

# The Primary/Secondary Quality Distinction

PHIL 232

January 25, 2022

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## 1 Background

Aristotle distinguishes between primary and secondary qualities in his discussion of generation and change (*On Generation and Corruption*, bk. II). He argues that we should distinguish between qualities that are responsible for or otherwise explain the coming-to-be and passing-away of things (primary qualities) and qualities which are distinct from these,

which are features of things, and whose character is explained by appeal to relationships among the primary qualities.

Primary qualities for Aristotle include hot, cold, wet, dry. These qualities are the basic explanatory building blocks for things. Relationships amongst these qualities define the four basic elements—viz. earth, air, fire, and water—out of which everything was thought to be made.

The Aristotelian distinction understood the primary qualities as qualities that were manifest to our senses, and thus understood the physical world—nature—as the kind of thing whose fundamental features were primarily intelligible via the senses. This would all change by the seventeenth century.

## 2 Mechanism & Materialism

The seventeenth century saw the rise of two distinct but related positions: *mechanism* and *materialism*. *Materialism* is a metaphysical theory concerning the natural world. It claims that the natural world consists fundamentally of a kind of *thing* or *stuff*—matter—and that this stuff, organized in various ways according to natural laws as characterized by physics, determines the nature and features of all the objects we experience as part of the objective (and thus mind-independent) natural world. Materialism says that there is fundamentally only one kind of thing—matter. Materialism thus stands in opposition to a *dualist* view like that articulated by Descartes. Descartes argues that there are fundamentally *two* kinds of thing—matter, and mind—and that the natural world consists of these two kinds of thing interacting with one another, sometimes in very special ways (as with the ensouled bodies of human beings).

*Mechanism* is part of a theory of *explanation*. Lisa Downing, a scholar of the Early Modern period, puts it this way,

[Mechanistic doctrine] states that all macroscopic bodily phenomena should be explained in terms of the motions and impacts of submicroscopic particles, or corpuscles, each of which can be fully characterized in terms of a strictly limited range of (primary) properties: size, shape, motion (or mobility), and, perhaps, solidity or impenetrability. (Downing 1998, 381)

A 'corpuscle' is an extremely small parcel of matter with a determinate size, shape, motion, location, etc. It is the features of individual corpuscles, plus their interactions, which mechanism takes as sufficient for explaining the characteristics and behavior of the natural (mate-

rial) world. Thus, while the claim that the natural world consists of nothing but corpuscles, or material particles, is a metaphysical claim about what there is, mechanism is an explanatory claim concerning how appeal to microscopic particles and their features is sufficient for explaining all natural phenomena. These views thus compliment one another and often go together.

Locke himself sometimes frames his understanding of mechanism in terms of what he calls the 'corpuscularian hypothesis'.

I have here instanced in the corpuscularian hypothesis, as that which is thought to go furthest in an intelligible explication of those qualities of bodies; and I fear the weakness of human understanding is scarce able to substitute another, which will afford us a fuller and clearer discovery of the necessary connexion and coexistence of the powers which are to be observed united in several sorts of [bodies]. (IV.iii.16)

There is a great deal to be said about both the doctrine of materialism and that of mechanism, as well as their development and influence in the seventeenth and eighteenth centuries. But here I focus on just one issue—the specific properties corpuscles were thought to have, and the explanatory role of these properties relative to all the other apparent characteristics of objects.

Notice two things about mechanism. First, it ultimately concerns unobservable, or at least, *unobserved* entities (corpuscles). This means that the explanation of observable phenomena depends on the existence and characteristics of unobserved phenomena. This, in and of itself, is a dramatically anti-Aristotelian move. The fundamental explanatory level of reality is one which is removed, and perhaps ineluctably so, from our direct apprehension in experience.

