

Form without Matter
Empedocles and Aristotle on Color Perception

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INELUCTABLE MODALITY OF THE
VISIBLE: at least that if no more,
thought through my eyes.
Signatures of all things I am here to
read, seaspawn and seawrack, the
nearing tide, that rusty boot.
Snotgreen, bluesilver, rust:
coloured signs. Limits of the
diaphane. But he adds: in bodies.
Then he was aware of them bodies
before of them coloured. How? By
knocking his scone against them,
sure. Go easy. Bald he was and a
millionaire, *maestro di color che sanno*.
Limit of the diaphane in. Why in?
Diaphane, adiaphane. If you can
put your five fingers through it, it is
a gate, if not a door. Shut your eyes
and see.

James Joyce, *Ulysses*

“Quand nos yeux se touchent, fait-il
jour ou fait-il nuit?”

Jacques Derrida, *Le toucher*, Jean-Luc
Nancy

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Preface

This is an essay in the philosophy of perception written in the medium of historiography.

My motives for writing the present essay, for pursuing the philosophy of perception through its history, derive from a number of sources. Let me take this opportunity to describe some of them.

For a number of years, over a series of papers (Kalderon, 2007, 2008, 2011b,a,c) that followed on from an earlier collaboration (Hilbert and Kalderon, 2000), I have defended an antimodern conception of color and color perception. According to that conception, colors are mind-independent qualities of material surfaces, transparent volumes, and radiant light sources, and color perception is the presentation of particular instances of these qualities in the visual awareness afforded by the subject's perceptual experience. This is how, I argue, our color experience presents itself as being, and I undertook to defend this conception from challenges that arise from the problem of conflicting appearances—what Hume (1748) regarded as the “slightest bit of philosophy” required to reject any such conception of color and color perception. This conception is an antimodern conception of color in that, in the face of a consensus that persisted for four centuries—remarkable indeed in philosophy—colors are not conceived to be secondary qualities. Indeed, they are on a par with shape. And this conception is an antimodern conception of color perception in that color perception is not merely a mental reaction, a conscious modification of the perceiving subject, but the presentation of mind-independent qualities of spatiotemporal particulars located at a distance from the perceiving subject.

Defending an antimodern conception of color and color perception prompted me to investigate premodern conceptions of color and color perception. I had, at any rate, been drawing on ancient sources in thinking about the problem of conflicting appearances as it arises in its contemporary guise. However, just because the conception defended was antimodern, did not make it premodern. I turned to premodern sources for at least two reasons.

First, to further loosen the grip of the modern conception of color and color perception. Though thoroughly convinced of its error, it had been my experience

that the effects of this dominant paradigm lingered in my thinking, and I engaged with premodern thinkers to counteract this. In this regard, I was self-consciously following the example of Deleuze whose early historical studies were an attempt to break free from what was, within his tradition, the then dominant structuralist paradigm.

Second, not only did I seek alternative perspectives in order to see the subject matter with fresh eyes—to think outside the modern paradigm, but I was also prepared to learn from my predecessors. Both about color and color perception, but also about problems or challenges that had been obscured by the modern paradigm. Aristotle was a natural figure for me to focus on. He was the great defender of the manifest image in the classical world. And like Aristotle, I was engaged in just such a reconciliationist project.

The problematic relationship between contemporary philosophy of perception and its history provided an additional motive. Approximately forty years ago philosophy of perception remained a central and relatively active area of concern. For various reasons, philosophy of perception ceased to be an area of active concern and was no longer regularly taught as part of the core curriculum. There was thus a period of forgetting.

I have mixed feelings about this. The present renaissance in the philosophy of perception perhaps owes its renewed energy precisely to this forgetting. On the other hand, I was frustrated that hard won insights had been lost. To address this, at least for myself, I undertook to study its history. The present essay grew out of that study.

There were more specific motives as well. For example, I have long been puzzled by the prevalence of a primordial family of tactile metaphors for visual awareness. Thus the objects of perception are said to be “grasped” or “apprehended”. Visual experience puts us into perceptual “contact” with its objects. Broad (1965), for example, speaks of visual awareness as a mode of “prehension”. What unites these metaphors is that they are all a mode of assimilation and ingestion is a natural variant. I wanted to understand what would make these metaphors apt. Most contemporary philosophers deploy these metaphors with little self-consciousness. They are lifeless in their hands. Looking at earlier occurrences of these metaphors, when they were more vivid and powerful, could, however, provide guidance. As Nietzsche insightfully observed:

The relief-like, incomplete presentation of an idea, of a whole philosophy, is sometimes more effective than its exhaustive realization: more is left for the beholder to do, he is more impelled to continue working on that which appears before him so strongly etched in light and shadow, to think it through to the end, and to overcome even that constraint which has hitherto prevented it from stepping forth fully

formed. (Nietzsche, 1996, §178 92)

With that in mind, I undertook what might be described as a conceptual genealogy. That is to say, I looked at early historical occurrences of these metaphors, when they remained strongly etched in light and shadow, in order to interpret their significance for us. Unsurprisingly, in their very earliest occurrences, they do not occur as metaphors at all. Thus according to Empedocles, color perception is literally a form of ingestion. Colors are understood to be effluences, fine material bodies, that must be taken within the interior of the eye in order to be presented to the organ of sight and so be seen. For early thinkers, deploying tactile descriptions for visual awareness is not unselfconscious. Rather it is the means of conceptual innovation, that is to say, the means of self-consciously reconceptualizing perceptual experience and its relation to its object. It is easier to see what made tactile metaphors for visual perception apt when self-consciously deployed by these early thinkers, in a way that it is difficult, if not indeed impossible, to do merely by reflecting upon the unselfconscious, lifeless, and yet widely prevalent use of these metaphors by contemporary philosophers of perception.

The present essay makes historical and philosophical claims. The way I approach Aristotle's texts illustrates how historical and philosophical claims combine in the present work. Beginning with the phenomenon under investigation, as we presently understand it to be, I would ask how it might appear so that it would be apt, or at least intelligible, to describe the phenomena the way Aristotle describes it. This prompted me to closely examine and elaborate Aristotle's visual examples. On this basis, I make some important claims of interpretation, for example, about the nature of transparency as conceived by Aristotle. To read Aristotle's texts in this way, is not merely the exercise of interpretive charity, though that it may be. It is also to use Aristotle's text as a means of attending to the phenomena under investigation. On this basis, I make some important philosophical claims, for example, about the puzzles that arise about sensory presentation and what the nature of sensory presentation must be like if these puzzles admit of genuine resolution.

