

# REDUCTION AND REVELATION IN ARISTOTLE'S SCIENCE OF SENSIBLE QUALITIES

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## 1. The Aristotelian Problem of Sensible Qualities

It is easy for modern readers to get the impression that colors and other qualities familiar to us from sense experience are not an ontological problem for Aristotle. What we know as the problem of color and other “sensible qualities” began with the advent of mathematical physics, and with subsequent empirical discoveries that disabused us of the intuitive notion that the causes of sense experience must be like the qualities manifest in them.<sup>1</sup> The result for modern theorists has been that colors and other sensible qualities cannot unproblematically be identified with either causes or manifest features of our experience. Identifying sensible qualities with the causes cited in physical explanations of our experiences of them has become a matter of “reducing” them to properties that have little or nothing in common with the qualities manifest in the experiences they produce. Conversely, identifying them with the “primitive” qualities familiar to us from sense experience has been thought to require denying them their intuitive role as causes of those experiences. Aristotle, by contrast, writes as though these qualities are also causes of the experiences that present them to us.

<sup>1</sup>See, e.g. Chirimuuta (2015), who makes the provocative claim that “colors were not an ontological problem before Galileo” (19). The contrast between the nature of the causes cited in psychophysical explanations of color experience and the qualitative properties manifest in those experiences is a consistent theme of modern philosophical and scientific discussions of color; see, e.g., this well known remark from the psychologist and cognitive scientist Palmer (1999): “[t]he colors we see are based on physical properties of objects and lights that cause us to see them as colored, to be sure, but these physical properties are different in important ways from the colors we perceive” (95).

On a standard reading, Aristotle regards colors, sounds, flavors and the like as mind-independent properties of objects and their environment, and he takes them to be characterized essentially in terms of the qualitative features manifest in our experiences of them. Yet Aristotle also regards these qualities as causes of those experiences, as “special sensible objects” whose psychological role is to bring about actual perception of themselves. For Aristotle, but not for us, the explanatory connection between the causes of sense experience and the qualities manifest in those experiences seems unproblematic. But if so, it would seem to be only because he is ignorant of the empirical realities that make colors and other sensible qualities an ontological problem for us.

This impression, however, is misleading. Sensible qualities do pose an ontological problem for Aristotle, but it is not the same as the problem they pose for us. Aristotle is not ignorant of the possibility that the causes of sense experience may be fundamentally unlike the qualities manifest in the experiences they produce. To the contrary, he explicitly rejects the attempts of contemporaries like Democritus to explain sense perception by reference to causes of this sort, sharing with modern primitivist theorists the intuition that any “reduction” of sensible qualities to such causes would effectively eliminate them from our ontology.<sup>2</sup> But where this intuition leads modern primitivists either to the eliminativist conclusion that sensible qualities are never instantiated by the objects we experience as having them, or else to the anti-reductive conclusion that they cannot strictly be identified with the causes of sense experience, it indicates to Aristotle that any plausible theory of sensible qualities must be able to account for their role as *both* causes *and* manifest features of our experiences of them. As Aristotle understands it, this is not a problem of revising our intuitive conception of what sensible qualities are in light of fundamental physics, but of understanding how the qualities familiar to us from sensory experience could also operate as causes of those experiences. It is a problem, as Aristotle puts it, of stating “what color is, or what sound is, or what odor and flavor are, and similarly in regard to touch . . . such that [each] will produce perception and actuality” (τί χρώμα ἢ τί ψόφον ἢ τί ὀσμὴν ἢ χυμόν, ὁμοίως δὲ καὶ περὶ ἀφῆς . . . ὃν ποιήσει τὴν αἴσθησιν καὶ τὴν ἐνέργειαν, *Sens.*

<sup>2</sup>Democritus famously claimed that objects have qualities like color and flavor “by convention” (νόμῳ), but “in reality” (ἐτεῆ) are nothing but composites of imperceptible atoms traversing a void (S.E., *M.* 7.135 = 68B125 DK). Ancient sources also report that he attempted to explain objects’ sensory appearance by reference to geometrical features of atoms given off by these composites; see esp. Theophrastus, *Sens.* 60–82. As Taylor (1999, 175–79) notes, Democritus is plausibly read as defending a sort of dispositionalism about sensible qualities, but according to Aristotle his view amounts to the eliminativist assertion that, e.g., there are no colors (*GC* 1.2, 316a1–2: Δημόκριτος . . . χροῖαν οὐ φησιν εἶναι; cf. Theophrastus, *Sens.* 63). What accounts for Aristotle’s reading is less a lack of charity than an unwillingness to revise his conception of sensible qualities in a way that conflicts with the primitivist intuition that they are manifest to us in sense experience as they essentially are. See below, sect. 3.2, for further discussion. For the role of this intuition in modern primitivist theories, see Boghossian and Velleman (1989), cf. Allen (2016, 114–30).

3, 439a10–17).

Extant interpretations have left it unclear how Aristotle's own theory of sensible qualities addresses this problem. According to one prominent interpretive approach, Aristotle takes sensible qualities to be essentially characterized in terms of their psychological role; colors, flavors, and the other qualities identified as special objects of the senses in the perceptual psychology Aristotle develops in *De Anima* 2.5–3.2 are all essentially dispositions to affect perceivers and bring about perception of themselves.<sup>3</sup> This approach plausibly accounts for the status of sensible qualities as both causes and manifest features of sense experience, but it appears to conflict with Aristotle's own explanation in *De Sensu* 3–5, which accounts for their efficacy in bringing about perception by reference to their capacities to produce perceiver-*independent* changes in the environment.<sup>4</sup> Drawing on this account from *De Sensu* 3–5, other commentators have proposed that Aristotle identifies sensible qualities with powers to produce these perceiver-independent changes, or the non-dispositional grounds of these powers.<sup>5</sup> But this approach has been thought to have the converse difficulty of showing how sensible qualities, so conceived, could play the psychological role Aristotle assigns to them in *De Anima* 2.5–3.2. How, without equivocation, could Aristotle hold that sensible qualities are simultaneously causal properties whose actuality consists in the production of perceiver-independent changes and special sensible objects whose nature as such is to affect perceivers and bring about perception of themselves?<sup>6</sup>

I think Aristotle has a good response to this question and, more generally, to the

<sup>3</sup>See Broadie (1993), Marmodoro (2014, 134–41), and Caston (2018), who share the view that sensible qualities are real, existentially perceiver-independent properties whose essential natures are nevertheless characterized in terms of their power to produce sense experience. Contrast Irwin (1988, 313–14), cf. Ross (1906, 149–50), Taylor (1990, 140–41), who argues for an anti-realist version of the same interpretive approach.

<sup>4</sup>Not all proponents of this approach will agree with this assessment. Caston (2018) claims that even though “colors . . . are essentially visible and perceptible” (59), color is nevertheless “not defined as a disposition to produce a visual experience of a certain kind”, but rather as “something that *has* that disposition as a consequence of its own nature” (60, original emphasis). In this Caston seems to agree with Silverman (1987), but as I think Silverman rightly points out, what belongs to a kind as a consequence of its essential nature is *not* part of its definition and essence, but rather “a property belonging . . . in virtue of its essence but not found in an account of that essence” (272); cf. *Metaph.* 5.29, 1025a30–34, *APo.* 1.7, 75b1, and, for recent discussion, Bronstein (2016, 173–75). If that's right, then one must either deny that sensible qualities are essentially perceptible, or else accept that they are defined as dispositions to produce sense experience. In what follows I make a case for a version of the first alternative.

<sup>5</sup>Cf. the definitions of color proposed by Ganson (1997) (color is “the power to change light”), Kalderon (2015) (color is “the power to affect light”), and Broackes (1999) and Ierodiakonou (2018) (color is the “degree of transparency” in colored bodies).

<sup>6</sup>See, for instance, Broackes (1999), who proposes that the conflict between the apparent perceiver-dependence of color in *De Anima* 3.2 (see sect. 2.2) and the account offered in *De Sensu* 3 can be attributed to a “slide between thinking of a power and thinking of the ground of that power” (67).

ontological problem he takes sensible qualities to pose. The source of the difficulties faced by these interpretations is not any tension in Aristotle's theory of sensible qualities, but rather a failure to take into account its explanatory sophistication. For Aristotle, sensible qualities are a subject of *scientific* inquiry, an inquiry aimed at showing how the features observed to belong universally and necessarily to sensible qualities are consequences of what they are essentially. Central to this explanatory project is a distinction between attributes that belong to sensible qualities *essentially* and the "merely" per se or intrinsic features that belong to them somehow or other *in virtue of* what they are essentially, but this distinction has not been given its due emphasis in scholarly discussions of Aristotle's theory of sensible qualities.<sup>7</sup> In what follows, I argue that this has been a mistake. In Aristotle's view, colors, flavors, sounds, and the other qualities identified as special objects of the senses in *De Anima* 2.5–3.2 are indeed powers to affect perceivers and bring about perception of themselves. In this role, moreover, they are dependent on the presence of perceivers to be what they are in actuality. But commentators have been wrong to suppose that the status of sensible qualities as sensible objects is an attribute that belongs to them essentially. To the contrary, Aristotle explicitly distinguishes an account of the essence of sensible qualities from an account of their psychological role. To this extent, commentators have been correct to locate Aristotle's account of the essence of sensible qualities in *De Sensu* 3–5. However, interpretations offered along these lines have stopped short of showing how the account Aristotle offers in these chapters satisfies the explanatory demands placed upon it by a science of sensible qualities. In particular, it remains to be shown how sensible qualities, understood as properties essentially characterized in terms of their capacity to produce perceiver-independent physical changes, could perform their psychological role as both causes and manifest features of sense experience.

My aim in what follows is to complete this explanatory picture, to show how Aristotle's science of sensible qualities accounts for their psychological role as consequences of their essential nature. I begin in section 2 by defending the interpretation of Aristotle's science of sensible qualities I outlined above. My argument will be based on a detailed examination of the opening lines of *De Sensu* 3, where, I argue, Aristotle claims that the intrinsic connection between sense and sensible quality explored in *De Anima* 2.5–3.2 is a demonstrable consequence of their essential nature. In section 3 I turn to Aristotle's account of the essence of sensible qualities in *De Sensu* 3–5. I argue that this account explains the efficacy of sensible qualities in bringing about perception of themselves by characterizing them essentially in terms of certain

<sup>7</sup>A notable exception is Silverman (1987), who argues persuasively that visibility, the capacity to be perceived by sight, is a per se but non-essential attribute of color. My disagreement with Silverman is subtle, having to do with the way visibility belongs per se to color, but it has important consequences for the natural priority Aristotle extends to sensible qualities; see below, sect. 2 and note 24 for a concise statement of the difference between our interpretations.

“agent natures” productive of affections in both perceivers and sensory media. In this respect Aristotle’s account compares with modern reductive physicalist theories of color, but in contrast to its modern counterparts, Aristotle’s theory is consistent with the primitivist idea that the essential nature of sensible qualities is “revealed” in their manifest character in ordinary sense experience. Section 4 provides independent support for this claim, drawing on Aristotle’s under-explored appeal to the agent natures defining sensible qualities in his explanation of the practical value of the senses. As we’ll see, the resulting theory is anomalous from the point of view of the modern debate over the nature of sensible qualities, incorporating claims characteristic of both reductive physicalist and primitivist theories. Nevertheless, it offers precisely the sort of explanation of the psychological role of sensible qualities that a solution to the Aristotelian problem demands.

## 2. The Division of Explanatory Labor

In the opening lines of *De Sensu* 3, Aristotle introduces the question of what sensible qualities are (τί δὲ ποτε δεῖ λέγειν ὅτιοῦν αὐτῶν, 439a10; τί δὲ ἕκαστον αὐτῶν ὄν, a16–17). The question takes the form of a request for a *definition* (ὄρος, ὀρισμός), an account specifying the essence of the items in question.<sup>8</sup> Such an account of sensible qualities, however, must be distinguished from an account of their psychological role (439a6–17):

[1] Concerning the objects of each of the sense organs—I mean for instance color, sound, smell, flavor, and touch [i.e. haptic qualities such as hotness and moisture]—we stated in general in our remarks on the soul what their function and actuality is in respect of each of the sense organs. But what we should say any one of them is—for instance what color is, or what sound is, or what odor or flavor are, and similarly in regard to touch—we should [now] examine, and first of all in regard to color. [2] Each, then, is spoken of in two ways, on the one hand in actuality and on the other in potentiality, and we said in our remarks on the soul in what way color and sound are the same as or different from the senses in actuality, [i.e. the same as] vision and hearing. [3] Now, however, let us say what each of them is, such that [each] will produce perception and actuality.<sup>9</sup>

<sup>8</sup>See, e.g., *APo.* 2.10, 94a11–19, *Top.* 1.5, 101b38–102a1.