Second, the explanatorily relevant features of corpuscles are taken by mechanists to be their *geometric* properties—viz., size, shape, location, and state of motion. What are not included are those features which we might think of as tied to specific ways of sensing the world—e.g. their colors, tastes, or smells.<sup>1</sup> This bifurcation in explanatory role meant both that greater emphasis was placed on our *mathematical* understanding of the natural world, and that our purely sensory grasp of the natural world no longer played a significant role (perhaps no role at all) in telling us how and why the world appears to us as it does. To see

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<sup>1</sup> One feature—solidity—may or may not occupy a special role, being the only proper sensible (sensory quality tied to a specific sense modality, in this case touch) that may yet be explanatorily fundamental for the mechanist. We'll return to this issue later when discussing Locke and Descartes's theories of matter.

this this shift to the characteristically modern version of the “primary/secondary” quality distinction at work, it helps to start with Galileo.

### 3 Galileo on Real Qualities

#### 3.1 Background: Galileo (15 February 1564 – 8 January 1642)

[Galileo Galilei](#) was an Italian physicist, mathematician, astronomer, and philosopher who played a major role in the Scientific Revolution. His achievements include improvements to the telescope and consequent astronomical observations and support for [Copernicanism](#).

His contributions to observational astronomy include the telescopic confirmation of the phases of Venus, the discovery of the four largest satellites of Jupiter (named the Galilean moons in his honour), and the observation and analysis of sunspots. Galileo also worked in applied science and technology, inventing an improved military compass and other instruments.

Galileo’s championing of heliocentrism ([remember?](#)) was controversial within his lifetime, when most subscribed to some form of the Ptolemaic geocentric system. He met with opposition from astronomers, who doubted heliocentrism for various reasons. The matter was investigated by the Roman Inquisition in 1615, and they concluded that it could be supported as only a possibility, not an established fact. Galileo later defended his views in his *Dialogue Concerning the Two Chief World Systems*, which appeared to attack Pope Urban VIII and thus alienated Galileo from the pope and the Jesuits, who had both supported him up until this point. In 1633 he was tried by the Inquisition, found “vehemently suspect of heresy”, forced to recant, and spent the rest of his life under house arrest.

#### 3.2 The Assayer

The *Assayer* was written in 1623 as a defense of Galileo’s scientific and philosophical views against Jesuit criticism. Specifically, it was written in response to Jesuit professor Orazio Grassi, whose *Astronomical Balance* of 1619 criticized various aspects of Galileo’s views concerning astronomy and physics. It particularly pleased the new pope, Urban VIII, to whom it had been dedicated. Galileo’s dispute with Grassi permanently alienated many of the Jesuits who had previously been sympathetic to his ideas, and Galileo and his friends were convinced that these Jesuits were responsible for bringing about his later condemnation, though the evidence for this is not conclusive (see ([Blackwell and Foscari](#) 1991; [Blackwell](#) 2008)).

To “assay” is to examine something in order to assess its nature, particularly in respect to testing a metal or ore in order to determine its quality or worth. So the title of Galileo’s works references the idea of examination of worth in its own examination of the physical and astronomical doctrines put forward by Grassi.

### 3.2.1 Galileo’s Scientific Rationalism & the Conceivability Argument

In the *Assayer* Galileo argues that we should distinguish between two different classes of feature which a material body might have, and that only one of these classes is relevant to providing explanations of the nature and behavior of physical phenomena.

Accordingly, I say that as soon as I conceive of a corporeal substance or material, I feel indeed drawn by the necessity of also conceiving that it is bounded and has this or that shape; that it is large or small in relation to other things; that it is in this or that location and exists at this or that time; that it moves or stands still; that it touches or does not touch another body; and that it is one, a few, or many. Nor can I, by any stretch of the imagination, separate it from these conditions. However, my mind does not feel forced to regard it as necessarily accompanied by such conditions as the following: that it is white or red, bitter or sweet, noisy or quiet, and pleasantly or unpleasantly smelling; on the contrary, if we did not have the assistance of our senses, perhaps the intellect and the imagination by themselves would never conceive of them. Thus, from the point of view of the subject in which they seem to inhere, these tastes, odors, colors, etc., are nothing but empty names; rather they inhere only in the sensitive body, such that if one removes the animal, then all these qualities are taken away and annihilated. (Galilei 2008, 185)

We might formalize his argument as follows:

1. Thinking of a material object requires thinking of it as having a particular set of qualities (i.e. size, shape, location, motion, etc.)
2. Thinking of a material object does not require thinking of it as having specific sensory qualities (e.g. color, taste, smell, sound)
3. The only qualities possessed by a material object are those which we must attribute to it in thought
4.  $\therefore$  Sensory qualities are not qualities of material objects, but rather features of our consciousness of those objects — i.e. “sensations” [from 1-3]

5.  $\therefore$  If there were no conscious beings there would be no sensory qualities (e.g. colors, tastes, smells, etc.). [from 4]

Galileo thus argues from the conceivable separation of the geometric qualities of objects from the 'proper sensibles' such as color and smell, to the fundamentality of the geometric qualities and the ultimate unreality (or subject-dependence) of the purely sensory qualities.

Central to this argument is the assumption which lies behind premise (3), that the only qualities we need attribute to a material being are those which we must attribute to it in thought. This assumes what we can call '*modal rationalism*'.

**Modal Rationalism:** The actual, possible, and necessary features of reality may be determined by examining the actual, possible, and necessary features of the concepts and conceptual relations by which we think about reality

This view should be familiar from reading Descartes. Descartes also thought that we could move from claims about dependence and distinctness relations concerning our thoughts (e.g. that our thoughts of material body depend, one and all, on our thought of extension) to conclusions concerning the nature of the objects we think about in the mind-independent world (e.g. that all the properties of a material substance depend, as its modes, on extension). This assumption lies behind Descartes's 'wax argument' concerning the nature of body and his 'real distinction' argument concerning the independence of mental substance from the existence of any body. Descartes, of course, attempts to justify his modal rationalism in the *Meditations* by appealing to the existence and veracity of God. Galileo, in contrast, provides no such epistemological ground for his assumption.

## 4 Descartes on Sensory Qualities

In the *Sixth Meditation* Descartes argues that bodies exist because otherwise God would be deceiving us regarding our idea of body. This argument, if successful, tells us that bodies must at least have qualities understood as modes of extension. What it does not do is tell us whether bodies *only* have qualities understood as modes of extension. Descartes needs this stronger claim to hold because his physics describes a material world that is uniform, differentiated into shapes and sizes only by motion. He cannot allow that sensible qualities are causally efficacious qualities distinct from the geometrical ones specified by his arguments in the *Fifth* and *Sixth Meditations*. Otherwise the uniformity of his picture of the physical world is threatened.

Descartes's argument against sensory qualities is not obvious in any of his writing. By the end of the *Meditations* we seem to have a kind of epistemic argument against sensory qualities.

1. We know that bodies must have geometrical qualities corresponding to our clear and distinct geometrical ideas, otherwise God would be a deceiver.
2. We do not know that bodies must have sensory qualities (e.g. color, taste, smell, odor, etc.).
3.  $\therefore$  Until we have good reason, we should refrain from positing sensory qualities in bodies.

This is a kind of burden shifting argument against the proponent of sensory qualities in bodies (see (Rozemond 1998, 66–75) for discussion). Is there a more direct argument that Descartes makes?

It isn't clear, but in the *Principles of Philosophy* he looks as if he aims to provide the requisite argument that sensory qualities are not in bodies in the same manner as geometric qualities.

For as regards hardness, our sensation tells us no more than that the parts of a hard body resist the motion of our hands when they come into contact with them. If, whenever our hands moved in a given direction, all the bodies in that area were to move away at the same speed as that of our approaching hands, we should never have any sensation of hardness. And since it is quite unintelligible to suppose that, if bodies did move away in this fashion, they would thereby lose their bodily nature, it follows that this nature cannot consist in hardness. By the same reasoning it can be shown that weight, colour, and all other such qualities that are perceived by the senses as being in corporeal matter, can be removed from it, while the matter itself remains intact; it thus follows that its nature does not depend on any of these qualities. (**Principles** II.4; AT 8A:42; CSMI:225)

However, this argument leaves us wondering why an opponent couldn't simply respond that Descartes hasn't shown that we can conceive of a body that is not hard, but rather only that we can it conceive of a body whose hardness we cannot experience. For this reason the argument appears unsuccessful.