The present approach can seem starkly opposed to the approach associated with Burnyeat and Williams. On this alternative, mindful of lines of possibility forever cut off, since the historical conditions that made them possible may no longer obtain, there is a readiness to encounter the alien, what is not intelligible in terms that we presently understand. Thus Burnyeat (1992) notoriously claims that Aristotle's philosophy of mind is simply no longer credible. It is easy to exaggerate the difference in approach. I agree that part of the point and interest of the history of philosophy is encountering perspectives other than our own. Indeed, that is what prompted me to look to the ancients. But incommensurability is a hard claim. It is only after we have done our best to understand the thought of another and failed, should we consider whether we have encountered something genuinely alien. The

remaining difference between Burnyeat and myself is neither a matter of methodology, nor temperament, but concerns a larger philosophical background. There is, perhaps, a sense in which Burnyeat is right: Aristotle's philosophy of mind is no longer credible within the modern paradigm that Burnyeat endorses. But I am skeptical about that paradigm. I believe that we presently have resources to think of perceptual experience in other terms. And so I also believe that we presently have resources in terms of which Aristotle's philosophy of perception may be understood. Many of Burnyeat's criticisms of Aristotle is the result of cleaving too closely to the modern paradigm. Nor is he alone in this. It is arguable that the criticisms of Broadie (1993) and Sorabji (1971) (to cite but two prominent examples) are as well.

In pursuing the philosophy of perception through its history, and, in particular, pursuing it through a close examination of Aristotle's psychological writings, I am following the path laid out before me by the ancient commentators. Though not a linear commentary, and not following the methodologies of the commentators, let alone the Neoplatonist background assumptions of many of them, like the work of the ancient commentators, the present essay is meant to be a contribution to the philosophy of perception and not, or not merely, to the history of ideas. Given the professionalization of philosophy, with its seemingly incumbent specialization, the present essay thus has a divided readership. I mean to address both contemporary philosophers of perception and historians interested in Aristotle's psychological works. I fear that I am bound to disappoint both.

The philosophers of perception, even if they are willing to follow me in the examination of the history of their subject matter, may be disappointed since little in what follows may be aptly described as introductory. Major themes of *De Anima* are simply ignored if they are not directly relevant to the narrative. However, introductions to Aristotle's thought have been written by others better suited to the task than I. And the project of bringing out what I take to be what is of continuing interest in Aristotle, his contributions to the metaphysics of color and the metaphysics of sensory presentation, dictated the present approach. The philosophers of perception may also be disappointed that I do not do more to integrate contemporary philosophical concerns into the discussion. Here, I can only say that I wanted to broaden, not only these concerns, but our approach to them.

Historians, I suspect, will be disappointed for other reasons. They will miss, perhaps, familiar scholarly apparatuses, and may complain of the lack of systematic engagement with alternative interpretations, especially in light of the explosion of interest in Aristotle's psychological writings over the last four decades. In writing the present essay, I experimented with engaging more systematically with the (vast) secondary literature. This had two drawbacks. First, the book would have tripled in size without a proportionate gain in substance. But, second, and more impor-

tantly, I found that the narrative thread was quickly lost, and that I was pulled into controversies that were not my main preoccupation. Historians might also be put off by the extensive use of quotation. Here, I was motivated to put before the eyes of those unfamiliar with ancient philosophy crucial aspects of the texts under discussion and so share my enthusiasm with this literature. This also explains the choice of translations. I wanted to draw on readily available translations so that the uninitiated may more easily consult them in assessing the present work.

Despite my concerns about a divided readership, I remained undeterred. Moreover, I remained undeterred for historical and philosophical reasons. Reading *De Anima* and *De Sensu* through the lens of Empedoclean puzzlement had the effect that certain passages came powerfully to life in a way they had not for me before. Moreover, few, if any, were seeing what I was seeing. So despite my lack of expertise, or perhaps because of it, I felt I could make some small contribution to our collective understanding. Moreover, reading Aristotle through Empedocles held out the promise of making progress in topics central to my thinking. And thus I persisted in the present literary high-wire act. Whether it was advisable for me to do so without a net is for the reader to decide.

Concerning *De Anima* and *Parva Naturalia*, Hammond (1902, vii) wryly remarks of Aristotle's "breveloquence". Given the brevity of their description, Aristotle's visual examples require careful elaboration in offering an interpretation of them. In so doing, I have been mindful of Sorabji's (2003, 225) warning that interpretation requires creativity and that this invites invention. I have done my best not to contribute to the long history of "distortions", fruitful though that history may be. Two features of the present work may nevertheless invite the charge of invention: (1) a reliance on a metaphysics of fire of Heraclitean provenance, and (2) a portrait of Aristotle's philosophical concerns that perhaps only an Oxford realist could love.

A Heraclitean fire burns throughout this book. Reflection on Heraclitean fire reveals explanatory resources available to Aristotle insofar as the presence and activity of the fiery substance is meant to be the determinant of light and visibility. The threat of invention arises in the form of potential anachronism. Here, I can only say that I have made my case in what follows and that one should be mindful of the explanatory fruits of the attribution.

The second feature of the present essay that might invite the charge of invention is the similarity between Aristotle's perceptual realism, as I portray it, and the Oxford realism inaugurated by Cook Wilson (1926) and extended and elaborated by a variety of thinkers, including, Prichard (1909, 1950a), Ryle (1949), Austin (1961, 1962), Hinton (1973), and more recently, McDowell (1994), Travis (2008), and Williamson (2000). Here, too, the threat of invention arises in the form of potential anachronism. Here, too, I have made my case in what follows, but this is not all that I can say.

It ought not to be surprising that there are similarities between Aristotle and the Oxford realists, since the former influenced the latter. Cook Wilson, in revolting against idealism, drew upon Aristotle's realism as a model. And Aristotle's philosophy was drawn upon, in different ways, in the development of Oxford realism by subsequent thinkers in this tradition. Cook Wilson explicitly worked on Aristotle, and many of the early thinkers in this tradition took Greats. Ryle wrote on Plato and developed, in his own way, in *The Concept of Mind*, ideas derived from Aristotle's *De Anima*. Austin edited a book series on Aristotle and borrows a title of Aristotle's for his lectures on Ayer and perception. Non-accidentally, it turns out, as Austin borrows, as well, some philosophical doctrines and examples. (For a revealing account of the connection between Aristotle and Oxford philosophy, especially ordinary language philosophy, see Ackrill 1997, Introduction.) It ought not to be surprising, then, that Aristotle and the Oxford realists should share a family resemblance. For the early Oxford realists, Aristotle was a distant if revered ancestor from whom they drew strength and sustenance in their defense of perceptual realism against the idealism that the moderns had bequeathed to them.