<sup>9</sup>περὶ δὲ τῶν αἰσθητῶν τῶν καθ’ ἕκαστον αἰσθητήριον, οἷον λέγω χρώματος καὶ ψόφου καὶ ὁσμῆς καὶ χυμοῦ καὶ ἀφῆς, καθόλου μὲν εἴρηται ἐν τοῖς περὶ ψυχῆς, τί τὸ ἔργον αὐτῶν καὶ τί τὸ ἐνεργεῖν καθ’ ἕκαστον τῶν αἰσθητηρίων. τί δὲ ποτε δεῖ λέγειν ὅτιοῦν αὐτῶν, οἷον τί χρῶμα ἢ τί ψόφον ἢ τί ὁσμὴν ἢ χυμόν, ὁμοίως δὲ καὶ περὶ ἀφῆς, ἐπισκεπτέον, καὶ πρῶτον περὶ χρώματος. ἔστι μὲν οὖν ἕκαστον διχῶς λεγόμενον, τὸ μὲν ἐνεργείᾳ τὸ δὲ δυνάμει. τὸ μὲν οὖν ἐνεργείᾳ χρῶμα καὶ ὁ ψόφος πῶς ἐστὶ τὸ αὐτὸ ἢ ἕτερον ταῖς καθ’ ἐνέργειαν αἰσθήσεσιν, οἷον ὁράσει καὶ ἀκούσει, εἴρηται ἐν τοῖς περὶ ψυχῆς. τί δὲ ἕκαστον αὐτῶν ὄν ποιήσει τὴν αἴσθησιν καὶ τὴν ἐνέργειαν, νῦν λέγωμεν.

As I read these lines, Aristotle is making three claims about the connection between the perceptual psychology of *De Anima* 2.5–3.2 and the account of sensible qualities to follow in *De Sensu* 3–5:

1. Sensible qualities were considered in *De Anima* 2.5–3.2 only insofar as they have the status of *special sensible objects*—that is, only insofar as they are qualities to which the special senses are essentially relative.
2. Considered as special sensible objects, sensible qualities are powers to produce sensory affection in suitably equipped perceivers. However, it is not by reference to this perceiver-*dependent* actuality that sensible qualities are defined.
3. The task of defining sensible qualities themselves, in a way that also explains their per se connection to the senses perceptive of them, does not belong to the perceptual psychology of *De Anima* 2.5–3.2; rather, it is the work of a *science* of sensible qualities, which Aristotle proposes to carry out beginning in *De Sensu* 3.

Other readings are, of course, possible.<sup>10</sup> But if the one I've sketched is correct, then Aristotle is asserting the explanatory priority of the account of sensible qualities given in *De Sensu* 3–5 over what was said about them in service of the perceptual psychology developed in *De Anima* 2.5–3.2. For while the latter discussion considered sensible qualities insofar as they have the status of *objects* of sense perception, the task of the former will be to specify what sensible qualities *are*, in order to explain their role in bringing about sense perception and actuality more generally. My aim in this section is to defend this reading, taking each of its three claims in turn.

### 2.1. *Sensible qualities as Sensible Objects in De Anima*

In *De Anima* 2.6, Aristotle identifies color, sound, odor, flavor, and haptic qualities like hot and cold, wet and dry, as “special sensible objects” (ἴδια αἰσθητά). The designation, as Aristotle characterizes it in this chapter, indicates two features of the relation these qualities bear to the sensory capacities perceptive of them, first that each is perceptible non-incidentally within only one sense modality, color by sight, sound by hearing, odor by smell, flavor by taste, and hotness and moisture by touch; and second, that the sense perceptive of each is immune to error concerning it (*DA* 2.6, 418a11–12). More generally, the designation ‘special sensible object’ indicates the relevance of these qualities for Aristotle’s explanatory project in *De Anima* 2.5–3.2. Aristotle is seeking a “scientific” account of the perceptive soul, a definition specifying the capacity of living things to perceive that makes clear the soul’s role in bringing about actual perceiving (*DA* 2.2, 413a13–20). Understanding how the presence of soul enables living things to perceive, however, requires first an understand

<sup>10</sup>See G. R. T. Ross (1906, 149–50), W. D. Ross (1955, 194), and Ganson (1997)

of what sort of activity perception is, and this, Aristotle thinks, requires a prior understanding of the “correlative objects” (ἀντικείμενα) in relation to which perception is actualized, since in general it is in terms of its activity and objects that a capacity must be defined.<sup>11</sup>

‘Sensible object’ (αἰσθητόν) is Aristotle’s word for the correlative object of the perceptive soul. According to the “common” (κοινῆ) account of perception offered in *De Anima* 2.5, sensible objects in general stand to the senses perceptive of them as agent to patient in Aristotle’s theory of action and passion.<sup>12</sup> Perception, for Aristotle, is a process of “assimilation” (ὁμοίωσις), a kind of motion and affection in which that which perceives (τὸ αἰσθητικόν), namely a living organism insofar as it is endowed with the capacity to perceive, shifts from being potentially to being actually such as the sensible object acting on it already actually is (417a17–21, 418a3–6). But this generic description of the causal role of sensible objects requires further specification. As Aristotle had already observed, perception belongs to living things in several specifically different ways (*DA* 2.2, 413b2–7, 414a2–4; 2.3, 415a3–6). Animals are by definition living things endowed with the capacity to perceive,<sup>13</sup> but while all animals possess the contact senses, touch and taste, only some additionally possess distance senses, sight, hearing, and smell. Accounting for these differences among animal kinds requires an understanding of the specific differences in the way sensible objects act on and affect the senses perceptive of them. For this reason, Aristotle announces in *De Anima* 2.6 that “we must first give an account of the sensible objects concerning each sense” (λεκτέον δὲ καθ’ ἐκάστην αἴσθησιν περὶ τῶν αἰσθητῶν πρῶτον, 418a6–7), namely the qualities identified as the special objects of the senses, since “it is to these that the essence of each sense is naturally relative” (πρὸς ἃ ἡ οὐσία πέφυκεν ἐκάστης αἰσθήσεως, 418a25).

The identification of sensible qualities as special objects of the senses therefore highlights their causal role in bringing about actual perception of themselves, a role that also explains their relevance to a scientific account of perceptive soul. From this, however, it should not be inferred that sensible qualities are *essentially* powers to produce perception of themselves. This, I suggest, is the lesson of the opening sentence of Aristotle’s preface to *De Sensu* 3, which distinguishes sensible qualities’ “function and actuality in respect of each sense organ”, which is supposed to have been discussed in *De Anima*, from what each sensible quality *is*. In *De Anima*, sensible qualities are considered in their psychological role as sensible objects and causes of sense experience, but this psychological role must be distinguished from what sensible qualities are in their essential nature.

<sup>11</sup>See *DA* 2.4, 415a14–22; cf. *Metaph.* ©.8, 1049b12–17.

<sup>12</sup>See *GC* 1.7, esp. 323b29–324a14.

<sup>13</sup>See *DA* 2.2, 413b1–2, *Sens.* 1, 436b10–12; *Somn.* 1, 454b25; *Juv.* 1, 467b22; 3, 468a18; 4, 469b4; *PA* 2.7, 653b22; 4.5, 678b4.

Aristotle has good reasons to insist on a distinction between sensible qualities and sensible objects. For one, they belong to distinct predicative categories. Attributes such as color and flavor are kinds of *quality*, specifically kinds of *affective quality*, since a subject's being qualified in the way characteristic of each sensible quality makes it productive of affections in other things—including, but not limited to, *perceptual affections*.<sup>14</sup> Sensible *objects* by contrast belong to the category of *relatives*, which indicate, not a way in which a predicative subject is said to be qualified, but rather a way it is *of*, or relative to, something else.<sup>15</sup> Of course, colors *are* visible, flavors *are* tasteable, and sensible qualities *are* generally sensible, but for Aristotle this should not be taken as evidence that colors, flavors, and sensible qualities generally are *essentially* related to the senses perceptive of them. To the contrary, these qualities are said to be sensible only “because something else is relative to them” (1021a30–b3):

For ‘object of thought’ signifies that there is thought of it [sc. that of which ‘object of thought’ is predicated], yet thought is not relative to that of which there is thought, since the same thing would have been said twice. Similarly, sight too is the sight of something, but not of that of which there is sight—although this of course is true to say. Rather, [sight is] relative to color or relative to something else of this sort. Put in the other way, that [sight] is of that of which there is sight, the same thing will be said twice.<sup>16</sup>

Even if they are spoken of relative to the senses perceptive of them, colors and other sensible qualities are prior in nature and being to the senses perceptive of them (cf. *Metaph.* Δ.11, 1019a1–4). To say that color is visible is to say that there is sight of it, but it is not to say that color is essentially or by definition an object of sight. If it were, the assertion that sight is of *color* would be exactly as (un)informative as the assertion that sight is of *that of which there is sight*. The fact that it isn't indicates for Aristotle not only that color is not *essentially* visible, but that its status as visible is a consequence only of the nature of *sight*, which (in this example) is asymmetrically defined as the sense perceptive of color.<sup>17</sup>

The same priority is implied by Aristotle's appeal to sensible qualities as the objects to which the senses are essentially relative in *De Anima* 2.6. An account of the special senses requires an understanding of the objects they specially perceive because

<sup>14</sup>See *Cat.* 8, 9a38–b9, cf. *Metaph.* Δ.14, 1020b9.

<sup>15</sup>*Cat.* 7, 6a36–37, b28–36.

<sup>16</sup>τό τε γὰρ διανοητὸν σημαίνει ὅτι ἔστιν αὐτοῦ διάνοια, οὐκ ἔστι δ' ἡ διάνοια πρὸς τοῦτο οὐ ἔστι διάνοια (δις γὰρ ταῦτὸν εἰρημένον ἂν εἴη), ὁμοίως δὲ καὶ τινός ἐστιν ἡ ὄψις ὄψις, οὐχ οὐ ἔστιν ὄψις (καίτοι γ' ἀληθές τοῦτο εἰπεῖν) ἀλλὰ πρὸς χρῶμα ἢ πρὸς ἄλλο τι τοιοῦτον. ἐκείνως δὲ δις τὸ αὐτὸ λεχθήσεται, ὅτι ἐστὶν οὐ ἔστιν ἡ ὄψις.

<sup>17</sup>This passage therefore revises Aristotle's account from *Cat.* 7, which also argues that sense and sensible quality are not “coordinate in nature” (ἅμα τῇ φύσει, *Cat.* 13, 14b27–29), but does so on the grounds that the existence (rather than the being) of sense implies, but is not implied by, the existence of what it perceives (7b35–8a12).

the senses will be by definition potentials to be such as these qualities actually are. If, however, these qualities were sensible by virtue of being *of* the senses perceptive of them, the resulting account of the relevant sense would be uninformative, as if one defined sight as the sense perceptive of that of which there is sight. A scientific account of perceptive soul therefore calls for an understanding of the nature of sensible qualities to the extent that they have the status of special sensible objects, but indeed *only* to this extent, since it is only insofar as they can act on perceivers that their nature bears on the definition of the senses perceptive of them.

With only a few exceptions, Aristotle's remarks on sensible qualities in *De Anima* 2.5–3.2 adhere to these disciplinary boundaries.<sup>18</sup> In general, the emphasis of these chapters is on clarifying the potentialities present in the sense and the sensory medium in virtue of which the qualities specially perceived by those senses bring about actual perception; and apart from the exceptions noted above, very little is said about what these qualities are in themselves, such that they could activate these potentials in the medium and the perceptive sense. However, the lesson to be drawn from this is not that sensible qualities are *essentially* powers to bring about perception of themselves, but rather that they are objects of inquiry for a psychological investigation of perceptive soul only to the extent that they have a “function and actuality” in relation to the senses essentially perceptive of them.

