compel any particular philosophical view, but they give general constraints and guide philosophers in one direction or another. It’s easier to believe there are resemblances of secondary qualities in the head if you believe in the multiplication of species, intentional inherence, and the importance of the ventricles. It’s harder to believe in them if you are a corpuscularian who believes that the substance of the brain is more important than the cavities within them and that the natural properties of bodies such as the brain are the determined by the size, shape, number and motion of their determinate solid parts. When the anchor of the Baconian synthesis was lost, along with its varieties of inherence, early modern thinkers had to rethink the puzzle of how light and other stimuli could generate appearances and sensations in the brain, and mind-body problem was born. During the middle ages, the Baconian synthesis was subjected to both mild and radical criticism, but progress in anatomy and new theories of matter constituted a crisis that required the adoption of new theories.

Without the medieval theory of perception, something new needs to be said about how light causes sensation. Willis solves the problem through a continuity and similarity between light and spirit.

In order to think that there’s a problem in mind-body interaction, you have to think that there are some constraints on the relations between cause and effect. As Hume observes, if you think that anything can cause anything, then there won’t be a puzzle about how matter in motion can cause perceptions (Treatise 1.4.5.30). Locke, however, seems to require some sort of congruity between cause and natural effect, so the radical dissimilarity between bodies in motion and ideas of secondary qualities leads him to conclude that one can’t cause the other without some sort of divine assistance.
The principle that bodies can only knock, impel, and resist one another applies here as well:

Body as far as we can conceive being able only to strike and affect body; and Motion according to the utmost reach of our Ideas, being able to produce nothing but Motion, so that when we allow it to produce pleasure or pain, of the Idea of a Colour, or Sound, we are fain to quit our Reason, go beyond our Ideas, and attribute it wholly to the good Pleasure of our Maker (4.3.6)

He thinks we know enough about the lack of resemblance between primary qualities and the ideas of secondary qualities to know that there can’t be a natural explanation for how the first causes the second. Ideas of secondary qualities aren’t anything like primary qualities and they can’t be deduced from them, “nor any correspondence or connexion be found between them and those primary Qualities which (Experience shews us) produce them in us” (4.3.28). They affect naturally only the primary qualities of other bodies and qualities deducible from those primary qualities. The problem is worse if we imagine that thought inheres in an unextended soul, since that’s “a Subject we cannot conceive the motion of Matter can any way operate upon (4.3.6).

6.2 The God of the Gaps

Locke believed in the God of the Gaps. The expression is usually used derisively and sometimes as the name of a fallacy, but I don’t intend it that way. As I use the phrase, adherents to the God of the Gaps believe three things: first, that phenomena ought to be explained naturally as far as possible, second, that if a phenomenon can’t be explained naturally, then it ought to be explained by divine intervention, and, third, that in the course of history, there are phenomena that can’t be explained naturally.

The first principle is rejected by philosophers such as Malebranche (Recherche 2.273-84, 3.194-234=Search 446-452, 657-86) and Berkeley (PHK §§25-30), who are willing to appeal to divine intervention as a first resort. The second principle is rejected by
philosophers such as J. L. Mackie (1982: 84-87), who are happy to allow for some unexplained phenomena. The third principle is rejected by philosophers such as Francis Bacon (Confession 108) and Spinoza (TTP Ch. 6), who believe that all events in history can be explained naturally.

We’ve already considered Locke’s report that Newton’s Principia convinced him of the reality of action at a distance. Recall: “The gravitation of matter towards matter, by ways inconceivable to me,” according to Locke,

is not only a demonstration that God can, if he pleases, put into bodies powers and ways of operation above what can be derived from our idea of body, or can be explained by what we know of matter, but also an unquestionable and every where visible instance, that he has done so. (2nd Reply 4.467-68)

Universal gravitation is for a Locke a proof that God has supplemented matter as we understand it with powers beyond what we can understand.

Locke’s attempt to explain sensation naturally takes him from external object, to sense organs, and on to the brain. He surmises that the character of the produced ideas is partially determined by the character of our sense organs. Among the causes of obscure ideas, he includes dull organs and slight and transient impressions upon them. Using an ancient simile, he compares sensation to a wax and seal, which depends on the wax being the right consistency and the seal’s being applied with the right force (2.29.3). Once our sense organs are affected, they jangle our animal spirits, “fluid and subtile Matter, passing through the Conduits of the Nerves,” (3.9.16) which “thereby convey to the Brain some Motion, which produces these Ideas” of primary and secondary qualities (2.8.12).55 That’s the point at which God steps in.

55 The ideas that Locke is referring to here are of primary qualities, but he stipulates that other ideas are produced “After the same manner” (2.8.13).
He believes that there is no natural way to get sensations to inhere in material bodies, so he appeals to divine intervention. He reassures us that it isn’t inconceivable “that God should annex such Ideas to such Motions” (2.8.13). No other explanation is available, but that explanation will suffice. Locke could, in principle, allow for the production of sensation as the result of unknown aspects of the substance of body or spirit, but it’s not clear this possibility has occurred to him.

Locke’s positive account of the production of sensation is a nice illustration of his theo-physical principles. Phenomena are explained naturally as far as possible. So far as he can, he describes the process of perception in naturalistically respectable terms, keeping in mind what was known of anatomy and perspective. Where a phenomenon can’t be explained naturally, it ought to be explained supernaturally. Locke is sure that the production of sensation can’t be explained naturally, so at that point, he appeals “to the arbitrary Will and good Pleasure of the Wise Architect” (4.3.29).

Some might worry that an appeal to divine intervention ruins the corpuscularian theory of perception. The modern naturalist may think that the appeal to divine intervention vitiates any explanation. On the other hand, a Berkeleian critic might think that once God is brought in as the proximate cause of our ideas, he can stand as the sufficient cause of the phenomena. We should apply Ockham’s Razor and not posit mind-independent bodies as their distal causes. Locke takes a middle path and invokes the God of the Gaps.

Locke’s argument for the possibility of thinking matter appeals the necessity of divine intervention in order to explain body-mind interaction. Since we can only conceive of body as “being able only to strike and affect body” and of motion as “being able to produce nothing but motion”, we have to go beyond our ideas and attribute the production of sensation “to the good Pleasure of our maker” (4.3.6). Though we have to grant that God
“annexed Effects to Motion, which we can no way conceive Motion able to produce,” that doesn’t give us a reason for thinking he’s done it through thinking matter or an attached soul. (ibid.)

The fact that thought is beyond the natural powers of bodies shouldn’t make you confident that an omnipotent can’t give thought to a solid substance. (It’s in this context that Locke rejects the principle that the ‘unconceivableness’ of a hypothesis is decisive reason for embracing the contrary). As a general principle, Locke thinks that we should avoid positing the inconceivable, but by his measure, it’s “not much more remote from our Comprehension to conceive, that GOD can, if he pleases, superadd to Matter a Faculty of thinking, than that he should superadd to it another Substance, with a Faculty of Thinking” (ibid.). That is, both thinking matter and the attachment of a soul to body require divine intervention in ways that are inconceivable to us, but the inconceivability isn’t of a sort that should make us think that one divine option is more likely than the other. So, he concludes, we can’t know, “by the contemplation of our own Ideas,” whether God has “given to some Systems of Matter fitly disposed, a power to perceive and think” or whether he’s “joined and fixed to Matter so disposed, a thinking immaterial Substance” (ibid.).

Another good example of Locke’s belief in the God of the Gaps comes in his attempt at theological geology, a discipline that Thomas Burnet had made fashionable with his Sacred Theory of the Earth. Locke owned a copy of the book, its sequel, and two replies to it (Library ##534, 535, 244, 1613), and he praises it in one of his letters to Stillingfleet. Burnet had also anonymously criticized some of the ethical doctrines in the Essay, and Locke replied irritably to the criticisms in remarks bound together with his reply to Stillingfleet. As a consequence, Locke refers to Burnet as a learned man of unquestioned piety who wrote a “wonderfully ingenious” book (1st Reply 4.141) in the same volume that he refers to him as
someone who “may well be ashamed of his name” (to Anon. 4.187) and as someone who “shows so much ignorance, or so much malice, that he deserves no other answer but pity” (to Anon. 4.188).

Burnet had attempted to account for the dramatic geological events described in the Bible—fall, flood, apocalypse—as the product of natural, deterministic geological processes (Rossi 35-36). Locke denies that the flood can be explained entirely without divine intervention, but he tries to minimize divine deviations from the current natural order. According to him,

since the Deluge cannot be well explained without admitting something out of the ordinary course of Nature, I propose it to be considered whether God’s altering the Center of gravity in the Earth for a time (a thing as intelligible as gravity it self, which perhaps a little variation of Causes unknown to us would produce) will not more easily account for Noah’s Flood, than any Hypothesis yet made use of to solve it (Education §192).

Locke thinks that there’s no natural way to explain the flood, so we have to attribute it to God (Stuart 1998: 355-57, Anstey 2011b: 99-101). He explains the flood by a generally applicable principle of nature, the theory of gravity, as far as possible, with only a nudge to the Earth’s center of gravity occurring outside the usual course of nature. Locke probably got the idea that a change in the center of gravity would lead to a disaster from Robert Hooke, who explained earthquakes and the presence of marine fossils on dry land in that way (Earthquakes 346-47; Drake 79). He certainly doesn’t suppose that the flood might occur without any explanation at all.

Locke’s belief that divine agency should be appealed to only as a last resort comes out in his reluctance to posit miracles:

though it be as easie to Omnipotent Power to do all things by an immediate over-ruling Will; and so to make any Instruments work, even contrary to their Nature, in subserviency to his ends; Yet his Wisdom is not usually at the expence of Miracles, (if I may so say) but only in cases that require them, for
the evidencing of some Revelation or Mission to be from him (*Reasonableness* 91)

God’s power allows him to constantly intervene in the world, but his wisdom keeps him from doing it more than necessary.

Locke defines miracles as “a sensible operation, which, being above the comprehension of the spectator, and in his opinion contrary to the established course of nature, is taken by him to be divine” (*Miracles* 9.256). He worries that this will make miracles relative to a spectator, but concludes that beyond a certain point, skepticism about divine intervention is irrational. One might reasonably doubt a miracle when Jesus waves his hand and the weather calms or even when he cures involuntarily shaking hands, but once he heals the blind and raises the dead, “every rational thinking man must conclude” that “no man can do these signs which thou dost, except God be with him” (*Miracles* 9.259, in the last phrase Locke quotes John 3.2).

In an argument against the possibility of a science of bodies, Locke argues that since we can’t possibly perceive the connections between various basic phenomena and any possible natural explanation, they must depend on God’s volition:

> the coherence and continuity of the parts of Matter: the production of Sensation in us of Colours and Sounds, *etc.* by impulse and motion; nay, the original Rules and Communication of Motion being such, wherein we can discover no natural connexion with any Ideas we have, we cannot but ascribe them to the arbitrary Will and good Pleasure of the Wise Architect (4.3.29)

Let me read between the lines and enunciate the principles behind the inference. Locke assumes that the fundamental features of matter and the psycho-physical law connecting body and mind have explanations, which are either natural or supernatural. We know enough to know they have no natural explanation, so they must have a supernatural explanation, and thus they must be produced by the arbitrary will of God.
Right after arguing that these phenomena are due to the unaccountable will of God, Locke offers the following nudge for those of his readers who are reluctant to appeal to divine intervention: “I need not, I think, here mention the Resurrection of the dead, the future state of this Globe of Earth, an such other Things, which are by every one acknowledged to depend wholly on the Determination of a free Agent” (ibid.). If he did feel the need to mention them, it would be to argue that since all of his respectable readers are willing to appeal to divine activity in some contexts, they shouldn’t hesitate in this one.

From the premise that fundamental propositions about bodies and their actions depend on God’s will and the previously defended premise that we can only have knowledge of universal propositions that don’t depend on the will of an agent, it follows that we can’t have knowledge of fundamental features of bodies and their actions. Locke thus concludes that we can’t attain “philosophical Knowledge of the Bodies that are about us” and that we should give up hope of “a perfect Science of natural Bodies” (ibid.), where ‘science’ means a system of derivations from known first principles.

Locke believes in the possibility of superaddition because he doesn’t want to “limit the omnipotency of God” (2nd Reply 4.464) with respect to the powers that he can add to substances. According to him, such superaddition can only be precluded if “it can be proved to be a contradiction, that God should give to some parts of matter qualities and perfections, which matter in general has not”; this is true even “though we cannot conceive how matter is invested with them, or how it operates by virtue of those new endowments” (2nd Reply 4.462-63). So long as it doesn’t entail a contradiction, he believes that God can make qualities inhere in substances by fiat.

According to Ayers, when Locke says that “we cannot but ascribe” these phenomena to God, he doesn’t mean to ascribe them to God (1991: 2.146-51). Ayers interprets him in
this way because of Locke’s assertions that properties are derived with mathematical necessity from essences. On its own, such assertions aren’t really restricting since, as Ayers argues (1981: 226-31; 1991: 2.18-25), Locke uses the term ‘property’ in accordance with its technical scholastic sense. If Locke thinks of a proprium in the way that Franco Burgersdijk did, as features derivable with necessity from an essence, then the claim that properties are derivable with necessity from a real essence is a tautology.56

The trouble arises from the fact that Locke implies that yellow is a property of gold on several occasions (2.31.6, 3.6.2, 3.9.17). Since being yellow on Locke’s analysis is the power to produce the idea of yellow in observers, and that power requires the divine imposition of a psycho-physical law, it seems as if it can’t be derived with mathematical necessity from gold’s real essence (M. Wilson 1999b: 200-03).

It seems to me that Locke equivocates. When it serves his purposes, he uses Burgersdijk’s stricter notion of proprium. In other contexts, he uses a looser standard where a ‘property’ is just a quality that depends on a real essence and flows from it without exception. This seems more likely to me than Ayers’s approach, which requires him to adopt implausible readings not only of skeptical argument against the possibility of a science of bodies, but also of Locke’s discussions of miracles, of gravity, of the existence of God, and of the possibility of God’s superadding thought to matter (Ayers 1981: 240-48, 1991: 1.118-20, 2.148, 2.151-52, 2.169-83).

On my reading, Locke’s anti-Hobbesian argument that our idea of body is as obscure as our idea of spirit contradicts his argument that God must explain the cohesion of matter

56 Downing quotes from Essay 3.11.23 where Locke implies that knowing the real essence of bodies would allow us to infer their “Properties and Operations” in something like the way that we can derive the properties of a triangle from its definition, and asserts that it commits him to ‘Essentialism’ (2013: 161-62), the doctrine that “All of bodies’ qualities, powers, and behavior follow from their real essences (that is, their real and ultimate physical constitutions) plus spatial relations among bodies” (2013: 160). In light of the technical notions of ‘property,’ the passage only commits him to the proposition that if we knew the real essences of bodies we would be able to derive their operations and any other qualities derivable from such real essences.
and the communication of motion. In the argument against Hobbes, he implies that clearer ideas would allow us to understand the foundations of impulse and cohesion. In the argument against the possibility of a science of bodies, he argues that these phenomena don’t have natural explanations, and they have to be attributed to divine intervention.

There are ways to resolve this tension, but I don’t think that they are worth the effort. Locke thinks that he knows a few things but is ignorant of many others. Some of these couldn’t possibly be known, but others would if he had more or better ideas (4.3.22). Given his position of ignorance, he doesn’t have many tools to sort out which is which, other than the relative intensity of a feeling of in comprehension. This is the sort of thing that comes and goes. He didn’t have to contradict himself, but it’s easy to see how he might lose track.

Locke’s God is responsible for the furthest outlines of the world, including the origin of thought and the transformation of the world after the second coming. Other things that we can’t explain are, on his view, either immediately explained by divine activity or indirectly through mechanisms God has established.

As an illustration of Locke’s open attitude towards the ways in which corporeal mysteries might be resolved, consider his oblique description of how matter might have been initially created. During an argument against supposing that matter is co-eternal with God, Locke suggests that if “we would emancipate us from vulgar notions” we might get a “dim and seeming conception of how Matter might at first be made.” He excuses himself from going into details, on the grounds that such an account “would perhaps lead us too far from the Notions, on which Philosophy now in the World is built, it would not be pardonable to deviate so far from them; or to enquire, so far as Grammar it self would authorize, if the common settled Opinion opposes it” (4.10.18).
A footnote in the second edition of Coste’s French translation of the *Essay* explains:

long after [Locke’s] death, Sir Isaac Newton, to whom I was accidentally speaking of this part of Mr. Locke’s book, discovered to me the whole mystery. He told me, smiling, that he himself had suggested to Mr. Locke this way of explaining the creation of matter; and that the thought had struck him one day, when this question chanced to turn up in a conversation between himself, Mr. Locke, and the late Earl of Pembroke. He thus described to them his hypothesis:—We may (he said) have some rude idea of the creation of matter, if we suppose that God by his power had (at a certain time) prevented the entrance of anything into a certain portion of space,—space being in its own nature penetrable; for henceforward *this portion of space* would be endowed with *impenetrability*, one of the essential qualities of matter; and we have only again to suppose that God communicated the same impenetrability to *another portion of space*, and we should then obtain an idea of the *mobility* of matter, another of its essential qualities (Fraser 2.322)

That is, God might make certain portions of space impenetrable and then allow the impenetrability of a region of space to pass onto other contiguous regions of space.

The details of the account belong to Newton’s intellectual history rather than to Locke’s, but it’s worth observing two points. First, Locke is sympathetic to Newton’s hypothesis. That’s clear from Locke’s tone and from the context in which he places the passage. Second, Locke takes the hypothesis to be not only incompatible with philosophy as ordinarily practiced, but also, in some way, with grammar. More precisely (and more oddly) he suspects that grammar might not permit asking whether the hypothesis is compatible with accepted doctrine. If this refers to anything in the *Essay*, it’s a reference to the argument where Locke asserts that our practice of describing ordinary kinds as “a thing having such or such Qualities” (2.23.3.) implies that in addition to the various qualities, there’s the thing that has the qualities

Locke’s oblique account of Newton’s hypothesis confirms that he thinks that a physio-theological hypothesis could be incompatible with current grammatical practice. It shows, moreover, that he takes Newton’s account to be incompatible with the account that he develops in *Essay* 2.23. On his own account, solidity and impulse arise from a poorly
grasped corporeal substratum. On Newton’s account, God creates impenetrability and mobility by fiat, without a substratum. Locke is nevertheless sympathetic to Newton’s hypothesis and considers it a live option. We may conclude that Locke isn’t dogmatic about conjectural matters that fall outside our circle of knowledge.

6.3 Locke on the Production of Sensation

The medieval theory of perception had given satisfactory answers to two central problems in the philosophy of mind. The first is how external stimuli, especially light falling on the eyes, gives rise to sensations and appearances. The second is how appearances and sensations depend on the physiological state of the perceiver. The medievals solved these problems with a unified theory: light allows for the multiplication of color species in a transparent medium and the eye winnows these species in a way that generates visual images. Other sense organs allow for the transmission of species through their proper channels. Sensible species exist in a secondary way in the medium. When they exist in this way in a living animal’s sense organs, they constitute sensation. When these sensations come together to form phantasms, they constitute a rich form of mental imagery, and when these images are in the middle ventricle they can be used to generate intelligible species or notions.

It’s plain that Locke wants to take up the topics of scholastic psychology. He tells us that he intends his concept of idea to play the roles that phantasms, sensible species, and intelligible species had played, specifying that he uses the term ‘idea,’ “to express whatever is meant by Phantasm, Notion, Species, or whatever it is, which the Mind can be employ’d about in thinking” (1.1.8; Yolton 146, Spruit 2.506-07). ‘Notion,’ Leen Spruit argues (2.84-88. 135-43), was a renaissance substitute for earlier talk of intelligible species.
Locke wants to take on this project without its noxious anatomy and optics (Spruit 2.510-13). He does this by sticking to the introspectively accessible part of the theory and trying to avoid speculations about its physiological underpinnings.

He borrows from Descartes the word ‘idea’ as the name for the mode of a thinking thing. Unlike Descartes, Locke doesn’t think that he knows the essence of mind, whether ideas inhere in an immaterial soul, or whether God has superadded them to matter. Locke also shies away from the sort of physiological speculation that Descartes undertakes in the *Treatise on Man* and *The Passions of the Soul*. Locke sidesteps these metaphysical and biological questions by stipulating,

> I shall not at present meddle with the Physical Consideration of the Mind; or trouble my self to examine, wherein its Essence consists, or by what Motions of our Spirits, or Alterations of our Bodies, we come to have any Sensation by our Organs, or any *Ideas* in our Understandings; and whether those *Ideas* do in their Formation, any, or all of them, depend on Matter, or no. These are Speculations, which, however curious and entertaining, I shall decline, as lying out of my Way, in the Design I am now upon (1.1.2).

As a substitute for a biology of ideas, Locke offers us quasi-logical definitions. First, at the end of the first chapter, as “whatsoever is the Object of the Understanding when a Man thinks” (1.1.8) and then a bit more comprehensively in the chapter on primary and secondary qualities as “Whatsoever the Mind perceives in it self, or is the immediate object of Perception, Thought, or Understanding” (2.8.8). As the objects of thought and perception, we can know their obvious characteristics, without knowing how they relate to our brains.

Instead of the physical consideration of the mind, Locke proposes to use what he calls a “Historical, plain Method” to “consider the discerning Faculties of a Man, as they are employ’d about the Objects, which they have to do with” (1.1.2). Judging by the book that follows this proposal, the historical, plain method consists in examining the evidence.
provided by tales about other cultures, anecdotes about the blind and mad, observations of children and animals, and careful and skeptical introspection. It does not include the dissection of the eye or brain, nor does it include positive conjectures about the relations between mind and body or ideas and animal spirits.

John Norris, an English Malebranchian, wants Locke to say whether he believes that ideas are corporeal, asserting that until the nature of ideas is explained “all further Discourse about them is but to talk in the Dark” (Reflections 3). In Locke’s Essay, Norris complains, this task is “wholly omitted and passed over in deep silence; which I cannot but remark, as a Fundamental defect in this Work” (ibid. 3-4). Locke responds with churlish vigor:

Perhaps I was lazy and thought the plain historical method I had proposed to myself was enough for me perhaps I had other business and could afford no more of my time to these speculations, nay possibly I found that discovery beyond my reach and being one of those that do not pretend to know all things am not ashamed to confess my ignorance in this and a great many other . . . There are some happy geniuses who think they either are not or ought not be ignorant of anything . . . If you once mention ideas you must be presently called to an account what kind of things you make these same ideas to be though perhaps you have no design to consider them any further than as the immediate objects of perception or if you have you find that they are a sort of sullen things which will only show them what but will not tell you whence they came nor whither they go nor what they are made of and yet you must be examined to all those particulars whether they be real beings or no, in the next place whether they be substances or modifications of substances and whether they are material or immaterial substances and then upon their being material you must answer to an hundred solid questions (to Norris 10-11).

All right, then. An idea is an immediate object of perception and, as such, “can be no other but such as the Mind perceives it to be” (2.29.5). Even so, ideas have their mysteries, mysteries that Locke does not believe that the plain historical method can solve.57 He does not pretend to know whether ideas are corporeal.

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57 François Duchesneau (1996) considers Locke’s application of his methodological strictures to the closely related problem of the materiality of the mind.
Sometimes Locke will talk about sensations as if they were qualities existing in the world and carried into the mind, and sometimes he takes care to disown that implication. After declaring “Our Senses, conversant about particular sensible Objects, do convey into the Mind, several distinct Perceptions of things,” he emends: “which when I say the senses convey into the mind, I mean, they from external Object convey into the mind what produces there those Perceptions” (2.1.3). A related example of loose talk is at Essay 2.3.1, where he implies that nerves convey ideas from sense organs to the brain:

there are some Ideas, which have admittance only through one sense, which is peculiarly adapted to receive them . . . . And if these Organs, or the Nerves which are the Conduits, to convey them from without to their Audience in the Brain . . . are any of them so disordered, as not to perform their Functions, they have no Postern [back door] to be admitted by; not other way to bring themselves into view, and be perceived by the Understanding. So, it seems, ideas come in through the sense organs, travel up the nerves, where they are considered by the mind.