Chapter I

Empedocles

I.1 Dialectic

The present essay concerns Aristotle's dialectical engagement with Empedocles about the nature of color perception. It is only by paying careful attention to such engagement can we arrive at a proper understanding of Aristotle's notorious definition of perception as the assimilation of the sensible form without the matter of the perceived object. I shall argue that Aristotle's definition of perception is a resolution of a puzzle or *aporia* about the nature of perception that animated Empedocles' theory of vision. The puzzle concerns the sensory presentation of remote sensible objects as when we see the brilliant white of the distant sun. This chapter details the original form of Empedoclean puzzlement and shows how Empedocles' theory of vision is an attempt to resolve such puzzlement, though an attempt that, as we shall see in chapter 2, Aristotle rejects as unworkable. But before we discuss the puzzle which animates Empedocles' theory of color vision, it will be useful to briefly describe Aristotle's dialectical engagement with the *endoxa* more generally.

Dialectical argument is a mode of reasoning that uses the *endoxa* as premises. The *endoxa* are the reputable opinions of one's predecessors. The reputable opinions:

... are accepted by everyone or by the majority or by the wise—i.e. by all, or by the majority, or by the most notable and reputable of them.
(Aristotle, *Topica* I 1 101^a35–37; Pickard-Cambridge in Barnes 1984b, 2-3)

The opinions of the many and the wise are the source of both truth and error. Dialectical argument contrasts, in this way, with geometrical demonstration. Geometrical demonstration begins, not with the opinions of predecessors which may be a source of truth or error, but with premises that are primitive truths.

That the relevant opinions are widespread or are offered by the wise at least

makes it likely that some element of truth is to be found among them. This is important insofar as dialectical argument is an alethic activity:

For the study of the philosophical sciences it is useful, because the ability to puzzle on both sides of a subject will make us detect more easily the truth and error about the several points that arise. (Aristotle, *Topica* I 2 101^a35–37; Pickard-Cambridge in Barnes 1984b, 3–4)

Dialectical argument thus serves a dual purpose. On the one hand, it makes it easier to discern what truth there is in the respected opinions of the predecessors. On the other hand, it makes it easier to eschew the errors of these same predecessors. Within the context of philosophical inquiry, then, dialectical argument is a means of determining the truth and avoiding error. If that is right, then this leaves open the possibility that at least some of what Empedocles has to say is true, at least on some understanding of what was said—though not necessarily Empedocles'. Thus, for example, in chapter 7, we shall see how Aristotle accepts Empedocles' analogy between the eye in seeing and a lantern DK 31B84 but only on a novel understanding of that analogy. And in chapter 9, we shall see that while Aristotle accepts the Empedoclean claim that perception is a mode of assimilation, he has a very different understanding of what assimilation involves in perceptual experience.

Dialectical argument proceeds by first collecting and organizing the respected opinions of one's predecessors and then by developing certain puzzles or *aporiai* concerning the opinions that have been collected. These difficulties or puzzles either arise directly from the opinions of the many or the wise—when they conflict, say—or is the result of the development of these opinion with material external to the *endoxa*. Determining, as best one can, what the appropriate resolution of such difficulties would be, is a means of avoiding the errors in the *endoxa* while importantly preserving what insights there are as one advances one's judgment. The conclusion of a dialectical argument, if successful, is a genuine advance in judgement. It is an advance not only that by means of it one may come to know something about which one was previously ignorant, but it is also an advance in the sense that dialectical argument is ampliative in the way that geometrical demonstration is not. The truth known on the basis of dialectical argument is not already contained among what the truths there are in the reputable opinions of one's predecessors.

A sense of how dialectical argument may advance judgment emerges in Aristotle's discussion, in the *Metaphysica*, of the relevance of the dialectical argument for philosophical inquiry:

For those who wish to get clear of difficulties it is advantageous to state the difficulties well; for the subsequent free play of thought implies the solution of the previous difficulties, and it is not possible to untie a knot which one does not know. But the difficulty of our thinking points to

a knot in the object; for in so far as our thought is in difficulties, it is in like case with those who are tied up; for in either case it is impossible to go forward. Therefore one should have surveyed all the difficulties beforehand, both for the reasons we have stated and because people who inquire without first stating the difficulties are like those who do not know where they have to go; besides, a man does not otherwise know even whether he has found what he is looking for or not; for the end is not clear to such a man, while to him who has first discussed the difficulties it is clear. Further, he who has heard all the contending arguments, as if they were the parties to a case, must be in a better position for judging. (Aristotle, *Metaphysica* B 1 995^a27–995^b4; Ross in Barnes 1984a, 28)

Identifying and critically assessing such puzzles forces one to examine assumptions that may never have been questioned and yet may prove to be false. Moreover, unexamined false assumptions can hinder further investigation. In these ways, dialectical argument is a means of avoiding error. In identifying and assessing such puzzles one knows better how to conduct one's inquiry. Moreover, in the course of dialectical reasoning one gains experience with the object of inquiry thus putting one in a better position to judge of its true nature. In these ways, dialectical argument is a means for determining the truth. Thus in order to be free from the distorting influence of false assumption as well as to be in a better position for judging the true nature of perception, Aristotle must first consider the difficulties that arise in the *endoxa* concerning the nature of perception.

In *De Anima*, Book 1 is devoted to an elaborate and extended discussion of these difficulties as they arise with respect to the motion of the soul and whether the soul is best conceived as a kind of harmony. In contrast to the characterization of the *endoxa* given in *Topica*, however, he restricts himself to the opinions of the wise as opposed to the many. Empedocles is prominent among the wise whose opinions are considered in Book 1. However, it would be a mistake to see Aristotle's dialectical engagement with the *endoxa* as confined to Book 1. For example, *De Anima* 11 5 begins by discussing an *aporia* about alteration as it is understood by the *endoxa*, albeit one that echoes important elements of the Book 1 discussion of the motion of the soul. Moreover, Aristotle's dialectical engagement with Empedocles is not itself confined to Book 1, nor is his engagement with the reputable opinions of other predecessors, Plato prominent among them.