### 2.2. Perceiver-Dependence in *De Anima* 3.2

Aristotle once again stresses the priority of sensible qualities when, in the preface to *De Sensu* 3, he reminds us that the *De Anima* examination of perceptive soul had clarified “in what way color and sound are the same as or different from the senses in actuality”. The reference here is to *De Anima* 3.2, where Aristotle derives a further consequence from the observation that sensible objects stand to the senses perceptive of them as agent to patient of qualitative affection (425b25–426a10):

Now, the actuality of the sensible object and of the sense are one and the same, but the being of each is different. I mean for instance sound in actuality and hearing in actuality. For it is possible, while having [the sense of] hearing, not to hear, and what has sound is not always sounding. But *whenever* that which is capable of hearing is active and that which is capable of sounding sounds, *then* hearing in actuality and sound in actuality come about simultaneously, of which [pair] one could say that the one is hearkening and the other is sounding. Indeed, if the motion and the productive affection and the passive affection are present in what is moved, it is also necessary that sound and hearing in actuality be present in what is in potential [sc. the patient of the auditory affection]. For the actuality of the agent and the mover comes about in what suffers [the motion and affection], which is why it is not necessary for the

<sup>18</sup>Two major exceptions are found in the chapters on the special objects of vision (*DA* 2.7) and hearing (*DA* 2.8), but there are special circumstances that account for each; for discussion, see sects. 2.3 and 3.

mover to be moved. Therefore the actuality of that which is productive of sound is sound or sounding, while [the actuality] of that which is productive of hearing is hearing or hearkening; for hearing is double, and sound is double. And the same account applies to the other senses and sensible objects.<sup>19</sup>

Commentators on *De Sensu* 3 often interpret Aristotle's allusion to the sameness and difference of sense and sensible quality in actuality as a reference to the first line of the quoted passage: sensible qualities in actuality are the same in number but different in being from the senses actually perceiving them.<sup>20</sup> But this reading elides the distinction between sensible qualities and sensible objects that Aristotle has kept clearly in view so far in *De Anima* 2.5–3.2. As *sensible objects*, colors, sounds, and other sensible qualities are in actuality the same in number but different in being from the senses perceptive of them, since in this capacity the actuality of a sensible object is identical to a passive affection present in a perceiver. As *the qualities they are*, however, sensible qualities can be actual even in the absence of perceivers.

This point is well made by Alexander in his commentary on *De Sensu* 3 (*In De Sens.* 42.4–15 Hayduck):

To be sure, there is one account of being a sense in actuality and another of being a sensible object in actuality. But instead of saying this, here [Aristotle] says “. . . color and sound in actuality. . .”, because actual color is not the same as actual sight, nor is actual sound the same as actual hearing. For these can be in actuality even if they are not [for instance] seen, whereas it is not possible for these to be sensible objects in actuality apart from perception. Hence by speaking of [color and sound being the same and different] “. . . to the senses in actuality”, he is [in fact] making clear the claim that “it was said in *De Anima* in what way actually perceptible color and actually perceptible sound are the same, respectively, as actual sight and actual hearing, and in what way they are different”. For it is as actual sensible objects that [these qualities] stand as correlative objects of these [senses].<sup>21</sup>

<sup>19</sup>ἢ δὲ τοῦ αἰσθητοῦ ἐνέργεια καὶ τῆς αἰσθήσεως ἢ αὐτὴ μὲν ἐστὶ καὶ μία, τὸ δ' εἶναι οὐ τὸ αὐτὸ αὐταῖς· λέγω δ' οἶον ὁ ψόφος ὁ κατ' ἐνέργειαν καὶ ἡ ἀκοὴ ἢ κατ' ἐνέργειαν· ἔστι γὰρ ἀκοὴν ἔχοντα μὴ ἀκούειν, καὶ τὸ ἔχον ψόφον οὐκ αἰεὶ ψοφεῖ, ὅταν δ' ἐνεργῇ τὸ δυνάμενον ἀκούειν καὶ ψοφῇ τὸ δυνάμενον ψοφεῖν, τότε ἢ κατ' ἐνέργειαν ἀκοὴ ἅμα γίνεται καὶ ὁ κατ' ἐνέργειαν ψόφος, ὡν εἴπειεν ἂν τις τὸ μὲν εἶναι ἄκουσιν τὸ δὲ ψόφῃσιν. εἰ δὲ ἐστὶν ἢ κίνησις (καὶ ἢ ποίησις καὶ τὸ πάθος) ἐν τῷ κινουμένῳ, ἀνάγκη καὶ τὸν ψόφον καὶ τὴν ἀκοὴν τὴν κατ' ἐνέργειαν ἐν τῷ κατὰ δύναμιν εἶναι· ἢ γὰρ τοῦ ποιητικοῦ καὶ κινητικοῦ ἐνέργεια ἐν τῷ πάσχοντι ἐγγίνεται· διὸ οὐκ ἀνάγκη τὸ κινεῖν κινεῖσθαι. ἢ μὲν οὖν τοῦ ψοφητικοῦ ἐνέργειά ἐστι ψόφος ἢ ψόφῃσις, ἢ δὲ τοῦ ἀκουστικοῦ ἀκοὴ ἢ ἀκουσις· διττὸν γὰρ ἢ ἀκοὴ, καὶ διττὸν ὁ ψόφος. ὁ δ' αὐτὸς λόγος καὶ ἐπὶ τῶν ἄλλων αἰσθήσεων καὶ αἰσθητῶν.

<sup>20</sup>See, e.g., G. R. T. Ross (1906, 149), W. D. Ross (1955, 196–97), and Miller (2018, 212)

<sup>21</sup>ἄλλο δὲ ἐστὶ τῷ λόγῳ κατ' ἐνέργειαν αἰσθήσει εἶναι καὶ ἄλλο κατ' ἐνέργειαν αἰσθητῷ. ἀντὶ δὲ τοῦ ταῦτα εἰπεῖν φησι· <τὸ μὲν οὖν ἐνέργεια χρῶμα καὶ ὁ ψόφος.> οὐ γὰρ τὸ κατ' ἐνέργειαν χρῶμα ταῦτόν ἐστι τῇ κατ' ἐνέργειαν ὅψει οὐδὲ ὁ κατ' ἐνέργειαν ψόφος ὁ αὐτὸς τῇ ἀκοῇ· δύναται γὰρ ἐνέργεια ταῦτα εἶναι καὶ μὴ ὀρώμενα, ἀλλ' οὐκέτι οἶόν τε ἐνέργεια αὐτοῖς αἰσθητοῖς εἶναι χωρὶς αἰσθήσεως. ἔστιν οὖν τὸ λεγόμενον· ‘τὸ μὲν οὖν ἐνέργεια χρῶμα αἰσθητὸν καὶ ὁ ἐνέργεια ψόφος αἰσθητὸς πῶς ἐστι

Alexander's interpretation picks up on Aristotle's own indication in the passage quoted from *De Anima* 3.2 that sensible qualities have a perceiver-independent actuality in addition to the one numerically identical to the passive affection of a perceiver. Sound and hearing can both be spoken of as potential and as actual, and *whenever* both are in actuality in the appropriate conditions, *then* they are actualized simultaneously. Equally, however, there is an actuality of each that is independent of the other. As Aristotle had argued in *De Anima* 2.5, hearing and other sensory capacities are said to be actual in two ways. In the same way that a mathematician can be said to know geometry simply by virtue of *possessing* knowledge she is not actively *using*, living things can be said to be actual perceivers both when they are actively suffering perceptual affection and when they simply possess the capacity to be so affected; and whereas actual perceptual affection requires the presence of a suitable sensible object, the possession of a capacity to be so affected does not. Similarly, sensible qualities can be in actuality in the absence of actual perceivers. This happens, for instance, when a colored body produces chromatic motions in an illuminated medium or a sounding body produces sonic motions in a continuous parcel of air.<sup>22</sup> It is only when these motions produce affections in the animate, functioning organs of a suitably equipped perceiver that the actuality of color or sound comes to be and is preserved and destroyed simultaneously with the actuality of the sense perceptive of it.

Notice, however, that even though Aristotle acknowledges two actualities of both sense and sensible quality, he stops short of committing himself to the stronger claim that they have two actualities *in the same way*.<sup>23</sup> Aristotle describes the perceiver's transition from mere possession to the exercise of a sensory capacity in episodes of actual perceiving as "a progression [sc. of that which perceives] into itself and into its fulfillment" (εἰς αὐτὸ ἢ ἐπίδοσις καὶ εἰς ἐντελέχειαν, *DA* 2.5, 417b6–7). One reason this description captures what is distinctive about a perceiver's transition into actual perceiving—a transition known to the tradition as one into "second" actuality perceiving—is that coming actually to be affected by a sensible quality does not involve a change on the part of the perceiver, who retains the potential to be so affected (cf. *DA* 2.5, 417b2–5). This feature of second actuality perception is paralleled

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ταῦτὰ τὸ μὲν τῆ κατ' ἐνέργειαν ὄψει, τὸ δὲ τῆ κατ' ἐνέργειαν ἀκοῆ, καὶ κατὰ τί ἕτερα, ἐν τοῖς Περὶ ψυχῆς εἴρηται. ἐδήλωσε δὲ τοῦτο διὰ τοῦ εἰπεῖν <ταῖς κατ' ἐνέργειαν αἰσθήσεσι> ταῦταις γὰρ τὰ κατ' ἐνέργειαν αἰσθητὰ ἀντίκειται.

<sup>22</sup>For this effect of color, see *DA* 2.7, 418b1–2, 419a9–10; for sound, see *DA* 2.8, 420a2–4. Analogous actualities apply to flavor and haptic qualities, though here a distinction must be drawn between the role of flesh as sense organ and as sensory medium; see *DA* 2.11, 423b12–20.

<sup>23</sup>Contrast Caston (2018), who claims "Aristotle treats perceptibles and perceptual powers as strictly parallel" in the above quoted passage of *DA* 3.2 (52); cf. Osborne (1983, 407), Kosman (1975, 513–14), Silverman (1987, 272–73), Polansky (2007, 386–91). As several commentators have rightly noted (see Marmodoro (2014, 131), Corcilius (2016, 202–203n20), Caston (2018, 56–57n52)) Aristotle never explicitly characterizes the two actualities of sensible qualities in terms of first and second actuality. Nor is the parallel as strict as Caston claims, as I'll argue presently.

in the actuality of a sensible quality, which, as an agent productive of an affection in some patient, is not changed in its transition from being potentially to being actually perceived. However, Aristotle's description is also meant to capture the idea that the transition into second actuality perception is a *fuller* realization of the capacity to perceive, a progression into the fulfillment of the activity it is essentially the capacity for. By contrast, Aristotle gives no indication that, for instance, the fullest realization of the essential nature of color is for it to be seen.

