10
LOCKE
The primary and secondary quality distinction

Lisa Downing

The three distinctions

In Book 2, chapter 8, of John Locke's *magnum opus*, the *Essay Concerning Human Understanding*, he formulates perhaps the most famous and influential version of the distinction between primary and secondary qualities. (It is also the first version to use the terminology of primary and secondary qualities. Important early-modern precedents include Galileo, Descartes and Boyle.) Before one can begin an attempt to analyze Locke's distinction between primary and secondary qualities, one must confront the question: which distinction? The difficulty is that there seem to be at least three primary/secondary-quality distinctions in play in the *Essay*, including a metaphysical distinction, an epistemological distinction, and a physical/scientific distinction. Our first task, then, is to characterize these three distinctions and, then, to consider their relations.

The metaphysical distinction

An unrefined and misleading first pass at Locke's metaphysical distinction might be this: primary qualities are really in bodies, and secondary qualities are not, being merely appearances in our minds. The first amendment we need is that Locke does not deny that secondary qualities are in bodies; however, they are not in bodies in the way that we naïvely take them to be, and they are in bodies in some way inferior to the way in which primary qualities are there. Thus, the metaphysical distinction is, most broadly, a distinction between qualities which are really in bodies and qualities which are, at best, in bodies only in some lesser or dependent fashion. Such a distinction is suggested by the beginning of 2.8.9,[1] where Locke describes the primary qualities as "utterly inseparable from the Body, in what estate soever it be," and is clearly indicated by Locke's repeated insistence that he is identifying the qualities which "*are really in them*, whether any one's Senses perceive them or no" (2.8.17), as opposed to those which are "*imputed*" (2.8.22), and "nothing in the Objects themselves, but Powers" (2.8.10) or "*are no more really in them, than Sickness or Pain is in Manna*" (2.8.17). Let us attempt some further refinements. Perhaps the clearest thing in these matters is that secondary qualities, for Locke, are powers, mere powers, and nothing in the object but powers. They are *dependent* because these powers are causally derived from more basic primary qualities. Primary qualities, then, are really in bodies in that they are intrinsic and irreducible; unlike secondary qualities, they cannot be removed by a reconfiguration of more basic qualities. Such primary qualities ground all of the other powers and behaviors of bodies. Thus, the core of this metaphysical distinction can be captured by the distinction between the intrinsic and irreducible qualities of bodies (the qualities that are always in them and inseparable from them) and other qualities which are dependent on and reducible to those primary qualities.

Now, not *all* powers derived from the intrinsic and irreducible qualities count as secondary for Locke. We have yet to take account of the special role of the senses in the notion of secondary quality. Roughly, it is the powers to produce sensory ideas in us directly that Locke singles out as secondary qualities. Below (in the third section), we will refine this further by considering macroscopic qualities generally and Locke's notion of resemblance. For present purposes, however, of outlining and relating Locke's three distinctions, we should keep our focus on the primary qualities. Locke's metaphysical notion of primary quality can be captured fairly simply by the formula, "the intrinsic and irreducible qualities of bodies."

The epistemological distinction

To locate what I will call the epistemological version of Locke's primary/secondary quality distinction, we need to examine a notorious passage from 2.8:

> Qualities thus considered in Bodies are, First such as are utterly inseparable from the Body, in what estate soever it be; such as in all the alterations and changes it suffers, all the force can be used upon it, it constantly keeps; and such as Sense constantly finds in every particle of Matter, which has bulk enough to be perceived, and the Mind finds inseparable from every particle of Matter, though less than to make it self singly be perceived by our Senses. *v.g.* Take a grain of Wheat, divide it into two parts, each part has still *Solidity*, *Extension*, *Figure*, and *Mobility*; divide it again, and it retains still the same qualities; and so divide it on, till the parts become insensible, they must retain still each of them all those qualities. For 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, all which distinct masses, reckon'd as so many distinct Bodies, after division make a certain Number. These I call *original* or *primary Qualities* of Body, which I think we may observe to produce simple *Ideas* in us, *viz.* Solidity, Extension, Figure, Motion, or Rest, and Number. (2.8.9)