Given the burden shifting argument above, it is open to Descartes to pursue a weaker, but still attractive (given his physics) position—viz. one according to which we appeal to Ockham's razor, and aim to construct a physical theory with as few ontological types as possible (see (Downing 2011, 113–14) for discussion). Hence, if we can get by in the course of offering physical explanations without positing sensory qualities, then wouldn't this be grounds for thinking that sensory qualities aren't really in bodies, or at least not in them in the way that geometric qualities are?

In Pr I.70 Descartes mounts a more ambitious argument. He says,

it is quite different when we suppose that we perceive colours in objects. Of course, we do not really know what it is that we are calling a colour; and we cannot find any intelligible resemblance between the colour which we suppose to be in objects and that which we experience in our sensation. But this is something we do not take account of; and, what is more, there are many other features, such as size, shape and number which we clearly perceive to be actually or at least possibly present in objects in a way exactly corresponding to our sensory perception or understanding. And so we easily fall into the error of judging that what is called colour in objects is something exactly like the colour of which we have sensory awareness; and we make the mistake of thinking that we clearly perceive what we do not perceive at all. (AT 8A:34-5; CSMI:218)

Descartes here argues that there is something *unintelligible* about the claim that colors (and presumably colors are no different from other sensory qualities in this respect) resemble our sensations of them. If it is simply unintelligible to attribute colors to bodies, then Descartes has the stronger conclusion that he needs, for the claim that bodies are colored (or hard, or have tastes, etc) would be an empty one.

But *why* exactly is it that it is unintelligible for a body to be colored in the manner in which we sense bodies as being colored? Descartes doesn't make this clear, but we can speculate a bit based on what he does say. For example, Descartes thinks that the essence of body is extension, and that we are to understand all other properties of body via this "principle attribute" or essence. So one reason for enforcing the unintelligibility claim may be based on the fact that there is no intelligible route from the property of being extended to the property of being colored.

However (following ([Downing 2011](#))) there are at least two different notions Descartes could be gesturing at with the intelligibility claim. On the one hand, he could be arguing that color cannot be intelligibly connected with extension, while on the other hand he could be arguing that color cannot be derived from extension. Both of these arguments construe the relation of a property (or mode) to a substance in different ways. According to the first, in order for some property to be considered a mode of a substance, it must be capable of being intelligibly related to the substance's principle attribute. In the case of color, however, just such a relation seems possible, since we cannot conceive of color as being instantiated without it being instantiated in some spatial region, and thus as having some extensive magnitude. So



if Descartes is attempting to exclude colors and other sensory qualities from physical objects based on their compatibility with the essence of body, this weak requirement won't do.

The stronger position is that color must be derivable from extension in the same manner that, e.g., size and shape are derivable from extension. It is difficult to see how this could be done. But it is also not clear that Descartes properly motivates the stronger position. The fact that a property needs to be conceivable through the essence of a substance does not show that the property needs to be *derivable* from the essence. The fact that Descartes never properly articulates why we should prefer the stronger claim then ultimately undermines the success of his overall argument.

## 5 Locke on Ideas & Qualities

In the *Essay* Locke, in a way similar to that of Galileo and Descartes, distinguishes between our idea of a thing and the features or 'qualities' of the thing itself.

Whatever the mind perceives in itself—whatever is the immediate object of perception, thought, or understanding—I call an idea; and the power to produce an idea in our mind I call a quality of the thing that has that power (E II.viii.8)

So, for Locke, qualities are in objects, and those qualities are powers to produce ideas in minds like ours. Locke thus seems to distinguish between things that depend on *us* – ideas in minds, and things that depend on *objects* – powers to cause those ideas. Moreover, Locke distinguishes between the 'active' and 'passive' powers of an object. Active powers are those powers of a substance to causally affect other substances—fire has the active power to melt gold. Passive powers are those powers of a substance *to be causally affected by others* - gold has the passive power to be melted by fire. It is tempting, and perhaps correct, to read Locke here as using the term 'power' to describe the modal features of an object - what it is possible (perhaps *physically* possible) for the object to affect and be affected by.