To the extent that commentators have seen evidence for a perceiver-dependent *second* actuality of sensible qualities, it has been thought to come from the following passage of *De Anima* 3.2, in which Aristotle appears to concede that there are no actual colors, or flavors, or sensible qualities generally in the absence of actual perceivers (426a15–26):

But since there is [numerically] one actuality of the sensible object and that which is perceptive of it, though the being [of each actuality] is different, it is necessary that hearing and sound, *when spoken of in this way*, are destroyed and preserved at the same time as one another, as are flavor and taste and the other [sensible objects and senses] similarly. Spoken of as potential, however, this is not necessary. To the contrary, the earlier physical theorists who thought that there is no white or black without vision, nor flavor without taste, did not state matters well. For they spoke in one way correctly but in another incorrectly, since the sense and sensible object are spoken of in two ways: some as potential and some as actual, so that concerning the latter [sc. sensible objects in actuality] what they said applies, but in the case of the former [sc. sensible objects in potentiality] it does not apply. But those [theorists] spoke without qualification about what is spoken of not without qualification.<sup>24</sup>

Aristotle's concession is, however, more meager than it appears. To those of his predecessors who supposed nothing is *colored* or *flavored* without actual perceiving, Aristotle's reply is that nothing is an actual *sensible object* in the absence of actual perceivers. What these theorists failed to notice is that colors and flavors are called sensible objects two ways, potentially and actually. Admittedly, colors and flavors cannot be *actual* objects of sensation without actual perceivers, since being an actual object of sensation is identical to an affection present in a perceiver. Nevertheless, they are still *potentially* sensible objects, since colors and flavors in actuality produce medial motions that *would* produce perceptual affection in the presence of perceivers. Far from acknowledging the perceiver-dependence of sensible qualities, then, Aristotle

<sup>24</sup>ἔπει δὲ μία μὲν ἐστὶν ἐνέργεια ἢ τοῦ αἰσθητοῦ καὶ τοῦ αἰσθητικοῦ, τὸ δ' εἶναι ἕτερον, ἀνάγκη ἅμα φθεῖρεσθαι καὶ σώζεσθαι τὴν οὕτω λεγομένην ἀκοὴν καὶ ψόφον, καὶ χυμὸν δὴ καὶ γεῦσιν, καὶ τὰ ἄλλα ὁμοίως· τὰ δὲ κατὰ δυνάμιν λεγόμενα οὐκ ἀνάγκη· ἀλλ' οἱ πρότερον φυσιολόγοι τοῦτο οὐ καλῶς ἔλεγον, οὐθὲν οἰόμενοι οὔτε λευκὸν οὔτε μέλαν εἶναι ἄνευ ὄψεως, οὐδὲ χυμὸν ἄνευ γεύσεως. τῇ μὲν γὰρ ἔλεγον ὀρθῶς, τῇ δ' οὐκ ὀρθῶς· διχῶς γὰρ λεγομένης τῆς αἰσθήσεως καὶ τοῦ αἰσθητοῦ, τῶν μὲν κατὰ δυνάμιν τῶν δὲ κατ' ἐνέργειαν, ἐπὶ τούτων μὲν συμβαίνει τὸ λεχθέν, ἐπὶ δὲ τῶν ἐτέρων οὐ συμβαίνει. ἀλλ' ἐκεῖνοι ἀπλῶς ἔλεγον περὶ τῶν λεγομένων οὐχ ἀπλῶς.

here indicates that colors and flavors can be fully actual as colors and flavors even if they are never actual objects of perception.

This is just the conclusion we should expect given the ontological priority Aristotle attributes to sensible qualities over the senses perceptive of them. Colors, flavors, and other sensible qualities have the capacity to affect perceivers and bring about actual perception, but this capacity belongs to them only because there exist senses defined by their ability to be affected and actualized by qualities of this sort.<sup>25</sup> The presence or absence of perceivers therefore makes no difference from the ontological perspective of sensible qualities, for there could be sensible qualities even in a world without perceivers (*Metaph.* Γ.5, 1010b31–1011a2):

So in general, if sensible objects were all there were, there would be nothing if there were no ensouled things, since [in that case] there would be no perception. Now it is perhaps true that there would be no sensible objects nor sensations, since this [latter] is an affection of what perceives. But it is impossible that what underlies, [i.e.] that which produces perception, should also not exist without perception. For it is not the case that perception is of itself. Rather, there is also something else apart from the perception, which must be prior to the perception. For what moves is naturally prior to what is moved, and this no less if these are said in relation to one another.<sup>26</sup>

Whether we say that a world without perceivers is a world without sensible objects depends, I suggest, on how we interpret the modal content of terms like ‘visible’ (ὄρατόν) and ‘sensible’ (αἰσθητόν). Interpreted rigidly as referring to the qualities that, in our actual world of perceivers, the senses are essentially perceptive of, it appears to be true to say there would still be sensible objects in a counterfactual world without perceivers. In such a world, however, there would be no senses, so from the point of view of that world there would neither be qualities of which those senses are essentially perceptive. What is certain in either case is that “what underlies”, namely the qualities that are sensible objects in the actual world, *would* still exist, since these

<sup>25</sup>In the scholarly terminology of *APo.*, this makes their status as special sensible objects “per se<sub>2</sub>” attributes of sensible qualities (see *APo.* 1.4, 73a37–b1), akin to the way Aristotle thinks leaf-shedding belongs to broad-leaved plants primarily as a consequence of what leaf-shedding essentially is (namely, the coagulation of sap around the base of the stem); see *APo.* 2.16, 98b33–38, 2.17, 99a21–29. In this conclusion my view contrasts with that of Silverman (1987), who sees visibility as a per se<sub>1</sub> attribute of color and therefore as following necessarily from the essential nature of color. For a general account of the role of per se<sub>2</sub> predications in Aristotle’s theory of demonstration, see Bronstein (2016, 46–66).

<sup>26</sup>ὅλως τ’ εἴπερ ἔστι τὸ αἰσθητὸν μόνον, οὐθὲν ἂν εἴη μὴ ὄντων τῶν ἐμψύχων· αἴσθησις γὰρ οὐκ ἂν εἴη. τὸ μὲν οὖν μήτε τὰ αἰσθητὰ εἶναι μήτε τὰ αἰσθήματα ἴσως ἀληθές (τοῦ γὰρ αἰσθανομένου πάθος τοῦτο ἔστι), τὸ δὲ τὰ ὑποκείμενα μὴ εἶναι, ἃ ποιεῖ τὴν αἴσθησιν, καὶ ἄνευ αἰσθήσεως, ἀδύνατον. οὐ γὰρ δὴ ἢ γ’ αἴσθησις αὐτῆ ἑαυτῆς ἔστιν, ἀλλ’ ἔστι τι καὶ ἕτερον παρὰ τὴν αἴσθησιν, ὃ ἀνάγκη πρότερον εἶναι τῆς αἰσθήσεως· τὸ γὰρ κινεῖν τοῦ κινουμένου φύσει πρότερόν ἐστι, κἂν εἰ λέγεται πρὸς ἄλληλα ταῦτα, οὐθὲν ἦττον.

qualities are what they are prior to, and independently of, their capacity to bring about actual perception.<sup>27</sup>

### 2.3. *The project of De Sensu 3–5*

On the Alexandrian reading I've been defending, Aristotle's allusion to the sameness and difference of sense and sensible quality in actuality in the preface to *De Sensu* 3 is meant to call attention to the latter's perceiver-*independence*. The final sentence of the preface tells us why: whereas the *De Anima* examination of perceptive soul put focus on the perceiver-*dependent* actuality of sensible qualities, the actuality in respect of which sensible qualities have the status of objects of the special senses, the present investigation will consider "what each [sensible quality] *is*, such that each will produce perception and actuality".

Commenting on this line, Alexander remarks that Aristotle's aim is now to say "what each of them is, color and sound and similarly each of the [qualities] spoken of in connection with the other senses, such that [each] is potentially sensible" (τί δὲ ὄν ἕκαστον αὐτῶν, τό τε χρῶμα καὶ ὁ ψόφος καὶ ἕκαστον τῶν κατὰ τὰς ἄλλας αἰσθήσεις ὁμοίως, δυνάμει ἐστὶν αἰσθητὸν, *In De Sens.* 42.15–17). Alexander's claim is not, I think, that Aristotle is interested only in the potential of sensible qualities to be perceived.<sup>28</sup> It is rather that Aristotle is introducing an *order of explanation* according to which this potential to be perceived is a demonstrable consequence of what a sensible quality essentially is. This order of explanation is characteristic of Aristotle's conception of scientific inquiry in general. For Aristotle, scientific inquiry is a search for the causes explanatory of the universal facts we observe in the world, for instance why broad-leaved plants shed their leaves, or why the interior angles of a triangle sum to 180°. These facts, Aristotle thinks, express per se connections between real, scientifically knowable kinds, connections which obtain universally or for the most part because they obtain somehow *in virtue of* what these kinds are essentially. In seeking the causes of these per se connections, we are therefore seeking to understand how they are consequences of the *essence* of the relevant kinds. Explanation in Aristotelian science begins with and proceeds from the knowledge of essences.

The same order of explanation applies to the per se connection between sense and sensible quality. Colors are, always or for the most part, perceptible by sight, sounds by hearing, flavors by taste, and the per se connections expressed by these universal

<sup>27</sup>Cf. Broadie (1993, 156–57), Broackes (1999, 93n74); contrast Caston (2018, 43), who takes τὰ ὑποκείμενα to refer to potential sensible objects. This reading brings the passage in line with *Cat.* 7, 7b35–8a2, but as Aristotle indicates in the last line of the quoted passage, the account here relies on the revised account of the relativity of sense and sensible object given in *Metaph.* Δ.15; see note 17 above.

<sup>28</sup>Contrast Ganson (1997), who objects that Alexander's interpretation wrongly assumes that "when Aristotle speaks of the sensible quality in activity in *De Sensu* 3, he is talking about the property *perceptible*" (267).

facts must obtain somehow or other in virtue of what color and sight, sound and hearing, flavor and taste essentially are. The *De Anima* examination of perceptive soul had sought to understand these connections to the extent that they shed light on the essential nature of the senses; and because the senses turned out essentially to be potentials to be acted on by a certain kind of sensible quality, this examination also required some grasp of the nature of the qualities the senses are essentially perceptive of. Thus, for instance, Aristotle observed in *De Anima* 2.7 that color's "nature" (φύσις, 418b1–2) and "being" (τὸ χρώματι εἶναι, 419a9–10) is "to be capable of moving the actually transparent" (κινητικὸν τοῦ κατ' ἐνέργειαν διαφανοῦς). This observation was crucial to understanding the essential nature of sight and the other special senses because it made clear that it is the same potential in both sense and sensory medium that enables each to be affected by sensible objects as such. Sight is receptive of color because its organ is actually transparent in the same way as the visual medium that transmits chromatic motions to it; and the same is true for the other senses and their respective media. This conclusion shows that the per se connection between sight and color, and generally between sense and sensible quality, obtains because sensible qualities have the capacity to produce motions in the relevant medium. But it does not follow, as some scholars have supposed, that sensible qualities must therefore be *defined* as powers to move a medium.<sup>29</sup> To the contrary, both this actuality and the resulting capacity of sensible qualities to bring about actual perception must be explained by reference to what sensible qualities essentially are.

The preface to *De Sensu* 3 should therefore be read as an introduction to an Aristotelian *science* of sensible qualities. The aim of this science is to specify the essence of sensible qualities in a way that can account for their capacity to produce motions in the medium generally and, more specifically, the perceptual affections that ground the per se connection between these qualities and the senses essentially perceptive of them. In the next section, I argue that Aristotle explains this per se connection by defining sensible qualities in terms of the presence or absence of an "agent nature" capable of acting on the relevant medium. This explanation relies on a reductive analysis of sensible qualities in terms of the Aristotelian physical theories of mixture and motion. For this reason Aristotle's theory compares with modern reductive physicalist theories of color and other sensible qualities, but unlike its modern counterparts, Aristotle's theory does not have the problematic consequence that sensible qualities are therefore not manifest in experience as they essentially are. It will be up to the remaining sections to explain why.

<sup>29</sup>Contrast Ganson (1997, 272) and Kalderon (2015, 75); cf. Shields (2016, 231).

## 3. Essence, Reduction, and "Agent Natures"

I've argued that the preface to *De Sensu* 3 tasks an Aristotelian science of sensible qualities with explaining the per se connection of each such quality to the sense essentially perceptive of it. It is not obvious, however, that Aristotle achieves this explanatory objective in *De Sensu*. In its remaining chapters we find detailed discussion of only three of the qualities identified in *De Anima* as special sensible objects, namely color, flavor, and odor. For a discussion of sound (and voice) we seem to be referred back to *De Anima* (*Sens.* 4, 440b27–28), and despite indications both here and elsewhere in the corpus of a discussion of haptic qualities in *De Sensu*, nothing of the sort survives in our extant text.<sup>30</sup> Nevertheless, these chapters accomplish more than a survey of their contents might suggest. For it is clear from the accounts of color, flavor, and odor spanning *De Sensu* 3–5 that Aristotle envisions a common framework for articulating the essential nature of sensible qualities, one that we should expect also to explain their efficacy in actuality.