The initial thought, that primary qualities are "utterly inseparable from the Body" sounds consistent with the metaphysical version of the distinction canvassed above. However, Locke immediately goes on to provide what seems to be a method of identifying a particular list of qualities by means of sensory and conceptual criteria (Davidson and Hornstein 1984). The primary qualities, here, are those that (1) we always find in every observable particle of matter, no matter how small; and (2) we cannot conceive of bodies being deprived of. The grain of wheat example goes on to illustrate the application of the second, conceptual, criterion. This passage raises many questions about how the sensory and conceptual criteria are supposed to pick out just solidity, extension, figure, motion, rest and number as primary. (Can we conceive of bodies as lacking color? Descartes thought we could, and also thought that we sense bodies that lack color, but this won't work if Berkeley was right that "pellucid is a colour" [Descartes 1984–5: Vol. 1, 227; section 11 of part 2 of the *Principles*, Berkeley 1993: 357; entry 453 of the notebooks]. What about temperature?) But the most serious question raised by this passage is, What are these criteria for? So as not to presuppose an answer to this question without further consideration, I will use "the epistemological distinction" as a name for a version of the distinction according to which the primary qualities are those that the senses constantly find in body and the mind finds inseparable from bodies.

The scientific distinction

To diagnose yet a third distinction, we need only observe the remarkable coincidence between Locke's typical lists of primary qualities, and the lists of basic physical qualities proffered by the corpuscularian natural philosophy of Locke's time. Locke's friend and sometime collaborator, the natural philosopher, chemist and natural theologian Robert Boyle, coined the word "corpuscularian" as an adjective to identify a mechanist physics that attempts to be neutral between Cartesianism and atomism (Boyle 1991: 7). The most central feature of corpuscularian physics was the view that body can be exhaustively characterized by a short list of qualities, including size, shape, impenetrability, number, motion or rest. (Interestingly, Boyle doesn't put impenetrability on his list of "primary affections," presumably because it is a universal characteristic of all matter on his view, and thus not a characteristic that diversifies bodies [Boyle 1991: 50–1].) Locke's discussion of primary and secondary qualities, especially his lists, often seem like they could be taken straight from Boyle. Notably, Locke frequently uses the corpuscularian term of art "texture," meaning a particular spatial arrangement of particles, each with their own set of primary qualities (e.g. 2.8.18). He also uses the corpuscularian term of art, "corpuscle" (2.8.21). It thus appears that Locke has taken his distinction between primary and secondary qualities directly from what he regarded as the best physics of his day. This impression is reinforced by Locke's explicit apology for "this little Excursion into Natural Philosophy" (2.8.22). I will use the label "scientific" for this version of the distinction, despite the anachronism of it, to avoid the long-winded "natural philosophical." On this version of the distinction, "primary quality" denotes whatever qualities the best extant scientific theory takes to be intrinsic and irreducible in bodies. Since, on Locke's view, this turns out to be Boylean corpuscularian, we get corpuscularian lists of primary qualities.

In what follows, I will refer to Locke's core *list* of primary qualities – size (or bulk), shape (or figure), solidity and motion/rest – as the corpuscularian primary qualities or corpuscularian primaries. Locke's lists of qualities vary quite a bit; often he includes number and also texture (spatial arrangement). Not much of philosophical interest hangs on the variation, except for the issue of microscopic vs. macroscopic primary qualities, which is addressed below (in the third section, under "Macroscopic primary qualities").

How are the three distinctions bound into one position?

How are these three distinctions related, for Locke? Of course, one possibility is that Locke simply conflated them, moving from one to another without clear distinction. This would be an exceedingly uncharitable interpretation. It is also unnecessarily uncharitable. Our next step is to explore three different accounts of how the three distinctions are supposed to be related. I will argue that the third interpretation is the best interpretation of Locke's mature position.

The naïve interpretation (the first interpretation)

I call this interpretation naïve because it is the most obvious reading of the text, which, of course, should count as a point in its favor. As we will see, however, it has significant philosophical problems. This interpretation asserts that Locke held that the epistemological distinction tells us that the scientific and metaphysical distinctions coincide. That is, the sensory and conceptual criteria establish that Boyle was right – corpuscularian physical theory correctly characterizes the intrinsic and irreducible qualities of body. So, the metaphysically primary (intrinsic and irreducible) qualities of body are size, shape, solidity, motion/rest, and we know this by reflection on the (purported) fact that these are all and only the qualities that both (1) are always sensed in bodies and (2) cannot be conceived of as absent from bodies. This interpretation is a natural one for two reasons. First, Locke often writes as if we knew that the corpuscularian list of qualities (size, shape, solidity, motion/rest) are metaphysically primary, intrinsic and irreducible. Second, the way in which the sensory and conceptual criteria are presented in the very paragraph that introduces the notion of primary quality suggests that they are supposed to allow us to identify the metaphysically primary qualities.