The puzzle with which we will be primarily concerned, a puzzle about the visual presentation of the colors of remote external particulars, is a puzzle to be found in the respected opinion of Empedocles. So it is a puzzle that arises strictly within the *endoxa*, requiring no further development from without. Moreover, the *endoxa*, here, seems restricted to the wise. However, this may, in the end, be misleading.

Empedocles is attempting to reconcile certain aspects of the manifest image of nature with Parmenidean insights that may seem to conflict with it, and did so seem to Parmenides. Empedocles' theory of vision is part of this larger project. Empedoclean puzzlement arises from Empedocles' description of common phenomenological aspects of our experience of nature. Insofar as there are insights to be preserved in the respected opinion of Empedocles, the source of the puzzle described by Empedocles may lie with the way our sensory experience presents itself to be. But insofar as the source of the puzzlement lies, in part, with Empedocles' description of sensory experience, then the puzzle arises from the way the wise articulates the phenomenology of the many. In any case, the focus is on the object of dialectical inquiry, in the present instance, the visual presentation of the colors of remote external particulars.

1.2 The Answer in the Style of Gorgias

In the *Meno* Socrates attributes to Empedocles a conception of perception as a mode of assimilation of material effluences:

MENO: And how do you define color?

...

SOCRATES: Would you like an answer in the style Gorgias, such as you most readily follow?

MENO: Of course I should.

SOCRATES: You and he believe in Empedocles' theory of effluences, do you not?

MENO: Wholeheartedly.

SOCRATES: And passages to which and through which the effluences make their way?

MENO: Yes.

SOCRATES: Some of the effluences fit into some of the passages whereas others are too great or too small.

MENO: That is right.

SOCRATES: Now you recognize the term 'sight'?

MENO: Yes.

SOCRATES: From these notions, then, 'grasp what I would tell,' as Pindar says. Color is an effluence from shapes commensurate with sight and perceptible to it. (Plato, *Meno* 76^{a-d}; Guthrie in Hamilton and Cairns 1989, 359)

The main elements of the account are relatively clear. Objects emit material effluences. Effluences are fine bodies that are kind differentiated in terms of mag-

nitude. There are passages in which and through which material effluences may flow. Whether a material effluence may enter a passage depends upon its magnitude. The magnitudes of some kinds of material effluences are too great or too small for them to flow through a given passage. The magnitude of a material effluence must be commensurate with the magnitude of a passage in order for the effluence to fit the passage and so pass through it. Such passages exist in the membrane of the eye, thus allowing the eye to assimilate only a certain kind of material effluence, that is, the kind whose magnitude permits entry in ocular passages.

Thus we arrive at the answer in the style of Gorgias. That answer has three components. It specifies a kind of thing and two conditions that must be satisfied for a thing of that kind to be color. Color is (1) a kind of material effluence that is (2) commensurate with sight and (3) perceptible. First, color is a kind of material effluence, a chromatic effluence, say. Since material effluences are kind differentiated by magnitude, chromatic effluences have a distinctive magnitude. Second, chromatic effluences are commensurate with sight insofar as their distinctive magnitude permits entry in the passages of the membrane of the eye, the organ of sight. Notice, however, the assimilation of chromatic effluences by the organ of sight is not, by itself, the sensing of colors, otherwise the final condition would be redundant. The assimilation of chromatic effluence is at best a material precondition for their sensing. The thought seems to be this: In order for the chromatic effluences to be the object of sense, they first must be assimilated by the organ of sensation. It is only by assimilating chromatic effluences that they are presented to sight and are thereby seen. Socrates claims that the answer in the style of Gorgias may be generalized to the other sensory objects such as sound and smell (*Meno* 76^d), a claim echoed by Theophrastus' account of Empedocles (*De Sensibus* VII). If that is right, then Empedocles, at least as presented by Socrates, is in the grip of a general conception of sensory awareness for which ingestion provides the model. Compare—in eating an olive, the matter of the olive is taken in and presented to the organ of taste and thereby tasted. On the ingestion model, to be perceptible is to be palpable to sense.

The underlying thought is that in order for something to be the object of sense, it must be presented to the sense organ. On the ingestion model, it is a general feature that taste shares with paradigmatic cases of touch that is operative—the object of sensation must be in contact with the sense organ for it to be sensed. I say “paradigmatic” cases of touch since it is arguable, at least, that one can feel something that one is not in direct contact with. Thus one might feel the wooden frame of a Victorian rocking horse through the padding (the issue is further explored in chapter 2.2). Theophrastus' commentary supports the suggestion that, according to Empedocles, an object must be in contact with the sense organ for it to be sensed (on the reliability of Theophrastus as a doxographer see Kahn 1994; Bal-

tussen 2000). Following Aristotle's doxographic taxonomy (*De Anima* I 2 404^b12–15; cf *Metaphysica* B 4 1000^b5–8), Theophrastus counts Empedocles as a likeness theorist—as explaining perception in terms of the similarity of the elements that compose the object of sense and the sense organ. That attribution is controversial (see Kamtekar 2009). However, in *De Sensibus* xv, Theophrastus concedes that Empedocles remains silent on the compositional similarity of the material effluence and the sense organ that assimilates it, emphasizing instead the role of contact in perception (Kamtekar, 2009; Sedley, 1992):

For he attributes our recognition of things to two factors—namely, to likeness and to contact; and so he uses the expression “to fit”. Accordingly if the smaller touched the larger ones, there would be perception. And likeness also, speaking generally, is out of the question, at least according to him, and commensurateness alone suffices. For he says that substances fail to perceive one another because their passages are not commensurate. But whether the effluence is like or unlike he leaves quite undetermined. (Theophrastus, *De Sensibus* xv; Stratton 1917, 79)

To be perceptible is to be palpable to sense. If one began with that thought, a puzzle would naturally arise about vision, for vision seems to present the colors of distant objects. Color perception seems to involve the presentation of color qualities inhering in bounded particulars located at a distance from the perceiver. But how can one assimilate what remains inherent in a bounded particular remote from one? The puzzlement arise from the apparent tension between two claims:

- (1) The objects of color perception are qualities of external particulars located at a distance from the perceiver.
- (2) *The Empedoclean principle*: To be perceptible is to be palpable to sense—in order for something to be the object of perception it must be in contact with the relevant sense organ.

I conjecture that, whatever independent reasons Empedocles may have had for believing in material effluences, it is precisely this puzzlement that effluences are meant to address in his theory of vision. The basic idea is simple enough, at least in broad outline. Distant objects may be sensed by sensing the material effluences they emit. If the color of an object is the material effluence that it emits, then the color of a remote object can be assimilated and so be palpable to sight. In this way, we can see the color of a bounded particular remote from us consistent with the constraints imposed by the ingestion model.