Commentators for the most part agree on the basic features of this framework. The essential nature of a sensible quality can be discovered by a sort of chemical analysis. Each quality comes about from the *mixture* (in certain specific proportions) of a pair of primary contraries, white and black in the case of color, sweet and bitter in the case of flavor, and contraries "analogous" (ἀνάλογον, *Sens.* 5, 443b7–8) to those of flavor in the genus of odors perceptible by both human and non-human animals.<sup>31</sup> In this framework, generic differences between sensible qualities, as between colors and flavors, are attributable to differences in the contraries from which they are mixed, while specific differences, as between scarlet and vermilion, are attributable to differences in the ratio in which the relevant qualities are mixed. The result is that sensible qualities are identified with ratios or proportions (λόγοι) of the primary contraries, similar to the way harmonic intervals such as the octave (2 : 1) and the fourth (4 : 3) are identified as proportions of low to high pitch.<sup>32</sup>

What has been less well understood is how this framework accounts for the per se connection between sense and sensible quality that Aristotle tasks the science of sensible qualities with explaining. As the *De Anima* discussion of the senses made clear, this connection obtains because each of the embodied senses has the potential to be affected by the qualities it essentially perceives in the same way as the medium on which that quality has been observed to act, as for instance the seeing eye, like the

<sup>30</sup>See, in addition to *Sens.* 3, *Sens.* 7, 449b1–3, *Meteor.* 341a13–14, and, for discussion, Burnyeat (2004).

<sup>31</sup>In *De Sensu* 5 Aristotle also recognizes a class of odors perceptible only by humans, but it is unclear whether they constitute a unified genus; see 443b17–444a3, a28–b28. In any case, Aristotle's discussion of these odors is mostly limited to explaining their function in promoting human health.

<sup>32</sup>*Sens.* 3, 439b25–440a6; see Sorabji (1972) for a classic discussion of the difficulties attending Aristotle's appeal to mathematics in *Sens.* 3 and its sequels.

airy or watery medium that transmits chromatic motions to it, receives color by virtue of being actually transparent. What remains for a science of sensible qualities is to explain is why, given what each sensible quality essentially is, it moves and affects the specific medium and, by extension, the specific embodied sense it does in actuality. But, for all that has been said, it remains unclear how identifying sensible qualities with ratios of contraries can account for their ability to move and affect both sense and sensory medium.

My argument in this section will be that the explanation appears at a slightly deeper level of analysis. Aristotle's framework characterizes sensible qualities as ratios of a mixture of primary contraries, but these primary contraries are themselves characterized in terms of the presence and absence of some *agent nature*, a nature whose presence or absence in the appropriate subject determines its impact on the relevant medium and, by extension, the sense perceptive of it.<sup>33</sup> Commentators have remarked on Aristotle's appeal to these natures in connection with the material basis of sensible quality mixtures in the corporeal attributes of sensible bodies, but they play an equally important role in Aristotle's account of the medial motions sensible qualities produce in actuality. As Aristotle puts it, sensible qualities are ratios "of a mixture and motion" (τινας τῆς μίξεως καὶ κινήσεως, *Sens.* 4, 442a15), causal principles whose efficacy in bringing about sense affection is fully explained by the Aristotelian physics of mixture and change.

### 3.1. "Mixture and Motion"

Here, as in *De Anima*, color serves as a paradigm. The primary contraries of the color scale, white and black, are identical to the presence and absence of *transparency* (τὸ διαφανῆς), a nature which was identified in *De Anima* as the medium of vision but which Aristotle here claims is in fact (*Sens.* 3, 439a22–25):

. . . a certain common nature and potential, which is not separate but present in [the bodies typically called transparent] and inheres in other bodies as well, in some more, in some less.<sup>34</sup>

Transparency as such is a nature whose presence in a body endows it with the capacity to respond in a certain way to fiery bodies, but the nature of the response depends on whether the limits of the relevant body are determined by surfaces of its own. In unbounded bodies the response is *illumination*: light, for Aristotle, is just actual

<sup>33</sup>Like the idea that intermediate sensible qualities are compounds of a pair of primary contraries, the identity of these contraries to the presence and absence of some nature seems to be a feature of Aristotle's general ontology of quality genera; see *Metaph.* I.4, 1055a33–35, I.7, 1057b22–34, and, for discussion of the problems with this model, Castelli (2018, 182–86).

<sup>34</sup>. . . ἀλλά τις κοινή φύσις καὶ δύναμις, ἢ χωριστὴ μὲν οὐκ ἔστιν, ἐν τούτοις δ' ἔστι, καὶ ἐν τοῖς ἄλλοις σώμασιν ἐνυπάρχει, τοῖς μὲν μᾶλλον τοῖς δ' ἥττον.

transparency in the unbounded air and water that visual creatures inhabit.<sup>35</sup> But in bounded bodies, and more specifically in surfaces continuous with illuminated air and water, actual transparency is *color*. It is therefore the presence and the absence of transparency in the surface of bounded bodies, and the resulting capacity or incapacity to become actually transparent in the presence of fiery bodies, that defines the primary contraries of color (*Sens.* 3, 439b14–18):

So that which when present in air produces light may also be present in the transparent [sc. in bounded bodies]; it may also fail to be present, but rather there may be absence of it. So as in the former case the one [sc. the presence] is light and the other [sc. the absence] is darkness, it is in this way that white and black come about in bodies.<sup>36</sup>

For a body to be colored, then, is for it to have some degree of transparency in its surfaces (if it has them).<sup>37</sup> White bodies will have a maximal degree of surface transparency, black bodies a minimal degree, and bodies whose colors are mixed from white and black will have surface transparency in degrees intermediate between these extremes. As commentators have rightly pointed out, any degree of surface transparency implies certain material facts about a colored body, for instance that it contains so much airy or watery stuff, since transparency is a nature common to these elements.<sup>38</sup> Equally, however, the degree of surface transparency present in a sensible body indicates the character of its chromatic response to fiery bodies, since it is precisely to the extent that transparency is present in its surface that the body will be capable of producing the chromatic motions in illuminated media that, for Aristotle, characterize the actuality of color. Surface transparency is, as I have been putting it, the “agent nature” definitive of color.

Aristotle seems to appeal to the presence and absence of agent natures also in the accounts of flavor and odor presented in *De Sensu* 4 and 5. “Flavors”, Aristotle claims, “are the affection or privation of nutriment” (τοῦ τροφίμου οἱ χυμοὶ ἢ πάθος εἰσὶν ἢ στέρησις, *Sens.* 4, 441b24–25) in the moistened dry. Sweetness is identical to the nourishing elements of assimilated food (442a2, a8), while bitterness is the absence of these elements in the moistened dry, “just as black is the absence of white

<sup>35</sup>See *DA* 2.7, 418b9–13, *Sens.* 3, 439a19–21.

<sup>36</sup>ἔστι μὲν οὖν ἐνεῖναι ἐν τῷ διαφανεῖ τοῦθ' ὅπερ καὶ ἐν τῷ ἀέρι ποιεῖ φῶς, ἔστι δὲ μή, ἀλλ' ἐστερηθῆναι. ὡς περ οὖν ἐκεῖ τὸ μὲν φῶς τὸ δὲ σκότος, οὕτως ἐν τοῖς σώμασιν ἐγγίγνεται τὸ λευκὸν καὶ τὸ μέλαν.

<sup>37</sup>See *Sens.* 3, 439b11–12: “hence color would be the limit of the transparent in a bounded body (ὥστε χρῶμα ἂν εἴη τὸ τοῦ διαφανοῦς ἐν σώματι ὠρισμένῳ πέρας)”. Commentators are perhaps right to doubt that this assertion amounts to a definition of color, given that it appears to be conditional on the Pythagorean assumption that color is a limit and to imply that the interior of a bounded body is colorless; see Broackes (1999, 59–69) and Kalderon (2015, 77). However, as Ierodiakonou (2018, 83–84) points out, Aristotle's point may be that there can be actual color, color producing chromatic motions in transparent media, only at the surface of a bounded body.

<sup>38</sup>Cf. *DA* 3.1, 425a1–2; see, e.g., Broackes (1999) and Caston (2018, 64–65).

in the transparent” (ὡσπερ τὸ μέλαν στέρησις ἐν τῷ διαφανεῖ τοῦ λευκοῦ, 442a25–26). The genus of odor perceptible by both human and non-human animals is also “the affection from what is flavored” (ἀπ’ ἐγγύμου ἐστὶ τὸ πάθος, *Sens.* 5, 443a8), only here nutriment acts on a nature that, like the transparent, is common to both air and water (443b12–14). Moreover, the accounts given of sound and haptic qualities such as heat and moisture outside of *De Sensu* can be interpreted on analogy with this general picture. Aristotle tends to think of hot and cold, wet and dry as contraries of presence and absence.<sup>39</sup> Similarly, according to the account of sound from *De Anima* 2.8 to which Aristotle seems to refer us, the specific differences of sounding bodies that are made clear in actual sound are sharp (ὀξύ) and flat (βαρύ) in pitch, which correspond respectively to the presence and absence of speed in the sonic mass set in motion by the percussive impact of those bodies.<sup>40</sup>

Given the explanatory aims of Aristotle's science of sensible qualities, it is tempting to see in these appeals to agent natures a common explanation of the capacity of sensible qualities to move sensory media and, by extension, the embodied senses essentially perceptive of them. Sensible qualities are ratios of a pair of primary contraries opposed to one another as the presence and absence of some agent nature capable of acting on the relevant medium. The mixture of these contraries in any ratio represents a degree of the presence or absence of this agent nature, which in turn determines a sensibly qualified body's capacity or incapacity to affect both sense and sensory medium. To the extent we find evidence for this interpretation, it appears in *De Sensu* 7, a chapter Aristotle dedicates to the question whether it is possible to perceive several specifically or generically different sensible qualities simultaneously. The chapter is admittedly aporetic, but in the course of his discussion Aristotle articulates a set of principles governing the relation between the actuality of a sensible quality and the ratio that defines it that are firmly rooted in his physical theory of mixture.<sup>41</sup> Every sensible quality is more perceptible on its own, unalloyed with any competing affection (*Sens.* 7, 447a17–18). Sensory and other cognitive affections, however, can compete for our attention, and in a special case of this more general phenomenon, competing affections can mix and blend with one another. This happens when the motions and affections are produced by homogeneous qualities, since mixture can only occur between contraries, and “the motions of contraries are [themselves] contrary” (αἱ τῶν ἐναντίων κινήσεις ἐναντίαι, 448a1–2). When contrary motions mix, moreover, the character of the resulting affection will be a function of the

<sup>39</sup>For cold as the privation of heat, see, e.g., *Cael.* 2.3, 286a25–26; *GC* 1.3, 318a16–18; *Metaph.* Λ.4, 1070b11–12. Aristotle is less clear about wet and dry, but cf. *GC* 2.2, 330a12–25, which seems to suggest that dry, in the primary sense in which it stands contrary to wet, is the absence of moisture in a body, whether “foreign” or its own.

<sup>40</sup>*DA* 2.8, 420a27–b4; see also *GA* 5.7, 786b26–787a23, where Aristotle distinguishes vocal pitch and volume in terms of the relative and absolute speeds of the sonic mass set in motion.

<sup>41</sup>See esp. *GC* 1.10, 328a23–31; cf. *GC* 2.7, 334b9–15, *Meteor.* 4.4, 382a5–6.

relative “proportions” of the contrary motions in the mixture. The greater or more preponderant motion cancels out the lesser, but the lesser reciprocally diminishes the impact of the greater (447a20–24; cf. *Div.* 2, 464b5, *GA* 5.1, 780a8–9). Thus, for instance, color mixtures will appear darker to the extent that black (or a darker color) dominates over white (or a lighter color) and lighter to the extent that white (or the lighter color) dominates over black (or the darker).

Aristotle's proposal, I suggest, is that the motions produced by sensible qualities in actuality can likewise be understood as “mixed motions” whose qualitative character reflects the ratio in which its contrary constituents were mixed. The primary contraries, for instance white and black, sweet and bitter, produce “pure” perceptual motions unalloyed with any competing contrary. When these contraries enter into quality mixtures, however, the perceptual motion they produce is a function of the relative proportions in which they are mixed. Thus an intermediate color appears darker or lighter to the extent that black or white predominates in its quality mixture, and an intermediate flavor appears more bitter or sweet to the extent that bitter or sweet dominates over its contrary in its quality mixture. To generalize this pattern of explanation, *qualitative* differences among homogeneous sensible qualities reflect *quantitative* differences in the ratio of the quality mixture constitutive of each. The ratio of contraries with which Aristotle identifies sensible qualities is therefore, as it were, *doubly* realized, informing both the quality mixture reflecting the presence or absence of the relevant agent nature and the qualitative character of the motion that mixture produces in actuality. A ratio of “a mixture and motion”.