Locke makes it clear, however, that his considered view is that qualities are in bodies and ideas are in the mind. He writes about external ideas often enough that he offers us the following guide to interpretation: “Ideas, if I speak of sometimes, as in the things themselves, I would be understood to mean those Qualities in the Objects which produce them in us” (2.8.8). He has told us that by ‘idea’ he means whatever is meant by species, and the traditional view was that species multiply across a medium into our sense organs. Scholastic ways of thinking creep into Locke’s writing either directly or indirectly and when he notices, he disavows the implication. The scholastic doctrine that species travel into the mind survived into the early modern period in updated ways, as we’ve seen in the case of Willis for whom optical species move through fluids in the nerves. We can find moving ideas in Shakespeare. The priest in Much Ado About Nothing proposes that Hero feign death in order to recover Claudio’s affections. He justifies this plan with the promise that
When he shall hear she died upon his words,
The idea of her life shall sweetly creep
Into his study of imagination,
(4.1.222-24)

When Locke writes about ideas in things moving into the mind, he’s using an ordinary turn of phrase that grew out of a previous scientific theory. He’s not revealing his truest, deepest opinions.  

Though Locke says that he won’t pursue the question of “by what Motions of our Spirits, or Alterations of our Bodies, we come to have any Sensation by our Organs” (1.1.2), sometimes he can’t help himself. He wants to be able to construct his preferred physical theory out of the simple ideas produced by sensation. In addition, he wants to fit the empirical and introspective psychological facts. He always wants to explain phenomena naturally as possible and to minimize appeals to divine intervention.

According to Locke, the qualities in objects are “united and blended” but “the Ideas they produce in the Mind, enter by the Senses simple and unmixed” (2.2.1). He justifies this thesis by observing that even if ideas are produced in a single organ (as ideas of motion and color are produced in sight), they are still as distinct as ideas produced by different organs. If ‘distinct’ means non-identical, then, of course, any two ideas are distinct, or they wouldn’t be two. The important part of the claim is that the produced ideas are simple.

Locke says of this doctrine, “t’is plain” (ibid.), but tisn’t (Hall 1987: 12-13). His empiricist predecessor Gassendi didn’t assume that our senses only produce simple ideas in

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58 Jonathan Bennett has been as interested as anyone in the question of why Locke talks about ideas as being in the things. According to him, it’s the result of Locke’s confusing the problems of the veil of ideas and the problem of inherence (1968: §§5; 1996). I worry that explaining confusions through other confusions multiplies our interpretive questions. Bennett considers the possibility that this language is a remnant of the medieval theory of perception, but rejects this interpretive possibility because Locke rejects that theory (1996: §9). Of course, he rejects the theory. The most plausible interpretation is that Locke is speaking with the vulgar when he writes of ideas being in things and that his true view is that ideas are in the mind and qualities in the things.
us (LoLordo 2007: 75), and it certainly isn’t obvious in itself. We are better off looking to Descartes for antecedents to his view.

Descartes’s fourth observation governing sensation in the Sixth Meditation is that “each of the motions that occurs in the part of the brain that immediately affects the mind brings nothing to the mind except for some single sensation” (AT 7.87=CSM 2.60). The proposed principle is a simple psycho-physical law. When Locke says that ideas come into the mind simple and unmixed, he means that the first ideas produced in us are all simple. The varieties of movements in neural fluids systematically produce simple ideas and only simple ideas. Geneviève Brykman calls this Locke’s “pulverization of the given.”

In the Meditations, the principle is part of a theodicy of sensory error. If God directly produced ideas of cat and chair, it’s not obvious what his excuse would be for not producing ideas of poison or unhealthful when looking at hemlock or sugar. More generally, the principle lets Descartes capture the fact that our sensory knowledge of the world is limited by the stimulation of the surfaces of our sense organs. I expect that Locke came across the principle in Descartes, and it’s the sort of thing that is easy to take on board when one is first thinking about the philosophy of mind, and, once ensconced among one’s first principles, difficult to dislodge.

We might also think of this principle as a way of minimizing divine intervention, in something like the way that a furniture store might minimize its labor costs by making customers assemble their products at home. Like a piece of furniture put together by a customer, it’s not obvious how much weight this analogy can bear.

Locke is happy to modify this principle in light of the psychological data. Although the connection between primary qualities and sensations can’t be deduced, it can still be

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59 “Pulvérisation du donné” (1991: 17). She translates her own phrase as “resolution of the datum into its simple components” (1996: 110), which is clearer, perhaps, but less fun.
investigated by observation, introspection, and hypothesis. He qualifies Descartes’s basic psycho-physical principle in two ways: first by allowing for sensory adaptation and second by giving a role to attention.

Sensory adaptation is the change of responsiveness in a sense organ after being presented with a constant stimulus. In distinguishing primary from secondary qualities, Locke gives an early description of what later became known as the ‘three bowl experiment’ (2.8.21). If you put one hand in bowl of warm water and the other in a bowl of cold water, and then place both hands in a bowl with lukewarm water, the same water feels warm to one hand and cold to another (Tritsch 1990).

He argues that the best explanation for the three-bowl experiment is that the sensation of cold is caused by a decrease in the motion of neural fluids and the sensation of heat is caused by an increase (2.8.21; Curley 458, Mackie 1976: 22-23). The same water speeds up the animal spirits in a cooled hand and slow down the spirits in a warmed one.

More generally, Locke suggests that all sensation is caused by the varying modes of motion in our neural fluids and that the abatement of this motion must therefore cause a new sensation (2.8.4). He thus offers us a neural account of sensory adaptation: our nerves are set up to register differences in temperature, rather than absolute temperature. He is following similar suggestions in Francis Bacon (NO 2.13, 2.20), Descartes (AT 1.424=CSMK 3.66), and Boyle (Mechanical 8.341-42; see Woolhouse 1983: 150-52).

A second way in which Locke modifies the basic Cartesian principle that one motion in the brain causes one sensation in the mind is in his treatment of attention. For Locke, the mind is mostly passive in perception narrowly construed (“bare naked perception”) (2.9.1). On the other hand, he believes that some passive perceptions have active preconditions (4.13.1-2). So, for example, we might move our bodies and orient our eyes to put ourselves in a
position to sense. In such cases by a power within ourselves, we put our bodies into motion and are active in that respect (2.21.72)

In Locke’s account of attention, we don’t just affect the orientation of our sense organs, but we affect how we are affected by the stimulation of our sense organs. Just as a person won’t form distinct ideas of reflection without attention, “he will no more have all the particular Ideas of any Landscape, or of the Parts and Motions of a Clock, who will not turn his Eyes to it, and with attention heed all the Parts of it” (2.1.7). Locke also believes that close attention to one thing diminishes attention to others. So, if we are attentively considering one thing, we might not perceive something else which we would have noticed otherwise (2.1.8, 2.19.3). In such cases, the sense organs are affected in the very same way, but an idea is only formed when we pay attention (2.9.4).

His British successors attacked Locke for his belief in gappy abstract ideas (PHK Introduction §§11-18, Treatise 1.1.7). The landscape and clock examples imply that Locke believes in unsaturated visual imagery as well. On his assumptions visual imagery can be more and less filled in depending on whether the perceiver is paying attention. Existence and unity are ‘suggested’ to the understanding by every external object and every internal idea (2.7.7). Perhaps the point of ‘suggested’ is that these ideas aren’t invariably caused by entities, but only when we attend to them in a certain way. Locke is careful not to go overboard in this direction. In many cases, he tells us, if our sense organs are affected, the mind can’t refuse or alter the produced simple ideas (2.1.25).
Chapter 7  The Malleability of Perception

7.1  The Idea of Solidity

Locke’s proclaimed neutrality on the anatomical bases of sensation promises a description of appearances unadulterated by presuppositions and scientific commitments. This is not what we find when we read the Essay. We’ve been looking at how the scientific revolution affects the way Locke thinks. Let us now consider ways in which developments in the seventeenth century affect the way he perceives.

The conceptual influences that I’ll be considering in this chapter are something a grab bag. In this section I’ll discuss the ways that Locke’s corpuscularianism affects his account of the idea of solidity. In the three sections after that I’ll look at how the discoveries of the retinal image and of the principles of perceptive influenced his doctrine that the immediate object of sight is a two-dimensional array. In the last section, I’ll consider how various metaphysical doctrines affect his view on the location of appearance and in particular on the location of ideas of secondary qualities.

In Locke’s chapter on the idea of solidity, he presents psychological considerations cheek by jowl with physical considerations. He gives us the expected description of the character of the idea of solidity and the circumstances in which we acquire it in the same chapter in which he describes an experiment in which a metal sphere was compressed and in which he offers an analysis of the impenetrability of water. As we’ll see, his physics leaks into his phenomenology.

Locke resists giving a definition of solidity. According to him, it is a simple idea, and he denies that any such idea can be defined (3.4.7). He compares the challenge of defining it to the challenges of defining simple ideas of sight:
the simple Ideas we have are such, as experience teaches them us; but if beyond that, we endeavour, by Words, to make them clearer in the Mind, we shall succeed no better, than if we went about to clear up the Darkness of a blind man’s mind, by talking; and to discourse into him the Ideas of Light and Colours (2.4.6).

If asked to define the term, he directs the questioner to circumstances where the relevant simple idea may be distinctly produced: “I send him to his Sense to inform him: Let him put a Flint, or a Foot-ball between his Hands; and then endeavour to join them, and he will know” (ibid.).

Though Locke believes that solidity is indefinable he doesn’t believe that nothing can be known about it or that the idea cannot be used to deduce consequences. He sets out five. As a result of solidity, a body 1) “fills space,” 2) “excludes all other solid Substances,” and 3) will “for ever hinder any two other Bodies, that move towards one another in a strait Line, from coming to touch one another, unless it removes from between them in a Line, not parallel to that which they move in” (2.4.2, see also 2.27.2). Solidity is also the cause of 4) the “resistance” of bodies and 5) their “mutual Impulse” (2.4.5). The last consequence is the one of the two examples of primary qualities having “a necessary dependence, and visible connexion one with another” that he lists in Essay 4.3.14.

In arguing that solidity is distinct from hardness, Locke reports,

60 Locke also lists “protrusion” at 2.4.5, but I suppose that’s the same thing as filling space.
61 Robert Wilson (218) quotes the passage where Locke directs someone looking for a definition of solidity to “put a Flint or a Foot-ball between his Hands; and then endeavour to join them” and remarks, “the notion of solidity that one would get from the experience Locke describes . . . is one of incompressibility, the sort of resistance that keeps bodies out of one another’s place that Locke mentions elsewhere in II.iv, including at the end of iv.4 in discussing hardness and softness.” I don’t think that Locke believes that incompressibility, ordinarily so called, is an intuitively obvious consequence of solidity. We may observe that the football that Locke mentions would have been a compressible object, probably an inflated pig’s bladder with a leather casing. In defense of his postulation of air particles, Boyle (Physiological 2.22) had observed, “if the sides of a blown Bladder be somewhat squeeze’d betwixt ones hands, they will, upon the removal of that which compress’d them, fly out again, and restore the Bladder to its former figure and dimension.” I think that Locke intends his football to be a similar example of a compressible but solid object. Locke challenges him who thinks “that nothing but Bodies that are hard, can keep his hands from approaching one another, . . . to make a trial, with the Air inclosed in a Football” (2.4.4). The air in a football is not hard, but it meets Locke’s third criterion—unless it moves aside, bodies coming towards it from opposite directions cannot touch. Very strictly speaking, all this shows is that meeting criterion 3 need not entail hardness. The point of the section, however, is to distinguish solidity from hardness, so his implication is that air is solid in the relevant sense.
the Experiment, I have been told, was made at Florence, with a hollow Globe of Gold fill’d with Water, and exactly closed, farther shews the solidity of so soft a body as Water. For the golden Globe thus filled, being put into a Press, which was driven by the extreme force of skrews, the water made it self way through the pores of the very close metal, and finding no room for a nearer approach of its Particles within, got to the outside, where it rose like a dew, and so fell in drops, before the sides of the Globe could be made to yield to the violent compression of the engine, that squeezed it (2.4.4).

David Knight discovered that Locke was misreporting an experiment run by the Academie del Cimento with a silver globe. The expermenters “found that a golden globe distends itself and does not show the effect” (45). Setting that detail aside, does the experiment show that the metal globe is not solid? By criteria 2 and 3, it is supposed to be impossible for one solid body to move through another without the second moving out of the way. In the Florentine experiment, the water (described as solid) moves through the globe without the globe moving out of the way.

The answer, of course, is that Locke assumes that water is composed of solid particles and that there are pores in the gold through which these particles may pass. Solidity is something he attributes to every piece of matter. He’s confident that mills and pestles can only transform a grain of wheat by dividing it, even when the division goes beyond the point of perceptibility (2.8.9). So far as he can conceive, this division can’t remove solidity from either whole or part. Locke doesn’t really think that division can rarify matter into a kind of stuff that can literally and strictly overlap with the material parts of a golden globe.

Since Locke believes that pestles can only reduce grains to insensible parts by division, we should expect him to give a similar analysis of the transformation of rigid bodies into fluids through heating. In fact, that’s what we find. On the one side, he thinks that analogical reasoning suggests that fire consists in the rapid motion of insensibly small particles (4.16.12). On the other, he analyzes what it is to melt gold as “to destroy the consistency of its insensible parts, and consequently its hardness, and make it fluid” (2.21.1).
Put together and generalized, the passages imply that heat is constituted by rapidly moving corpuscles and that it melts rigid objects by impulsive division which separates their solid parts (for antecedents see Bacon NO 2.20, Descartes AT 9.7-8=CSM 1.83, and other texts cited in Pasnau 2011a 476-79).

In illustrating inference by analogy, Locke offers the following argument for a corpuscularian account of heat: “observing that the bare rubbing of two Bodies violently one upon another, produces heat, and very often fire it self, we have reason to think, that what we call Heat and Fire, consists in a violent agitation of the imperceptible minute parts of the burning matter” (4.16.12). The analogy is between heat and fire that are obviously caused by motion and heat and fire with an unknown cause. Tendentiously, Locke moves from the premise that rubbing macroscopic bodies produces heat and fire in some cases to the conclusion that heat and fire consist in the violent motion of imperceptible parts.

A gappy object, existing only where its matter is, excludes other fluids from being in any part of the same irregular place. Gases and liquids may be considered as strictly solid and as possessing all the consequences that Locke draws from solidity if they are thought of as gappy objects. They fill space, they exclude other matter from being in the very same places at the same time, and they prevent corpuscles from passing through their locations without pushing corpuscles aside. They may resist other bodies and push against them. A fortiori, the constituent corpuscles themselves are also solid. Still, air may be compressible in that its parts may be pushed closer together, it may pass through the pores of rigid objects, and its particles may mingle with the particles of another portion of matter.

So much for the physics of solidity. Now let us consider its appearance. We might think that we are thus presented with a choice between taking Locke’s physical theory seriously and taking his account of sensation seriously. Peter Alexander does the former. He
distinguishes between “absolute” and “relative” solidity. Only corpuscles possess absolute solidity. “We get the idea of absolute solidity through our senses,” he tells us, “although absolute solidity is not strictly observable” (Alexander 140). Robert Wilson (218) distinguishes between ‘experiential solidity’ and ‘theoretical solidity’, where experiential solidity is the solidity of ordinary objects and the idea of theoretical solidity is “the idea of completely filling the space within one’s boundaries.” According to Wilson, the important kind of solidity for Locke is experiential solidity, the kind of solidity that ordinary objects possess.

Neither of these interpretations fits well with passages where Locke emphasizes the univocity of solidity. At 2.4.1, he tells us that we acquire the idea of solidity from perceptibly large masses of matter and then the mind attributes it to all bodies, perceptible and imperceptible:

though our Senses take no notice of it, but in masses of matter, of a bulk sufficient to cause a Sensation in us; Yet the Mind, having once got this Idea from such grosser sensible Bodies, traces it farther, as well as Figure, in the minutest particle of Matter, that can exist; and finds it inseparably inherent in Body, where-ever, or however modified.

At 3.10.15, in explaining why ‘matter’ is not a count noun, Locke implies that ‘solidity’ is an unequivocal term, referring to a determinate, invariant idea: “we no more conceive, or speak of different Matters in the World, than we do of different Solidities; though we both conceive, and speak of different Bodies, because Extension and Figure are capable of variation.”

Alexander is stuck with saying that when Locke calls water solid and implies that air is solid, he doesn’t mean solid in the strict and important sense of being absolutely solid. On Wilson’s account, the examples are solid in the most important sense, but what Locke says
about them is false. An experientially solid body does not exclude other bodies from the same place and does not prevent other bodies from passing through it.

I say Locke can eat his cake and have it too. He is just talking about what Alexander calls ‘absolute’ solidity and what Wilson calls ‘theoretical’ solidity, and he believes that ordinary objects possess this kind of solidity. It is true that fluids and ordinary bodies aren’t absolutely solid, if these are taken as agglomerations of matter and void. Locke, however, thinks of them as entirely material, with no part that is a void. That is, he thinks of them as divided, gappy objects, made only of matter, and only present where matter is present. Locke’s commitment to corpuscularianism comes through. Yes, the water starts on one side of the globe and ends up on the other. He makes it clear that he thinks that the water doesn’t pass through the matter of the globe. Rather, it passes through the ‘pores’ in the gold. Alexander’s and Wilson’s choice between taking Locke’s assertions seriously and taking his examples seriously turns out to be a false dilemma (Stuart 2013: 57-65).

Still, as a matter of philosophy we can appreciate Alexander and Wilson’s distinctions. It’s remarkable that Locke thought he could perceive absolute and theoretical solidity. The sensation of touch presents me with various degrees of resistance. As it seems to me, no simple and homogeneous idea is produced by everything I touch. On a modern psychological account of touch, we sense two qualities corresponding to Lockean solidity, compliance, which is the springiness with which an object resists pressure, and weight, which can be judged by holding an object and judged more accurately by lifting or wielding it (Lederman and Klatzky 1445-46).

In my discussion, I want to respect two central Lockean doctrines about ideas. First, a person can’t have an idea without noticing it (1.2.5, 2.10.2), and, second, an idea is as it seems (2.29.5, 4.3.8). So, on the one hand, I don’t want to say that everyone has a single,
uniform idea of solidity. Only someone in the grip of a theory would say that there’s a simple homogeneous sensation of solidity that we receive from compressing a balloon, pushing against a stone wall, holding a stone, dangling our feet in the water, and walking on the beach. At any rate, speaking for myself, I don’t feel any single homogeneous sensation in all those cases.

On the other hand, I don’t want to say that Locke doesn’t have any such sensation. He is in the grip of a theory and believes that we receive a homogeneous idea of solidity any time our weight is supported and any time we hold a body (2.4.1). If it seemed to him that he did, then that is, at the very least, evidence that he did. Instead, I conclude that Kuhn was right, and the scientific theories we adopt can affect the way we perceive the world.

7.2 The Retinal Image and the Visual Array

Let us consider a related case in greater detail. According to Locke, “When we set before our Eyes a round Globe, of any uniform colour, v.g. Gold, Alabaster, or Jet, ‘tis certain, that the Idea thereby imprinted in our Mind, is of a flat Circle variously shadow’d, with several degrees of Light and Brightness coming to our Eyes” (2.9.8). He believes that adults have acquired ideas of three-dimensional shapes (presumably by touch) and, in the sighted, these ideas of three-dimensional shapes have become psychologically associated with two-dimensional visual arrays.62 Thus, when a person receives the idea of a variously colored flat circle, her faculty of judgment quickly forms ideas of three-dimensional globes,

having by use been accustomed to perceive, what kind of appearance convex Bodies are wont to make in us; what alterations are made in the reflections of Light, by the difference of the sensible Figures of Bodies, the Judgment presently, by an habitual custom, alters the Appearances into their Causes (ibid.).

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62 Here I adopt the standard reading of the passage as advanced by Menno Lievers (407-10) and others. Recent papers by Martha Bolton (1994) and Laura Berchielli (2002) have offered alternatives to the standard reading. I criticize these alternative readings in my forthcoming ‘Locke on Perception.’
The eyes present us with a variety of colors and shadows arranged in a plane. From the testimony of the senses, we then infer the presence of a uniformly colored sphere. Judgment takes that which is truly a variety of shadow or colour, collecting the Figure, it makes it pass for a mark of Figure, and frames to itself the perception of a convex Figure, and an uniform Colour; when the *Idea* we received from thence, is only a Plain variously colour'd, as is evident in Painting (ibid.).

Two faculties are involved in Locke’s story, perception and judgment. Perception presents us with the way the world seems. Judgment constrains an appraisal of how the world is, an appraisal that is derived from the appearances, but doesn’t displace them. When we look at a uniformly colored sphere, we see a variously colored circle, and we judge there to be a uniformly colored sphere.

William Molyneux asked Locke whether a person blind from birth and restored to sight would be able to identify a globe as a globe and a cube as a cube when presented with them at a distance. Locke places his answer in the same section as his discussion of looking at a sphere because it illustrates his understanding of the different contributions of the two faculties. Perception will present the newly sighted person with a shaded circle and a shaded hexagon in a two-dimensional array, as it does to people who have been sighted since birth. The person who is newly sighted, however, hasn’t established the relevant empirical associations that judgment needs to move that two-dimensional array to recognizing the sphere and the cube. Thus, the newly sighted person won’t be able to tell which figure is which.

A.D. Smith opens his excellent paper, “Space and Sight,” by remarking,

One of the most notable features of both philosophy and psychology throughout the eighteenth and nineteenth centuries is the almost universal denial that we are immediately aware through sight of objects arrayed in three-dimensional space. This was not merely a denial of Direct Realism, but a denial that truly visual objects are *even phenomenally* presented in depth (481).
Locke is a good early example of the tendency that Smith observes. Times have changed. As Smith writes, “It is hard to think of a more radical reversal in thinking than the one that separates such an outlook from that which prevails today; for this erstwhile orthodoxy is hardly given even serious consideration in our own times, at least among philosophers” (482, see also Anscombe 1981a: 3). How could this doctrine come and go? How can there be fashion in phenomenology? In the story that I will tell, thinking about retinal imagery and realistic painting in certain ways led Locke to see the world in a certain way.

Locke appeals to the discovery of the retinal image in reply to one of Malebranche’s arguments against the scholastic view that sensible species pass from extended objects to our soul. Malebranche argues, “one can see from the same place or the same point a very large number of objects in the sky and on the earth; thus, the species of all these bodies would have to be reducible to a point. But they are impenetrable, since they are extended, therefore . . .  etc.” (Recherche 1.440=Search 220-21). The sensible species of distant bodies are themselves extended, so they can’t all fit onto the unextended soul. In his Examination of P. Malebranche’s Opinion of Seeing all Things in God, Locke doesn’t try to defend what he calls “the learned gibberish of the schools” (Exam 9.215), but he does discuss Malebranche’s objections to scholasticism insofar as they apply to Locke’s own view.

Locke first treats Malebranche’s objection as a point about optics and replies with Kepler’s discovery that the lens of each eye focuses an image on the retina behind it:

as to what is said, that from one point we can see a great number of objects, that is no objection against the species, or visible appearances of bodies, being brought into the eye by the rays of light; for the bottom of the eye or retina, which, in regard of these rays, is the place of vision, is far from being a point (Exam 9.216).

Appearances of bodies are produced on the retina by rays of light, and the retina is extended. This reply only deals with “P. M.’s objections against so much of material causes as my
hypothesis is concerned in” (Exam 9.217). Locke doesn’t have any account of the leap from retinal imagery to consciousness. The best he can do is say that this lacuna makes his theory no worse than Malebranche’s: “when by this means an image is made on the retina, how we see it, I conceive no more than when I am told we see it in God” (ibid.). As he does in the Essay, he emphasizes in the ‘Examination’ that the mechanism by which neural motions “produce ideas in our minds” works “in a manner to me incomprehensible (ibid.).