One may wonder whether the theory of effluences is wholly adequate to this task, at least without supplementation. Can we really see remote colored particulars on Empedocles's theory of vision, or are these occluded from view by the

chromatic effluences they emit? Thus a Berkelean worry naturally arises about the immediate objects of sensation, the assimilated effluences, screening off the external objects that emit them. Moreover, it is not just colored objects that appear at a distance, but the colors themselves seem somehow confined to the remote bounded region in which they inhere. This aspect of color phenomenology is unexplained and perhaps inexplicable if sensed color is an effluence palpable to the perceptive part of the soul located within. Finally, there is a worry that in identifying colors with kinds of material effluences, Empedocles conflates ontological categories. Effluences are material bodies, but colors are not bodies, not even very fine bodies. Colors are, instead, qualities that could not exist apart from the bodies in which they inhere, at least according to the *Categoriae*. (Not only does Aristotle have the resources to press this objection, but, as we shall see, when the same issue arises with respect to light, he adopts a parallel position, that light is not a body but a state, chapter 3.2.) Fortunately, it is the puzzle that arises from Empedocles' conception of sensory presentation, and not his resolution of it, that is our focus here.

1.3 Empedocles' Theory of Vision

Empedocles' own theory of color vision is more elaborate than the answer in the style of Gorgias. Despite being more elaborate, the ingestion model remains at the core of that theory.

One element missing from the account that Socrates offers to Meno is the eye's emission of fiery effluences. That effluences may flow out of passages as well as in is consistent with, if not indeed suggested by, Socrates' general description of passages in which and through which effluences may flow. This is worth considering, since it can seem to offer an explanation that conflicts with the explanation of color vision in terms of the assimilation of material effluences. And while Aristotle notes the apparent tension, Theophrastus provides the basis for understanding the role the emission of fiery effluences plays in the assimilation of chromatic effluences.

Aristotle (*De Sensu* II 437^b27–438^a3) cites the following passage from Empedocles:

As when someone planning a journey prepared a lamp,
the gleam of blazing fire through the wintry night,
and fastened linen screens against all kinds of breezes,
which scatter the wind of the blowing breezes
But the light leapt outwards, as much of it as was finer,
and shone with its tireless beams across the threshold;
in this way [Aphrodite] gave birth to the rounded pupil,
primeval fire crowded in the membranes and in the fine linens.

And they covered over the depths of the circumfluent water
and sent forth fire, as much of it as was finer.
(Empedocles, DK 31B84; Inwood 2001, 103 259)

On this basis, Aristotle maintains that, like Plato in the *Timaeus*, Empedocles explains vision in terms of the emission of fire. But then he remarks “Sometimes he accounts for vision thus, but at other times he explains it by emanations from the visible objects” (*De Sensu* II 438^a3–4; Beare in Barnes 1984b, 5). So, at the very least, Aristotle thinks that Empedocles is potentially offering distinct explanations of color vision—one in terms of the eye’s emission of a fiery effluence and the other in terms of the eye’s assimilation of chromatic effluences. But if Empedocles explains vision by the assimilation of chromatic effluence, why does he also need the emission of a fiery effluence? Is Empedocles really offering conflicting explanations of vision?

In the passage cited by Aristotle, Empedocles describes the anatomy of the eye by analogy with an artifact, a screened lamp, constructed from linen or shaved horn, say. While it is controversial how to understand the composition of the screen (see Wright 1981, 240–241), interpreting the screen as composed of linen has the advantage of more closely echoing the fine membrane that Aphrodite weaves. Just as there is fire in the interior of a screened lamp, there is a primeval fire in the interior of the eye, or perhaps the pupil. And just as the screen of linen or shaved horn surrounds the fire in the lamp’s interior, there is a membrane that surrounds the fire in the eye’s interior. Moreover, the membrane plays a similar role to the screen. Just as the screen protects the interior fire from the wind which would extinguish it, the primeval fire is protected from the depth of the surrounding water by the membrane of the eye. Finally, just as light passes through the screen, the primeval fire can pass through passages in the membrane of the eye.

What is the surrounding water? Some commentators maintain that the membrane separates interior fire from interior water. Other commentators maintain that the membrane separates interior fire from exterior water. On the former interpretation, the membrane divides the eye’s interior, and the surrounding water is the vitreous humor (Beare 1906, 16; Wright 1981, 241–242). On the latter interpretation, the membrane surrounds the eye, and the surrounding water is the lachrymal fluid on the surface of the eye (Sedley, 1992). The former interpretation is supported by Theophrastus’ (*De Sensibus* xv) attribution of interior water and interior fire to the eye. On the other hand, if we take seriously one particular aspect of the analogy, that the surrounding water is like the wind in being external, then it is hard to understand the surrounding water as anything other than lachrymal fluid. So presented, these interpretations can seem like stark alternatives. However, a hybrid interpretation is possible. On the hybrid interpretation, interior fire and water are separated from one another and from exterior water by means of the

eye's membrane (Lloyd 1966, 326; Jerodiakonou 2005, 26 n39). On the hybrid interpretation, interior water is the vitreous humor and exterior water is the lachrymal fluid. The evidence for the alternative interpretations equally support the hybrid interpretation, and I adopt it here as a working hypothesis.

Why must fiery effluences be emitted if the eye is to assimilate chromatic effluences? Theophrastus offers the basis of an explanation:

The passages <of the eye> are arranged alternately of fire and of water: by the passages of fire we perceive white objects; by those of water, things black; for in each of these case <the objects> fit into the given <passage>. Colors are brought to our sight by an effluence. (Theophrastus, *De Sensibus* VII; Stratton 1917, 71–73)

How are we to understand the passages of the eye being arranged alternately of fire and water? Here is a simple model that coheres with the text (perhaps not the only one): Picture the passages in the membrane of the eye as being arranged in a regular array (see Figure 1.1). There are two kinds of passages, fire passages and water passages. Each kind of passage is adjacent to the alternate kind of passage. So fire passages are always adjacent to water passages and water passages are always adjacent to fire passages. Fire passages are passages in the membrane of the eye lined with fire emitted from the interior. The fire emitted from the interior merely lines the passages, it does not emanate beyond the eye as on Plato's account of perception in the *Timaeus*. This has the effect of narrowing the passage, thus allowing only smaller effluences to pass, such as white effluences. Water passages are the passages in the eye that are not lined with fire. The magnitude of the surrounding water, the lachrymal fluid, is too great, say, to enter these passages. However, they count as water passages since any effluences entering them must pass through the surrounding water. Water passages are wider than fire passages thus allowing the passage of effluences of greater magnitude, such as black effluences. In being commensurate with, respectively, the fire and water passages in the membrane of the eye, white and black effluences may be assimilated by the eye and so be palpable to sight.