Against the obviousness of this interpretation, however, stands Locke's epistemic modesty, a commitment at the core of his philosophical identity. Why would Locke rashly assume that sense perception and reflection on sense perception reveal to us the intrinsic and irreducible qualities of bodies? This seems unjustifiably optimistic and goes against the grain of Locke's consistent interest in reminding us of our epistemic limitations. Furthermore, he lectures Descartes harshly for what would seem to be a very similar infraction:

> I shall not now argue with those Men, who take the measure and possibility of all Being, only from their narrow and gross Imaginations: but having here to do only with those, who conclude the essence of Body to be *Extension*, because, they say, they cannot imagine any sensible Quality of any Body without Extension, I shall desire them to consider, That had they reflected on their *Ideas* of Tastes and Smells, as much as on those of Sight and Touch; nay, had they examined their *Ideas* of Hunger and Thirst, and several other Pains, they would have found, that they included in them no *Idea* of Extension at all, which is but an affection of Body, as well as the rest discoverable by our Senses, which are scarce acute enough to look into the pure Essences of Things.
>
> If those *Ideas*, which are constantly joined to all others, must therefore be concluded to be the Essence of those Things, which have constantly those *Ideas* joined to them, and are inseparable from them; then Unity is without doubt the essence of every thing. For there is not any Object of Sensation or Reflection, which does not carry with it the *Idea* of one: But the weakness of this kind of Argument, we have already shewn sufficiently. (2.13.24–5)

Our senses are "scarce acute enough to look into the pure Essences of Things" and we ought not to expect our "narrow and gross Imaginations" to fare better. This is quintessential Locke and moreover it seems correct: It is optimistic to expect that the intrinsic and irreducible qualities of bodies are so readily identified.

In defending the naïve interpretation against this critique, one might defend optimism: Why not suppose, defeasibly, that Locke's sensory and conceptual criteria successfully identify the metaphysically primary qualities of bodies and thus show that Boyle was right? After all, Locke thought that Descartes' views about the essence of body were in fact defeated and he did not eschew all conceptual argument (see Jacovides 2002). Arguably, it would have been reasonable for Locke to trust the sensory and conceptual criteria if the results – a corpuscularian account of the primaries – were unproblematic. As a matter of fact, however, Locke became over time increasingly dissatisfied with mechanist physics: It could not explain cohesion, impulse, or how ideas are caused (4.3.29). And the success of Newton's *Principia Mathematica* and his attractionist theory of gravity convinced Locke, by the time of the correspondence with Stillingfleet and the fourth edition of the *Essay*, that the corpuscularian account of body's nature that fits with our conception of matter could not be fully adequate (see also Locke 1989: 246):

> 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. (Locke 1823: Vol. 4, 467–8)

> ... gravitation of matter towards matter, and in the several proportions observable, inevitably shows, that there is something in matter that we do not understand. (Locke 1823: Vol. 4, 464–5)

Surely these difficulties suffice to motivate the search for other interpretations of the relations among Locke's three distinctions.

The naturalist interpretation (the second interpretation)

An interpretation made prominent by Peter Alexander (1985) is that the *Essay* simply begins from the assumption that the best scientific theory of the time is broadly correct; the *Essay* is premised on the truth of corpuscularianism. So, Locke assumes that the scientific distinction and the metaphysical distinction coincide. The sensory and conceptual criteria, on this sort of interpretation, can function merely as reminders of the appeal of corpuscularian theory: it coheres with the conception of body we derive from reflection on sensory experience.[2]

This interpretation undeniably has its attractions. Since naturalism is attractive to many contemporary philosophers, this seems a charitable interpretation of Locke. More significantly, it neatly explains the above-noted remarkable coincidence between Locke's lists of primary qualities and corpuscularian physical theory. Against it, however, there are at least three points. First, as briefly argued in the second section, under "The naïve interpretation," above, by the time of the fourth edition of the *Essay*, Locke holds that Newton has shown that corpuscularianism isn't an adequate physical theory. If the *Essay* were premised on the truth of corpuscularianism, this surely would have called for more revision. Second, in every edition, Locke thinks of the work of the *Essay* as being prior to physical theorizing.