Locke’s implication that we see our retinal images needs analysis. It’s not one that would have occurred to anyone before Kepler or one that follows from Kepler’s discovery. Locke repeats the claim with an explanatory analogy: “we may be said to see the picture in the retina, as, when it is pricked, we are truly said to feel the pain in our finger” (Exam 9.218). But the simile also needs analysis. According to Locke, all pains, including pains both “of Body or Mind, as they are commonly distinguished” are really “only different Constitutions of the Mind” (2.20.2). The difference between corporeal pains and mental pains lies entirely in their casual antecedents; that is, in whether they were “occasioned by disorder in the Body” or “by thoughts of the Mind” (ibid.). So, a pain caused by injury to the finger will be a pain of the body, while envy, which for Locke is “an uneasiness of Mind, caused by the consideration of a Good we desire, obtained by one, we think should not have had it before us” (2.20.13), will count as a pain of the mind. So here’s a way of understanding the upshot of Locke’s analogy: visual ideas belong to the retina because retinal images cause them.

It’s hard to believe that this is all that there is to Locke’s analogy between perceiving pain in a finger and perceiving our retinal imagery. After all, the thrust of a sword might cause the idea of pain in us, but he isn’t tempted to say that the pain is in the sword (2.8.13). A salient feature of a pain in the finger is that we feel it in the finger. We might imagine its
seeming to someone as if the visual array were at the back of his eyes. I’d be surprised if anyone could manage to perceive his visual array upside-down, backwards, and segmented in two, in alignment with his retinal images.

Contrast Locke’s simile with Malebranche’s assertion “that we would judge or sense colors at the bottom of our eyes just as we judge that heat is in our hands, if we were given our senses in order to discover the truth” (Recherche 1.203=Search 57). According to Malebranche, if the function of our senses were to reveal the world as it is, then colors would seem to us as if they were on our retinas. For Malebranche, they don’t seem to be there.

Let me suggest that the point of Locke’s comparison between feeling pain in a finger and seeing the retinal image is this: the ideas in the visual array immediately and directly correspond to the state of our retinal images, just as corporeal pains immediately and directly correspond to a bodily injury. He believes that the connections between body and mind are straightforward and each patch of each retinal image produce a corresponding patch in the visual array.

At Essay 4.2.11, Locke attempts to explain why we don’t have sciences based on simple ideas and their modes beyond those of number and extension, even though his theory of knowledge suggests that we should. The problem, he decides, is that we don’t have proper measures of the degrees of our simple ideas, because we can’t perceive the corpuscles upon which those degrees depend. If we could measure the corpuscularian sources of our sensations, then we could proceed with a science of sensation. So, he hypothesizes,

supposing the Sensation or Idea we name Whiteness, be produced in us by a certain number of Globules, which having a verticity about their own Centres, strike upon the Retina of the Eye, with a certain degree of Rotation, as well as progressive Swiftness; it will hence easily follow, that the more the
superficial parts of any Body are so ordered, as to reflect the greater number of Globules of light, and to give them that proper Rotation, which is fit to produce this Sensation of White in us, the more White will that Body appear, that, from an equal space sends to the Retina the greater number of such Corpuscles, with that peculiar sort of Motion.

Locke assumes that, if the idea of white is produced by corpuscles with a certain spin, then the more such corpuscles strike the retina, the whiter the body will look. On this assumption, if we could measure the number of light corpuscles of a color type that strike the retina, then we could exactly measure the degrees of our simple ideas of color. Locke’s assumption that apparent brightness is entirely and proportionately determined by the number of light corpuscles that strike the retina turns out to be wrong. As a matter of fact, more photons strike the retina from a lump of coal in daylight than from a piece of paper in the shade, but the coal still looks darker than the paper (Hardin 83). This would have been a good place for Locke to bring in the notion of adaptation that he had appealed to in his discussion of the three-bowl experiment.

Stephen Gaukroger (79) claims that Locke probably would have known about Newton’s prism experiments reported in *Philosophical Transactions of the Royal Society* in the early 1670s, but I don’t think Locke would have chosen this example if he believed that white light was composed of light of other colors. Indeed, the example is even a little retrograde by Cartesian standards. Descartes identifies chromatic colors with corpuscles with a particular spin in the eighth discourse of the *Meteorology* (AT 6.329-35=Olscamp 334-338; Darrigol 46-47). At the beginning of the *Optics* he asserts that surfaces have chromatic colors when they impart a certain spin to light corpuscles and that we call surfaces ‘white’ if they “reflect these rays without bringing any other change in their action” (AT 6.92=Olscamp 73). Descartes identifies white surfaces with those that scatter light corpuscles without

63 A ‘chromatic color,’ that is, a color with a hue, as opposed to black, white, and shades of grey (Hardin 210).
changing their spin, and thus in effect identifies white light with a mixture of corpuscles with varying spin. There’s a Newtonian account of light in Chapter eleven of the *Elements of Natural Philosophy*, but J.R. Milton (2012) has shown that that work was not entirely composed by Locke.

In putting forward his hypothetical account of color, Locke not only borrows Descartes’s theory of light according to which white light is composed of particles with a certain spin, but he also adopts a retinal version of the *Sixth Meditation* principle that motions in the brain only bring about a single sensation.

Malebranche thinks that we see the sides of a cube as squares (*Recherche* 1.44=Search 221). Locke thinks that this is a simple mistake, a mistake that reading the *Essay* would have averted (*Exam* 9.218). According to him, apparent figures are determined by the shapes cast on the retina: “we see the figures and magnitudes of things rather in the bottom of our eyes than in God: the idea we have of them and their grandeur being still proportioned to the bigness of the area, on the bottom of our eyes” (*Exam* 9.217-18). As H.E. Matthews observes, this passage implies that Locke believes that there is a systematic mapping from the retina to our visual ideas: “The most natural way to read this is to take the ‘idea’ to be the mental counterpart of the retinal image, since it is proportioned to it” (18).

In favor of Malebranche’s opinion, when we take a close, accurate view of a cube, the sides look like squares, since they are squares. In favor of Locke’s opinion, the different sides of the cube take up different proportions of the visual field. I’m inclined to split the difference. There’s one way of looking a cube so that its sides seem to be squares and another way so that its sides seem to be irregular quadrilaterals.

It’s a defect in Locke’s account of depth perception that he doesn’t mention binocular vision. He does say that our ordinary inability to notice the blind spot is partly due
to our having two eyes (Exam 9.216). Perhaps in characterizing Locke’s view we should say that he thinks that a certain motion striking the retina in a healthy eye is sufficient, but not necessary for having a visual sensation. So if a corpuscle strikes either a portion of the left retina with a certain motion or the corresponding portion of the right retina, then a color idea of a certain type will be produced in the corresponding part of the visual field. The correspondence that God sets up would have to be an inversion from left to right and from up to down in order to reorient the inversion of the retina images. This two-dimensional array of ideas would then, on Locke’s account, be transformed by principles of association into ideas of three-dimensional objects.  

Locke’s view is coherent, but it’s hardly the only picture compatible with the optical facts. Smith describes “a possibility that today suggests itself to us quite naturally: that pre-conscious processes can extract three-dimensional information from what is given to the eye, and can issue, as their first conscious upshot, in phenomenally three-dimensional visual experience” (A.D. Smith 492, see also Hatfield and Epstein 364).

Here are two variants of this possibility. According to the first, which we might call ‘biological three-dimensionalism’, the brain mechanically takes the two retinal images along with mechanical signs of all the other available perceptual clues and forms a physical perceptual model from which an idea of the three-dimensional objects of sight arises in some mysterious manner.

On the second account, which might be called ‘theistic three-dimensionalism,’ our sense organs produce corporeal traces in our brain, and God produces ideas of three-

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64 In a previous version of this discussion (Jacovides 2012: 75), I had argued that Locke’s rhetorical question “How frequently do we, in a day, cover our Eyes with our Eye-lids, without perceiving that we are at all in the dark?” (2.9.10) shows that he thinks that unnoticed ideas of black are produced in us when we blink. On reflection, I don’t think that’s right. All that follows from the passage is that we don’t notice that we’re blinking. In view of Locke’s epistemology of perception, according to which it’s impossible to have an idea without noticing it, but operations and faculties require care and attention to perceive, it seems unlikely that Locke thought that these unnoticed eyelid closings were accompanied by an array of ideas of black.
dimensional objects in accordance with those traces. This is Malebranche’s considered view as presented in the Seventeenth *Elucidation*, published after Locke’s death. “By this general law,” Malebranche writes, “God gives us precisely the perceptions of objects that we would give ourselves,” if we had exact knowledge of our cerebral states, optics, and geometry, and if we were able to make accurate, instantaneous inferences from these (*Recherche* 3.305= *Search* 733-34; Kemp Smith 1905, Bréhir 1938).

Biological and theistic three-dimensionalism are compatible, of course. For some seventeenth-century theists the difference would just be a matter of emphasis. Does God or the brain carry out the most important part of the calculation taking us from retinal images to three-dimensional perception?

Against biological three-dimensionalism, Locke would probably deny that mere matter could transform two-dimensional imagery into three-dimensional imagery. Consider his argument that bird songs show that birds store ideas in memory:

> For it seems to me impossible, that they should endeavour to conform their Voices to Notes (as ‘tis plain they do) of which they had no *Ideas*. For though I should grant Sound may mechanically cause a certain motion of the animal Spirits, in the Brains of those Birds, whilst the Tune is actually playing; and that motion may be continued on to the Muscles of the Wings, and so the Bird mechanically be driven away by certain noises, because this may tend to the Birds Preservation: yet that can never be supposed a Reason, why it should cause mechanically, either whilst the Tune was playing, much less after it has ceased, such a motion in the Organs of the Bird’s Voice, as should conform it to the Notes of a foreign Sound (2.10.10).

To put the point anachronistically and unfairly, Locke’s argument is that birds must have ideas of memory, because no mere mechanical process could produce the playback of a tape recorder. His willingness to present this argument shows that has a low opinion of the processing power of mere matter, and he would not have been sympathetic to a view according to which the transformation of the retinal imagery into a corporeal representation of a three-dimensional world occurs mechanically.
Locke would certainly not argue that Malebranche's theistic three-dimensionalism goes beyond the power of God. But, as we've seen, Locke's general tendency is to explain phenomena naturally as far as possible, and then to appeal to God only when the possibility of any natural explanation has been exhausted. With respect to the theory of perception, this theological attitude helps explain Locke's preference for Descartes's psycho-physical law by which one motion produces one sensation over a Malebranchean system according to which God does most of our cognitive processing for us. Locke's relatively simple mapping from retinal imagery to our first visual ideas, followed by a natural process that works in accordance with principles of habit and association, gives God less to do in a way that fits with Locke's general theo-physical principles. Of course, all such considerations are at best suggestive and don't come close to proving that the first ideas we receive from sight are two-dimensional.

7.3 Realistic Paintings and the Visual Array

Locke's reflections on the realistic paintings of his day provide a second source of his belief that we perceive a two-dimensional array. He wrote most of the Essay while in exile in Holland at the tail end of the golden age of Dutch painting. He seems to think of them as experts on ideas of colors. According to him, a painter has "the Ideas of White and Black, and other Colours, as clearly, perfectly, and distinctly in his Understanding, and perhaps more distinctly, than the Philosopher, who hath busied himself in considering their Natures" (2.8.3).

He tells us that the idea we receive from viewing a globe, "is only a Plain variously colour'd, as is evident in Painting" (2.9.8). The last clause is often misread as ‘evident from
Painting, which isn’t what Locke says or means. He isn’t offering an argument from painting to phenomenology. Rather, he’s offering a phenomenological description, a description of how the globe seems. ‘Evident’ means visible here. What’s visible when we look at a globe is like what’s visible in a realistic painting of a globe.

Though Essay 2.9.8 doesn’t contain an argument from painting, we could reconstruct one from some of Locke’s remarks in “Of the Conduct of the Understanding.” He wants to warn his readers of the cognitive dangers of the association of ideas. Before we can be fully prepared “against this evil,” Locke warns,

he that would cure it when habit has established it, must nicely observe the very quick and almost imperceptible motions of the mind in its habitual actions. What I have said in another place about the change of the ideas of sense into those of judgment, may be proof of this (Conduct 3.277-78).

Locke refers back to his account of vision in order to defend his position that the association of ideas is ubiquitous and barely noticeable.

In reiterating his point, he writes,

let any one not skilled in painting be told, when he sees bottles, and tobacco-pipes, and other things so painted as they are in some places shown, that he does not see protuberances, and you will not convince him but by the touch: he will not believe that, by an instantaneous legerdemain of his own thoughts, one idea is substituted for another (Conduct 3.278).

Some people, Locke tells us, need to touch certain paintings in order to be convinced that they’re flat. He supposes that this fact supports his account that we move by unthinking custom from two-dimensional ideas of sight to ideas of three-dimensional objects. In both situations, “one idea is substituted for another” because of their “customary connexion” (ibid.).

Presumably, he’s thinking that the viewer’s idea of protuberance can’t be acquired through sight, since, after all, the painting is flat. But since we eventually see the portrayed

65 E.g. by A.D. Smith (487) and Bolton (1994: 80n20)
objects as three dimensional, what must be happening is the activation of a habitual
association between the two-dimensional array that sight presents us with and the ideas of
three-dimensional objects that judgment produces. If the example supports that part of
Locke's psychological theory, then it supports his doctrine that we see a two-dimensional
array.

I don’t think that Locke’s example can justify his theories. His opponents who
believe vision presents us with three-dimensional objects can give an account of the
deception that is at least as plausible as his. They can just say that the mysterious process
that takes us from the retinal images to consciousness gives ideas of three-dimensional
objects when we look at fruit and also when we look at paintings of fruit. There’s no
paradox in saying that a flat object appears to have depth. Smith observes, “to say of a
painting that it is trompe l’oeil is to say that it looks three-dimensional” (A.D. Smith 487).
That’s the phenomenon to be explained and, as Smith argues, nothing about that
phenomenon demands that we postulate a preceding or parallel consciousness of the
painting as flat.

Realistic painting shows we can see a two-dimensional object as three-dimensional.
Locke asserts that we see three-dimensional objects as two-dimensional. The first
proposition doesn’t justify the second.

Locke doesn’t deny that three-dimensional objects eventually produce ideas of three-
dimensional objects, but he asserts that they produce these ideas through the intermediary of
a two-dimensional array of ideas. The disagreement between Locke and his foes is not over
whether a painting might be judged to have depth, but rather over whether the first ideas
produced by sight are two-dimensional.
The details of the case tell against Locke, I think. He doesn’t have in mind any old painting of breakfast, but rather a *trompe l’oeil* painting that can make us hesitate in our judgments about whether we’re looking at something real or something painted on, “a practical joke that provokes our eyes to the point of insult, and of doubt” (Grootenboer 4). I’m not sure that I believe Locke’s claim that those who can’t paint won’t be convinced by words that they aren’t seeing genuine bulges. It depends, perhaps, on the ‘places’ he has in mind where these painting are shown. In galleries, as Nelson Goodman observes, “the appropriate conditions of observation (e.g., framed, against a uniform background, etc.) are calculated to defeat deception” (1976: 34-35). But the right painting, say, Jan van der Vaart’s ‘Violin Suspended from a Peg,’ in the right household setting may well provoke genuine incredulity (Wheelock 80).

Anyone might be taken aback at the first moment of sight. As Hanneke Grootenboer writes, “Trompe l’oeils display objects so realistically painted that the distinction between reality and representation is beyond our perception—at least for a split second” (4). For present purposes, that’s the important moment. When we look at a *trompe l’oeil*, the depicted object seems to be real and have depth in the first instance, and only later can we see the painting as flat. This is the opposite of what Locke’s theory predicts. Insofar as *trompe l’oeils* provide us with a crucial experiment to decide between his theory and his rivals’, it seems to undermine his own view.

Locke tells us that sight presents us with ideas like those visible in painting. We’ve been considering paintings from the consumer’s point of view. Perhaps it would be more helpful to look at them from the painter’s point of view. At *Essay* 2.8.6, he argues, “one may truly be said to see Darkness. For supposing a hole perfectly dark, from whence no light is reflected, ‘tis certain . . . it may be Painted.” The principle behind the argument is that
whatever can be painted can be seen. It seems to follow from that principle that we can see
the two-dimensional array before us. After all, we can paint it.

Anscombe quotes the *Essay’s* discussion of globes and circles and suggests that
Locke’s variety of shadow and color

is what you’d get if, adopting the suggestion of Leonardo,\(^{66}\) you held up a glass pane
vertically before you when you were looking straight ahead and supposed to be
painted on it with utter accuracy exactly the colour behind it, as seen, in every part of
it. The result represents what is thought of as the minimal, uninterpreted visual
impression, which is the basis of all else (1981b: 43).

Alberti had presented the metaphor before Leonardo, and it’s a way of making the problem
of perspective vivid (*On Painting* 39-42; Lindberg 150). Such a colored pane could only
present what’s seen to a single eye, it has a boundary in a way that vision does not, and it
wouldn’t vary in focus between center and periphery, foreground and background in the way
that real vision does (Snyder 505, 520-23). Even so, a painting produced in this manner
would “with a high degree of approximation” (Pirenne 170) replicate the distribution of light
on the retina. Since retinal imagery is the raw material from which vision is constructed, we
should expect subjective similarities between looking at a painting that corresponds to this
supposition and looking at the scene through an unpainted window.

Of course, there are differences between an array of ideas and a painted
windowpane. As Anscombe writes, “the pane would in turn be only an ordinary object of
perception: it does duty for something else; it merely carries what *has to be understood as a
picture of a purely visual object*” (1981b: 43). There’s an old joke about Einstein’s explanation
of radio. Imagine a giant cat with its tail in New York and its head in Los Angeles. You pull
the tail in New York and the head meows in Los Angeles. Radio is just like that, only

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\(^{66}\) “Perspective is nothing else than the seeing of an object behind a sheet of glass, smooth and quite
transparent, on the surface of which all the things may be marked that are behind this glass” (*L. Notebooks* 992)
without the cat. The visual array is just like a painted pane of glass, only without the paint and without the glass.

Paintings, like retinas, don’t provide us with conclusive reasons to believe in a two-dimensional visual array. At most, they can help explain why someone expects to see a two-dimensional visual array. Alberti’s sheet of glass would be irrelevant to Locke’s assertions if it didn’t correspond to something available to introspection. We could, Anscombe suggests (1981a: 15-16), imagine someone (perhaps created by a Malebranchean God) who could see things as three-dimensional objects but who could not describe the scene as an array of colors and shadows. That is, the person would be able to see a brown dog on a purple mat, but wouldn’t be able to see what was before her as a plane of color patches.

We could even imagine someone producing realistic paintings by instinct and inspiration without being able to see color patches or Alberti’s pane. After the painting is done, however, it’s hard to imagine someone having anything like our color vision and not being able to see the patches of paint. And anyone who can follow Alberti’s advice would be able to see what’s before him as an array of color patches.

7.4 Ways of Seeing

As a matter of fact, many people who can’t paint can see what is before them as a two-dimensional array. At least I can, and Locke could as well. He introduces the proposition that globes present us with an idea of a flat circle with the phrase “‘tis certain,” which is as close as he comes to directly offering a reason for it. It seems to me that Locke takes the existence of a two-dimensional visual array to be immediately obvious. Perhaps this is actually enough to justify a limited version of his claim. We have first person authority on the question of what ideas we have. If Locke honestly reports that, on at least one occasion,
vision presented him with the idea of a two-dimensional array, then there’s no sense in denying his report.

Let me bring out two features of Lockean ideas in a way that makes it plausible that he was, indeed, sometimes presented with the idea of a variously colored flat circle when he looked at a uniformly colored globe. First, for Locke, an idea “is the immediate object of Perception, Thought, or Understanding” (2.8.8). We may extract the meaning of this definition by considering Locke’s analysis of Malebranche’s assertion that “when we perceive any sensible thing, there is in our perception sentiment and pure idea” (Exam 9.232). In reply, Locke writes,

If by ‘sentiment,’ which is the word he uses in French, he means the act of sensation, or the operation of the soul in perceiving; and by ‘pure idea,’ the immediate object of that perception, which is the definition of ideas he gives us here in the first chapter; there is some foundation for [the distinction between sentiment and idea] (Exam 9.232-33).

Locke goes on to argue that, given such a definition of ideas and the doctrine that we perceive all ideas in God, Malebranche would be committed to the result that color and scent are in God: “taken thus, I cannot see how it can be avoided, but that we must be said to smell a rose in God, as well as to see a rose in God; and the scent of the rose that we smell, as well as the colour and figure of the rose that we see, must be in God” (Exam 9.233). The argument only makes sense if by ‘the immediate object of perception,’ Locke means what we smell, see, or perceive in some other way.

Malebranche’s definition of ‘idea’ in 3.2.1 of The Search after Truth is like Locke’s definition of idea in Essay 2.8.8. I want to pick up the hint: what he means by the immediate object of perception, thought, or understanding is what we perceive, think, and understand. In being the objects of thought, they differ from Thomistic sensible and intelligible species, which for Aquinas are merely the means by which we sense and think of the objects of
cognition and not the objects of cognition themselves (see e.g. ST 1.85.2; Yolton 148, Perler §7).

The second point to make about Lockean ideas is one that I mentioned already: they are as they seem (Bolton 1992: §4). Anscombe (1981a) distinguishes between the material and intentional objects of sensation: the material object is the sensed external object (if anything), while the intentional object is what we seem to sense. Intentional objects are the objects of perceptual verbs, such that the truth of the resulting proposition doesn’t depend on whether the object is actually present, but rather on whether it seems to be present, as in, e.g., ‘When you screw up your eyes looking at a light, you see rays shooting out from it,’ and ‘With this hearing aid, when you talk I hear some screeching noises; no low tones and the consonants are very indistinct’ (ibid. 12). The material object of perception, in contrast, is that external object that is usually present in perception, and which is sometimes other than the way it seems (ibid. 13-14)

Lockean ideas are like Anscombe’s intentional objects (Mackie 1985: 222-24, Chappell 1994: 27-35). They are objects of perception that are as they seem to be. “For let any Idea be as it will,” Locke writes, “it can be no other but such as the Mind perceives it to be” (2.29.5). The ink on a page, he argues, makes the same idea as a perfectly dark hole (2.8.6). The relevant similarity is between what we seem to see when we look at ink spots and holes and not between ink spots and holes as they are in themselves.

Here is my defense of Locke: in many circumstances, it’s possible for a person to see what’s before her as a two-dimensional array of color patches. Once we realize that, which we see is up to us. James J. Gibson asks us to consider “the railroad tracks extending to the horizon. They are ‘seen’ in one sense of that term to converge; they are ‘seen’ in another

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67 I owe this point to Jeff Brower.
sense of that term not to converge. . . . By adopting the appropriate attitude, one can have
either kind of visual experience” (1952: 149, see also Gombrich 327-29 and Kelly §2).\(^{68}\) I’m
sure that the world appeared to Locke as two-dimensional on occasion, and his
autobiographical reports to that effect have first-person authority.

This is only a limited defense of Locke. I don’t think that he has shown that ideas of
a two-dimensional array are always present or that they are temporally or epistemically prior
to our perceptions of three-dimensional objects. Rather, I follow Gibson in thinking, “the
resulting pictorial impression is not the basis of ordinary perception. . . . So far from being
the basis, it is a kind of alternative to ordinary perception” (151).

According to E.H. Gombrich, “the total ambiguity of one-eyed static vision is
logically compatible with the claims of geometrical perspective but incompatible with the
idea that we ‘really’ see the world flat or curved” (393). His expression ‘total ambiguity’
surely goes too far. I once saw a rabbit through my front window, and I tried without
success to see it as a duck. In some circumstances and for some people, it is close to
impossible to see the world as an array of color patches. Only foolish and difficult
concentration would allow someone to see two-dimensional arrays while walking down a
busy sidewalk or when a pitched ball is nearing fast.

Everyone agrees perception is less malleable than most cognitive capacities. As
Jerome Bruner (124) puts it, perceptual inferences “appear to be notably less docile or
reversible” than conceptual inferences. Though Zenon Pylyshyn concedes that “vision as a

\(^{68}\) J.L. Austin argued against thinking that the word ‘perceive’ is ambiguous (Austin 84-102; here I’m indebted
to an anonymous reviewer). Anscombe (1981a 17) reports that Austin “remarked casually that there were
perhaps two senses of ‘object of sight’.” I am with Austin on the semantic issues, but Gibson is right to point
out that we can see railroad tracks as parallel and we can, if we choose, see them as converging at the vanishing
point.
whole is cognitively penetrable,” he has tried to demarcate an “early vision system” which “is encapsulated from cognition” (344).