Against the present model, one might object that the fire and water passages in the membrane of the eye are so called because of the elemental composition of the effluences that are commensurate with them. Thus fire passages only admit fiery effluences, and water passages only admit watery effluences. This is a plausible explanation of Empedoclean nomenclature and coheres well with Theophrastus claim that the eye, as conceived by Empedocles, consists of “fire and its opposite”. However, at least by itself, the suggestion fails to reconcile the answer in the style of Gorgias with the eye's emission of fiery effluences. Fortunately, it is less a genuine alternative to the present model than a plausible supplement. Suppose, then, that

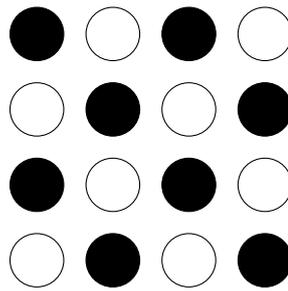


Figure 1.1: Array of fire and water passages in the membrane of the eye. Fire passages are white, water passages are black.

fire is the elemental composition of white effluences and that water is the elemental composition of black effluences. The smaller fiery effluences are commensurate only with the fire passages, the passages lined with fire, and the larger watery effluences are commensurate only with the water passages, the passages not so lined but merely surrounded by external water. The fire passages lead to the primeval fire within, itself confined and bound by a fine membrane. Just as fire passages lead to fire in the eye's interior, water passages lead to water in the eyes' interior. And each are bound and separated from one another by the fine membrane Aphrodite wove.

If black effluences are composed of water and their magnitude is commensurate with the water passages in the membrane of the eye, how is it that the surrounding water, the lachrymal fluid, does not leak through? How is it that watery effluence and not the surrounding water is commensurate with water passages? While effluences may be kind differentiated in terms of magnitude, perhaps these kinds are not aligned with elemental divisions. Fine bodies composed of water may differ in magnitude, and so constitute different kinds of effluence. The surrounding water, due to its greater magnitude, say, is not commensurate with the water passages in the membrane of the eye. That is how Aphrodite's Love constrains them. Only a certain kind of watery effluence is commensurate with ocular passages, the kind of watery effluence emitted by distal objects and that constitute the color of the objects that emit them.

Moderns will react to this model with a mixture of familiarity and strangeness. The idea of an array of different kinds of receptors is familiar from vision science. The strangeness, for us, is that Empedocles places this array on the surface of the eye instead of the retinal interior (for a comparison of Empedocles' theory with modern theories of vision see Siegel, 1959). This strangeness ought not to blind us to the way in which Empedocles' view is, nevertheless, a respectable piece of natural philosophy. Specifically, Empedocles view coheres well with the dominant

medical opinion of his time. Arguably, it was designed to so cohere. The presence of lachrymal fluid is both necessary for sight and necessary for the reflective appearance of the eye. This encouraged the opinion that the reflective appearance of the eye explained the eye's capacity for sight, and hence that the surface of the eye is the locus of sight. (Consider the view that Aristotle attributes to Democritus, *De Sensu* II 438^a 5ff.) Notice how this can seem inconsistent with the ingestion model. On the ingestion model, the interior of the eye is the locus of sight. Empedocles' own more elaborate theory can be motivated, in part, by the reconciliation it offers. Empedocles' reconciles the ingestion model to the dominant medical opinion of his day by conceiving of the receptors on the surface of the eye as water-bound passages to its interior.

Even taking the model on its own terms, questions remain. The perception of black and white is relatively straightforward. White effluences emitted from distal objects are assimilated through fire passages, black effluences emitted from distal objects are assimilated through water passages, and so each is made palpable to the organ of sight. But what about the perception of the other hues? How, on this model, is the perception of red explained? Theophrastus complains that Empedocles owes us an explanation but fails to provide one:

Now since, for him, the eye is composed of fire and of its opposite, it might well recognize white and black by means of what is like them; but how could it become conscious of gray and the other compound colours? For he assigns <their perception> neither to the minute passages of fire nor to those of water nor to others composed of both these elements together. Yet we see the compound colours no whit less than we do the simple. (Theophrastus, *De Sensibus* XVII; Stratton 1917, 81)

Perhaps the perception of red can be explained in terms of the ratio of black and white assimilated (Ierodiakonou, 2005). So understood, Empedocles anticipates, in this way, Aristotle's account of the generation of the hues, *De Sensu* III 439^b ff. This Aristotelian hypothesis at least has the virtue of explaining the perception of chromatic hues only in terms of elements already present in the model. That the elements of the model should prove sufficient for the perception of color quite generally is suggested by the concluding line of Theophrastus' description of that model: "Colors are brought to our sight by an effluence". In the passage cited by Aristotle (*De Sensu* II 437^b 27–438^a 3; Empedocles DK 31B84), the Love that binds the primeval fire in the eye's membrane is Aphrodite's Love and is the principle of harmony. If the perception of red is due to the ratio of black and white among the assimilated effluences, then the perception of red is due, in part to the principle of harmony. Could Aphrodite's Love take so marvelous a form? (We shall return to this question in chapters 5 and 6.)

Empedocles own theory of color vision is more elaborate than the answer in the style of Gorgias. Despite being more elaborate, the ingestion model remains at the core of that theory. Theophrastus' insight is that the emission of fiery effluences is not an alternative account of color vision as Aristotle supposed, but a necessary precondition for the assimilation of chromatic effluences. So even on Empedocles' more elaborate theory of color vision, a conception of sensory awareness as a mode of assimilation remains at its core. Key features of that theory are driven by the central principle of the ingestion model, the Empedoclean principle, to be perceptible is to be palpable to sense.

1.4 Empedoclean Puzzlement

I believe that Empedocles' puzzlement about the sensory presentation of the remote objects of sight is a natural one. The puzzlement survives abandoning what surely is the immediate culprit in the ingestion model, the principle that to be perceptible is to be palpable to sense.