Third, and most importantly, there is good reason to take the metaphysical distinction to be the central version of the distinction. If we look at the beginning of 2.8, we see that it is introduced as a sort of appearance/reality distinction, as an important qualification to the earlier thought that because we are passive in sense perception, the mind is a sort of mirror (2.1.25). This is the point of Locke's introductory discussion in 2.8 of positive ideas (e.g. the idea of cold) from privative causes (e.g. the absence of motion). But if the distinction is first and foremost a metaphysical one, why foreclose the possibility that our science hasn't yet hit on the correct account of it? That Locke's notion of primary quality is metaphysical, and that he regards the correct account of it as an open question, is further established by the fact that he sees it as logically connected to the notion of real essence, which is manifestly an abstract, metaphysical notion in his theorizing. It is this last point that motivates the third interpretation, so I will turn to expounding it.

The third interpretation – corpuscularianism as uniquely good exemplar of the metaphysical distinction

Locke officially introduces his notions of real and nominal essence as follows:

> *First, Essence* may be taken for the very being of any thing, whereby it is, what it is. And thus the real internal, but generally in Substances, unknown Constitution of Things, whereon their discoverable Qualities depend, may be called

> their *Essence*. This is the proper original signification of the Word, as is evident from the formation of it; *Essentia*, in its primary notation signifying properly *Being*. And in this sense it is still used, when we speak of the *Essence* of particular things, without giving them any Name.
>
> *Secondly*, The Learning and Disputes of the Schools, having been much busied about Genus and Species, the Word Essence has almost lost its primary signification; and instead of the real Constitution of things, has been almost wholly applied to the artificial Constitution of *Genus* and *Species*. 'Tis true, there is ordinarily supposed a real Constitution of the sorts of Things; and 'tis past doubt, there must be some real Constitution, on which any Collection of simple *Ideas* co-existing, must depend. (3.3.15)

The notion of real essence outlined here is an abstract, metaphysical one; the real essence of something is its fundamental principle or constitution, the source of its further qualities. Locke goes on in 3.3.17 to note two different hypotheses about what the real essences of material substances are like: the first, an Aristotelian hypothesis, and the second, broadly corpuscularian. While in much of the *Essay*, Locke describes real essences in thoroughly corpuscularian terms, I suggest that this passage tells us exactly how to understand such talk. Locke considers that corpuscularian theory *illustrates* the abstract metaphysical notion of real essence and provides a concrete *hypothesis* about what real essences might be like. But real essence and primary quality are closely connected notions. A real essence is the ultimate source of a thing's observable qualities. Primary qualities are the intrinsic and irreducible qualities of bodies that ground their other powers. A body's real essence is thus some particular instantiation of a set of primary qualities, i.e. a configuration of primary qualities. Textual evidence that Locke sees the logical connection between these two abstract, metaphysical notions is provided by passages such as 4.6.7: "we know not the real Constitutions of Substances, on which each *secondary Quality* particularly depends." "Real constitution" is systematically used by Locke as synonymous with "real essence." He says here, then, that secondary qualities depend on real essences. But, of course, Locke usually describes secondary qualities as depending on *primary qualities*. This highlights the logical relationship between these two notions.

What falls out of this observation is the following interpretation of Locke's threefold primary/secondary quality distinction: The notion of primary quality is first and foremost an abstract, metaphysical one, the notion of an intrinsic and irreducible quality of bodies. The scientific version of the distinction, the corpuscularian account, *illustrates* this metaphysical notion and provides a concrete *hypothesis* about what the intrinsic and irreducible qualities of bodies in fact are. Officially, however, it is just an hypothesis; Locke remains open to the possibility that the metaphysically primary qualities of bodies are in fact different from the corpuscularian list. (They might, for example, include qualities unfamiliar from sense perception, say, spin or charm.)

Of course, this raises as a puzzle the question of what the sensory and conceptual criteria are doing in 2.8.9. The answer is that they point out the way in which corpuscularianism is more than a *mere* hypothesis: It represents a uniquely intelligible

hypothesis for us, because it corresponds to the way in which we conceive of bodies based on reflection on sense perception. Corpuscularianism thus provides a uniquely good illustration of the abstract notions of primary quality and real essence, and a uniquely natural proposal as to what the primary qualities might be and what real essences might be like (see Downing 1998; also compare McCann 1994). Another way to put this point is that what's unique about corpuscularian physical theory is that it proposes that the real essence of body corresponds to the nominal essence that we assign to body (Ayers 1981: 229; Atherton 1984: 418).