### 5.1 Locke's Adaptation of the Primary/Secondary Distinction

Locke thinks that the kinds of qualities in objects may be divided into two classes - primary and secondary.

Qualities thus considered in bodies are, First, such as are utterly inseparable from the body, in what state soever it be; and 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 itself 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 (II.viii.9).

Primary qualities are, for Locke, the geometric/kinetic features of substances – their shape, size, motion, and solidity. These qualities are in bodies independently of our perception of them, and cannot be altered (at least as *determinables*) or removed from bodies. Hence, even in division of a body, its parts retain these determinate features (though their determinate features may differ from the body of which they were parts). Locke goes on.

Secondly, [there are qualities] which in truth are nothing in the objects themselves but powers to produce various sensations in us by their primary qualities, i.e. by the bulk, figure, texture, and motion of their insensible parts, as colours, sounds, tastes, &c. These I call secondary qualities (II.viii.10, 14, 23).

Next, there are the *secondary* qualities, which are explanatorily less significant, and are 'nothing in the objects themselves but powers'. Hence there is some indication here that we have a contrast in the sense in which primary as opposed to secondary qualities are *real*. Primary qualities are *really in* bodies, while secondary qualities are *mere powers* to produce ideas in us. This way of putting the distinction suggests something like Galileo's conclusion, that the secondary qualities are merely subjective. But it also raises problems.

### 5.1.1 Problems

As we saw above, Locke initially introduces the notion of a quality in terms of a power to produce ideas. But his definition of a secondary quality is in terms of its being 'nothing in the object itself' but a power to produce ideas. But primary qualities are also qualities, and thus powers to produce ideas. So where are we supposed to get a *distinction* between primary and secondary qualities? We seem to get something like the following argument (see [Rickless 1997](#)) for discussion):

1. Shape is a primary quality

2. If shape is a primary quality then it is a quality
3. Qualities are powers to produce ideas
4.  $\therefore$  Shape is a power to produce an idea—presumably the idea of shape
5. But secondary qualities are also powers to produce ideas
6.  $\therefore$  There is no primary/secondary distinction between qualities

This is certainly not the conclusion Locke wants us to draw. We appear to have several options.

1. Deny that primary qualities are “qualities” in Locke’s

sense—i.e. deny that they are powers B. Agree that primary qualities are powers but deny that they are the same sort of power as secondary qualities C. Posit that Locke uses “quality” in two different senses:

- Quality<sub>1</sub>: X is a quality<sub>1</sub> iff X is a property
- Quality<sub>2</sub>: X is a quality<sub>2</sub> iff X is a power to cause an idea in one’s mind
- Maintain that there is only one sense to “quality” but distinguish

between real qualities and mere qualities

- “Real” qualities are qualities which are more than mere powers in things, and exist even in the absence of things they affect
- “Mere” qualities are no more than powers in things and cease to exist when the things they affect are absent

There is a fair bit of textual evidence for (D).

The particular Bulk, Number, Figure, and Motion of the parts of Fire, or Snow, are really in them, whether any ones Senses perceive them or no: and therefore they may be called real Qualities, because they really exist in those Bodies (II.viii.17)

The Idea of Heat or Light, which we receive by our Eyes, or touch, from the Sun, are commonly thought real Qualities, existing in the Sun, and something more than mere Powers in it (II.viii.24)

Were there no fit Organs to receive the impressions Fire makes on the Sight and Touch; nor a Mind joined to those Organs to receive the Ideas of Light and Heat, by those impressions from the Fire, or the Sun, there would yet

be no more Light, or Heat in the World, than there would be Pain if there were no sensible Creature to feel it, though the Sun should continue just as it is now, and Mount Aetna flame higher than ever it did (II.xxxi.2)

Let us consider the red and white colours in porphyry. Hinder light from striking on it, and its colours vanish; when light returns, it produces these appearances in us again. Can anyone think that any real alterations are made in the porphyry by the presence or absence of light; and that those ideas of whiteness and redness are really in porphyry in the light, when it obviously has no colour in the dark? (II.viii.19)

In these four passages Locke seems to come extremely close to the Galilean position that all secondary qualities are merely subjective, while primary qualities are *real*—that is, they really exist in substances independently of the existence of any perceiver.