Generally speaking, observations are most likely to be influenced by theory in cases in which “the phenomenon to be observed were ambiguous, degraded, or required a difficult perceptual judgment” (Brewer and Lambert 180). Locke’s perception of a uniformly colored sphere as a variously colored circle seems like an exception to this general principle. The viewing conditions are degraded or difficult, and the relevant phenomenon isn’t any more ambiguous than almost every other visual phenomenon.

The invention of the stereoscope was important to the development of 19th century psychology mostly, as Nicholas Wade and Hiroshi Ono (1985) argue, because it allowed for the manipulation of some of the empirical variables that produce depth perception, but partly, I think, because it’s difficult to look into a stereoscope and see a two-dimensional array. That’s the difficulty motivating Bertrand Russell’s quick rejection of the doctrine that we see a two dimensional array: “Berkeley’s theory of vision, according to which everything looks flat, is proved false by the stereoscope” (51).

Even so, Gombrich and Gibson are right to think that we may, in most situations, see what is before us either as a two-dimensional array or as bodies in space. Wittgenstein maintains that a person needs to be aware of two alternatives in order to sensibly use the words ‘seeing as’ in a first person avowal. By way of example, he asserts that someone looking at a knife and fork wouldn’t be able to meaningfully use the expressions “I see that now as knife and fork” or “that’s now a fork for me” (195). I think that the ambiguity of vision extends to cutlery. With a little bit of exposure to epistemology or art theory, just about anyone can see what he sees to the left of the plate as either a fork or as a two-dimensional array of color patches.
I don’t want to overemphasize the symmetry between the two ways of seeing. I agree with the modern consensus that untutored sight sees three-dimensional objects and depth. Dogs and cats see cats and dogs; they don’t see color patches. Our ability to see color patches is a product of civilization—paintings, optics, and epistemology. I’m sure that in day-to-day vision, Locke’s eyes presented him with three-dimensional objects. Only when he sat down to do epistemology did he see what was before him as an array of color patches.

Considerations from painting and the anatomy of the eye prodded Locke to think that vision presents us with a two-dimensional array and that this array is the basis of our further visual judgments. Because he believes that sensations come to us separately and in accordance with a simple psycho-physical rule, he’s inclined to believe that our first visual ideas correspond pretty directly to our two-dimensional retinal images. Because some of us can produce realistic paintings by painting color patches in the visual array, he infers that we can come to have thoughts of depth after being presented with a two-dimensional array. These considerations would have been inert if he couldn’t see what he saw as a two-dimensional array of colors and shadows. But he could, and they were not.

Eric Schwitzgebel denies that he can see what’s before him as a two-dimensional array: “For what it’s worth, as I stare at the penny now, I’m inclined to say it looks just plain circular, in a three-dimensional space—not elliptical at all, in any sense or by any effort I can muster. I can’t manage any Gestalt switch; I discern no elliptical ‘apparent shape’” (590). We might try to prod Schwitzgebel towards being able to see two-dimensionally. We might ask him to carry out Alberti’s thought experiment, or ask whether he can discern multiple apparent colors in a concave homogeneously colored object. But if all that fails, we have no reason to doubt his sincerity, any more than we have reason to doubt the sincerity of people who say they can’t see the numbers in an Ishihara test for color blindness.
If the philosophical community can trust Schwitzgebel’s ability to describe how things appear to him, then it ought to extend the same courtesy towards Locke (and to me). The principle of charity can be misused, and I do think that Locke is mistaken when it comes to ordinary unreflective sphere viewing. Still, when a great philosopher carefully and contemplatively describes what he finds inside his own mind, we should not dismiss it in a hurry. Philosophers of mind attempt to combine psychology, common sense, and logic. The most important application of logic in this context is to reveal the logical form of psychological statements, that is to say, to elucidate the valid inferences that follow from psychological statements with a certain structure. As a matter of logical form, we would like to evaluate claims about intentional objects by the way their subjects take these objects to seem.

Consider the usefulness of being able to see the world as a two-dimensional array. We would expect the ability to carry out Alberti’s thought experiment to be a useful aid to the painter and to the photographer. In a similar manner, being able to see a chessboard as an assemblage of threats and strong points helps the chess player, and being able to see an image from a super-collider as tracing the paths of sub-atomic particles helps the physicist. Often, seeing the world in a different way does correspond to a difference in capacity.

Let us return to our earlier puzzle. In the eighteenth and early nineteenth century, almost everyone thought that what we see is obviously two-dimensional and in the twentieth century almost everyone thought that what we see is obviously presented with depth. How was that possible? It was possible because it’s possible to see what’s before us in either way. When we see things in one way, we have first person authority that we are seeing things in that way, so a person’s view’s about the immediate object of sight will seem not only right,
but obviously right. Since one way of seeing drives out the other, at least for the moment, philosophers and psychologists might think that alternatives are obviously wrong.

The fact that the blind spot was discovered late in the history of civilization, the fact that we don’t notice our own blinking, the fact that glaucoma patients are slow to admit that they are losing peripheral vision, and the fact that a broad range of the visual field is subjectively clear though only a narrow region is objectively clear all illustrate the *modus operandi* of the human visual system: it receives fragmentary neural stimuli and presents continuous and detailed appearances without revealing the gaps in input. Sometimes, when the input is ambiguous in the right way, the visual system may present one of two incompatible appearances. In some of these cases, the subject may be able to move from one of these appearances to the other through an act of will. In other cases, other cues may determine what the subject sees.

In the *Structure of Scientific Revolutions* (62-64) Kuhn reports experiments by Bruner and Leo Postman in which subjects have difficulty identifying playing cards with anomalous colors. Those results have been built upon by other psychologists, and people indeed see what they expect to see and have trouble perceiving objects that run contrary to expectations (Pylyshyn 342-43, Puri and Wojciulik 2007). Aspect perception is susceptible to contextual prodding (Brewer and Lambert 178-79). If we expect a duck we’re more likely to see a duck. Children are more likely to see duck-rabbits as rabbits on Easter Sunday (Brugger and Brugger, 1993). If you see a duck-rabbit in a sequence of unambiguous ducks, it will look like a duck (Long and Toppino 2004 757-58). Since aspect perception is subject to societal pressure, it is subject to fads and fashions. Psychologists and philosophers in the eighteenth

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69 John Horner and San Tung (2011) argue that Bruner and Postman’s results are due to task difficulty, and not resistance to novelty, but even though they used manipulated video images rather than real trick cards, they still produced slower identification times with trick cards images than with images of regular cards, and their results are still consistent with the principle that expectations shape perception.
century were taught by Locke and others that vision presents them with a two-dimensional visual array, and they saw what they expected to see.

So what we think we see depends on what we expect to see, and, when it comes to our ideas, what we think we see is what we actually see. Locke’s historical, plain method turns out to be partly a matter of description and partly a matter of invention. The fat fingers of introspection aren’t supple enough to pick up unmodified perceptions.

7.5 The Veil of Ideas

Another way that the malleability of perception shows up in Locke’s work is with respect to location. He has three reasons for internalizing ideas and for thinking of them as inner proxies of the outside world. The first is his doctrine that we see a two dimensional array, combined with his belief the three dimensionality of the outside world. The second is an argument from the premise that we can think of non-existent objects. The third is an argument from the premise that ideas, unlike external objects, are spatially present to their perceivers.

Since Locke has talked himself into seeing a two-dimensional array but he thinks that the things themselves are three dimensional, he can’t think that we see the things themselves. Ideas are the immediate objects of perception, and he can’t think that they’re external bodies, since external bodies aren’t flat.

Locke finishes his story of the transformation of ideas of sensation in a way that suggests that he might think that the objects of judgment are the external things themselves: “the Judgment presently, by an habitual custom, alters the Appearances into their Causes.” So, for example, when we look at a uniformly colored globe, judgment transforms an array of shadow and color that the eyes present us with into “the perception of a convex Figure,
and an uniform Colour” (2.9.8). If these lines were all that we had to go by, we might think that Locke identifies the ideas that are the object of judgment with the external globes and their qualities.

That this isn’t Locke’s view can be seen from considering his reply to an early critic, a reply that makes it clear that he believes that ideas are always distinct from external objects. In 1697, John Sergeant criticizes Locke’s epistemology, arguing that the distinction between idea and object made knowledge impossible: “Wherefore those who have only in their Minds Similitudes or Ideas, and do only Connect or Discourse of them, which Ideas are not the Thing, nor conceiv’d to be It . . . . Therefore they have no Solid Knowledge of any Thing” (Solid, Preface §25). Sergeant grants that there are ideas or resemblances in the imagination, but he denies that there are any in the mind (ibid.). According to him, notions are in the mind, notions allow for knowledge, and a notion “is the very thing it self existing in my understanding” (Solid, 2nd Preliminary, §3).

Against Sergeant, Locke argues that the things themselves can’t be in our understandings. The argument is wedged into Locke’s second reply to Stillingfleet as an attempt to reach some common ground against Sergeant. Locke writes to the bishop,

Not thinking your lordship therefore yet so perfect a convert of Mr. J.S.’s, that you are persuaded, that as often as you think of your cathedral church, or of Des Cartes’s vortices, that the very cathedral church at Worcester, or the motion of those vortices, itself exists in your understanding; when one of them never existed but in that one place at Worcester, and the other never existed any where in rerum natura (2nd Reply 4.390-91).

From these examples, Locke concludes, “your lordship has immediate objects of your mind, which are not the very things themselves existing in your understanding” (2nd Reply 4.391; Ott 2004: 115-16). There are two arguments here, one depending on the non-existence of Cartesian vortices and the other depending on Stillingfleet’s distance from his cathedral.
Both depend on the uniformity principle that if the material object of thought is distinct from its intentional object in one case, then they are distinct in every case.

The vortices argument relies on the Platonic principle that he who thinks, thinks something (*Theaet.* 189a, see Anscombe 1981a: 15). When we think about Descartes’s hypothesized vortices, the intentional object of our thought exists. But there is no material object of thought in this case, since the purported vortices don’t really exist. So intentional objects are distinct from material objects. That is to say, ideas are distinct from external bodies and their qualities.

In this light, it’s easier to understand the opening sections of the chapter on primary and secondary qualities, in which he argues that sensation gives us positive ideas, whether or not the cause is a privation (2.8.1; Carriero 20-21). Locke is setting up a contrast between ideas and qualities. The causes of cold, darkness, black, and rest might all be privations, but the ideas themselves are all clear and positive. So, for example, shadows, privations of light, produce positive ideas as much as the human beings that cast those shadows do (2.8.5). Nothing can be both a privation and a positive entity, so the idea is one thing, and the arrangement of particles that produce that idea is another (2.8.2).

Locke’s second argument against Sergeant assumes that intentional objects are spatially present to the thinker. On that assumption, when Stillingfleet is in London and thinks of his cathedral in Worcestershire, the intentional object of his thought is in London, even though the building is in Worcestershire. So the material object and the intentional object are distinct.

Intentional objects are pulled in two directions with respect to place. On the one hand, they depend on perceivers. To that extent they are reasonably considered as modes of perceivers, and modes are commonly held to exist at the same place as the substance in
which they inhere. Locke appeals to a similar principle elsewhere. He argues against realism about universals, because one real being can’t be in two places at the same time (2nd Reply 435-36). This way of thinking is encouraged by the project of tracing appearances from remote causes through a medium, up the nerves and to the brain. If A causes B which causes C which then causes D, we expect D to be near C and not out by A.

On the other hand, intentional objects are as they seem, and they seem to be out in the world. Locke doesn’t really give any credit to the second consideration, summarizing his definitions of ideas and qualities with the phrase “Ideas in the Mind, Qualities in Bodies” (2.8.7 marg.). He only considers the apparent places of ideas as a source of illusion—pains seem to be in the body, but they’re really in the mind (2.20.2), warmth seems to be in the fire, but it’s really in the perceiver (2.8.16). Recall that Locke believes that both bodily pains and mental pains are both “only different Constitutions of Mind” and that in spite of the common way of distinguishing them, they only differ in their causal antecedents (2.20.2). Generally speaking, he believes that ideas are as they seem, but he seems willing to make an exception for location.

Locke borrows Descartes’s thought experiment of walking closer and closer to a fire (AT 7.83=CSM 2.57; Maier 1968: 49, 66) to show the continuity between the idea of warmth and the idea of pain (2.8.16). He also compares the ideas of whiteness and cold that snow produces with the pain it can also produce (ibid.), and the ideas of whiteness and sweetness with the pain and sickness that a laxative produces (2.8.18), both times challenging his opponent to give “some Reason to explain” (ibid.) why ideas of pain and sickness are nowhere when they aren’t felt but “the Sweetness and Whiteness, effects of the same Manna on other parts of the Body, by ways equally as unknown, should be thought to exist in the

70 Locke offers a teleological explanation of the phenomenon at Essay 2.7.4: heat and light are pleasant in small doses and painful in large ones in order to protect our organs from damage.
Manna, when they are not seen nor tasted” (ibid.; Rickless 311-12). ‘Manna’ refers to a kind of laxative, probably the gum of the manna ash tree (*OED* s.v. ‘manna’ 3a). From a medical point of view, 2.8.18 is a physician’s diatribe against a constipation remedy.

It’s as if Locke is trying to pull off a magic trick. He’s directing our attention inward and trying to get us to see what he wants us to see. He wants us to see ideas of color, smell, sound, and warmth as internal sensations. Peter Alexander distinguishes between ‘in the mind’ as meaning *mind-dependent* and as meaning *located where the mind is*. According to him, Lockean ideas are mind-dependent but located on the surfaces of things (103-13). As philosophical description of intentional objects, I’m sympathetic to Alexander’s position, but, as a matter of interpretation, Locke doesn’t make any such distinction and, given the effort that he puts into convincing his reader that ideas are internal to the mind, I don’t think that we should attribute such a distinction to him.

One might worry that this veil of ideas obscures too much and that after draping it Locke might have troubles recovering the external world. Bennett (1971: 69) coined the term ‘veil of perception’ in order “express what is wrong with the theory.” Locke worries about this at least a bit, enough for him to think it worthwhile to write a chapter justifying our claims to have knowledge of external things. He argues that our senses confirm one another, that our intended actions conform to the deliverances of the senses (4.11.7), and that our vivid ideas of perception have external causes (4.2.13, 4.11.4-6).

Locke concedes that the level of certainty for sensitive knowledge falls short of the certainty associated with intuition and demonstration (4.2.14). Even so, he argues that it’s impossible to genuinely doubt the existence of external qualities (4.11.2) and that the skeptic who tries won’t be able to engage in rational discourse (4.2.14, 4.11.3), will starve (4.11.10), and will injure himself (4.11.8). For Locke, our senses give us good enough certainty about
the external world: the best assurance that human nature can give us on the subject (4.11.2) and good enough for human happiness (4.2.14, 4.11.3, 4.11.8).

Are the arguments that Locke offers for the existence of external things in the Essay good enough? That depends on our purposes and the standards that we require for our purposes. By my lights, his arguments are enough to show us that our ideas don’t arrive in us without rhyme or reason. I think that there would be grave practical difficulties in simply rejecting the existence of external things and that, by raising those difficulties, Locke establishes that it’s prudentially certain that such things exist.

The arguments aren’t enough to overcome the possibility that there’s a maximally powerful evil demon doing his utmost to fool us, but such doubt, as Hume noted, “were it ever possible to be attained by any human creature (as it plainly is not) would be entirely incurable; and no reasoning could ever bring us to a state of assurance and conviction upon any subject” (Enquiry 12.1.3). If we take a step back and suppose that our rational faculties are intact yet our senses are radically deceived (say, if we are brains in vats on a planet near Alpha Centauri), we don’t obviously get any closer to a practically relevant doubt.

Locke’s appeal to practical considerations and his implication that the level of certainty for sensitive knowledge is lower than that for intuition and deduction suggest that he didn’t think that he could or needed to refute every tenuous philosophical doubt that might be raised with respect to the senses. If he did, removing the veil of ideas wouldn’t be enough.

Michael Huemer (409) argues that, with respect to refuting the brain in a vat hypothesis, the direct realist who believes that our perceptual beliefs are justified independently of our awareness of mental phenomena has an advantage over the indirect realist who believes that the justification of our perceptual beliefs depends on such
awareness. According to Huemer, the direct realist can appeal to her knowledge that she has hands, while the indirect realist can’t start there because of self-imposed restrictions. That’s fine as far as it goes: if you start with more, you can get more. But if the indirect realist is allowed principles such as A) *if our senses testify that we have succeeded in our intentional actions, then the testimony of that sense is probably reliable*, B) *the vivacity and involuntariness of sense perception suggests that it has an external cause*, or C) *ordinary bodies are the most likely causes of the appearances of ordinary bodies* then it won’t be long until he can infer the existence of external bodies and be on level terms with the direct realist.

If there’s objectively a one in a septillion chance of being a brain in a vat, the chances ought to be the same for indirect and direct realists. Having the right epistemology is no defense against alien brain extraction. Assuming that the direct realist is biologically similar to the indirect realist, every skeptical possibility that can be pressed against the indirect realist can be transformed and pressed against the direct realist. So, the skeptic may ask the indirect realist how he knows that there are external objects loosely corresponding to our ideas, and then the skeptic may follow up that question by asking the direct realist how she knows that bodies are anything like the way they appear. I make these remarks not to undermine direct realism—I don’t believe that our awareness of external entities depends on our awareness of internal entities—but rather to cast some doubt on its decisive relevance to the problems of skepticism.
Locke thinks that he needs to excuse the “Excursion into Natural Philosophy” in his chapter on primary and secondary qualities. He justifies his digression into the corpuscularian sources of perception as “being necessary, to make the Nature of Sensation a little understood, and to make the difference between the Qualities in Bodies, and the Ideas produced by them in the Mind, to be distinctively perceived, without which it were impossible to discourse intelligibly of them” (2.8.22).

He can’t be attempting to correct the sloppiness of philosophers who have muddled the concepts of idea and quality; he wouldn’t need to discuss natural philosophy to make that point. Besides, no philosopher in history has been sloppier in his use of the terms ‘idea’ and ‘quality’. Rather, he draws the distinction between ideas and qualities so we may not think (as perhaps usually is done) that [ideas] are exactly the Images and Resemblances of something inherent in the subject; most of those of Sensation being in the Mind no more the likeness of something existing without us, than the Names, that stand for them, are the likeness of our Ideas, which yet upon hearing, they are apt to cause in us. (2.8.7)

Thus, Locke’s main goal in his discussion of primary and secondary qualities is to show that ideas of secondary qualities are not likenesses of qualities of bodies. In the detailed table of contents, he summarizes §§15-23 of the chapter on primary and secondary qualities with the line “Ideas of primary Qualities are resemblances; of secondary, not.”

For Locke, corpuscularianism entails two theses about ideas: first, a positive resemblance thesis, that ideas of primary qualities resemble something in bodies, and, second, a negative resemblance thesis, that ideas of secondary qualities don’t resemble
anything in bodies. After arguing that perceptions are produced by the impulsive motions of imperceptibly small bodies, he writes,

> From whence I think it is easy to draw this Observation, That the *Ideas of primary Qualities of Bodies, are Resemblances* of them, and their Patterns do really exist in the Bodies themselves; but the *Ideas, produced in us by these Secondary Qualities, have no resemblance* of them at all (2.8.15).

Today resemblance isn’t part of the standard conceptual repertoire in philosophy of mind, so the inference is no longer quite as easy for us to draw. On an unsophisticated way of taking Locke’s words, he means that ideas of primary qualities are like the qualities they represent and ideas of secondary qualities are unlike the qualities they represent. If we take his assertions in this unsophisticated way, our reward will be a satisfying understanding of the central arguments of his chapter on primary and secondary qualities. With these arguments, Locke attempts to justify his assertions about resemblance.

Some may be skeptical, thinking that the assertions, interpreted literally, are either too absurd or too obvious to have reasons supporting them. I take this skepticism to rest on deep foundations of charity, so I’ll try to undermine these foundations by giving a sympathetic and historical exposition of Locke’s positive thesis that primary qualities resemble the ideas that represent them. I’ll begin by criticizing rival interpretations of Locke an resemblance, say what it means to believe that ideas resemble qualities, and explain the plausibility of the belief in his environment.

One group of interpreters emphasizes Locke’s allusions to the scholastic theory of perception. He explicitly associates the term ‘resemblance’ with the scholastic theory of perception when he describes as “learned gibberish” the “peripatetic doctrine of the species” that “material species, carrying the resemblance of things by a continual flux from the body

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71 We could read the relevant sentence as a comparison between ideas and bodies, but, judging by 2.8.7, 16, 25 and 2.32.14, Locke has qualities in mind.
we perceive, bring the perception of them to our senses” (Exum 9:215; Woolhouse 1977, 95-96; Heyd 1994, 16). Locke certainly doesn’t believe that the perception of secondary qualities works through the multiplication of species.

Edwin McCann (1994: 64) and Thomas Heyd (13) imply that this background alone should enable us to understand the resemblance theses (see also Palmer 1974). However, as John Carriero observes (28-30), even if the contrast with scholastic theory explains the meaning of Locke’s negative thesis that secondary qualities do not resemble our ideas of them, this contrast cannot explain his positive thesis that primary qualities do resemble the ideas that represent them. Locke does not believe that scholastic theory adequately explains our perception of primary qualities. After all, he does not believe that disembodied forms of bulk, figure, number, and solidity multiply across the air and strike our eyes. From the standpoint of the twenty-first century, the positive thesis is the puzzler. Like Berkeley (PHK §8), we have no difficulty seeing how ideas of secondary qualities might not resemble something outside the mind; the difficulty lies in seeing how any ideas might.

A second interpretation of the resemblance theses results from tailoring Locke’s conclusions about resemblance to fit the argument that precedes them. Several commentators have done this by interpreting his notion of resemblance so that an idea ‘resembles’ its quality just in case the quality explains the production of its idea. For instance, Bennett (1971: 106) writes that

since ideas cannot resemble either bodies or qualities of bodies, [Locke’s theses] must be either discarded or transformed. The only plausible transformation is into something like the following: in causally explaining ideas of primary qualities, one uses the same words in describing the causes as in describing the effects (shape-ideas etc. are caused by shapes etc.); whereas in causally explaining ideas of secondary qualities one must describe the causes in one vocabulary and the effects in another (colour-ideas etc. are caused by shapes etc.). If this is not what Locke’s ‘resemblance’ formulations of the primary/secondary contrast mean, then I can find no meaning in them.
Edwin Curley (§5) and Keith Allen (2008a: 285-86) less reluctantly give similar accounts.

Plainly, Bennett’s reluctance is understandable. This analysis is tailored to the structure of Locke’s arguments for his resemblance theses, but it strays far enough from the ordinary meaning of ‘resemblance’ that we should reluctant to attribute it to him (see also Stuart 2013: 91-93). One could stipulate that by ‘resemblance’ one means the relation that holds between a quality and its idea when the quality helps to explain the production of the idea. However, Locke does not thus stipulate and without some such special linguistic background, the English word cannot bear that meaning.\(^{72}\)

Bennett, Curley, and Allen sweep resemblance under the rug by asserting that Locke is merely obscurely reiterating what he said in §§11-14. Such an approach does not judiciously confront the resemblance theses. Locke does believe that all and only those qualities that resemble ideas explain the workings of perception, but surely he does not suppose that is what the word ‘resemblance’ means.

According to a third interpretation, resemblance is just accuracy of representation. An idea of a quality resembles that quality in a body just in case the body has that quality (Woozley 34-35, Mackie 1976: 49-50). Such an interpretation domesticates Locke’s notion of resemblance and avoids the baffling implication that anything in the mind actually takes on a shape when we contemplate that shape (Ayers 1986: 21-22). On this reading, when Locke denies that the ideas of secondary qualities resemble the corresponding qualities, he denies that bodies actually have secondary qualities.