But if the corpuscularian list is just an hypothesis about what the primary qualities of bodies might be, why does Locke not present these lists in some more qualified fashion? The reply is twofold. First, it is simply the case that Locke often writes in terms of the most intelligible hypothesis about what might fill this metaphysical role. Additionally, at an early stage of the writing of the *Essay*, he was inclined to assume that Boyle's theory was true, and while revisions to the fourth edition of the *Essay* amend this, they don't remove all traces of the earlier view (see Downing 2008).

The central advantages of this interpretation are that it respects the fundamentally metaphysical character of the distinction, it recognizes the parallel status that ought to attach to real essence and primary quality, it represents the sensory and conceptual criteria as meant to accomplish something they can accomplish, and it gives Locke a consistent attitude towards corpuscularian physical theory throughout the *Essay* – it is an hypothesis upon whose truth it is not his business to pronounce (4.3.16).

Remaining issue: Is the distinction founded on relativity arguments?

In passages such as 2.8.21, some have read Locke as arguing in something like this fashion: The water feels cold to one hand and warm to the other. But the water cannot be both cold and warm. Therefore, temperature is not a quality of the water itself. This sort of relativity argument might seem a convenient way of stripping the secondary qualities from bodies, leaving the primary. It would be possible to defend an analog of the "naïve interpretation" above, suggesting that Locke is trying to use relativity arguments to ground, philosophically, the claim that size, shape, solidity, motion/rest, number are metaphysically primary. This seems to be how Berkeley read Locke. However, such arguments are so bad and Berkeley's criticisms so good that this is nowadays a very unpopular reading. The central problem with such arguments is that, as Berkeley observed in section 14 of his *Treatise Concerning the Principles of Human Knowledge*, they don't establish that the quality in question isn't in bodies, just that we do not know by sense which quality (heat or cold) is in the body. And, as Berkeley also pointed out, there is plenty of perceptual variability when it comes to qualities such as size, shape, and motion; so if this argument is taken to show that color is in the mind, it should be taken to show that shape is there as well (Berkeley 1993: 94). Most contemporary commentators agree that in one way or another we should see these arguments as illustrating the explanatory power of corpuscularian mechanism. On interpretation one above, this offers further confirmation that Boyle was right. On interpretation two, this further illustrates the attractiveness of Boyle's mechanism, though it isn't supposed

to establish its truth. On interpretation three, it further exhibits the naturalness of Boyle's theory and further illustrates how metaphysically secondary qualities may be grounded in and explained by metaphysically primary ones.

Refining the metaphysical distinction

I have argued that the primary/secondary quality distinction for Locke was primarily a metaphysical distinction, that a primary quality is an intrinsic and irreducible quality, and that a secondary quality is a power to produce an idea in a perceiver, grounded in primary qualities. We can refine this distinction further by asking two difficult questions: (1) What about macroscopic primary qualities? (2) What are powers and to what extent are secondary qualities dependent on our senses?

Macroscopic primary qualities

On the interpretation of the primary/secondary quality distinction laid out thus far, the core distinction is between fundamental (primary) properties and other qualities which causally result from these fundamental properties. This suggests that primary qualities are properties of the inner constitutions of things, which, if the corpuscularians were right, would be corpuscular constitutions. This fits with many of Locke's descriptions of primary qualities (e.g. 2.8.10, which attributes primary qualities to the "insensible parts" of objects); however, he also speaks of macroscopic qualities, e.g. the size, shape, motion of observable material objects, as primary qualities. But the situation is complicated, for Locke also specifically acknowledges that all macroscopic, observable qualities are *powers*, powers to produce ideas in perceivers (2.8.8). The key here is Locke's (much-debated) notion of resemblance. Some of our ideas may resemble the ultimate qualities of bodies, that is, may give us an accurate conception of the types of qualities that are intrinsic and irreducible in bodies. Any qualities corresponding to such ideas count as primary for Locke. Thus, the notion of primary quality turns out to be disjunctive: both the intrinsic, irreducible properties of bodies (which might belong only to submicroscopic parts, and so be unobservable) *and* those macroscopic qualities or powers (which might themselves be reducible) which provide us with an accurate conception of the intrinsic, irreducible properties count as primary qualities (see Downing 1998). Thus, again, if the corpuscularians were right, the shapes of corpuscles would be primary qualities, and so would be the shapes of apples. (It is theoretically possible, however, that all observable qualities are primary, or that none are. Locke is inclined to suppose that the truth lies in-between.)