### 3.2. Aristotle's Physicalism

On the interpretation I've proposed, Aristotle's account of the essence of sensible qualities in *De Sensu* 3–5 compares in important respects to modern physicalist theories of color. By *physicalist* theories I mean those that identify colors with certain “physical” properties of colored objects. What makes the relevant properties “physical” depends in part on the background assumptions of the theory on offer.<sup>42</sup> But according to one well known definition in the philosophical literature on color, physicalist theories hold that “colors are to be identified with properties whose natures (a) are specifiable in ways that do not employ color concepts, and (b) are not constituted by relations to the psychological states of perceivers.”<sup>43</sup> According to this definition, physicalist theories of color are both *reductive* and *objectivist*. They are reductive because (a) the nature of the colors can be fully understood without reference to any ineliminably

<sup>42</sup>In particular, it depends on whether the class of physical properties is “narrowly” restricted to those whose natures can be fully characterized in the vocabulary of the physical sciences (including perhaps disjunctions of such properties), or whether it also includes properties that supervene on “narrowly” physical properties; see Allen (2015, 207–10) for discussion.

<sup>43</sup>See Byrne and Hilbert (1997, xxii); cf. Chirimuuta (2015, 45), Byrne and Hilbert (2020).

qualitative notions, but rather (these theories stipulate) by reference to properties fully specifiable in the canonical vocabulary of the physical sciences. These properties are also objective, to the extent that (b) specifying their nature in the canonical vocabulary of the physical sciences does not require adverting to perceptual subjects or any psychological state these properties are apt to produce in perceptual subjects.

As I've presented it, Aristotle's theory is objectivist and reductivist in precisely the same way. We saw the evidence for Aristotle's objectivism in section 2. The status of sensible qualities as special objects of the senses does not belong to them essentially, but as an explanatory consequence of their essential nature; they are sensible only because there exist sensory capacities defined by their potential to be affected by qualities of this sort. In this section, I have given reasons for thinking that Aristotle's account of the essence of sensible qualities is reductivist as well. Admittedly, at one level of analysis, Aristotle seems to define colors, flavors, and the like qualitatively as ratios of primary contrary qualities, black and white in the case of color, bitter and sweet in the case of flavor, and so on. We've seen, however, that the task of explaining the per se connection between sense and sensible quality requires that these primary contraries be understood, not as primitive qualities, but as the presence and absence of some agent nature, a causal principle defined by its perceiver-independent effects. The same reductive analysis should be extended to the sensible qualities defined in terms of these primary contraries. The ratios with which Aristotle identifies sensible qualities are ratios of a mixture and motion. Applied to sensibly qualified bodies, the ratio defines a corporeal mixture indicating the degree of presence or absence of a certain agent nature, whether surface transparency, nutriment, or some other nature whose actuality moves and affects a sensory medium. Applied to moved media, the ratio defines a motion or affection whose qualitative character is determined by the proportions of that corporeal mixture. Realized in either way, Aristotle sees sensible qualities as linking seamlessly with his physical sciences, as mind-independent features of the world whose behavior can be fully characterized in terms of Aristotelian chemistry and dynamics.

It is important, however, not to take this comparison with modern reductive physicalist theories too far. Aristotelian physics is a far cry from our own, and modern reductive theories have consequences that are neither shared by a reduction to the basic terms of Aristotelian science nor acceptable to Aristotle himself. Recall from section 1 that the properties with which modern reductive physicalist theories identify sensible qualities seem to be fundamentally different from how those qualities appear in sense experience. According to *reflectance physicalists*, for instance, surface colors are identical to disjunctions of "surface spectral reflectance" types, properties that determine the proportions of incident light reflected at every wavelength in the visible spectrum.<sup>44</sup> So described, however, the connection between colors and the

<sup>44</sup>See Byrne and Hilbert (2003) and Byrne and Hilbert (2020).

qualities familiar to us from color experience seems to be entirely contingent. This apparent contingency has been the source of some common objections to reductive physicalist theories of color. It is evident from experience, for instance, that the colors stand in certain higher order relations of similarity, difference, and exclusion: pink is desaturated red, vermillion is more similar to scarlet than it is to any shade of yellow; orange can be yellowish or reddish, but there is no reddish green. Intuitively, these relations specify necessary or even essential features of the colors—can there be a shade of pink which is not a desaturated red?—and they were moreover crucial to certain advancements in color science, for instance the development of the opponent-process theory of color vision.<sup>45</sup> It is not obvious, however, that these higher-order relations can be explained by reference to surface spectral reflectance types or any other properties cited in psychophysical explanations of color experience. And even if it is possible for these relations to be explained in terms of such properties (for instance, using Byrne and Hilbert's theory of "hue magnitudes"), it is not obvious that such an explanation can account for the phenomenological fact that these relations appear to be *constitutive* of what the colors are.<sup>46</sup>

Not so on an Aristotelian reduction of sensible qualities. As we've seen, Aristotle shares the primitivist intuition that anything deserving the name 'color', or 'flavor', or the name of any other sensible quality must bear the characteristic features familiar to us from our experience of these qualities. This is clear, for instance, from Aristotle's arguments in *De Sensu* 4 against Democritus' "eliminative" reduction of sensible qualities to geometrical figures. One problem with Democritus' theory, according to Aristotle, is that geometrical figures do not share the higher-order relations that, in his view, structure our experience of sensible qualities. For Aristotle, sensible quality spaces are essentially structured by a distinctive pair of extreme contraries, with intermediate qualities differing from each other and from the extremes by proprietary relations of more and less. Thus, color space is structured by relations of comparative lightness and darkness, flavor space by relations of comparative sweetness and bitterness, and so on. But while "all the objects of the senses have contrariety, as white is contrary to black in color and bitter to sweet in flavor" (τὰ μὲν αἰσθητὰ πάντα ἔχει ἐναντίωσιν, οἷον ἐν χρώματι τῷ μέλανι τὸ λευκὸν καὶ ἐν χυμοῖς τῷ γλυκεῖ τὸ πικρὸν, *Sens.* 4, 442b17–19), this fact becomes inexplicable on a Democritean reduction of these qualities to geometrical figures: "of what polygon is the sphere the opposite" (τίνι γὰρ τῶν πολυγώνων τὸ περιφερὲς ἐναντίον, *Sens.* 4, 442b20–21)? In Aristotle's theory, by contrast, these manifest relations are not contingent features of sensible qualities, but constitutive of what they are essentially. Ochre appears darker than

<sup>45</sup>See Hardin (1993, 26–45).

<sup>46</sup>See Byrne and Hilbert (2003, 13–15) for the theory of hue magnitudes. For the argument from the "genuineness" of these similarity relations, see Allen (2015, 205); for response, see Byrne and Hilbert (2020).

canary yellow because it is essentially a ratio of a mixture and motion containing a greater proportion of black relative to white. Similarly, oily flavors are more bitter to the taste than saline flavors because oily flavors are essentially ratios of a mixture and motion containing a greater proportion of bitter relative to sweet. And in general, Aristotle's theory regards the qualitative differences that structure sensible quality spaces as manifestations of quantitative differences in the ratios that define what each quality essentially is.

This feature of Aristotle's theory has not been emphasized by commentators who defend physicalist interpretations along the lines I've been pursuing, but it is crucially important for Aristotle's solution to the ontological problem with which we began.<sup>47</sup> Recall from section 1 that Aristotle's problem is to show how a plausible account of the role of sensible qualities as causes of sense experience could be compatible with the idea that they are also manifest in the experiences they produce. As we've seen, Aristotle accounts for the causal role of sensible qualities by identifying them with the presence and absence, in various degrees, of some agent nature capable of moving and affecting the relevant medium. So the challenge for him is to understand how sensible qualities, so conceived, could be manifest features of the experiences they produce. We are now in a position to see how: because the higher-order relations of similarity and difference that characterize our experience of sensible qualities are actual manifestations of quantitative differences in the ratio in which these qualities are mixed, the connection between the essential nature and manifest character of sensible qualities is not contingent but *essential*. Experience presents us with sensible qualities *as they essentially are*.

For some commentators, this conclusion will appear too strong. Even if the essential nature of sensible qualities is somehow manifest to us in experience, Aristotle is nevertheless committed to the idea that this nature can only be understood in terms of an esoteric scientific *theory*. This has suggested to some commentators that Aristotle, like modern reductive physicalists, denies "Revelation", a controversial thesis considered by some primitivist theorists to express a core commitment of our ordinary conception of color. In Mark Johnston's canonical formulation, Revelation states that the essential nature of a color like canary yellow is "fully revealed" by a standard experience as of something canary yellow.<sup>48</sup> Ordinary color experience, in other words,

<sup>47</sup>See, e.g., Broackes (1999), who advocates a "careful agnosticism" between reductive and non-reductive readings of Aristotle's theory in part on that grounds that a reductive reading has difficulty accounting for the role of sensible qualities in explaining perceptual states (103). The difficulty, I take it, has to do with explaining how sensible qualities on a reductive reading could be manifest in the way presupposed by Aristotle's theory.

<sup>48</sup>Cf. Johnston (1992, 223); I follow Gert (2008, 142n29) and Allen (2016, 131) in reading Revelation as a thesis about the *essential* nature of sensible qualities, rather than their "intrinsic" nature, as in Johnston's original formulation. Other metaphors employed in these discussions have it that such properties are "laid bare" (Harding 1991, 291), "displayed" (Hardin 1993, e.g. at 66), "disclosed"

is sufficient for us to *know* the essential nature of the color presented to us in that experience, in such a way that further investigation of the colors, while perhaps leading to the discovery of additional facts about them and their status as features of the objects we experience to have them, could not put us in a better position to know them as they essentially are. Depending in part on the sort of knowledge thought to be at issue, Revelation can be taken to express a variety of different claims about the epistemic value of color experience.<sup>49</sup> But given that any formulation would seem to imply that experience *alone* suffices for knowledge of the essential nature of the colors, Revelation may appear incompatible with any theory on which such knowledge requires grasp of a scientific theory. If so, then to the extent that Aristotle sees colors and other sensible qualities as canonically defined in terms of his chemistry and dynamics, he would seem to be committed to denying Revelation.<sup>50</sup>

On one way of interpreting the thesis, I think this assessment of Aristotle's position is correct. Certainly it is false on his view that experience alone could yield scientific knowledge of the essential nature of sensible qualities. Knowledge of the essence of a scientifically knowable kind requires a grasp of its role in explaining the *per se* features of that kind, and this, Aristotle thinks, requires understanding a universal and necessary connection between what that kind essentially is and the attributes that belong to it as such. Perception on its own, however, can give us knowledge only of particulars.<sup>51</sup> So even if we were presented in experience with an instance of a kind in way that made manifest the connection between its essence and one of its *per se* attributes, perception alone would not be enough to give us knowledge that this is the essential feature *universally* explanatory of the *per se* attribute in question.<sup>52</sup>

Notice, however, that Aristotle's reasons for denying that experience alone could yield scientific knowledge of the essential nature of sensible qualities have nothing to do with any difficulty in the supposition that these natures are somehow manifest in experience, but rather with the inability of perceivers as such to grasp the universal connections he takes to be the subject matter of scientific inquiry. To this extent, I suggest, Aristotle leaves room for a view on which the essential nature of sensible qualities *is* revealed in the experience of them. On such a view, the restriction of perception to the cognition of particulars would mean that the essence of sensible

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(Campbell 2005), or "made transparent" (Campbell 1997) in experiences as of them.

<sup>49</sup>For recent critical discussion of the varieties of Revelation and its status as a core belief about the colors, see Campbell (2005), Byrne and Hilbert (2007), Allen (2016, 131–54), and Gert (2017, 23–27).