\(^{72}\) In a useful paper that properly emphasizes the importance of the resemblance theses, John Campbell attributes something more unusual to Locke. According to him, Locke means by ‘resemblance’ the relation that holds between a simple idea and a quality, just in case only one “fine structure” corresponds to the simple idea (1980: 582). Not only does Campbell groundlessly attribute to Locke the doubtful doctrine that objects that are three feet long, spherical, or solid are more likely to have a common fine structure than objects that are yellow or smell of almonds, but his interpretation strays too far from the ordinary meaning of ‘resemblance’ (Bennett 1982: 754-55).
Whatever else is wrong with this account, it isn’t anachronistic. Descartes explicates being similar as ‘conforming’ (“similes esse sive conformes” AT 7.37=CSM 2.26) in the Third Meditation. When Descartes says that the idea of the sun that he gets from astronomy resembles the sun more than the idea he gets from sensation (AT 7.39=CSM 2.27), all that he means is that astronomy is a better guide to the size of the sun than immediate sensation (M. Wilson: 1999a: 21-23).

Locke, however, believes that some objects actually are red, some are loud, and some are bitter. He repeatedly asserts that secondary qualities are powers to produce ideas in us (at 2.8.14, 15, 23, 24, 26 and elsewhere); for example, a fire’s heat and color are its powers to produce the corresponding ideas (2.23.7). Since fire manifestly does have these powers, it follows on his account that it is hot and red. When Locke denies that ideas of secondary qualities resemble anything in bodies, he doesn’t mean to assert that bodies lack secondary qualities (Stuart 2013: 95-96).

Most commentators have resisted literal interpretations of the resemblance theses, in part because they think that on such an interpretation the positive resemblance thesis would be too crazy to for Locke to believe. An interesting exception is Ayers. He believes that Locke intends the positive resemblance thesis literally, but Ayers hates the thesis thus interpreted so much that he only indirectly attributes it to Locke. After criticizing John Yolton’s thesis that Locke’s thesis that Lockean ideas aren’t intermediate cognitive objects, he writes,

the notion of ‘resemblance’ between ideas and qualities, and the remark that ‘A Circle or Square are the same, whether in Idea or in Existence’, now take on a disturbing ambivalence, being open both to the ‘charitable’ interpretation and to one which is considerably more problematic (1991: 1.64-65).

73 As we have seen in Bennett (see also Curley 451).
What is it about the interpretive ambivalence that Ayers finds so disturbing? I suggest that his caution and his distress result from attributing an opinion to Locke that he takes to be not just mistaken, but inconceivable.

I personally do not think that Locke’s opinion is especially scandalous, but that does not matter. For exegetical purposes, the important question is not whether the positive resemblance thesis, literally interpreted, seems crazy to us, but whether it would seem crazy to a competent seventeenth century philosopher. In fact, at the time, it is a perfectly ordinary view. Let me begin with a bit of physiological background by describing contemporary accounts of corporeal ideas.

Consider the following exchange in the *Fifth Objections and Replies*. Gassendi tells Descartes that “I do not so much dispute that you have an idea of body as insist that you could not have such an idea if you were really an unextended thing.” In defense of this insistence, Gassendi launches a long series of pointed questions:

For I ask you, how do you suppose that you, an unextended subject, can receive a species or idea of a body that is extended? If such a species comes from a body, it is without doubt corporeal and has parts beyond parts, and to that extent is extended. If it is imprinted in you from some other necessarily eternal source, in order to represent an extended body, it must again have parts and in the same manner be extended. Otherwise, if it lacks parts, how could it represent parts? For if it lacks parts, how will it manage to represent parts? If it lacks extension, how will it represent an extended thing? . . . It seems, therefore, that the idea does not utterly lack extension. Yet unless it lacks it, how can you, if you are going to be unextended, how will you be its subject? How will you apply it to yourself or use it? (AT 7.337-38=CSM 2.234)

Gassendi believes that ideas of extended things must resemble the things they represent. Descartes paraphrases Gassendi’s challenge as a request to explain “how I suppose that I, an unextended subject, can receive the species or idea of a body that is extended.” He replies temperately that
no corporeal species is received in the mind; the pure understanding both of corporeal and incorporeal things is done without any corporeal species. In the case of imagination, however, which can only be of corporeal things, there indeed needs to be a species which is a real body and to which the mind applies itself, but which is not received in the mind (AT 7.387=CSM 2.265).

He takes Gassendi’s talk of resemblance literally, and he does not treat the challenge as if it were foolish. In his response, Descartes alludes to his theory that the soul inspects corporeal images on the pineal gland. In the earlier *Treatise on Man*, he asserts that the rational soul directly considers figures “which are traced in the spirits on the surface of gland H [the pineal gland], which is the seat of the imagination and of the common sense, which must be taken for the forms or images that the rational soul will consider immediately” (AT 11.176-77=CSM 1.106; Kemp Smith 1963: Ch. 6, MacIntosh 333-35).

Gassendi and Descartes’s belief that the mind sometimes contemplates a literally extended corporeal image is common in the seventeenth century (Michael and Michael 1989). Willis (*Anatome* 136=*Anatomy* 96, *de An. Brut.* 64-65=Brutes 35-36), Hooke (*Light* 141-47; Macintosh 346-50), and Malebranche (*Recherche* 1.247-48=*Search* 88-89) all share it.

Locke is tempted to speculate about the physiological basis of memory, including guesswork about the malleability of the organ of thought. He tells us that he will not inquire whether the Temper of the Brain make this difference, that in some it retains the Characters drawn on it like Marble, in others like Free-stone, and in others little better than Sand, . . . though it may seem probable, that the Constitution of the Body does sometimes influence the Memory; since we oftentimes find a Disease quite strip the Mind of all those Ideas, and the flames of a Fever, in a few days, calcine all those Images to dust and confusion, which seem’d to be as lasting, as if graved in Marble. (2.10.5)

He warily associates ideas with images drawn on the brain.

Locke avoids confronting Gassendi’s problem by declaring that it is not his topic. His remarks about the malleability of the brain notwithstanding, he generally shies away from the sort of physiological speculation that Descartes undertakes in the *Treatise on Man*
and in The Passions of the Soul. Recall his programmatic remark that he isn’t going to examine whether “Ideas do in their Formation, any, or all of them, depend on Matter, or no” (1.1.2). Recall also his dismissive reply to Norris’s demand that Locke clarify his opinion about the relation between ideas and matter.

I give this background not because Locke believes that ideas are composed of matter. Rather, in keeping with the theme of my book, I want to examine physiological doctrines to which he was sympathetic and which might make him susceptible to believing that ideas of primary qualities resemble something in bodies.

8.2 Resembling Ideas

I’ll divide my treatment of the putative resemblance between ideas and individual qualities between central cases and peripheral ones. Locke’s illustrative examples of resemblance for primary qualities are almost always imagistic. I’ll go over them to show that he means the doctrine the ideas of primary qualities resemble something in bodies. I would also like to convince broadminded readers that the doctrine is intelligible. These examples show what he’s thinking of in his favored, central cases. On the other hand, not every idea that he believes resembles something in bodies is a mental image or an aspect of a mental image.

Let me begin with the central cases. For geometrical qualities, it helps to think of the relevant resembling ideas as mental images. It is easier to see how he can believe in squareness in mental images than to see how he can believe in square thoughts. By a mental image, I stipulate that I mean an intentional object that can be drawn on a piece of paper. Locke offers anamorphic drawings as a useful analogue for obscure ideas, since ideas “are, as it were, the Pictures of Things” (2.29.8, Hall 1990: 15-16).
Locke’s opinion that the immediate intentional object of sight is two-dimensional pushes him towards thinking of that object as a mental image. “Methinks,” he writes, the Understanding is not much unlike a Closet wholly shut from light, with only some little openings left, to let in external visible Resemblances, or Ideas of things without; would the Pictures coming into such a dark Room but stay there, and lie so orderly as to be found upon occasion, it would very much resemble the Understanding of a Man, in reference to all Objects of sight, and the Ideas of them (2.11.17).

Lockean ideas of figures are images of figures, something like the images cast on the back wall of a camera obscura (2.12.17). If the objects of sight are mental, two-dimensional entities, then they are visual images.

Recall Locke’s assertion that the idea presented in sight “is only a Plain variously colour’d, as is evident in Painting.” He believes that the received idea is a variously colored two-dimensional surface akin to the ones we see in paintings (compare Goodman 1977: Chs. 8, 10). The visual array that Locke thinks that we receive upon looking at a three-dimensional object will thus count as a mental image.

A difficulty in thinking of qualities as embedded in images is that images are primarily of things and not of qualities of things. When Locke discusses his paradigmatic resembling ideas, ideas of figure, he gets over this difficulty through loose use of language. We ought to distinguish between, for example, a square, which is a regular four-sided polygon, and a squareness, which is a quality that inheres in a square. Squares have four sides, but a squareness is not the sort of thing that can have sides. Since both the geometrical entities that bodies resemble and the geometrical qualities that bodies possess may be called figures, Locke can slide between the two by discussing the ideas of triangle, circle, and square as if they were ideas of qualities.

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74 Here I am indebted to Rogers Albritton.
This kind of slide is more difficult to make with other qualities. To make sense of Locke’s treatment of some ideas as images, we need to find some connection between images and simple ideas. Ayers offers the helpful proposal that “simple ideas are not so much parts as aspects of what is presented in experience” (1991: 1.17). Unfortunately, the texts Ayers cites in defense of his interpretation are at best inconclusive (1.49-51). Most of what Locke says suggests that simple ideas are components of complex ideas and not aspects of them (for example, at 2.2.2 and 2.11.6). His belief that we construct complex ideas out of the raw data of the senses guides some of his remarks (2.2.1).

On the other hand, if some simple ideas are aspects of images, just as qualities are aspects of bodies, it will be easier to make sense of a resemblance between a simple idea and a quality. If we follow Locke’s instructions, we will think of a visually received idea of a refrigerator as an image. I find it difficult to think of the ideas of building, white, unity, existence, and height as literal parts of that image.

By saying that an imagistic complex idea strictly resembles a body with respect to F, I mean that the idea is F and the body is F. For these images, a simple idea of F strictly resembles a quality in a body, if the idea is an aspect or component of a complex idea, and the complex idea strictly resembles the body with respect to F. Literal resemblance does not require strict resemblance. The plastic Statues of Liberty on sale in the gift shop resemble the original without metaphor or partial truth, even though they may not possess exactly the same shape or color as the original. Strict resemblance is the limiting case of literal resemblance. I bring it up only to help explain what I mean when I say that I want to interpret Locke’s resemblance theses literally.

The laws of logic do not demand that everything extended be corporeal. After all, the images cast by a slide projector are extended and incorporeal. (I call these images
incorporeal since their colors do not inhere in any body. The screen remains white throughout the slideshow; light is not paint.) Moreover, the point of view that makes it hardest to conceive of extended incorporeal ideas is the point of view that Locke refuses to adopt. Using introspection or the other tools of the plain, historical method, a philosopher can raise up a mental image and consider it as extended and shaped. A much harder task: thinking of the soul as an immaterial substance with ideas as its immaterial modes while imagining that these modes might somehow be extended. For the most part, Locke refuses to take up this point of view, except to illustrate the limits of human understanding. Perhaps people cannot know more by willfully closing their minds to certain perspectives. Nevertheless, they can imagine more that way.

All of this is groundwork. I want to prepare the possibility that he has this belief so that when I present supporting texts, they are not dismissed or reinterpreted.

Locke explicitly asserts that figures exist in ideas just as they exist in bodies. At 2.8.18 he writes, “A Circle or Square are the same, whether in Idea or Existence.” In defending the possibility of applied mathematical knowledge, he writes, “Is it true of the Idea of a Triangle, that its three Angles are equal to two right ones? It is also true of a Triangle, where-ever it really exists” (4.4.6). These passages imply that our ideas have shapes and that these shapes have geometrical properties. If it is a mistake to say that images have figures in the same sense that bodies do, then Locke makes that mistake.

It should be uncontroversial that Locke believes that we can number ideas just as we can number bodies. According to him, “Number applies it self to Men, Angels, Actions, Thoughts, every thing that either doth exist, or can be imagined” (2.16.1). For what it is worth, Frege approvingly quotes this passage in §24 of *The Foundations of Arithmetic.*
Someone might retort that this resemblance is irrelevant. Though three images may be three in number in the same sense as three mice, an image of three mice is just one image. True enough, but an image of three mice is threefold in a certain way; it has three salient parts. Perhaps this is not enough for strict resemblance, but it puts the relation between an image of three mice and three mice within the outer limits of literal resemblance. Notice that not all things that represent multiplicities resemble their objects in this way. The phrase ‘the Chicago Seven’ represents seven people, but it does not contain seven salient parts.

We can guess how Locke would apply some length predicates to ideas. My first inclination is to say that my image of the Statue of Liberty is taller than it is wide, for example. Mental images take up a certain portion of the visual field, and we have a large amount of control over how much of the visual field they occupy. One mental image of the Statue of Liberty can be larger than another, and not because the first represents the statue as larger. If one mental image takes up more of the visual field than a second does, then the first is larger than the second. To speak that way is not to speak in metaphors. Indeed, the sizes of mental images have been subjected to extensive and ingenious empirical investigation (Kosslyn 35-91).  

Let me turn to the peripheral cases. On my stipulated definition, we can see that though many Lockean ideas are mental images, some of them are not. In explaining the obstacles to a demonstrative science of ethics, Locke tells us that geometrical “diagrams drawn on Paper are Copies of the Ideas in the Mind, and not liable to the Uncertainty that Words carry in their Signification.” In contrast, we cannot use written copies of our “moral

75 I have in mind the investigation of “the pictorial properties of imagery that are evident to introspection” that according to Kosslyn and his colleagues William Thompson and Georgio Ganis (7), characterizes the first phase of recent psychological debates over imagery. Later parts of that debate concern the character of the neural mechanisms underlying those images, but those mechanisms are not my topic.
Ideas, we have no sensible marks that resemble them, whereby we can set them down”
(4.3.19; Ashworth 1984: 69-71).

Any mental entity you can draw a picture of is an image.

So the fact that images intelligibly resemble external objects with respect to some spatial characteristics can’t be the complete story. There are other qualities which Locke says or implies resemble qualities in the world, but which can’t be thought of as images or as inhering in images. These include moral qualities, determinate extension, motion, and solidity. Let me say what I can to make sense of these resemblance claims as well. Insofar as Locke has a general account of how ideas resemble qualities, we can figure it out by thinking about these cases.

Locke appeals to resembling ideas to explain how we can have rational, non-trifling knowledge of applied geometry (4.4.6). He wants to explain the possibility of substantial, real knowledge of ethics along the same lines. Resemblance here has to be understood without appeal to imagery, since he explicitly says that we can’t draw pictures of our moral ideas. We might dismiss this on the ground that our concern is how ideas of primary qualities resemble and not how ideas of other sorts of qualities might resemble, but the accounts of how geometrical ideas and how moral ideas give us substantial knowledge are supposed to run in parallel:

in the same manner, the Truth and Certainty of moral Discourses abstracts from the Lives of Men, and the Existence of those Vertues in the World, whereof they treat: Nor are Tully’s Offices less true, because there is no Body in the World that exactly practices his Rules, and lives up to that pattern of a virtuous Man, which he has given us, and which existed no where, when he writ, but in Idea. If it be true in Speculation, i.e. in Idea, that Murther deserves Death, it will also be true in Reality of any Action that exists conformable to that Idea of Murther. (4.4.8).

Ayers believes that every idea described in the Essay is an image, but he may have a somewhat idiosyncratic conception of what that means (1991: 1.28-29, 44-51).
The idea of a virtuous man is a pattern that particular humans may live up. When Cicero wrote *de Officiis* that pattern exist nowhere but ‘in Idea.’ The point of Locke's restriction to the time when Cicero wrote is that, not long afterward, the pattern was instantiated in Jesus. Propositions such as *murder deserves death* can be true in idea, and, if they are, they will be true in reality.

For Locke, virtue, justice and gratitude are primarily ideal objects of thought. Those ideas serve in his system of ethics the same role that Plato's forms served in his. They are archetypes of morality, and actions in the world are moral or immoral insofar as they conform to those ideas (2.30.4, 2.31.3-4).

These moral qualities can’t be thought of as aspects of some other complex idea. With mental images we have inner proxies that might possess geometrical qualities. There’s nothing like that for morality, as if we might have grateful ideas or ideas that have committed murder. Though the ideas of ethics can’t be understood as mental images they can still be understood as analogous to mental images. If mental images of figures can be internal doubles of external shapes, then ideas of murder can be internal doubles of external acts. And if proofs in pure geometry deal with idealized circles that need not exist in the real world, then proofs in theoretical ethics can deal with idealized cases that need not exist in the real world.

I want to say similar things about ideas of determinate length, ideas of motion, and ideas of solidity. In reply to Norris, he writes that “an idea of a circle, of an inch diameter, will represent, where, or whenvsoever existing, all the circles of an inch diameter; and that by abstracting from time and place” (*Books* 10.250). Although the rules of punctuation are not settled in the seventeenth century, his description of the representation of size here echoes his description of the representation of shape at 4.4.6 of the *Essay*, and there he emphatically
asserts that ideas share geometrical properties with bodies. But he can’t think that our ideas are an inch wide in the very same way that a quarter is an inch wide, because then ideas bigger than our skulls wouldn’t fit in our skulls. He could believe that inches are present in a different way in the mind than in the world.

In the chapter on our ideas of duration, Locke says that none of the motions of heavenly bodies by which we measure time “do ever all at once exist, but only in the Ideas I have of them in my Memory derived from my Senses or Reflection” (2.27.28). Locke’s view is that motions don’t exist all at once, but our ideas of them, at least our ideas of them retrieved from memory, do. He thus implies that the idea of motion and the quality motion have a different relation to time and that they have different temporal structures.

Locke is conspicuously silent about whether the idea of solidity literally resembles solidity. In fact, he does not mention solidity in the section containing the resemblance theses or in the preceding four sections defending the corpuscularian theory of perception. This means that he does not include an account of the production of the idea of solidity. Moreover, these sections contain four distinct lists of primary qualities that explain the production of ideas, and solidity is missing from them all.

On reflection, we should not expect Locke to say that solidity inheres in the mind or in ideas in the same way as it inheres in bodies. That would commit him to thinking matter or to corporeal ideas in a way that he doesn’t want to be committed. Still, he does list solidity as a primary quality more than once (2.8.9, 22, 23), so he is committed to the proposition that our ideas of primary qualities resemble something in bodies. We should be able to make sense of those claims even on the supposition that ideas are incorporeal. I think Locke would say that solidity inheres in one way in bodies and the very same quality inheres in a different way in the mind.
We should treat ideational existence as something like intentional or spiritual existence in the following sense: it allows for understanding a quality without all the preconditions and consequences that normally accompany those qualities in their external existence. So, we can fit the idea of three feet long in our skulls and we can have the idea of murder without their being a dead body in our heads. In all these cases, the same quantity, sort, or mode inheres in mind and world, but it inheres in a different way in the mind.

Locke doesn’t think that everything that we’re aware of has this kind of double existence. We know that roses are red, but he doesn’t think that the redness in mind resembles anything in the world. He also doesn’t seem to think that substances exist in the mind either. He treats the thesis that Worcester Cathedral might exist in Stillingfleet’s mind in London as a reductio ad absurdum. On this score, Locke might be contrasted with Descartes, who declares, “the idea of the sun is the sun itself existing in the intellect, not indeed formally existing, as in the sky, but objectively existing, i.e. in that way in which objects are normally in the intellect” (CSM 2.75=AT 6.102).

Part of the explanation for why Locke is willing to allow qualities but not substances existence in the mind is epistemological. He doesn’t think that we have the explanatory grip on substances that we base a science on. In contrast, he thinks that the ideas of mathematics and morality are good enough to serve as foundations for deductive systems of knowledge.

Part of the explanation is metaphysical. Locke is a conceptualist about universals. He thinks that the essences of species are abstract ideas (3.3.13), that sorts are complex ideas (3.6.1), that relations are comparisons (2.25.5), and he goes out of his way to define ‘mode’ as the name for a sort of idea (2.12.4). The proper place for Lockean universals is in the mind. For him, the hard question is whether they exist out in the world as well.
8.3 Locke's Theory of Representation

Locke believes that our ideas are internal and immediate objects of thought, that we can’t consider external things immediately, and that we have to settle for contemplating their ghostly, geistliche, internal counterparts. We should take him seriously when he tells us that “the Mind knows not Things immediately, but only by the intervention of the Ideas it has of them” (4.4.3). We should also take him seriously when he asks, “How shall the Mind, when it perceives nothing but its own Ideas, know that they agree with Things themselves?” (ibid.).

Because he places ideas inside perceivers, they end up serving double duty, first as intentional objects of thought and perception and, second, as internal representations of the external world. Lockean ideas aren’t essentially and universally representative. He believes that the ideas of pain and sickness do not intrinsically represent anything outside themselves. According to him, they are merely unpleasant sensations that befall us (Ayers 1991: 1.63).

Still, though ideas don’t represent always and essentially, many of them represent circumstantially and extrinsically. Locke’s chapter on the reality of our knowledge implies that he believes that ideas represent in virtue of contingent relations between them and the outside world. He answers his own question of how the mind can know that its ideas correspond to anything out in the world arguing that there are “two sorts of Ideas … we may be assured, agree with Things” (4.4.3). He argues that our ideas signify external entities

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77 According to James Gibson (1917: 20), Locke believes that ideas are “essentially representative.” Gibson argues that “a ‘psychical fact’ which is not the apprehension of an object is for [Locke] a sheer impossibility” since “to have admitted it would have been to run directly counter to the principle which was fundamental for his conception of mind, that ‘to be in the understanding is to be understood’” (ibid., the quotation from Locke is at Essay 1.2.5). Gibson’s interpretive argument seems fallacious. We may grant that Locke believes that every idea is in the understanding and thus that every idea is understood. He is not therefore committed to the proposition that every idea, even the idea of pain, represents something.

78 Actually, Locke suggests that a third sort of idea corresponds to external objects. When we construct a complex idea of a substance by observation, we know that the ideas that hang together in that complex idea represent qualities that can possibly coexist together, both now and in the future, “for whatever have once had an union in Nature, may be united again” (4.4.12).
(and therefore can be constituents of real knowledge) because they happen to stand in the relations of causation and resemblance to external bodies.


are not fictions of our Fancies, but the natural and regular productions of Things without us, really operating upon us; and so carry with them all the conformity which is intended; or which our state requires . . . Thus the Idea of Whiteness, or Bitterness, as it is in the Mind, exactly answering that Power which is in any Body to produce it there, has all the conformity it can, or ought to have, with Things without us (4.4.4).

Ayers nicely describes Locke as treating such ideas as “blank effects” and remarks that within Locke’s theory of perceptual knowledge “such effects represent external things . . . solely in virtue of their evident external origin” (1991: 1.62). Simple ideas have a certain etiology and can thus represent their causes.  

According to Locke, God sets up the production of sensation so they can be marks of things:

*Ideas of Whiteness, and Coldness, Pain, etc.* being in us the Effects of Powers in Things without us, ordained by our Maker, to produce in us such Sensations . . . For these several Appearances, being designed to be the Marks, whereby we are to know, and distinguish Things, which we have to do with (2.30.2).

God made our sensations serve as marks for bodies by making bodies constantly produce those sensations. He thinks that for this distinguishing relation to obtain between ideas and things “it suffices, that they are constantly produced by them” (ibid.). The passage doesn’t show that Locke believes brute, God-given, intrinsic intentionality for simple ideas (pace

Walter Ott’s argument that simple ideas can only represent through resemblance assumes that what an idea represents is an obvious and individuating feature of that idea (2012: 1085-86). We should abandon that assumption, partly to make sense of the various passages that Ott cites (1080-81) where Locke says that simple ideas represent their causes (2.31.1, 2.32.16. 4.4.4). Lockean ideas are primarily and by definition the immediate objects of perception and thought, and they only contingently and secondarily represent external things. Some of them don’t represent anything at all.
Soles 44, Shapiro 582n54). Instead, God sets up a causal connection between bodies and our ideas so that we can use that connection to distinguish bodies from one other. The details are left to us as an exercise.\(^8\)

The importance of causation in Locke's account of the representational capacities of ideas comes out in his criticism of Malebranche’s theory of ideas. Locke asks,

> how can he know that there is any such real being in the world as the sun? Did he ever see the sun? No, but on occasion of the presence of the sun to his eyes, he has seen the idea of the sun in God, which God has exhibited to him; but the sun, because it cannot be united to his soul, he cannot see. How then does he know that there is a sun which he never saw? (Exam §20)

One might think that if he believes that ideas are the immediate objects of perception, then the same argument would apply to him, and so he must have a different view (Woozley 26-27, Yolton 160).