What sorts of powers are secondary qualities?

Secondary qualities, then, are powers to produce ideas in us directly, ideas which do not resemble the ultimate qualities of bodies, that is, do not give us an accurate conception of the sorts of qualities that are intrinsic and irreducible in bodies. Such qualities are

"mere" powers because of the non-resemblance. The point of adding "directly" is so as to distinguish secondary qualities from what scholars usually call "tertiary qualities" (and Locke calls at 2.8.26 "secondary Qualities, mediately perceivable"), which are powers to affect other objects such that they produce different ideas in us, e.g. the sun's power to melt wax. Color, taste, temperature, odor would all be such secondary qualities, if the corpuscularians were right. (And, although I've argued above that Locke isn't committed to the truth of corpuscularianism, I do think he thinks it overwhelmingly likely that colors, etc., are merely secondary and not intrinsic and irreducible.)

At least one tricky issue remains: How should we understand the powers that secondary qualities are? A fairly standard reading here is that secondary qualities are dispositions to produce ideas in perceivers. So the greenness of an apple is (something like) the disposition it has to produce a certain sort of idea in normal perceivers under standard circumstances. The object retains the disposition and remains green even if all perceivers leave the room or all perceivers are annihilated. Against this, it has been observed that Locke asserts emphatically that "Porphyre has no colour in the dark" (2.8.19). Matthew Stuart (2003) has argued powerfully from such passages that secondary qualities for Locke are "degenerate powers," that is, powers that objects have just in case an actual n-place relation obtains between an object, a perceiver and whatever other $(n-2)$ items are required for the production of an actual idea. Although there is a real tension in Locke on this issue, I think we are better off with the standard reading. Degenerate powers would be actualities, not potentialities. This does not fit with Locke's account of power in 2.21, which surely should be taken as his considered account. Furthermore (as Stuart himself observes), if things lose and gain secondary qualities at the drop of a hat, they will also lose and gain membership in kinds at the drop of a hat, something Locke shows no signs of countenancing. (E.g. the ring on my hand will cease to be gold whenever I avert my gaze, since yellowness is part of the nominal essence of gold.) The best explanation for the porphyry-type passages is that Locke is inclined to think that what are primarily (or, at least, in one important sense) green, red, colored, hot, etc., are our ideas, and that he is shifting to color-as-idea in these passages (see 2.8.17; for different versions of this sort of interpretation see Alexander [1985, 118] and Jacovides [1999, 2007]). Color-as-quality, however, is a disposition. Such dispositions depend for their existence on the primary qualities of bodies, and for their individuation on the faculties of perceivers.

Notes

1 All references to Locke's *Essay* are to Locke (1975), given by book, chapter and section numbers.
2 Note that this is not exactly how Alexander treats 2.8.9; see Alexander (1985: 119).

References

Alexander, Peter (1985) *Ideas, Qualities, and Corpuscles: Locke and Boyle on the External World*, Cambridge: Cambridge University Press.
Atherton, Margaret (1984) "Knowledge of Substance and Knowledge of Science in Locke's *Essay*," *History*