Another way of putting this point is that, according to Locke on interpretation D, the real or primary qualities of an object are *intrinsic* to it. That is, they are had by it independent of any relation that it might have to other things. “Mere” qualities, in contrast, are *relational*; they depend for their existence in part on the existence and nature of something other than the objects whose qualities they are. Locke indicates this in several places.

the greatest part of the ideas that make our complex idea of gold are yellowness, great weight, ductility, fusibility...all which ideas are nothing else but so many relations to other substances; and are not really in the gold, considered barely in itself, though they depend on those real and primary qualities of its internal constitution (II.xxiii.37)

Put a piece of gold anywhere by itself, separate from the reach and influence of all other bodies, it will immediately lose all its colour and weight, and perhaps malleableness too (IV.vi.11)

### 5.2 Restating the Primary/Secondary Distinction

With these distinctions in hand we might restate the distinction between primary and secondary qualities as follows.

**Primary Qualities:** Qualities of bodies which are “really” in them in the sense of being both: (i) non-relational and (ii) of a determinable which must be had by any body (e.g. solidity, extension, size, shape)

**Secondary Qualities:** Qualities of bodies, which are “merely” in them, and determined by their primary qualities to produce sensory ideas in perceiving subjects. These qualities are both (i) relational and (ii) of determinables which need not be had by every body (e.g. colors, sounds, tastes)

### 5.3 The Arguments for the Primary/Secondary Distinction

Locke presents a number of different cases in which he thinks we clearly see his primary/secondary distinction at work. Though it is not clear whether he considers these cases to be *arguments* for the distinction, or merely illustrative of it, I’ll be understanding them as arguments (though perhaps very compressed ones). We’ll take them in turn.<sup>2</sup>

#### 5.3.1 The Porphyry Case<sup>3</sup>

Let us 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 any one 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? (II.viii.19)

1. In the dark, porphyry is neither red nor white.
2. The real qualities possessed by porphyry in the dark are the same as the real qualities possessed by porphyry in the light.
3. ∴ Redness and whiteness are not real qualities in porphyry, whether in the light or in the dark.

#### 5.3.2 The Almond Case

Pound an Almond, and the clear white Colour will be altered into a dirty one, and the sweet Taste into an oily one. What real Alteration can the beating of the Pestle make in any Body, but an Alteration of the Texture of it?(II.viii.20)

1. The pounding of an almond changes its color and taste.

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<sup>2</sup> In my analysis of these three cases I follow (Rickless 1997) closely.

<sup>3</sup> **Porphyry** is an igneous rock of a reddish white color

2. The only real quality in an almond that it is possible to change by pounding it is its texture.
3. Neither the color nor the taste of an almond is identical to its texture.
4.  $\therefore$  The color and taste of an almond are not real qualities in it.

### 5.3.3 The Water Case

Ideas being thus distinguished and understood, we may be able to give an Account, how the same Water, at the same time, may produce the Idea of Cold by one Hand, and of Heat by the other: Whereas it is impossible, that the same Water, if those Ideas were really in it, should at the same time be both Hot and Cold (II.viii.21)

1. Water, at the same time, produces an idea of Heat when touched by one hand and produces an idea of Coldness when touched by the other hand.
2. Water that produces an idea of Heat when touched by a hand has [the quality] Heat.
3. Water that produces an idea of Coldness when touched by a hand has [the quality] Coldness.
4.  $\therefore$  Water, at the same time, has Heat and Coldness. (From 1, 2, 3)
5. Heat and Coldness are opposites.
6. It is impossible for opposite real qualities to exist in the same substance at the same time.
7. Heat is a real quality if and only if Coldness is a real quality.
8.  $\therefore$  Heat and Coldness are not real qualities. (From 4, 5, 6, 7)

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