Locke returns to the example, however, and makes the difference between his view and Malebranche’s clear:

> We have the ideas of figures and colours by the operation of exterior objects on our senses, when the sun shows them us; but how the sun shows them us, or how the light of the sun produces them in us; what, and how the alteration is made in our souls; I know not: nor does it appear, by any thing our author says, that he knows any more what God does when he shows them us. (Exam §30)

On Locke’s account, the sun is the mediated object of perception when I look at it, and it’s perceived by producing ideas in us which are the immediate objects of perception. Our ideas reveal the presence of the sun because the sun causes them. Malebranche, in contrast, denies that the sun produces ideas in us. The sun is the mediated object of perception, and can rightly be said to be seen on Locke’s account, because it produces ideas of circularity and

\(^8\) According to David Soles, “Locke believes that sceptics about the existence of an external world can be adequately rebutted by drawing attention to intrinsic differences among ideas of perception, on the one hand, and ideas of memory, imagination, etc. on the other. Such a rejoinder makes sense only on the assumption that ideas of perception are intrinsically representational” (43). I think that Soles is mistaken. Locke argues that because the idea of the sun in perception is vivid and involuntary in a way that the idea of the sun in memory is not, the perceived idea has a mind-independent cause. The merits of that argument don’t depend on whether the ideas represent the sun contingently or not (4.11.5).
bright, whitish yellow in us. Because Malebranche denies that the sun is a causal agent, he
can’t help himself to the same analysis (H.E. Matthews 15). 81

The second mechanism is through resemblance. However the details of Locke’s
conception of resemblance are understood, it’s plain that he takes resemblance to give the
possibility of something more than the mere awareness of some external quality; resembling
ideas give the possibility of an intelligible grasp of the workings of external objects
(Downing 1998: 388-89n15). Thus, he believes that ideas that represent through resemblance
reveal more about bodies than ideas that represent solely through being an effect.
Locke does offer an account of applied mathematics that rests on the putative similarity of
ideas and bodies and thus describes a second way in which our knowledge may correspond
to reality. It is in this context that he writes, “Is it true of the Idea of Triangle, that its three
Angles are equal to two right ones? It is true also of a Triangle, where-ever it really exists”
(4.4.6).

Ideas of figure are not mere blank effects. They do not just notify us of the presence
of their causes. Considering them gives us interesting knowledge of things that resemble
them, things of their sort. Since figures “are the same, where-ever, or however they exist”
(ibid.) contemplating ideas of figure gives us universal truths, truths that apply not only to
the triangles in our minds but also to triangular bodies. Ideas of figure represent what they
resemble, and the mathematician does not intend to make assertions about objects that do
not “agree with those his Ideas” (ibid.). Locke concludes that the mathematician “is sure
what he knows concerning those Figures, when they have barely an Ideal Existence in his

81 As for the other texts that John Yolton cites in defense of his thesis that Locke doesn’t really think of ideas
as true objects of thought and perception, I agree with Nicolas Wolterstorff’s assessment: “What emerges is
that certain passages are ambiguous. All the clear ones, however, seem to me to be in favor of the
interpretation of ideas as mental objects” (16n). Yolton acknowledges Locke’s criticisms of Sergeant, but still
thinks Locke “should have appreciated that Sergeant was rather close to his own view” (158-59). For more
criticisms of Yolton’s reading, see Ayers (1991: 1:56-65), Roland Hall (1990: 15-17), and Chappell (1994,:31-33).
Mind, will hold true of them also, when they have a real existence in Matter” (ibid.).

Admittedly, these considerations alone do not show that any triangles reside in the external world, but Locke has said enough to offer an account of the possibility of applied geometrical knowledge.

He has also said enough to explain why he believes that ideas that represent through resemblance reveal more about bodies than ideas that represent solely through being an effect. By contemplating a resembling idea, we can think of a body as it is in itself. By contemplating more than one resembling idea, we can think how bodies relate to one another, independently of the ways that they affect our senses. As I said, many commentators have recognized that Locke appeals to the causal ancestry of our ideas as a source of information about the outside world. Though Locke puts less emphasis on resemblance, it is a more promising source. Ideas that resemble bodies do not just provide us with the knowledge that some object has the power to produce a certain idea, they also provide us with objective, instructive, universal knowledge of the world beyond the veil of appearance.

Locke is not the first to place resemblance in the center of a theory of representation. In On Memory and Recollection, Aristotle wonders how a memory can represent an absent object. He thinks that considering the less puzzling case of a “figure drawn on a panel” can ease the mystery. Such a drawing “is both a figure and a likeness,. . . and one can contemplate it both as a figure and as a likeness” (450b21-24). Aristotle believes that the images of memory represent other things “in the same way.” Just as a drawing is a figure and a likeness, “one must also conceive the image in us to be something in its own right and to be of another thing. In so far as it is something in its own right, it is an object of contemplation or an image. But in so far as it is of another thing, it is a sort of likeness and
a reminder” (450b24-27). The word Beare translates as ‘image’ is ‘phantasma’. ‘Phantasm’ is one of three philosophical terms Locke offers as acceptable substitutes for the word ‘idea’ (1.1.8). I take it that Aristotle and Locke are saying the same thing.

Regular causal connections only tell us that something in the world brings about a certain perception in us. They don’t necessarily give illuminating information about that world. According to Locke, for that we need resembling ideas. By contemplating a resembling idea, we can think of a body as it is in itself. By contemplating more than one resembling idea, we can think how bodies relate to one another, independently of the ways that they affect our senses. Considering resembling ideas gives us interesting, universal knowledge of things that resemble them, things of their sort. They provide us with objective, instructive, universal knowledge of the world beyond the veil of appearance.

8.4 The Justification of the Positive Resemblance Thesis

According to Locke, then, ideas of primary qualities represent through resemblance. Ideas of secondary qualities, however, represent only through causation. We have not yet discovered what lies behind this asymmetry. He would say that almost every mental image of the Statue of Liberty is taller than it is wide, just as the statue itself is taller than it is wide. In this respect, images of the statue resemble the statue. If someone is willing to go this far with Locke, why should she bridle at saying that her image of the Statue of Liberty is green, just as the statue itself is green? She may look at a tuft of grass and ask whether that grass is a darker green than her image of the Statue of Liberty. Suppose she asks whether her image of the statue is the same shade of green as the statue. If her visual memory is accurate, why would the answer be no?
Such considerations do not prove that images have colors in the same sense as statues. Nevertheless, Locke needs to offer a justification for his asymmetrical treatment of the resemblance of ideas. Look at the problem from his perspective. Imagine that you believe that the immediate objects of perception are ideas and that these only problematically and extrinsically represent external things. Contemplating this field of ideas, you perceive some shapes, motions, colors, and sounds. Think of this as a matter of perceiving that certain shapes, motions, colors, and sounds inhere in your ideas. Which of these features resemble qualities outside your head and which do not?

Locke answers the question of what the world beyond our ideas is like by declaring that ideas of primary qualities resemble something in bodies and ideas of secondary qualities do not. We can comprehend how he reaches these conclusions if we recognize that he believes that the veil of ideas creates a presumption against thinking that anything in bodies resembles anything in the mind. He offers considerations for setting this presumption aside for primary qualities, and argues that no similar considerations justify setting it aside for secondary qualities.

Let us first consider what leads Locke to say that ideas of primary qualities resemble something in bodies. The main reason he adopts the positive resemblance thesis is that he believes that it follows from the corpuscularian theory of perception. If primary qualities are involved in the production of sensations, and we can perceive those very primary qualities inhering in our field of ideas, then it really is easy to draw the consequence that ideas of primary qualities resemble qualities of bodies.

On Locke’s assumptions, only resembling ideas can undergird an accurate, explanatory physical theory. If ideas of primary qualities were mere blank effects that told us

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82 Ned Block (518) has a reasonable response to a similar argument.
nothing about the workings of bodies, then corpuscularians could not take the first steps towards a theory of perception. At bottom, Locke's conclusion rests on his difficulty in seeing how we could represent the intelligible qualities of bodies if our ideas do not resemble those qualities.

Assume that his argument for a corpuscularian theory perception succeeds and yields a right and intelligible account of the external world. If we can only have right and intelligible theories on the condition that our ideas of the explanatory qualities of that theory resemble those qualities, then it follows that our ideas of the explanatory qualities of corpuscularianism resemble those qualities. That is to say, our ideas of primary qualities resemble the corresponding qualities (Alexander 195-96).

Someone might deny that the argument has any merit, even while conceding the conditional proposition that if the corpuscularian theory of perception is true, then external bodies resemble ideas with respect to primary qualities. After all, if we are seriously calling the objectivity of primary qualities into question, we cannot pretend at the same time to be certain of the truth of corpuscularianism. Bennett puts the point harshly:

It is true that Locke tries to confute the sceptic by covert appeals to empirical evidence; but even he would see that in the context of the anti-sceptical debate—the veil-of-perception doctrine—open references to ‘physical inquiries’ and to what ‘experience shows us’ would be merely grotesque (1971: 118).

Bennett does not deny that Locke appeals to physical considerations in determining what lies beyond the veil of perception; he just thinks that Locke would have enough shame to hide such appeals behind obscure talk. Bennett seems to identify the project of finding out what lies beyond the veil of ideas with the project of finding certain knowledge about the physical world. He uses the term ‘the veil-of-perception doctrine’ as an appositive gloss on ‘the anti-sceptical debate’. If by ‘the anti-sceptical debate’ Bennett means the debate over whether we
have certain knowledge of the external world, then this is a conflation; someone can surmise what lies beyond her ideas without aiming for certainty.

Someone who believes in a veil of perception has to put her best foot forward in judging what lies beyond that veil. Appealing to the conceivability and intelligibility of a physical hypothesis is a perfectly legitimate response to such a predicament. Locke does not think that we can be certain of the truth of corpuscularianism; at his most cautious, he writes merely that it “is thought to go farthest in an intelligible Explication of the Qualities of Bodies” (4.3.16). Bennett is quite right to insist that Locke would not appeal to such a theory to refute someone who denies that we can have certain knowledge. Nevertheless, since he believes that this hypothesis makes the most sense of experience, he is within his rights to assume its truth for the different project of determining what the world beyond our ideas is like.

A second reason for believing that primary qualities exist out in the world is that they cannot be separated from matter (2.8.9). Locke’s assertion that primary qualities are inseparable from bodies comes almost immediately before his defense of the corpuscularian theory of perception. The structure of the chapter thus allows that he might draw his positive resemblance thesis partially from his inseparability thesis.

In his discussion of inseparability, Locke denies that matter, by presenting us with misleading ideas, only appears to have primary qualities. He puts some effort into assuaging this concern. In case we worry that our hands and eyes deceive us into thinking that figure, bulk, and solidity are out in the world, he assures us that “the Mind finds them inseparable from every particle of Matter, though less than to make it self singly be perceived by our Senses” (ibid.). In case we worry that this reasoning is just groundless theorizing, unconnected to the empirical world, he assures us that primary qualities are “such as Sense
constantly finds in every particle of Matter, which has bulk enough to be perceived” (ibid.).

If primary qualities are inseparable from matter, then, on the supposition that matter exists, primary qualities exist out in the world. (The supposition that matter exists is not the question begging supposition that primary qualities exist in the world. Rather it is the supposition that solid substance exists out in the world, Essay 3.10.15.) If reason can only draw this extra-mental conclusion if the relevant ideas resemble bodies, then the relevant ideas must resemble bodies.

If you find it improbable that someone might reach a conclusion about the nature of our ideas from such considerations about inseparability, consider an earlier seventeenth century treatment of primary and secondary qualities. As I said earlier, Galileo declares that whenever I conceive any material or corporeal substance, I immediately feel the need to think of it as bounded, and as having this or that shape; as being large or small in relation to other things, and in some specific place at any given time; as being in motion or at rest; as touching or not touching some other body; and as being one in number, or few, or many. From these conditions I cannot separate such a substance by any stretch of the imagination (Assayer 274).

Like Locke, Galileo cannot conceive of a body without thinking of primary qualities, and again like Locke, he can conceive of it without thinking of secondary qualities. Galileo “does not feel compelled to bring in as necessary accompaniments” to a body “that it must be white or red, bitter or sweet, noisy or silent, and of sweet or foul odor” (ibid.). Immediately after these statements, he derides secondary qualities by asserting that “without the senses as our guides, reason or imagination unaided would probably never arrive at qualities like these” (ibid.). From his capacity to think of bodies without secondary qualities, Galileo seems to infer that we derive our ideas of secondary qualities from the senses.

He also seems to infer that all such ideas are mere blank effects. Just as Locke compares the generation of our ideas of secondary qualities to the production of a pain by a
fire (2.8.16), Galileo compares their generation to the production of a ticklish sensation by a feather (*Assayer* 275-77).

Locke owns Galileo’s works (*Library* #1208), and Boyle, Locke’s mentor in corpuscularianism, learns Italian in order to read them in the original language (Stewart 1991: xii). David R. Hilbert (3) observes that these passages from *The Assayer* are “a striking anticipation of Locke”, but we should be careful. Locke agrees that mere blank effects cannot represent qualities that are inseparable in the relevant sense. On the other hand, he rejects Galileo’s assumption that ideas of secondary qualities are second rate in virtue of coming from the senses. According to Locke, ideas of primary qualities also come from the senses (2.4 and 2.5). If he is to give us any account of how ideas of primary qualities allow us to perceive the inseparability of primary qualities, he must find some other feature of these ideas that makes them more than mere blank effects. Resemblance is in the air, so he picks that.

8.5 *The Justification of the Negative Resemblance Thesis*

Let us now turn to the negative resemblance thesis, that ideas of secondary qualities do not resemble anything in bodies. Berkeley’s position that no idea could resemble a quality in an unthinking substance does not seem to occur to him. Berkeley, as a matter of fact, takes this doctrine to the extreme of denying that ideas resemble non-ideas with respect to existence or being known: “*Spirits* and *ideas* are things so wholly different, that when we say, *they exist, they are known*, or the like, these words must not be thought to signify anything common to both natures. There is nothing alike or common in them” (*PHK* §142). Locke worries only about the opponent who maintains that our ideas of secondary qualities do resemble qualities existing outside our minds.
Locke believes that the veil of ideas establishes a presumption against thinking that anything like our ideas of secondary qualities inheres in bodies. Nothing about these ideas overcomes this presumption. Therefore, we should not believe that ideas of secondary qualities resemble anything in bodies.

Colors, smells, tastes, and sounds only make their entrance at the end of the corpuscularian story of perception. According to Locke, that we have no reason to think that anything like our ideas of them exists outside the mind. We do not need to appeal to secondary qualities to explain the workings of perception, and we do not find them inseparable from bodies. A critic who accepts Locke’s theory of perception cannot object that we directly see, smell, taste, or hear that external objects are white, stinking, sweet, or loud, since, according to that theory, the immediate objects of perception are ideas. As we have seen, these ideas do not intrinsically represent anything outside themselves.

To persuade his reader that ideas of secondary qualities are subjective states that have nothing in common with their causes, he compares these ideas to pains (2.18.13, 16-18; Atherton 118, McCann 1994: 65-66). He asserts that this comparison reveals the possibility that a cause might not resemble its effect, since it is

no more impossible, to conceive, that God should annex [ideas of color and smell] to such Motions, with which they have no similitude; than that he should annex the Idea of Pain to the motion of a piece of Steel dividing our Flesh, with which that Idea hath no resemblance (2.8.13).

Locke borrows this violent analogy from Descartes (AT 8a.321=CSM 1.284; Maier 1968: 49-50, 66).

With this similarity between the ideas of warmth and pain in hand, Locke argues that no compensating difference allows the reader to conclude that the ideas of color and temperature resemble something out in the world. He asks, “Why is Whiteness and Coldness in Snow, and Pain not, when it produces the one and the other Idea in us; and can
do neither, but by the Bulk, Figure, Number and Motion of its solid Parts?” (ibid.) As I’ll show in the next chapter ‘whiteness’ and ‘coldness’ are names for ideas on Locke’s official semantics. Whiteness, coldness, and pain are here simple ideas, and there is a presumption against thinking that they are features of snow, strictly speaking. This presumption would be overcome if attributing the qualities to bodies did some explanatory work, but in the present case, the primary qualities of the snow produce all the relevant ideas. Locke offers the same presumptive challenge two sections later. He tells us that since pain, sickness, sweetness, and whiteness are “all effects of the operations of Manna, on several parts of our Bodies, by the size, figure, number, and motion of its parts,” it follows that his opponents need to explain “why the Pain and Sickness . . . should be thought to be no-where, when they are not felt; and yet the Sweetness and Whiteness . . . should be thought to exist in the Manna, when they are not seen nor tasted” (2.8.18). He believes that no such reason can be provided and thus that we ought to believe that our ideas of sweetness and whiteness do not resemble anything out in the world.

I mentioned this passage earlier, in treating Locke’s attempts to place the appearances of secondary qualities inside the mind. On taking a second look, we can see it as a clean illustration of the reasoning behind the resemblance theses. The appearances of the laxative are caused by its primary qualities, so we have reason to believe that our ideas of primary qualities resemble something in bodies. No similar reasons can be given for thinking that our ideas of whiteness and sweetness are in the thing, so we should deny that the do, just as we deny that our ideas of pain resemble anything in the gum.

Lucretius argued from the variable colors of objects that they had no color in the dark (DRN 2.799-809; Guerlac 10). Sextus Empiricus appealed to variable appearances as a mode of bringing about the suspension of judgment (Outlines 1.91-99; Bolton 1983). Locke
argues from the variable appearances of the colors in porphyry to the conclusion that ideas of colors don’t resemble anything in the stone.

He asks us to consider the red and white colours in *Porphyre*: Hinder light but from striking on it, and its Colours Vanish; it no longer produces any such *Ideas* in us: Upon the return of Light, it produces these appearances on us again. Can anyone think any real alterations are made in the *Porphyre*, by the presence or absence of Light; and that those *Ideas* of whiteness and redness, are really in *Porphyre* in the light, when ‘tis plain it has no colour in the dark? It has, indeed, such a Configuration of Particles, both Night and Day, as are apt by the Rays of Light rebounding from some parts of that hard Stone, to produce in us the *Idea* of redness, and from others the *Idea* of whiteness: But whiteness or redness are not in it at any time, but such a texture, that hath the power to produce such a sensation in us (2.8.19).

I would reconstruct his premises as follows:

1. **Porphyry is red and white in the light.**

He asks us to consider the red and white colors in porphyry and says that they vanish when we obstruct the light.

2. **Porphyry is not red and white in the dark.**

Locke tells us that porphyry “has no colour in the dark.” According to Samuel Rickless (315), Locke just assumes that bodies lack colors in the dark, and this assumption saps its persuasive force. I think rather that the argument turns on peculiarities of porphyry, a slightly reddish rock with little crystals in it. Up close, the crystals look white and observers can see the reddish color. At a moderate distance, even in good light, the stone looks merely grey.

The third premise is

3. **Neither the presence nor the absence of light causes a real alteration in porphyry.**

This is the obvious assertoric content of the rhetorical question “Can anyone think any real alterations are made in the Porphyre, by the presence or absence of light?”
Peter Geach (71-72) calls the following proposition the Cambridge criterion of change: “The thing called ‘x’ has changed if we have ‘F(x) at time t’ true and ‘F(x) at time t’ false, for some interpretation of ‘F’, ‘t’, and ‘t’.” Geach calls a thing’s meeting the Cambridge criterion without really changing ‘a mere Cambridge change’ as when the number five ceases to be the number of someone’s children. Locke’s premises amount to saying that porphyry loses its red and white colors in a mere Cambridge change (see Heyd 22-23).

For Locke, as we have seen, the qualities that belong to a body as it is in itself are its propria and the determinations of those propria. Thus, in effect, in order for a body to lose a quality that belongs to a body as it is in itself, it has to change texture. I bet he would also grant that a change in composition counts as a change to a body as it is in itself (for discussion see Weatherson and Marshall §2.4). Hindering light from striking a rock doesn’t do either of those things.

There are two more principles that Locke tacitly relies upon to get from the premises to the conclusion. The first is a representational principle:

4. If an idea resembles a quality in a body, then the quality belongs to the thing as it is in itself.

Locke believes that only resembling ideas represent things as they are in themselves (Goldstick 1986, Downing 1998: 389-92). He writes,

the greatest part of the Ideas, that make our complex Idea of Gold, are
Yellowness, great Weight, Ductility, Fusibility, and Solubility, in Aqua Regia,
etc. all united together in an unknown Substratum, all which Ideas, are nothing else, but so many relations to other Substances; and are not really in the
Gold, considered barely in it self (2.23.37).

Locke here asserts that most of our ideas in the complex idea of gold represent relational features and don’t resemble anything in the gold. This suggests (though it does not imply) that, on his view, if an idea represents a relational quality, then it doesn’t resemble a feature
in the body. The conditional statement would make the argument in *Essay* 2.8.19 work, and it fits with Locke’s theory of representation.

The second principle he needs is a metaphysical principle:

5. If a body can lose a quality in a mere Cambridge change, then the quality doesn’t belong to it as it is in itself.

I think that this principle is both ancient (*Theaetetus* 154b) and plausible (Weatherson and Marshall §1.1). Locke’s conclusion is that no reasonable person can believe that “those Ideas of whiteness and redness are really in *Porphyre* in the light” and tells us, “whiteness or redness are not in [porphyry] at any time.” He uses ‘whiteness’ and ‘redness’ as names for ideas here. He is arguing for a special case of his negative resemblance thesis (Bolton 1983: 355).

C. The ideas of red and white don’t resemble qualities in porphyry.

Supplemented with his tacit principles, Locke’s argument is valid.

Locke believes that resembling ideas only represent things as they are in themselves. Because he thinks porphyry changes color without changing its internal constitution, he doesn’t believe that colors belong to objects as they are in themselves. He concludes that our ideas of color don’t resemble anything in bodies.

Near the end of the chapter, Locke offers a diagnosis of “the Reason of our mistake” in believing that ideas of color, sound, and heat resemble something in their causes.\(^\text{83}\) The diagnosis rests on a comparison between the sun’s production of ideas in us and its production of other effects in bodies. When a fair face is sunburned red, we are not tempted to think that the sun is also red, since the sun does not look red. As Locke puts it, “when we see Wax, or a fair Face, receive change of Colour from the Sun, we cannot

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\(^{83}\) The quoted words are from Locke’s table of contents summary of §§24, 25. Palmer (43-47) has a good discussion of these sections.
imagine, that to be the Reception or Resemblance of any thing in the Sun, because we find not those different Colours in the Sun it self” (2.8.25).

In contrast, we cannot compare the ideas that the sun produces in us with the sun itself, so we jump to the conclusion that our ideas resemble something in their cause. Because of our inability

to discover any unlikeness between the Idea produced in us, and the Quality of the Object producing it, we are apt to imagine, that our Ideas are resemblances of something in the Objects, and not the Effects of certain Powers, placed in the Modification of their primary Qualities, with which primary Qualities the Ideas produced in us have no resemblance (ibid.).

We cannot directly inspect the qualities in the object; our ideas get in the way (Palmer 46, Stuart 2013: 86-88). True, on Locke’s considered view, we cannot directly perceive the external bodies involved when the sun burns a fair face. In spite of that, we can set the image of the sun next to the image of the face and compare. Through this comparison, we may indirectly compare the external bodies. No similar proxies are available for a comparison between the idea of a secondary quality and its cause.
Chapter 9    Meaning and Secondary Qualities

9.1    Semantics without Resemblance

Locke thinks the corpuscularian theory of perception entails that ideas of secondary qualities don’t resemble anything in bodies. Given the standard account of semantics at the time, it would follow that positive judgments about secondary qualities would all turn out false. Analyzing secondary qualities as powers to produce ideas gives us a way of saving the truth of such judgments.