<sup>50</sup>Cf. Ganson (1997, 278–82), Caston (2018, 64–66).

<sup>51</sup>See *APo.* 1.31; cf. *Metaph.* A.1, 981b10–11; cf. *APo.* 1.18, 81b6; 1.24, 86a20; *Phys.* 1.5, 189a7; *DA* 2.5, 417b22; *EN* 2.9, 1109b23; 6.9, 1142a27; 7.5, 1147a26.

<sup>52</sup>See *APo.* 1.31, 88a12–17, where Aristotle gives as a hypothetical example the direct observation of light particles traveling through pores in a pane of glass. The perception of the porousness of this glass might be enough to satisfy us on the question why all glass is translucent, but even so, grasping this as the universal explanation would be the work of thought ( $\tau\hat{\omega}$  . . . νοῆσαι), not perception.

qualities is never manifest in experience in a way that makes immediate scientific understanding of that essence possible. Nevertheless, experience *would* still present sensible qualities as they are essentially characterized in Aristotle's science of sensible qualities. Thus, for instance, a visual experience as of a red object would present that object as having a certain degree of surface transparency, and a gustatory experience as of a sweet morsel would present that object as containing nutriment. These experiences would not amount to *scientific* knowledge of the essential nature of color and flavor, but they would provide direct and unmediated awareness of the nature of these qualities.

Aristotle's attitude towards Revelation is a crucial test of the interpretation I've proposed, so I'll dedicate the final section of this essay to presenting reasons for thinking that he has the sort of view I sketched in the last paragraph. The reasons are rooted in Aristotle's arguments for the value of the senses for the animals endowed with them. Commentators have not often remarked on how Aristotle's teleology of the senses draws on the science of sensible qualities developed in *De Sensu* 3–5.<sup>53</sup> But, as we'll see, for Aristotle the value of the senses consists principally in their capacity to make perceivers aware of the agent natures responsible for sense experience, since these natures bear in different ways on those perceivers' survival and flourishing. For this reason, I'll suggest that Aristotle advances a "practical" (as opposed to "theoretical") version of Revelation, on which ordinary experience provides direct and unmediated awareness of the qualities on which animal survival depends.

#### 4. Agent Natures as Objects of Sense Experience

On a theory of the sort I attributed to Aristotle in the last section, it should come as no surprise that the experience of qualities such as red and sweet can be understood equally as experience of the agent natures in terms of which those qualities are essentially characterized. To see why, consider again the contrast between Aristotelian and modern reductive physicalist theories. Modern physicalists regard color, for instance, as identical to physical properties that arguably do not exhibit the higher-order structural relations that characterize our experience of color. To the extent they don't, modern physicalists are committed to regarding color experience as a contingent mode of presentation of properties that are fundamentally different from how they appear in experience.<sup>54</sup> Aristotle too regards colors and other sensible qualities

<sup>53</sup>A notable exception is Robert Roreitner, who argues persuasively in his commentary on *De Sensu* 1, 436b1–437a17 that "all the claims about the usefulness of the senses made [in *Sens.* 1] can only be properly understood on the basis of an inquiry into perceptible objects that Aristotle is going to develop in *Sens.* 3–5" (CITE). The interpretation I offer in the next section is indebted to this argument.

<sup>54</sup>See Chalmers (2006) for a theory of perceptual content that makes this contingency explicit; cf. Johnston (1997).

as identical to physical properties, but in his view these properties stand essentially in quantitative relations that *explain* the higher-order structural relations that characterize our experience of these qualities: to see red is to see a certain degree of surface transparency, and to taste sweet is to taste the presence of nutriment. Our experiences of sensible qualities therefore cannot be regarded as contingent modes of presentation of the agent natures with which they are identical, for the simple reason that the connection between sensible quality and agent nature is not contingent but *essential*. As Aristotle might have put it, they are identical in number *and in being*.

#### 4.1. Agent Natures and the Value of the Senses

It is therefore unsurprising from the point of view of the present interpretation that we find Aristotle appealing to the identity between sensible qualities and the agent natures that essentially characterize them in accounting for the value of the senses for the animals that have them. The psychological significance of this topic is emphasized early in *De Anima*'s positive account of soul, where Aristotle observes that the differences among animals considered as a psychological kind exist in part because animals perceive in different ways (*DA* 2.2, 413b32–415a5). As we've seen, animals are by definition living things endowed with the capacity to perceive, but not all animals perceive in the same way: some have all five senses, others only some, and still others only touch, the "most necessary" (ἀναγκασιότατην, 414a4–5) and most widely distributed sense. Aristotle more than once alerts us to the need to explain these differences in animal perception (*DA* 2.2, 413b4–10, 413b32–414a4, 2.3, 414b33–415a1), and when the required explanation finally arrives in the concluding chapters of *De Anima* (*DA* 3.12–13) and the opening chapter of *De Sensu* (*Sens.* 1, 436b8–437a17), it quickly becomes clear that the causes in question are *final causes*, natural ends whose achievement hypothetically necessitates the use of the senses with which nature has endowed an animal kind. For Aristotle, "nature does nothing in vain" (μηθὲν μάτην ποιεῖ ἢ φύσις, *DA* 3.12, 434a31), so if a sensory capacity belongs to an animal kind, it must be because the exercise of that capacity is required for the "being" (τὸ εἶναι) and "survival" (σωτηρία) of members of that kind.<sup>55</sup>

Aristotle hinted at the crucial role agent natures would play in explaining how sense perception promotes the being and survival of animals already in *De Anima* 2.3, prompted by the observation that all animals have not only the contact senses, but also the capacities for pleasure, pain, and appetitive desire (414b6–16):

Furthermore, [all animals] have perception of nutriment, since touch is the sense perceptive

<sup>55</sup>In these chapters Aristotle also discusses the senses' contribution to animal "well-being" (τὸ εὖ); see *DA* 3.12, 434b22–26; 3.13, 435b19–25; and *Sens.* 1, 437a1–3. These contributions however are not meant to explain the presence of sensory capacities in the animal kinds that have them, but rather how the senses contribute to ends beyond those that explain their presence. See my Howton (2020) for a defense of this reading.

of nutriment. For all animals are nourished by the dry and the moist and the hot and the cold, and touch is the sense perceptive of these. But of the other sensible objects [all animals have perception (?)]<sup>56</sup> incidentally. For neither sound nor color nor odor contributes anything to nutriment, and flavor is an object of touch. Hunger and thirst, moreover, are appetitive desires, hunger being the appetite for the dry and hot, thirst for the cold and wet, while flavor is like a kind of seasoning of these. These matters must be made clear later, but for now let this much be said: namely, that to those animals to whom touch belongs desire belongs as well.<sup>57</sup>

Aristotle does not follow through with the argument begun here. But if, as it seems, he intends to get to the conclusion that touch and appetitive desire *must* be coextensive across animal kinds, the suppressed premise is likely to be this: it is *only* through the exercise of touch generically and taste specifically that animals could perceive the nourishing features of sensible bodies that hunger and thirst are appetites for. If so, then Aristotle here anticipates his argument for the contribution of the contact senses to animal survival in *De Anima* 3.12–13. These senses are necessary for all animals, Aristotle claims, because “if the animal will not have perception when making contact [sc. with another body], it will not be able to acquire some and avoid others, but without this, it will be impossible for the animal to survive” (ἀπτόμενον δέ, εἰ μὴ ἔξει αἴσθησιν, οὐ δυνήσεται τὰ μὲν φεύγειν τὰ δὲ λαβεῖν. εἰ δὲ τοῦτο, ἀδύνατον ἔσται σῶζεσθαι τὸ ζῶον, *DA* 3.12, 434b16–18). Specifically, taste is required because it is the “the sense perceptive of nutriment” (ἡ γεῦσις . . . τροφῆς γάρ ἐστιν, *DA* 3.12, 434b18), while touch as distinguished from taste is said to be necessary because “the excesses of the objects of touch, for instance those of hot or cold or hard, destroy the animal” (ἡ δὲ τῶν ἀπτῶν ὑπερβολή, οἷον θερμῶν καὶ ψυχρῶν καὶ σκληρῶν, ἀναιρεῖ τὸ ζῶον, *DA* 3.13, 435b13–14). This represents a refinement of Aristotle’s earlier observations,

<sup>56</sup>There is an ancient debate over how to complete this clause; see Ross (1961, 222–23) for a survey of the ancient proposals. I propose instead to read the clause in parallel with the first sentence of the quoted passage, supplying both with the grammatical subject “all animals” (τὰ . . . ζῶα πάντα) from 414b3 and supplying αἴσθησις to match the genitive construction. This construal, I think, is grammatically plausible, since it requires neither an unannounced change in subject or a textual emendation, as on other proposals; and it is moreover philosophically plausible, since it anticipates Aristotle’s claim at *DA* 3.12, 434b21–26 that the distance senses do not belong to animals per se, but only to roaming animals. Thus they are incidental to all animals (as a kind) in the sense that they belong to only but not all animals, in the way that, e.g., having a hypotenuse whose square is equal to the squares of the remaining sides belongs incidentally to triangles as a kind by virtue of belonging to all and only right triangles.

<sup>57</sup>ἔτι δὲ τῆς τροφῆς αἴσθησιν ἔχουσιν· ἡ γὰρ ἀφή τῆς τροφῆς αἴσθησις· ξηροῖς γὰρ καὶ ὑγροῖς καὶ θερμοῖς καὶ ψυχροῖς τρέφεται τὰ ζῶντα πάντα, τούτων δ’ αἴσθησις ἀφή· τῶν δ’ ἄλλων αἰσθητῶν κατὰ συμβεβηκός. οὐθὲν γὰρ εἰς τροφήν συμβάλλεται ψόφος οὐδὲ χρῶμα οὐδὲ ὄσμη, ὁ δὲ χυμὸς ἔν τι τῶν ἀπτῶν ἐστιν. πείνα δὲ καὶ δίψα ἐπιθυμία, καὶ ἡ μὲν πείνα ξηροῦ καὶ θερμοῦ, ἡ δὲ δίψα ὑγροῦ καὶ ψυχροῦ· ὁ δὲ χυμὸς οἷον ἥδυσμά τι τούτων ἐστίν. διασαφητέον δὲ περὶ αὐτῶν ὕστερον, νῦν δ’ ἐπὶ τοσοῦτον εἰρήσθω, ὅτι τῶν ζῶντων τοῖς ἔχουσιν ἀφήν καὶ ὄρεξις ὑπάρχει. Text following Förster as printed in Corcilius (2017).

but it coheres better with the account of flavor proposed in *De Sensu* 4. Because what nourishes the animal is “neither the dry without the moist nor the moist without the dry, but rather their mixture” (441b25–27), the value of taste consists in its ability to enable perception of salutary mixtures of tangible qualities, while the value of touch consists in its ability to enable perception of the unmitigated extremes that have the potential to harm or destroy the animal body.

In asserting that taste is both “perception of flavor” and “perception of nutriment”, it is unlikely that Aristotle is simply substituting extensionally equivalent expressions. To be sure, taste is defined by its receptivity to flavor, so the former assertion in a way explains the latter. But for it to be possible for the *experience* of sweet, say, not also to be the experience of the presence of nutriment, it would have to be possible to distinguish what it is to be sweet from what it is to have nutriment. This, however, is precisely what Aristotle's theory denies. In the same way that the identity between sweetness and the presence of nutriment makes it the case for Aristotle that animals “are nourished by the *sweet*” (τρέφεται τῷ γλυκεῖ, *Sens.* 4, 442a2–8), it also makes it the case that the gustatory experience of sweet is the gustatory experience of *nutriment*.