Indeed, Empedoclean puzzlement persists at least well into the twentieth century. Thus Bergson remarks:

A man born blind, who had lived among others born blind, could not be made to believe in the possibility of perceiving a distant object without first perceiving all the objects in between. Yet vision performs this miracle. In a certain sense the blind man is right, since vision, having its origin in the stimulation of the retina, by the vibrations of the light, is nothing else, in fact, but a retinal touch. (Bergson, 1907, 168)

But how can retinal touch perceive distant objects without first perceiving the objects between? Indeed, how can retinal touch perceive distant objects at all? Bergson never explains how this miracle is brought off. Less than half a century later, Broad reports a similar puzzlement:

It is a natural, if paradoxical, way of speaking to say that seeing seems to 'bring us into *contact* with *remote* objects' and to reveal their shapes and colors. (Broad, 1952, 33)

This natural if paradoxical way of speaking is ubiquitous among contemporary philosophers of perception, but the miraculous character of the phenomenon goes largely unremarked. A recent notable exception is Valberg (1992). Valberg addresses a puzzle that arises about the sensory presentation of distal objects if sensory experience is located where the perceiver is:

How could the man ‘out there’, at a distance from my head, be present in my experience, if my experience is something which is occurring ‘back up here’, inside my head? (Valberg, 1992, 141)

In its most general form, the puzzlement about how one may be in perceptual contact with remote objects is but one aspect of the problem discussed by contemporary philosophers under the rubric of presence in absence. The puzzlement consists in an inability to understand how to coherently combine the distal character of the objects of sight with a conception of sensory awareness as a mode of assimilation. It would be premature to dismiss that conception, even in its original Empedoclean form, as primitive physiology of vision. Indeed, Aristotle retains the conception of perception as a mode of assimilation even as he transforms it in rejecting Empedocles’ theory of effluences. Aristotle retains that conception presumably because he felt that there was an insight that should be preserved in Empedocles’ opinion.

Aristotle is not alone in thinking that there is an insight to be preserved in conceiving of sensory awareness as a mode of assimilation. Thus Broad (1952) speaks of the presentation of the objects of visual awareness as a mode of prehension. “Prehension” belongs to a primordial family of broadly tactile metaphors for sensory awareness that includes “grasping”, and “apprehending”. What unites these metaphors is that they are all a mode of assimilation, and “ingestion” is a natural variant (see Johnston, 2006; Price, 1932, 7). For what it is worth, assimilation as a metaphor for perception is inscribed in the history of the English language. The word “perception” derives from the Latin *perceptio* meaning to take in, or assimilate (Burnyeat, 1979, 102)—evidence, at least, for the persistence of an inclination. It is natural, then, to think of seeing as taking in the external scene before one. But then the question arises: How can one take in what remains external? And if one can, what could taking in mean, here, such that one could? Empedoclean puzzlement, in its most general form, consists in the persistence of this latter question.

It is worth wondering about the prevalence of tactile metaphors for visual awareness. There is an Aristotelian explanation, I think. The explanation is Aristotelian, not in the sense that Aristotle gives the explanation or even entertains it. Rather, it is Aristotelian in that it draws on resources available in Aristotle’s thought.

According to Aristotle, taste and touch are primitive forms of sensation common to all animals (though animals can and do differ in their possession of other sensory capacities). Whereas the objects of the distal senses are for the animal’s well-being, the objects of touch concern the animal’s very existence (*De Anima* 111 13 433^b31–434^a10). What we touch may put us in mortal danger or provide us with vital sustenance. Touch is primitively compelling because of its existential character.

Suppose then, at least in human beings, the primitive character of touch is manifest in our emotional responses to things. Often when we see something we are

drawn to touch it, even though there is no doubt about its presence or solidity. It is as if a thing's presence is most keenly felt when grasped. Thus we must endeavor to teach children to keep their hands to themselves, and even in maturity, polite notices are required to remind adults to not touch the display cabinet.

Grasping is sufficiently phenomenologically compelling that it becomes, in the cosmology of the Giants, a touchstone for reality. Thus in the *Sophist* the Eleatic Visitor reports:

One party is trying to drag everything down to earth out of heaven and the unseen, literally grasping rocks and trees in their hands, for they lay hold upon every stock and stone and strenuously affirm that real existence belongs only to that which can be handled and offers resistance to the touch. (Plato, *Sophist* 246^a; Cornford in Hamilton and Cairns 1989, 990)

If real existence belongs only to that which can be handled and offers resistance to touch, then only the palpable is real. Sensory perception is a mode of awareness. Awareness must be an awareness of what is real if it is to be awareness at all. It follows that the objects of perception must themselves be palpable. It is a further claim, however, that not only are the objects of perception palpable, but they are palpable, as well, to the organ of sense, in the way that Empedocles requires. Sensory perception presents itself as a mode of awareness of particulars arrayed in the natural environment. And the Empedoclean thought would be that perception could only be as it presents itself to be if its objects were palpable to the organ of sense. But even if real existence belongs only to that which can be handled and offers resistance to touch, it does not follow that the perceptible must be palpable to sense. Grasping may manifestly be a mode of sensing, but it does not follow that it is the only mode, or that all modes of sensory presentation must be understood on its model. The Giants' metaphysical principle, only the palpable is real, may not entail the Empedoclean principle, to be perceptible is to be palpable to sense, nevertheless the appeal of these distinct principles flow from a common source, the vivid and primitively compelling phenomenology of an external particular's resistance to touch.

If the presence of things is most keenly felt when grasped, if in the resistance to touch their presence is manifest in a primitively compelling manner, then it would be no surprise that we reach for tactile metaphors in characterizing sensory presentation, even as it figures in nontactile modes of sensory awareness such as vision. If the Aristotelian explanation is correct, then the tactile metaphors are emphasizing the presentation of the objects of sensory awareness. It is because objects grasped are presented to us in a primitively compelling manner, that grasping can serve as a paradigm of sensory presentation. On the Aristotelian explanation, the palpable is

real—touch is a genuine mode of sensory awareness. But neither the Giants' principle nor Empedocles' follows. The palpable may be real, but it is not the case that only the palpable is real. Aristotle accepts the Eleatic Visitor's observation that virtues and capacities are real if not palpable. Nor is it the case that only by being palpable to the organ of sense is an object perceptible. Indeed, Aristotle will argue that an object's contact with a sense organ precludes sensation.