The central text of scholastic philosophy of language is in the opening chapter of de Interpretatione (Ashworth 1981). There Aristotle asserts, “just as written marks are not the same for all men, neither are spoken sounds. But what these are in the first place signs of—affectations of the soul—are the same for all; and what these affectations are likenesses of—actual things—are also the same” (16a6-8). Different words in different languages immediately signify ways that the soul has been affected, and these words indirectly signify things that these affections resemble.

The syncretic character of medieval philosophy and its reliance on Aristotle provided the late scholastics with “a unified theory of knowledge” (Tachau xvi). The same intentional species that multiply across the air are the first intentions that allow language to move from mind to world in the main tradition of medieval semantics (Pinborg 59-60). Since Locke believes that ideas of primary qualities resemble qualities in bodies, he can help himself to the Aristotelian account for primary qualities, and when we look at his account of applied geometrical knowledge that’s what we find. Since he denies that our ideas of secondary qualities resemble anything in objects, he can’t use that account for those qualities. He needs
a different bridge from mind to world to make sense of our application of color words to bodies.

The basic solution is straightforward. As a substitute for resemblance, Locke proposes that simple ideas of secondary qualities represent through causation. “Simple Ideas”, he writes, “represent to us Things under those appearances which they are fitted to produce in us” (4.4.4). That is, they represent the things that cause them.

Locke doesn’t limit himself simple ideas of secondary qualities here and, in some contexts (e.g Essay 2.4 and 2.5), he counts ideas of primary qualities as simple. The examples that Locke gives at Essay 4.4.4 are of ideas of secondary qualities, but there’s a way of considering ideas of primary qualities as mere sensory effects of external objects. Such judgments as the tiny speck next to the moon is Jupiter and the rectangles on the horizon are grain silos can be true even though Jupiter isn’t tiny and silos aren’t rectangles.

Locke believes that the redness, the squeakiness, and the sourness that you find in your field of ideas don’t resemble anything out in the world. He would not, however, be at all happy to say that our judgments about color, sound, smell, and taste are all false. He wants our ideas of secondary qualities to provide us with knowledge (4.4.4), and he recognizes that ordinary judgments about these qualities allow us to distinguish objects for our uses (2.32.15). These anti-skeptical and pragmatic attitudes push him to interpret ordinary utterances about secondary qualities so that they come out right.

According to Locke, we can do that by analyzing secondary qualities as powers: “if Sugar produce in us the Ideas, which we call Whiteness, and Sweetness, we are sure there is a power in Sugar to produce those Ideas in our Minds, or else they could not have been produced by it” (2.31.2; Ayers 1991: 1.38-39). Since on Locke account, something is rightly called white if it produces the ideas of whiteness, we can know that there is something white
out there when the relevant simple ideas are produced: “whilst I write this, I have, by the Paper affecting my Eyes, that Idea produced in my Mind, which whatever Object causes, I call White” (4.11.2). The move allows philosophical judgments about secondary qualities to count as knowledge strictly so called. If our only acquaintance with a body is with the idea of blue that the body produces, we can still be certain that the body is blue, at least in the stipulated sense. His claim that secondary qualities are powers to produce ideas in us is not a description of certain objects in the world, but rather an attempt to describe how our secondary quality predicates work.84

84 Locke defines ‘secondary qualities’ as “Such Qualities, which in truth are nothing in the Objects themselves, but Powers to produce various Sensations in us by their primary Qualities” (2.8.10). He defines ‘quality’ as “the Power to produce any Idea in our mind” (2.8.8). Assuming that not all qualities are secondary qualities, commentators have some explaining to do. The problem splits scholars who take his definition of qualities as powers to produce ideas in us seriously (Curley §3, Bolton 1976: 306-07, J. Campbell 568-70, Alexander 165) from those who treat it as a mere slip (R. Jackson 1929: 71, Maier 1968: 65, Cummins 408-10, Mackie 1976: 11-12, Stuart 2003: 70). Which of these definitions should we take more seriously? What was Locke thinking when he offered these strangely overlapping definitions?

With respect to the first question, there are at least three reasons to take the definition of secondary qualities more seriously. First, only it is supported by other texts. If the definitions in §§8 and 10 were both deleted, we would have no idea that Locke ever considered primary qualities to be powers, but we would have plenty of texts where he declares secondary qualities to be powers (e.g. 2.23.8, 2.31.2), including passages in Book II, Chapter 8 where he is contrasting secondary qualities with primary ones (e.g. §§15, 22-23, 26; Stuart 2003: 70, Stuart 2013: 35-6). Second, Locke denies that primary qualities are powers by writing, “the simple Ideas whereof we make our complex ones of Substances, are all of them (bating only the figure and Bulk of some sorts) Powers” (2.31.8, Stuart 2003:70--‘bating’ means ‘with the exception of.’). Third, since imperceptibly small pieces of flour don’t have powers to produce ideas in us, we can easily reconstruct a sound argument against the thesis that primary qualities are such powers from materials that Locke provides us. Sound arguments for interesting conclusions are so rare in philosophy that I would hate to think that he stumbled across one without realizing it.

Even though Locke’s definition of quality as a power to produce ideas doesn’t cohere with the rest of the Essay, I think that something can be said about why he offered it. As Leibniz observes, Locke uses the word ‘power’ in at least two different ways (New Essays 216). His usual sense of ‘power’ is deflationary. On this account, powers are merely capacities to do things and not explanatory entities. We might call these ‘bare powers’ (a term Locke uses at 2.8.25) or dispositions. To say that a bare power such as ‘the digestive Faculty’ answers the question “what it was that digested the Meat in our Stomachs . . . is, in short to say, That the ability to digest, digested” (2.21.20). A different, explanatory notion of power shows up at 2.22.11. Locke there asserts, “Power being the Source from whence all Action proceeds, the Substances wherein these Powers are, when they exert this Power into Act, are called Causes.” We might call these ‘robust powers’. When Locke characterizes qualities as powers to produce ideas in us, he is mixing bare powers and robust powers (Bolton 2001: 111). Primary qualities are powers in the sense that they are responsible for producing the relevant ideas. A body produces sensations “by Reason of its insensible primary Qualities” (2.8.23). Secondary qualities are powers in the sense that having a secondary quality entirely consists in being able to produce a certain idea in perceivers. Such powers don’t give a serious explanation of the corresponding actuality.
If an object produces the right idea, the relevant secondary quality predicate applies, whether or not the object resembles the idea. A violet that produces the idea of blue “is equally from that Appearance, to be denominated Blue, whether it be that real Colour, or only a peculiar Texture in it, that causes in us that Idea” (2.32.14). In this manner Locke saves the truth and certainty of our useful ordinary assertions about secondary qualities in the face of his thesis that ideas of secondary qualities do not resemble anything in bodies. On his account a thing is properly called red if it has the power to produce the idea, redness, in us.

In order to illustrate this thesis, Locke invents the inverted spectrum hypothesis. He draws the consequence that there would be no “Imputation of Falshood to our simple Ideas, if by the different Structure of our Organs, it were so ordered, That the same Object should produce in several Men’s Minds different Ideas at the same time” (2.32.15). The relevant idea that determines whether an object is to be called ‘red’ is thus only a particular idea in the speaker’s head, and this can’t steer us wrong, even if the inverted spectrum hypothesis is true, and other people see things in a radically different way (Ayers 1991: 1.207-09).

Treating our ideas of secondary qualities as representing the things that produce them helps us to make our way in the world. Appearances allow us “to distinguish the sorts of particular Substances, to discern the states they are in, and so to take them for our Necessities, and apply them to our Uses.” Locke therefore concludes,

The Idea of Whiteness, or Bitterness, as it is in the Mind, exactly answering that Power which is in any Body to produce it there, has all the real conformity it can, or ought to have, with Things without us. And this conformity between our simple Ideas, and the existence of Things, is sufficient for real Knowledge (4.4.4)

He recognizes that ordinary judgments about secondary qualities are useful, and he thinks that justifies treating them as a source of knowledge. If we insisted on resemblance for
representation and truth, then lovers of truth would have to do without judgments of secondary qualities. But that would be inconvenient. So we should make do with mere blank effects for lack of anything better.

A sign of the semantic theory underneath Locke’s analysis of secondary qualities can be found just after he offers the deflating conclusion that ideas of secondary qualities don’t resemble anything in bodies. He gives the following analysis: “Flame is denominated Hot and Light; Snow White and Cold; and Manna White and Sweet, from the Ideas they produce in us” (2.8.16). The seventeenth-century notion of ‘denomination’ is closely tied to Aristotle’s notion of paronymy. Latin textbook writers had translated the Greek word as ‘denominativa,’ (for example, Phillipe Du Trieu in Manuductio 16). At least one seventeenth-century logician used the plural noun ‘denominates’ to translate Aristotle’s term ‘parōnuma’ (Art 142; Stuart 2003: 64, 94n17). In paronymy, Aristotle writes, “things get their name from something with a difference of ending” as “for example, the grammarian gets his name from grammar, the brave get theirs from bravery” (Categories 1a12-15). Locke has, in effect, overcome the problem of getting from words to things for secondary quality words by appealing to another bit of Aristotelian semantic apparatus, paronymy.

Chalk and snow are rightly called ‘white’ but the idea of whiteness isn’t. We may draw this lesson from an argument that he offers to show that the will cannot be rightly called free, since it isn’t an agent. “If Freedom can with any propriety of Speech be applied to a Power,” according to Locke, it would be applied to the capacity to act or forbear by choice, which capacity is freedom on his analysis. “But,” Locke complains, if any one should ask, whether Freedom were free, he would be suspected, not to understand well what he said; and he would be thought to deserve Midas’s Ears, who knowing that Rich was a denomination from the possession of Riches, should demand whether Riches themselves were rich (2.21.16).
This a paronymy joke with an Ovid reference thrown in, so the humor hasn’t aged well.

Let me explain the joke. Locke believes that no power can be free, and he illustrates this claim with the power to move or refrain from bodily motion in accordance with choice.

This power is properly called ‘freedom,’ and when a person has the power, that power “is that which denominates him free, and is Freedom it self” (ibid.)—that is, having the power named ‘freedom’ is what makes it appropriate to call a person free. According to Locke, it follows from the fact that a person is denominated ‘free’ from a certain power that the power is not itself free. For instance, a person who knows “that Rich was a denomination from the possession of Riches” would be a fool if he went on to ask whether riches are themselves rich. (Midas had preferred Pan’s pipes to Apollo’s lyre, so Apollo gave Midas donkey’s ears to suit his judgment.) More generally, only a fool would wonder whether $\psi$ might be F when $\phi$ is denominated F from $\psi$. If ‘redness’ denotes an idea, and things are denominated ‘red’ by causing such ideas, then, on Locke’s view, it’s a crude mistake to think that the idea should be described as red.

More details behind Locke’s account of how we denominate bodies with words for secondary qualities can be found in his chapter on abstract and concrete terms, Essay 3.8, where he presents a partial semantics for the term endings. In his treatment, abstract terms denote universals and the corresponding concrete terms are used to describe how particular things instantiate those universals. Abstract terms are “Names of abstract Ideas” (3.8.1) and they’re what we use when we want to talk about such ideas. His examples of abstract terms include ‘humanity,’ ‘animality,’ ‘rationality,’ and ‘whiteness.’ They are set off by the suffixes ‘-ity,’ ‘-ness,’ ‘-ice,’ and, in some Latin examples, ‘-itas’ and ‘-ietas’.

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85 The story is in Book 11 of Ovid’s *Metamorphoses.*
The distinction between the two sorts of terms stems from Anselm and something like it was widely adopted after him (Spade 1988). Locke takes it from the scholastic textbooks that he used to teach his students at Oxford. In the opening pages of his *Compendious Philosophy*, Scheibler distinguishes among simple words as “either 1. Concrete, which expresses something fusedly [concretim], that is to say, jointly, for example, ‘expert’ or 2. Abstract, which indicates something separated off from all other things, for example, ‘expertise’” (*Philosophia* Bk. 1 Sect. 1, Ch. 1 p. 9). Scheibler’s point is that concrete words such as ‘doctus’ refer to a composite of human being and learning, while ‘doctrina’ indicates the learning on its own.

When Locke says that abstract terms name abstract ideas, he means that we use those words to talk about our abstract ideas. We can have more than one motive for wanting to talk about such ideas. When Locke uses secondary quality words to denote ideas, he’s often illustrating his conceptions of intuitive and demonstrative knowledge. So, in defense of his definition of knowledge, he rhetorically asks, “For when we know that *White is not Black*, what do we do else perceive that these two Ideas do not agree?” (4.1.2). Knowledge of musical truths takes the same form. Words name the ideas of notes and we perceive the relation between the ideas:

If a man by frequent heareing & contemplateing of sounds can at pleasure revive in his minde the destinct Ideas of the severall notes of musick, he as certainly knows that where ever that note exists which he calls C faut [C below middle C] it is 3 notes off or higher then that he calles Gamut [G], as he knows that the outward angle of the extended side of a triangle is where ever it exists as big as the two opposite inner angles (*Draft B* §45; Shapiro 581)

If we could measure the degrees and shades of sounds and colors, he believes, we could then have the same certain knowledge by perceiving the agreement of these ideas that we get by
perceiving the ideas of geometry. In such contexts, which are quite common in Locke, he uses secondary quality words to denote ideas.

All general terms signify abstract ideas (3.1.6, 3.1.12), but we don’t always want to talk about our ideas. In ordinary assertions about external things, we use concrete terms, such as ‘man,’ ‘animal,’ ‘rational,’ and ‘white’. Such assertions, according to Locke, “are only in concrete, which is the affirming, not one abstract idea to be another, but one abstract Idea to be join’d to another” (2.8.1). The joining is through external things and the details depend on the logical form of the proposition.

When we say that ‘a man is white’ we mean that some external object falls under the abstract ideas signified by ‘man’ and ‘white’: “a Man is White, signifies, that the thing that has the Essence of a Man, has also in it the Essence of Whiteness, which is nothing but a power to produce the idea of Whiteness in one, whose Eyes can discover ordinary Objects” (ibid.). For our purposes, we should attend to the account of what it is for a body to fall under the abstract idea of white. Something has the essence of white, if it has the power to produce the idea of whiteness in those who aren’t blind.

Someone might object that Locke has gotten himself into a vicious circle. A body is white if it produces an idea of whiteness, but we move back to where we started if an idea of whiteness is just an idea that represents the quality white. The criticism misunderstands the relevant sense of ‘of’ in ‘idea of whiteness.’ For Locke, ‘whiteness’ is, strictly speaking, the name of an idea, and the relevant ‘of’ is a genitive of specification as in ‘city of Detroit’ or ‘feeling of anger’. When Locke says that fire produces an idea of pain in us at Essay 2.8.16

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86 The locution ‘idea of Φ’ doesn’t always work like that in Locke’s work. The idea of God isn’t God, for example.
and 2.9.3, he doesn’t mean that it produces a representation of pain. He means that it produces pain, which is an idea.

The value of Locke’s treatment is not that it accurately captures the semantics of ordinary language. It doesn’t even always capture his usage through most of the Essay. Incompatibly with his official account, he describes “Yellowness” as “a Power in Gold,” and not as an idea at 2.23.10. Along the same lines, he doesn’t use the word ‘lightness,’ in the Essay except once (4.16.4) meaning frivolity; he argues at 3.4.10 that ‘light’ is “properly” a name for an idea, though, by extension, the word may denote the cause of that idea. At 4.7.4, ‘Red’ and ‘Blew’ seem to be names of ideas.

On the other hand, the doctrines that abstract terms are names of ideas and that concrete terms are satisfied by external things fit pretty well with Locke’s usage in Essay 2.8. Where he uses an abstract term such as ‘whiteness’ (§§16-19, 24), ‘coldness’ (§§16, 17), ‘sweetness’ (§18), ‘redness’ (§19) and ‘softness’, (§24) he uses it to name an idea, while concrete terms such as ‘white’ (§§16, 19, 20, 23), ‘cold’ (§§16, 21), and ‘sweet’ (§16) are predicated of external objects. Locke’s remarks about the denomination of objects by concrete secondary quality terms at 2.8.16 and his remarks about the truth conditions for ‘a man is white’ in 3.8.1 may be properly reconstructed as a proto-Tarskian semantics for secondary quality words. An object satisfies the predicate “is white” just in case the object has a power to produce the idea of whiteness. Since we want to understand Locke’s analysis of secondary qualities, it’s helpful that his semantic theory and his semantic practice align in the chapter on secondary qualities.

87 I don’t think that Locke would say that all ideas of pain hurt. He says that the idea of the sun that we have in memory is less vivid than the one we receive in perception (4.11.5). I bet he would say the same thing about the remembered idea of pain.
As conceptual guidance for philosophers, the distinction between abstract and concrete terms points to the importance of distinguishing between descriptions of colors, sounds, smells, and tastes, and describing things as being colored, noisy, smelly, or tasty. Used as a noun, a secondary quality word names a characteristic. The corresponding adjective describes something else as having the characteristic. So, for example, in ‘red is a warm color,’ ‘red’ names the color red. In ‘the smell of cut grass is like the smell of unripe almonds,’ ‘the smell of cut grass’ and ‘the smell of unripe almonds’ are noun phrases that refer to smells. In ‘for middle C, the fifth is G,’ ‘middle C’ and ‘G’ name tones. In sentences such as ‘tomatoes turn red as they ripen,’ ‘the dessert is too sweet,’ and ‘the cello sounds especially mellow’ secondary-qualities words are being used adjectivally and predicated of tomatoes, a dessert, and a cello.

Syntax and morphology can’t do our thinking for us. Both ‘animal’ and ‘animality’ are nouns. Nor is every reference to the common sorts behind secondary qualities set off by a special suffix. ‘Red’ is a simple word that can refer to the general color and ‘smells like anchovies’ is a verb phrase. Still, sometimes we want to talk about universals and sometimes we want to talk about how things are, and it’s important to keep the objects of our talk straight.

I mentioned earlier that Locke uses concrete words as names for ideas at Essay 4.7.4. Indeed, whenever he uses the concrete word ‘red’ in the Essay as a name (as opposed to using it as a predicate), and it’s unambiguous whether it names an idea or a quality, it always names an idea (2.3.1, 2.18.6, 2.32.9, 3.4.11, and 3.4.16). This isn’t what we would expect in light of the discussion of concrete and abstract terms at Essay 3.8. Nor, for that matter, is it what we would expect in light of Locke’s thesis that secondary qualities are “Powers to
produce various Sensations in us” (2.8.10). The word ‘red’ is short, however, Locke is interested in talking about his ideas, and nothing much hangs on precision here.

According to Frank Jackson and Robert Pargetter, Locke “wavered between saying that [science] taught that colour was a property of experiences (ideas), not objects, and saying that it taught that colour was the disposition in objects to produce those experiences” (127). Locke didn’t contradict himself about the lessons of science, I don’t think. The vacillation in his treatment, such as it is, is due to a variation of intent. Sometimes he wants to discuss ideas, and sometimes he wants to discuss the conditions under which bodies are colored.

On Locke’s official semantics ‘redness’ denotes the idea of red, and roses and fires get called ‘red’ as paronyms, that is, derivatively and with a change of ending. When Locke writes, “Flame is denominated Hot and Light; Snow White and Cold; and manna White and Sweet, from the Ideas they produce in us” (2.8.16), this should be in light of his official semantics. He names the ideas that snow produces in us ‘whiteness’ and ‘coldness,’ and he thinks that snow is called ‘white’ and ‘cold’ derivatively from the names of those ideas. A snowball is rightly called ‘white’ and ‘cold’ because it produces ideas of whiteness and coldness.

In the Meditations, Descartes calls treating ideas as similar to things outside of him as the “principal and most frequent error” in judgment (AT 7.37=CSM 2.26). As a way of avoiding this error when thinking about color, he proposes restricting our color judgments to asserting that something in the body is producing a certain sensation in us. “We can’t understand any similarity between the color that we suppose to be in objects and that which we experience to be in sensation,” so we should limit ourselves to judging that “we perceive something in bodies, whose nature we are ignorant of, but which produces in us a certain very manifest and conspicuous sensation” (AT 8a.34=CSM 1.218 PP 1.70). When a body
produces a sensation in us, we should restrict ourselves to judging that there’s a body that
produces a certain sensation in us. The analysis is an act of epistemic hygiene intended to
keep us from making judgments that we don’t clearly and distinctly perceive to be true.

Locke is also keenly worried about the mistake of thinking that our ideas of
secondary qualities resemble something in bodies. His remedy is semantic. Partly, he’s
motivated by the Cartesian desire to construct philosophical certainty out of problematic
sensations. He also wants to preserve the truth of ordinary judgments about secondary
qualities made by ordinary people.

This is the part of the book in which the hero becomes the captain of his own
philosophy. Elsewhere, I’ve described Locke as the dupe of his circumstances, describing
phenomena as universal that are actually local products of his commitments or contingent
recent discoveries. Here I’m describing his persuasive and influential solution to the problem
of how corpuscularians can save the truth of secondary quality judgments. It’s worth seeing
how Locke uses semantics to ease one of the dislocations caused by the scientific revolution,
both because the thesis is famous and also as a reminder that transformations in physics
needn’t force us to abandon useful ways of talking.

Throughout this book, I’ve been emphasizing the relevance between Locke’s
scientific interests and his treatment of primary and secondary qualities. In an important
paper, Margaret Wilson observed this continuity in Locke and its revival in analytic
philosophy, and asked, “If philosophical work, at least in some areas, is no longer supposed
to be independent of scientific results and theory, then what is its specific and peculiar role in
telling us in what, say, the nature of colors consists?” (1999c: 481) Locke provides us with
one answer to this question. Philosophical analysis can show us how to preserve ways of
thinking and talking that are important to human life in the face of scientific discoveries that make those ways of thinking and talking precarious.

9.2 The Irreality of Powers and the Flexibility of Usage

So far as we know, the oldest way to contrast secondary and primary qualities is with respect to their reality. According to Democritus, “By convention color, by convention sweet, by convention bitter: in reality atoms and void” (B125). What he means by this is controversial, both now and in antiquity (Lee 22-28).

For Locke, primary qualities are real beings and secondary qualities are not. He complains that our terminology is misleading: “the Things producing in us these simples Ideas, are but few of them denominated by us, as if they were only the causes of them; but as if those ideas were real Beings in them” (2.31.2). With respect to predicates of fire, Locke argues, the word ‘painful’ is well-framed, while ‘hot’ and ‘light’ are misleading: “though Fire be call’d painful to the Touch, whereby is signified the power of producing in us the Idea of Pain; yet it is denominated also Light, and Hot; as if Light and Heat, were really something in the Fire, more than a power to excite these Ideas in us” (ibid.). The complaint is not that the words ‘light’ and ‘hot’ don’t fit his recommended semantics for abstract and concrete terms. Rather, the problem is that our secondary-quality predicates suggest a false ontology. The contrast he draws with ‘painful’ implies that he thinks that it would be more accurate to call fire ‘lightful’ and ‘hotful.’ Our present terminology misleads us into thinking that light and hot are “real Beings” in the fire. If they wore their dispositional nature on their sleeves, they wouldn’t mislead us in that way.

Rejecting the existence of secondary qualities as real beings does not commit a philosopher to believing that no object is rightly described as colored, noisy, tasty, smelly, or
warm. One may believe barns are red without believing that any rednesses, either particular or universal, inhere in them (Quine 10).

By way of analogy, suppose that a philosopher believes that red and green are real beings in bodies and that a body is rightly called ‘red’ when and only when it possesses the real being red and that it is rightly called ‘green’ when and only when it possesses the real being green. That philosopher could stipulate that a body is rightly called ‘gred’ if it possesses either red or green. The predicate ‘gred’ doesn’t need to correspond to a real being gred in order for it to be satisfied by red and green bodies. All that’s needed are red and green. The truth conditions do the rest of the work.