It is admittedly more difficult to see the role of agent natures in Aristotle's explanation of the value of the distance senses, but there are important clues. For Aristotle, the distance senses are not necessary for all animals, for not only do “sound and color and odor neither nourish nor produce growth or decay” (ψόφος δὲ καὶ χρῶμα καὶ ὄσμη οὐ τρέφει, οὐδὲ ποιεῖ οὔτ' αὔξησιν οὔτε φθίσιν, *DA* 3.12, 434b19–21), their excess also “do not destroy the animal . . . but only the senses organs” (οὐ διαφθείρει τὸ ζῶον . . . καὶ ψόφος καὶ ὄσμη, ἀλλὰ μόνον τὰ αἰσθητήρια, *DA* 3.13, 435b8–9). They are, however, necessary for animals endowed with *locomotion*, since their survival requires the ability “to perceive not only by contact but also remotely” (οὐ μόνον . . . ἀπτόμενον αἰσθάνεσθαι ἀλλὰ καὶ ἄποθεν, *DA* 3.12, 434b26–27), so that “by perceiving them in advance they might pursue nutriment and avoid mean and destructive things” (διώκωσί τε προαισθανόμενα τὴν τροφήν καὶ τὰ φαῦλα καὶ τὰ φθαρτικὰ φεύγωσι, *Sens.* 1, 436b20–437a1). Of course, because the qualities specially perceived by the distance senses are not identical to the tangible objects of pursuit and avoidance on which animal survival depends, they cannot facilitate distance perception of these objects *as such*. However, they can *inform* animals of the presence or absence of these objects in distant bodies, since, Aristotle claims, perception of the qualities specially perceived by the distance senses “reports many differences” (πολλὰς . . . εἰσαγγέλλουσι διαφορὰς) in sensible bodies. Sight, for instance, “reports many and various differences” (διαφορὰς . . . πολλὰς καὶ παντοδαπὰς . . . εἰσαγγέλλει, *Sens.* 1, 437a5–7) on account of the fact that “all bodies partake of color” (πάντα τὰ σώματα μετέχειν χρώματος, a7), a fact Aristotle takes to explain its superlative contribution to animals' practical activities as well as why common sensible objects such as shape, size, motion, and number are “most of all perceived” (αἰσθάνεσθαι μάλιστα, a8) by means

of this sense. Similarly, although “the object of smell contributes nothing to nutrition *as the object of smell*” (οὐ συμβάλλεται εἰς τροφήν τὸ ὄσφραντόν, ἢ ὄσφραντόν, *Sens.* 5, 445a28), animals nevertheless “come to be aware” (φροντίζουσιν, a2) through smell of what “contributes in some way to their tasting and eating” (τι συμβάλλεται πρὸς τὴν γεῦσιν ἢ τὴν ἐδωδὴν αὐτοῖς, a3–4).

In both cases the idea seems to be that experience of the qualities specially perceived by the distance sense in question makes clear not only the features of bodies in virtue of which they are qualified in that way, but also other features whose presence or absence matter for the animal's survival. And here we can see a role for the perception of agent natures. The capacity of sight to report as many differences as it does is plausibly due to the fact that color is *surface* transparency, so that by perceiving color animals come also to perceive other features of the surfaces of nearby bodies, including such common perceptible features as shape, dimension, and discontinuity with other bodies.<sup>58</sup> Similarly, it is because the odors available to both human and non-human animals are identical to the presence or absence of nutriment that smell can inform animals of features of bodies relevant to nutrition. For this reason too Aristotle claims that odors in this class can be pleasant for animals, depending on whether the animal is hungry or satiated.<sup>59</sup>

#### 4.2. Aristotle and Revelation

The role Aristotle assigns to the perception of agent natures in explaining the senses' contribution to animal survival offers further support for the interpretation I presented in section 3.2. As causes of sense affection, Aristotle thinks sensible qualities must be identified with the agent natures whose presence or absence makes a causal impact on the relevant perceptual medium. This does not mean, however, that sensible qualities could be any different in their essential nature from the way they are manifest to us in experience. Aristotle remains committed to the idea that experiences as of objects sensibly qualified in some way can also be understood as experiences as of the presence or absence in those objects of the agent nature that essentially characterizes the relevant sensible quality. All that is added by Aristotle's account of the

<sup>58</sup>Cf. *DA* 3.1, 425a16–19. Certainly it is part of Aristotle's view that perception of the common sensibles depends on their coextensiveness with special sensibles; see e.g. *DA* 3.1, 425b4–10, where color and properties such as motion, size, and number are said to “follow one another simultaneously” (ἀκολουθεῖν ἀλλήλοις ἅμα) in such a way that the latter would escape notice if we were unable to perceive specific differences in color.

<sup>59</sup>See *Sens.* 5, 443b21–24. Contrast Aristotle's account of the “incidental” (κατὰ συμβεβηκός) contribution of hearing to intellect and learning, which obtains (for animals capable of hearing differences in voice) only because vocal patterns are conventionally associated with linguistic meaning; see *Sens.* 1, 437a9–15. On one way of reading this argument, hearing's contribution is incidental precisely because there is no *per se* connection between the qualities it specially perceives and the *per se* cause of learning, namely language.

senses' contribution to animal survival is that sense experiences *must* be understood in this way, since it is as of the presence and absence of the agent natures in terms of which sensible qualities are essentially characterized that sense experience makes a difference to animal survival.

The conclusion that Aristotle rejects Revelation therefore seems to have been premature. To be sure, there are ways of formulating the thesis on which Aristotle would agree that the essential nature of sensible qualities is not fully revealed in sense experience. According to one much discussed formulation, Revelation is a thesis about *propositional* knowledge of the essential nature of the colors. So understood, it follows from Revelation that color experience *exhaustively* and *infallibly* reveals the essential nature of the colors: there is nothing in the essential nature of the colors that does not seem to be after careful reflection on color experience, nor is there anything that seems on careful reflection to be in the nature of the colors that isn't.<sup>60</sup> To the extent that this formulation implies that reflection on color experience is sufficient for an articulate, theoretical grasp of the essential nature of color, it is inconsistent with Aristotle's view that the essential nature of sensible qualities can only be understood in terms of his physical theories of mixture and motion. But in this conclusion Aristotle agrees with other theorists sympathetic to Revelation, for whom this formulation "is fumbling a much more intuitive point" about the way experience presents us with colors.<sup>61</sup> In Johnston's initial formulation, Revelation was supposed to capture the intuition denied by theorists for whom "visual sensations [are] arbitrary signs of the properties that cause them", a view Johnston associates with Descartes but which equally well captures what Aristotle objects to in the Democritean theory of sensible qualities.<sup>62</sup> Formulating Revelation as a thesis about our propositional knowledge of the essential nature of the colors certainly rules out such theories, but it does so at the cost of making knowledge of the essence of color far too easy.<sup>63</sup>

We get closer to a formulation of Revelation that captures the intuitive point Johnston and other sympathizers take it to express if we read it instead as a claim about the way experience *acquaints* us with colors (and other sensible qualities) as they essentially are. What the Cartesian and Democritean theories deny is that our experience of qualities like color is anything but an arbitrary sign, one whose experiential character reflects more about the peculiar nature of our minds or our perceptual physiology

<sup>60</sup>Cf. Byrne and Hilbert (2007, 77), who equate Revelation with the following biconditional: *p* is in the nature of the colors iff, after careful reflection on color experience, it *seems* to be in the nature of the colors that *p*. Byrne and Hilbert call the left-to-right direction of the biconditional "Self-Intimation" and the right-to-left direction "Infallibility".

<sup>61</sup>Cf. Campbell (2005, 109).

<sup>62</sup>See Johnston (1997, 223–24).

<sup>63</sup>Cf. Allen (2016, 131–55), who makes a plausible case that realist primitivists, who assert that colors are instantiated in mind-independent objects and supervene on their "narrowly" physical properties, are not committed to this version of Revelation in the way Byrne and Hilbert claim.

than about the essential nature of the property whose presence that experience indicates.<sup>64</sup> This hypothesis, however, contradicts our intuitive understanding of the way we are presented with sensible qualities in experience. The blinking red light on my wi-fi router is an arbitrary sign of the network error state that is currently preventing it from enabling a wireless internet connection. This sign may be effective in getting me to remove the error state (say, by indicating that I need to restart the router), but when the error state is removed and I see the blinking red light change to green, I am under no illusion that I've witnessed the change in properties that corrected the error. Intuitively, however, I *have* witnessed a change in color, and a natural way of explaining this difference is to say that the color, unlike the network error, is presented to me in experience *as it essentially is*, unmediated by any contingent or arbitrary mode of presentation.

For many of its advocates, this is the intuitive idea Revelation is supposed to express, and it goes a long way towards capturing the role of color experience in our cognitive lives.<sup>65</sup> In a similar way, I think, it captures the intuition behind Aristotle's account of the role of sense experience in the practical lives of animals. For Aristotle, the most basic and most necessary function of the senses is to present animals in experience with the objects of pursuit and avoidance on which their survival depends. As we've seen, in Aristotle's view, fulfilling this function requires that sense experience "reveal" the essential nature of the qualities perceived by presenting them as they essentially are, whether as the presence of nutriment or of surface transparency. This revelation is perhaps not "full" or exhaustive; I confess there is little evidence to suggest, for instance, that Aristotle thinks sensible qualities must be experienced *as mixtures*. But there is good reason to think that, to the extent the senses present us with the essential nature of sensible qualities, they do so infallibly. Recall from section 2.1 that the senses are immune to error concerning the qualities they specially perceive. Thus, Aristotle claims, sight may be in error about what is colored or where, and hearing may be in error about what is sounding or where, but they cannot be in error "that it is color or that it is sound" (ὅτι χρώμα οὐδέ' ὅτι ψόφος, *DA* 2.6, 418a15). It is controversial just what sort of immunity to error Aristotle is attributing the senses here, but one plausible hypothesis is that it is an immunity to error concerning the nature of the qualities they specially perceive, an immunity to error Aristotle articulates more fully elsewhere (*Metaph.* Γ.5, 1010b19–26).<sup>66</sup>

But it is not even the case that [a sense] is at odds with itself about an attribute at different times, but only about what that attribute belongs to. I mean, for instance, that the same wine might seem sweet at one time and not sweet at another, if either the wine or one's body has changed [sc. in the meantime]. But the sweet itself, as it is whenever it is, changes in no way

<sup>64</sup>Cf. Descartes, *The World*, AT XI 3–6; Theophrastus, *Sens.* 64.1–4.

<sup>65</sup>See Campbell (2005), Gert (2017, 23–24), and Brewer (2019, 281–82); cf. Allen (2016, 153–54).

<sup>66</sup>See Koons (2018) for an interpretation along these lines.

whatsoever. Rather, [the sense] has the truth about it, and it is necessary for anything that is to be sweet to be of such a nature.<sup>67</sup>

This sort of immunity to error should not be taken to imply that the senses are infallible guides to the presence or absence of the natures that they present perceives with in experience; only that, when these experiences are veridical, they present the perceiving animal with sensible bodies in precisely the respects in which they are good and bad for it.

## 5. Conclusion

The theory of sensible qualities I have attributed to Aristotle straddles the modern debate between reductive physicalist and primitivist theories. To explain their capacity as causes of sense experience, Aristotle identifies sensible qualities with the physical properties of sensibly qualified bodies in virtue of which they move and affect perceivers and sense media. Nevertheless, Aristotle thinks that the essential nature of these qualities is revealed in ordinary sense experience. From a modern perspective, the resulting picture of sensible qualities as simultaneously causes and manifest features of sense experience appears naive. But as I hope to have shown, it is in fact the product of an explanatorily sophisticated scientific theory, one which Aristotle finds necessary to meet the complex demands that, for him, make sensible qualities an ontological problem.<sup>68</sup>

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<sup>67</sup> ἄλλ’ οὐδὲ ἐν ἑτέρῳ χρόνῳ περὶ γε τὸ πάθος ἠμφισβήτησεν, ἀλλὰ περὶ τὸ ᾧ συμβέβηκε τὸ πάθος. λέγω δ’ οἶον ὁ μὲν αὐτὸς οἶνος δόξειεν ἂν ἢ μεταβαλὼν ἢ τοῦ σώματος μεταβαλόντος ὅτε μὲν εἶναι γλυκὺς ὅτε δὲ οὐ γλυκὺς· ἀλλ’ οὐ τό γε γλυκὺ, οἶόν ἐστιν ὅταν ἦ, οὐδεπώποτε μετέβαλεν, ἀλλ’ αἰεὶ ἀληθεύει περὶ αὐτοῦ, καὶ ἔστιν ἐξ ἀνάγκης τὸ ἐσόμενον γλυκὺ τοιοῦτον.

<sup>68</sup>I am grateful to Damien Storey for helpful feedback on an earlier draft.

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