Ayers, Michael (1981) "Mechanism, Superaddition, and the Proof of God's Existence in Locke's *Essay*," *Philosophical Review* 90: 210–51.
Berkeley, George (1993) *Philosophical Works: Including the Works on Vision*, edited by Michael Ayers, London: J.M. Dent & Sons; Rutland, VT: Charles E. Tuttle.
Boyle, Robert (1991) *Selected Philosophical Papers of Robert Boyle*, edited by M. A. Stewart, Indianapolis, IN: Hackett.
Davidson, A. I. and Hornstein, N. (1984) "The Primary/Secondary Quality Distinction: Berkeley, Locke, and the Foundations of Corpuscularian Science," *Dialogue* 23: 281–303.
Descartes, René (1984–91) *The Philosophical Writings of Descartes*, 3 vols, edited, trans. by John Cottingham, Robert Stoothoff, Dugald Murdoch, and Anthony Kenny, Cambridge: Cambridge University Press.
Downing, Lisa (1998) "The Status of Mechanism in Locke's *Essay*," *Philosophical Review* 107: 381–414.
—— (2008) "The 'Sensible Object' and the 'Uncertain Philosophical Cause'," in D. Garber and B. Longuenesse (eds), *Kant and the Early Moderns*, Princeton, NJ: Princeton University Press, pp. 100–16.
Jacovides, Michael (1999) "Locke's Resemblance Thesis," *Philosophical Review* 108: 461–96.
—— (2002) "The Epistemology under Locke's Corpuscularianism," *Archiv für Geschichte der Philosophie* 84: 161–89.
—— (2007) "Locke on the Semantics of Secondary-Quality Words: A Reply to Matthew Stuart," *Philosophical Review* 116: 633–45.
Locke, John (1823) *The Works of John Locke*, 10 vols, London: for Thomas Tegg.
—— (1975) *An Essay Concerning Human Understanding*, edited by Peter H. Nidditch, Oxford: Clarendon Press.
—— (1989) *Some Thoughts Concerning Education*, edited by J. W. Yolton and J. S. Yolton, Oxford: Clarendon Press.
McCann, Edwin (1994) "Locke's Philosophy of Body," in V. Chappell (ed.), *The Cambridge Companion to Locke*, Cambridge: Cambridge University Press, pp. 56–88.
Stuart, Matthew (2003) "Locke's Colours," *Philosophical Review* 112: 57–96.

Further reading

The best analysis of Boyle on qualities is Peter Anstey, *The Philosophy of Robert Boyle* (London: Routledge, 2000). Michael Ayers, *Locke*, 2 vols (London: Routledge, 1991) is of interest on every aspect of Locke. E. M. Curley, "Locke, Boyle, and the Distinction between Primary and Secondary Qualities," *Philosophical Review* 81 (1972): 438–64, is an influential article. E. J. Lowe, *Locke on Human Understanding* (London: Routledge, 1995) is an introduction to the *Essay*, with a dispositionalist interpretation of Locke on secondary qualities. An influential treatment which helped to revive interest in Locke's connection with Boyle is Maurice Mandelbaum, "Locke's Realism," in *Philosophy, Science, and Sense Perception: Historical and Critical Studies* (Baltimore, MD: Johns Hopkins University Press, 1964), pp. 1–60. Michael Jacovides, "Locke's Distinctions between Primary and Secondary Qualities," in Lex Newman (ed.), *The Cambridge Companion to Locke's* Essay (Cambridge: Cambridge University Press, 2007), pp.101–29, diagnoses multiple (six) versions of the distinction in Locke (an excellent source for further references). Samuel Rickless, "Locke on Primary and Secondary Qualities," *Pacific Philosophical Quarterly* 78 (1997): 297–319. Robert Wilson, "Locke's Primary Qualities," *Journal of the History of Philosophy* 40 (2002): 201–28. Kenneth Winkler, "Ideas, Sentiments, and Qualities," in Phillip D. Cummins and Guenter Zoeller (eds), *Minds, Ideas, and Concepts: Essays on the Theory of Representation in Modern Philosophy* (Atascadero, CA: Ridgeview, 1992), pp. 151–65, includes a short but judicious treatment of the distinction in Locke. A very good introduction to Locke, with a chapter on the distinction that provides useful historical context emphasizing Locke's anti-scholasticism, is R. S. Woolhouse, *Locke* (Minneapolis: University of Minnesota Press, 1983).

THE ROUTLEDGE COMPANION TO METAPHYSICS

Edited by
Robin Le Poidevin
Peter Simons
Andrew McGonigal
Ross P. Cameron

This edition published 2009 by Routledge
2 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

Simultaneously published in the USA and Canada
by Routledge
270 Madison Ave, New York, NY 10016

Routledge is an imprint of the Taylor & Francis Group, an informa business

© 2009 Robin Le Poidevin, Peter Simons, Andrew McGonigal and Ross P. Cameron for selection and editorial matter; individual contributors for their contributions

Typeset in Goudy Old Style Std by Saxon Graphics Ltd, Derby
Printed and bound in Great Britain by MPG Books Ltd, Bodmin

All rights reserved. No part of this book may be reprinted or reproduced or utilised in any form or by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying and recording, or in any information storage or retrieval system, without permission in writing from the publishers.

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data
A catalog record for this book has been requested

Hbk ISBN 13: 978-0-415-39631-8
Ebk ISBN 13: 978-0-203-87930-6