Likewise, Locke doesn’t believe that making sense of the truth that honey is sweet requires positing the existence of sweetness as a real being in honey. Instead, it requires an idea of sweetness in us, certain textures in honey and in our bodies, and some general principles governing body-mind interactions. His stipulated truth conditions do the rest of the work.

The point isn’t just that secondary qualities aren’t substances. Primary qualities aren’t substances either and they’re real beings in the relevant sense. The point is that we don’t have to posit secondary qualities existing as entities in bodies in order to explain how our secondary quality predicates operate. 88

Galileo had written, “tastes, odors, colors, and so on are no more than mere names so far as the object in which we place them is concerned, and . . . they reside only in the consciousness” (Assayer 274), and Locke’s work may be taken as an elaboration on that theme. Concrete secondary quality terms rightly apply to bodies, but the only existing entities denoted by our secondary quality words are ideas. A realist might object that such

88 My interpretation according to which Lockean secondary qualities aren’t real beings but have an explanatory foundation in bodies fits nicely with Ott’s (2009: Ch. 19) reading of Lockean relations as ideal entities with foundations in the world.
philosophers have no account of why all these things are red, if not for the presence of a
universal or a trope. Locke has a reply: these objects are red because they are apt to produce
ideas of red in us. Concrete secondary-quality terms rightly apply to bodies, but the only
existing entities denoted by our secondary-quality words are ideas.

When Locke denies that faculties are real beings, he doesn’t mean to “deny there are
Faculties both in the Body and Mind: they both of them have their powers of Operating, else
neither the one nor the other could operate. For nothing can operate, that is not able to
operate; and that is not able to operate, that has no power to operate” (2.21.20). That is to say:
to have the power to Φ is just to be able to Φ. Locke is happy with talk of powers and
faculties when “cloathed in the ordinary fashion and Language of the Country” and intended
for a general audience (ibid.) Such talk may be paraphrased away by talking about what a
thing is able to do.

In accordance with this analysis, he asserts that some scholastic theorizing about
powers rests on a mistake:

For it being asked, what it was that digested the Meat in our Stomachs? It
was a ready, and very satisfactory Answer, to say, That it was the digestive
Faculty . . . . What moved? The Motive Faculty: And so in the Mind, the
intellectual Faculty, or the Understanding, understood; and the elective Faculty, or
the Will, willed or commanded: which is in short to say, That the ability to
digest, digested; and the ability to move, moved; and the ability to
understand, understood. For Faculty, Ability, and Power, I think, are but
different names of the same things (Ibid.).

Some renaissance thinkers thought that psychology was the study of the faculties of the soul
and treated these faculties as something more than mere potentialities (Park 465-88). “This
way of Speaking of Faculties,” Locke complains,

has misled many into a confused Notion of so many distinct Agents in us,
which had their several Provinces and Authorities, and did command, obey,
and perform several Actions, as so many distinct Beings; which has been no
small occasion of wrangling, obscurity, and uncertainty in Questions relating

to them. (2.21.6)

This criticism was over a century old by the time Locke made it (Park 476-80). In fact, John
Passmore (162n) argues that Locke lifted part of his discussion from Ralph Cudworth’s
‘Treatise of Freewill’ (see also Darwall 172-75). According to the alternative treatment that
Locke here endorses, to say that something has a power to bring about an effect is not to
put one’s finger on what aspect of that thing brings about that effect. All that one is saying is
that the thing is able to bring about the effect.

Locke tells us that he calls bulk, figure, number, situation, and motion or rest “real Original,
or primary qualities, because they are in the things themselves, whether they are perceived or
no: and upon their different Modifications it is, that the secondary Qualities depend” (2.8.23;
Rickless 305, Stuart 2003: 93n5). He calls them real (and original and primary) because they
belong to things as they are in themselves, they belong to imperceptible bodies, and because
they are explanatory. That isn’t his analysis of what it is to be a real quality. Instead, those are
his reasons for believing that primary qualities, unlike secondary qualities, are real beings,
inhering in bodies.

Locke’s denial that secondary qualities are real beings accounts for his careless
attitude towards certain questions. Some dispositionalists about secondary qualities say that
objects have the ones that they seem to have as they appear to standard observers in
standard conditions. Is Locke among them? Sometimes he takes the ordinary conception that
bodies have the secondary qualities that they appear to have to standard observers under
standard conditions. At 3.8.1, he says that things are called ‘white’ if they can produce the
idea of whiteness in people whose eyes can see ordinary objects. At 2.23.10, he appeals to
ordinary lighting conditions: “to speak truly, Yellowness is not actually in Gold; but is a
Power in Gold, to produce that Idea in us by our Eyes, when placed in a due Light” (Stuart
2003: 95n28, 2013: 116n35). Locke’s account of seeing a uniformly colored sphere as “a flat Circle variously shadow’d” (2.9.8) implies that a solid jet sphere is uniformly black even though it presents the mind with a variety of ideas of colors.

On the other hand, Locke sometimes writes as if he believes that everything has the secondary qualities that it seems to have in those circumstances regardless of the circumstances (Rickless 307-08). He uses this incorrigible conception of secondary qualities when he wants to show how well simple ideas represent the world. So, “if Sugar produce in us the Ideas, which we call Whiteness, and Sweetness, we are sure there is a power in Sugar to produce those Ideas in our Minds, or else they could not have been produced by it” (2.31.2, compare 2.30.2, 2.31.12, 2.32.16; Ayers 1991: 1.38-39, Stuart 2003: 76). “And this conformity,” Locke tells us elsewhere, “is sufficient for real Knowledge” (4.4.4, compare 4.11.2). He also seems to endorse the incorrigible conception of secondary qualities at 4.6.11, where he asserts that if we “put a piece of Gold any where by it self, separate from the reach and influence of all other bodies, it will immediately lose all its Colour and Weight.” The relevant invisible fluid that sustains the color of gold is presumably light or its medium. He thus implies that objects lose their colors in the absence of light, and so color is not solely determined by the appearance of objects in standard lighting conditions (Stuart 2003: 68).

In accordance with the incorrigible conception, what color are objects when no one is looking at them? Not the color they would seem to have to standard observers in standard conditions, we might think, or the conception would collapse into the ordinary one.
Not the color that the object might seem to some possible observer, or each unobserved object will have every possible color.\footnote{89 Thus, if we push hard in a certain direction on the incorrigible conception of secondary qualities, we will end up with something like Stuart’s reading (2003) that bodies are only colored when they are being observed.}

If secondary qualities aren’t real entities that exist in bodies then philosophers need not investigate deeply the conditions under which they come and go. Not believing that secondary qualities are real beings allows Locke a certain degree of flexibility in his treatment of their semantics. He exploits this flexibility by offering different semantics in different passages, depending on the task at hand.\footnote{90 My way of looking at this is contrary in spirit to Hannah Dawson’s, who emphasizes Locke’s “general abhorrence at licentious uses of language” (213). I’m not sure that we disagree about any concrete particulars, however. I concede that Locke calls “Inconstancy in the use of” words, “plain cheat and abuse” (3.10.5), but he isn’t trying to deceive anyone or to score points with his analyses of secondary quality talk. It’s important to him that ordinary secondary quality judgments would still be true even if the scholastic theory of perception were true and our ideas of secondary qualities did resemble something in bodies (2.30.2, 2.32.14).}

In light of Locke’s metaphysics, his vacillation between ordinary and incorrigible conceptions of secondary qualities is a mere variation of usage that could be nicely handled with his distinction between civil and philosophical uses of language. “By their civil Use,” Locke means, “such a communication of Thoughts and Ideas by Words, as may serve for the upholding common Conversation and Commerce, about the ordinary Affairs and Conveniencies of civil Life, in the Societies of Men” (3.9.3). If we are using words with these purposes in mind, of course we want to distinguish between red and green paint, even if the paint is in sealed canisters and the canisters are in a dark storeroom. In such contexts, we ought to use the ordinary conception for our secondary-quality predicates.

“By the Philosophical Use of Words,” Locke means, “such an use of them, as may serve to convey the precise Notions of Things, and to express, in general Propositions, certain and undoubted truths, which the Mind may rest upon, and be satisfied with, in its search after true Knowledge” (ibid.). The infallible conformity of our simple ideas with the
corresponding powers in bodies is a plank in Locke’s account of the reality of our knowledge of the external world. The incorrigible conception of secondary quality predicates can be construed as a semantic solution to an epistemic problem.

If we are willing to grant Locke that an idea of red is produced in us every time an object appears red, we could stipulate either that the predicate ‘red’ applies to a thing if and only if it produces that idea in normal observational conditions or that the predicate applies if the thing does or would produce that idea, whether the circumstances are normal or not. On the civil use of our secondary quality predicates, bodies have the colors they would seem to have to standard observers under standard conditions. On the philosophical use of our terms, bodies have exactly the colors that they seem to have. The former stipulation is better for practical purposes, while the latter is part of Locke’s project of vindicating sensitive knowledge. This explains the variations in his usage.91

Bodies will be colored whether we speak with the crowd or with the philosophers. If secondary qualities aren’t real beings, then Locke may reasonably alternate between such views, depending on context. There is nothing to keep us from decreeing that an object is properly described as ‘red’ if it appears red to some observer (Bennett 1968: 115). The workings of our predicates are largely up to us.

Against my opinion, Lionel Shapiro replies, “it isn’t clear how the workings of our simple ideas could be up to us” (582n54). The causal connection between world and idea isn’t up to us. What’s up to us whether to use the word ‘sour’ in its civil or philosophical senses. That is, it’s up to us whether to say that a glass of orange juice is bitter if it produces the idea of bitterness in someone who has just brushed her teeth. I believe this is true of

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91 This distinction gives us one way of solving Antonia LoLordo’s (2008) puzzle of how Locke can make sense of perceptual error in light of his doctrine that simple ideas are all true. For Locke, we can also go wrong by supposing that an idea (either primary or secondary) resembles a quality in a body if it doesn’t actually.

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language as it is spoke. Given Locke’s willingness to present his analysis in terms of what we call white or sweet, the variations in his analyses of secondary qualities, and his denial that secondary qualities are real beings, I think he believes the same thing.

If the best scientific view of a time seems to conflict with a common and useful linguistic practice, a clever philosopher can make the two compatible though the invention of an appropriate semantics. Figuring out ways to make useful common practices and ways of talking compatible with the sciences can give depth to ordinary ways of talking and bring out the practical meaning of scientific theories. Locke’s analysis of secondary qualities is an exemplar of that sort of philosophy.

I don’t think that Locke is right to say that porphyry loses its red color in the dark, but I don’t think that matters much. People can disagree about whether ordinary objects change colors in unusual circumstances and about whether unusual objects change colors in different ordinary circumstances without disagreeing about the underlying physical facts. If there’s a common explanatory structure underlying a disposition to produce a certain appearance, then a predicate can track either the disposition to produce the appearance or the underlying structure. Locke’s treatment of light and some other qualities he describes as secondary shows that he’s alive to such possibilities.

Let us consider the red in porphyry. Is Locke’s assertion that it has no color in the dark any more plausible than the analogous premise that roses are not red in the dark? There is at least this difference: in dim light, porphyry looks dark gray. In fact, indoors at a distance of about ten feet the rock looks dark gray. In spite of the fact that porphyry looks as if it isn’t reddish in dim light, my first instinct is to say that porphyry is reddish all the same. The fact that it does not look that way in all circumstances merely reveals the limits of our eyesight.
Since this instinct may be a prejudice, we should try to consider the issue from a seventeenth century point of view. Scientific revolutionaries doubted that they should always study natural phenomena under natural conditions. According to Francis Bacon (NO pp. 20-21), “the nature of things betrays itself more readily under the vexations of art than in its natural freedom” (NO 1.98; Merchant 2012). This suspicion of natural conditions extends to natural viewing conditions; many of the great discoveries of the age are made with the microscope and the telescope. Boyle and Newton reject natural light as the best illumination for all research when they recommended darkening the room before carrying out experiments with prisms (Opticks e.g. 21, 24, 28.; Guerlac 19). Still, for all that, we might think that porphyry does not look red in the dark because there is not enough light for us to see that it is red.

In 1830, a gemstone was discovered that would have served Locke’s purposes better than porphyry. This stone, alexandrite, interacts with light in roughly the same manner as ruby and emerald (Nassau 89). A chromium impurity in an otherwise colorless background causes the color of all three gems. Differences in the background electrical field surrounding the chromium bring about the dramatic differences in their colors. An electrical field that is weaker than the corresponding field in rubies but stronger than the one in emeralds surrounds the chromium atoms in alexandrite. Alexandrite’s spectral transmittance pattern is also intermediate between ruby’s and emerald’s. According to Kurt Nassau:

The resulting appearance is quite unexpected: in blue-rich daylight or the similar quality light from a fluorescent lamp . . . we see an intense blue-green color, somewhat resembling emerald, while in red-rich candle light or the light from an incandescent lamp we perceive a deep red color, somewhat resembling a ruby . . . . Nature has found a way of avoiding the almost impossible task of providing a color truly intermediate between the green of emerald and the red of ruby! (ibid.)
One might think that incandescent bulbs and outdoor lighting are both, in their own ways, standard lighting conditions, and there is no sense in saying that one of them is more appropriate for determining the color of alexandrite. According to C. L. Hardin (73), the Commission Internationale de l’Éclairage “specifies a series of standard illuminants with controlled spectral characteristics, such as source A (incandescent lamp), source B (near sunlight) and source C (near daylight—‘North Daylight’ of the Munsell specification).”

Everyone is entitled to her own opinion about whether objects would change color if a gas that obstructed yellow light settled on the Earth (Averill 554) or if phenylthiourea would be bitter if the genes that currently make people taste it as bitter were bred out of existence (Bennett 1968: 105). Such questions seem especially amenable to the methods of armchair metaphysics, since they’re equivalent to asking whether certain predicates apply to certain objects in certain situations. If the objects or the situations are unusual enough, any competent English speaker’s intuition is as good as another’s. For that reason, disputes over which perceptual conditions are good enough to reveal the secondary qualities of objects can seem intractable without some wider framework, and they aren’t intrinsically enlightening. Without some such framework, we can’t tell whether one set of conditions better gets at the underlying reality or whether the choice is arbitrary and conventional.

9.3 Unitary Structures and the Possibilities of Language

There are of course substantial questions concerning secondary qualities, questions that go beyond mere semantics. We might wonder, for example, whether a uniformity of appearance reflects a uniformity in underlying structure. Even when it does, it’s sometimes useful to stick to a dispositional semantics.
Sensations of taste provide illustrations. Sourness and saltiness do map pretty well onto natural kinds. Sourness corresponds to titratable acidity in a way that suggests “that the sour receptor mechanism must function as a proton counter of sorts” (Bennett 1968: 105, Lawless 608-09). Bitterness, in contrast, corresponds to “no fewer than 19 distinct chemical families” and phenylthiourea and 6-n-propylthiouracil taste bitter to some people and not bitter to others (Lawless 610, 615-16).

The color of a thing depends on the light that comes from it, but there isn’t a common chemical structure that explains why both Antares and Mars look red (Hardin 2-7). Antares and Mars don’t have a common chemical structure. What they have in common is the power to produce the idea of red. Nor is it right to say that orange things are the ones that give off orange light. If a body reflects red light and yellow light, it will look orange, even if it doesn’t give off any light in the orange part of the spectrum (Hardin 26-28).

In the course of Locke’s argument that positive ideas can have privative causes, he offers a nice example of how radically different explanatory structures may produce the same idea in us. “A hole perfectly dark” produces an idea of black which can be painted. Once the hole is painted, we can compare the painting’s appearance with the appearance of the hole. That is, we can compare the ideas of black produced by the hole with the ideas produced by a filled in circle drawn in ink (2.8.6).

It’s hard to describe the primary qualities in a hole responsible for producing the idea of blackness, since it’s hard to conceive of how primary qualities can inhere in an absence such as a hole. In any case, the same complex of primary qualities doesn’t explain the blackness of a hole and the blackness of ink. The shadow and its drawing in Locke’s example both look black (2.8.4-5), but they don’t share a common explanatory structure.
When there are relatively unified underlying chemically explanatory qualities, we can still construct a useful semantics of appearance words. Consider ‘sweet’. Obviously, there are objective facts of the matter about glucose, sucrose, and fructose, and there’s no question that sugars such as those are sweet. We still sometimes want a notion of sweetness that goes beyond the mere questions of chemistry. Candy licorice isn’t especially sweet, even though it has a lot of sugar in it, because licorice root is naturally bitter. A chemist looking to make a new artificial sweetener couldn’t rely merely on knowledge of chemistry. In the end, to find out whether a certain compound is sweet, there are going to have to be human trials. Likewise, wind chill is a rough useful guide to subjective temperature, even though atmospheric temperature is a well-understood, unproblematic, and objective quality.

Where Locke thinks that a word signifies an idea that corresponds to a single underlying structure without resembling that structure, he’ll sometimes use the word to refer to the idea, sometimes to the power to produce that idea, and sometimes to the underlying structure. Locke uses the word ‘heat’ as a name of an idea at Essay 2.7.4 and 2.8.17. At Essay 2.23.7 and 2.31.2, heat is the power to produce the idea of heat. At 4.16.12, Locke infers that heat “consists in a violent agitation of the imperceptible minutes parts of the burning matter.”

Locke’s discussion of ‘light’ in Essay 3.4.10 shows an explicit concern with these semantic issues and a willingness to change his mind. He first dismisses the Aristotelian definition as worthless and then turns his attention to France: “When the Cartesians tell us, that Light is a great number of little Globules, striking briskly on the bottom of the Eye, they speak a little more intelligibly than the Schools,” but even “granting this explication of the thing to be true,” someone who didn’t already have the idea of light would by this definition “never have any Idea of Light” (3.4.10, 1-3 eds.). This criticism is developed at length, and in
the first three editions, it’s presented as grounds for dismissing the definition. Locke argued that the Aristotelian definition was useless and meaningless because it wouldn’t produce the idea of light in the blind, and the criticism of the Cartesians moves along the same path.

In the fourth edition, Locke replaces the faint praise of saying that Cartesians “speak a little more intelligibly” with the genuine praise that they “speak more intelligibly” and adds the final sentence which transforms what was a rejection of a definition into praise for a distinction: “And therefore the Cartesians very well distinguish between that Light which is the Cause of that Sensation in us, and the Idea which is produced in us by it, and is that which is properly Light.” Locke’s final position is that ‘light’ properly names a sensation, but, so long as we take precautions against confusion, it’s also ok to use the term ‘light’ to refer to the external corpuscles that cause that sensation.

His occasional willingness to use secondary quality terms to refer to the primary quality structures comes out in Essay 2.8.15, where Locke declares that “what is Sweet, Blue, or Warm in Idea, is but the certain Bulk, figure, and Motion of the insensible Parts in the Bodies themselves, which we call so.” His implication seems to be that, in bodies, ‘sweet,’ ‘blue,’ and ‘warm’ refer to certain complexes of primary qualities. Locke makes other remarks along these lines: simple ideas are ‘real’ because they can be used to “distinguish the Qualities, that are really in the things themselves” (2.30.2; Allen 2008b: 817), and the production of an idea of whiteness allows us to “know, that that Quality of Accident (i.e. whose appearance before my Eyes, always causes that Idea) doth really exist, and hath a Being without me” (4.11.2). Both of these remarks suggest that Locke is thinking of ideas of secondary qualities as corresponding to arrangements of primary qualities.

He sometimes talks this way, and his flexibility is understandable because of the semantic character of his attempts to save the truth of secondary quality judgments. On the
other hand, some of what he says isn’t compatible with identifying secondary qualities with the textures responsible for appearances. If secondary qualities are textures, then they belong to things as they are in themselves and they are real beings as much as primary qualities are real beings. I view these passages as misleading variations on Locke’s standard analysis of secondary qualities.

According to Jackson and Pargetter (127), what Locke “most wanted to say was that colour was not a non-dispositional, objective property of objects.” This is wrong, I think. It contradicts Locke’s occasional treatments of light and heat, and it’s inconsistent with his remark in Essay 2.8.15 that blue in an idea is bulk, figure, and motion in a body. Judging from his justification for his digression into “Physical Enquiries” (2.8.22) and from the marginal summaries of sections 15 through 22, what he most wanted to say was that our ideas of secondary qualities don’t resemble anything in bodies and that they don’t explain the operations of nature. Locke has a preferred semantics for secondary quality words, but he’s adaptable.

Jackson elsewhere writes,

there is . . . no deep metaphysical dispute between primary quality cum causal theories and dispositional theories. The dispute is over whether the dispositions to look coloured or the physical quality bases of those dispositions should be tagged as the colours; the dispute is ultimately over the distribution of names among putative candidates. As how we answer this labeling questions can have no cognitive, epistemic or practical significance (F. Jackson 1998: 104).

These remarks go too far, I think. People of good will don’t agree on the right theory of perception or about what the peculiar intentional object of sight is. There’s also useful work to be done on the semantics of secondary quality words in ordinary languages. Still, there is a wide range of agreement about the relevant science, and once people realize that they are
fighting over labels, they should stop squabbling and try to make themselves useful. Such conflicts aren’t clashes of paradigms; they’re disputes over verbiage.

Philosophers can make themselves useful by integrating science and ordinary thought, for example, by coming up with a semantics of secondary quality words that preserves the truth of standard competent secondary-quality judgments. Usual, practically useful ways of speaking can come to seem doubtful in light of scientific discoveries in surrounding regions. If these ways of speaking are so useful that people will continue to talk that way come what may, then a problem arises: we want to speak the truth, we want to speak in this way, but new developments in science make it seem as if speaking in this way isn’t speaking the truth. A philosophical semanticist can vindicate the practice by finding a way of interpreting our words so that they’re compatible with our best understanding of the world. That’s what Locke attempted to do.
Chapter 10 Last Words

Philosophy bends flexibly. The premises of metaphysics and philosophy of mind are either invented from scratch or borrowed from previous metaphysics, natural science, or other sources. Locke combined the corpuscularianism he had learned at Oxford with the more traditional metaphysics and epistemology he had learned in the same city.

Metaphysics is traditionally first philosophy, and there’s a metaphysical impulse towards covering up one’s tracks, whether this impulse is consciously recognized or not. In Locke’s case, this involves creating a theory of ideas according to which alternatives to corpuscularianism were not only improbable but inconceivable. By his own lights, such inconceivability claims do not guarantee the falsehood of the inconceivable views, but they do justify a presumption against the view.

By my lights, Locke’s inconceivability claims are contingent and depend on his interests and presuppositions. The problem is partly a matter of the malleability of perception: he takes corpuscularian solidity to be a simple perceptible quality and he takes impulse to be the only perceptible causal relation between bodies. Even setting aside these instances of motivated perception, Locke’s theory of ideas was excessively cramped. It ruled out not only the views of some of his scholastic predecessors but also successful theories that eventually displaced corpuscularianism, including his eventual interpretation of Newton’s theory of gravity. We have a natural tendency to conceive of things within certain boundaries. It’s hard to recognize the contingency of our assumptions and to see the possibilities of alternatives.

Phenomenology, considered as the description of how the world appears is diverting, interesting, and, taken narrowly and carefully, a source of knowledge. But we need to be cautious. We shouldn’t assume that the way that the world appears to us is independent of
our presuppositions. Nor should we assume that the way that things appear to us is the way that they appears to everyone.

It’s reasonable to be discouraged by the lack of progress and consensus in philosophy and likewise reasonable to look to the sciences for illumination and support. Most of the greatest epistemic achievements of humanity have come from the sciences. Science progresses, and if we can hitch the wagon of metaphysics to physics, then metaphysics will progress as well.

I don’t mean to say that all good philosophy has engaged with the science of the day. I just don’t think there’s any virtue in ignorance. Nor do I mean to say that knowledge of science is a substitute for philosophy. Not every philosophical question has a scientific answer.

People fight over the proper analyses of concepts when various alternatives would serve our various purposes. Once we realize that the boundaries of conception and perception aren’t the only possible ones, we might start looking for ways to transcend them. If we step back from our theories and preferences, alternatives appear before us. With a little cleverness, we can talk ourselves into seeing things from a new angle. If the history of philosophy can bring out alternatives to our ways of speaking, thinking, and perceiving, then the history of philosophy can be liberatory.
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