If the Aristotelian explanation is correct, then Empedoclean puzzlement, in its original form, is the result of overgeneralizing from a paradigm case. To be sure, vision involves the presentation of colors inhering in bounded particulars remote from the perceiver. But if the presentation of color in sensory consciousness is too closely modeled on a capacity to grasp or take in something material, then a puzzle arises that only the theory of effluences may resolve. If indeed it does. I have already mentioned three reservations: (1) the Berkelean worry about the immediate objects of perception, the assimilated effluences, screening off the distal objects that emit them; (2) that perceived color itself appears to inhere in the remote bounded region of the external particular; and (3) that colors belong to a different ontological category from material bodies. As we shall see in the next chapter, Aristotle has his own criticisms to make of Empedocles' theory of color vision. Far from being a necessary condition on perception, contact with the sense organ precludes perception. Placing a colored particular on the eye blinds the perceiver to the particular and its color (*De Anima* II 7 419^a13–14). If Aristotle's criticism proves cogent, then Empedoclean puzzlement, in its original form, not only involves an overgeneralization from a paradigm case but a misconception of it as well. If to be palpable is to be imperceptible, then not even touch works by the object of sense being in contact with the sense organ. Grasping may be a paradigm case of sensory presentation, but not because it involves an object being in contact with a sense organ. Rather, it is a paradigm case because objects grasped are presented to us in a primitively compelling manner. But even if we resist the temptation to which Empedocles apparently succumbed, to overgeneralize, in this way, from a misconception of a paradigm case, there remains the question: What could the sensory presentation of qualities of remote external particulars be, if not simply their being palpable to sense?

1.5 Definition

In *De Anima* II 12 424^a18–23, II 5 418^a3–6 Aristotle defines perception as a mode of assimilation of the sensible form without the matter of an external particular. This is an instance of Aristotle's dialectical refinement of the *endoxa* (on Aristotle's dialectic in *De Anima* see Witt, 1995). While denying that sight involves the assimilation of material effluences, Aristotle retains Empedocles' conception of sensory

awareness as a mode of assimilation, it is just that we assimilate form without matter. Indeed, this pattern of dialectical refinement continues in the very next line where Aristotle uses Plato's metaphor of wax receiving an impression, not to characterize judgment as Plato does in the *Theaetetus* 194^c–195^a, but to characterize the assimilation of sensible form in perception. Given this pattern of dialectical refinement, we can be confident that Aristotle was engaging with Empedocles' thought in his definition of perception. And while it remains controversial how to understand the assimilation of sensible form, I believe progress can be made by interpreting Aristotle's definition of perception as addressing Empedocles' puzzlement about how remote objects can be present in sensory consciousness. Recall Empedoclean puzzlement begins with the natural thought that in seeing one takes in the external scene. The question then arises: How can we take in what remains external? And if one can, what could taking in mean such that one could? The proposal is to interpret Aristotle's definition of perception as an answer to this latter question—a remote object can be present in sensory consciousness by assimilating its sensible form while leaving its matter in place. Understanding how Aristotle's definition of perception so much as could be a resolution of Empedoclean puzzlement imposes a substantive constraint on interpreting that definition, for so interpreted, it is making an important claim about the metaphysics of sensory presentation.

Aristotle's definition of perception is a dialectical refinement of the *endoxa* insofar as it seeks to preserve an Empedoclean insight while resolving a puzzle about how remote objects can be present to sensory consciousness. Empedocles' puzzlement about the nature of sensory presentation persists to this day, though now in the guise of discussions of presence in absence. Perhaps there are insights of Aristotle's own that ought to be preserved when confronting Empedoclean puzzlement as it arises in its modern guise. If there are, then a conception of sensory presentation that preserved Aristotle's insight into the proper resolution of Empedoclean puzzlement would itself be a dialectical refinement of the respected opinion of Aristotle. What these insights might be and whether any conception of sensory presentation answers this description remains to be determined.

Chapter 2

Perception at a Distance

In its original form, Empedoclean puzzlement about the sensory presentation of remote objects consists in the apparent tension between two claims:

- (1) The objects of color perception are qualities of external particulars located at a distance from the perceiver.
- (2) *The Empedoclean principle*: To be perceptible is to be palpable to sense—in order for something to be the object of perception it must be in contact with the relevant sense organ.

Short of embracing the theory of effluences, how might one respond to Empedoclean puzzlement as it arises in its original form? Either (1) or (2) may be rejected, or an alternative reconciliation may be proposed, one not involving the assimilation of material effluences.

In case it is unobvious that anyone would reject (1), Parmenides counts among its deniers. Specifically, Parmenides (DK 28B8.41) claims that it merely appears that things alter their color. The Way of Mortal Opinion, in maintaining otherwise, conflates appearance with reality. Strictly speaking, this claim is consistent with remote external particulars having unchanging colors. However, if we bear in mind the broader philosophical context, it is plausible that Parmenides meant to deny not just that things alter their color as they appear to do, but that things are colored at all. Colors are qualities that appear in sensory experience and are in this sense part of the sensible world. The sensible world is associated with becoming as opposed to being. Perhaps, the underlying thought is that it is characteristic of sensory experience that it presents us with a flux of sensible qualities. Sensible qualities, qualities that appear in sensory experience, are subject to change. Since change is impossible, things merely appear to have sensible qualities. The attributes of the one being of The Way of Truth are intelligible as opposed to sensible. There are thus no qualities of external particulars that are the objects of color perception.

Despite his shift to a pluralist metaphysics, Democritus retains Parmenides' color irrealism. Concerning Democritus, Sextus Empiricus reports:

And Democritus in some places abolishes the things that appear to the senses and asserts that none of them appears in truth but only in opinion, the true fact in things existent being the existence of atoms and void; for "By convention," he says, "is sweet, by convention bitter, by convention hot, by convention cold, by convention color; but by verity atoms and void." (This means: Sensible objects are conventionally assumed and opined to exist, but they do not truly exist, but only the atoms and the void.) (Sextus Empiricus, *Against the Logicians*, *adv. math.*, VII; Bury 1997, 135–136)

Linguistic conventions may license, in certain circumstances, our predicating "white" of the sun given the character of the sensory experience it elicits, but there is nothing corresponding to this predication over and above this sensory reaction to atomic stimuli. There are thus no qualities of external particulars that are the objects of color perception.

Parmenides and Democritus deny (1) by denying the existence of the colors. A more modern denial of (1) retains the existence of the colors but denies that they are qualities of external particulars. Thus while Berkeley (1734) maintains that colors are the objects of sight, he denies that they are qualities inherent in external bodies. Berkeley (1744) himself cites ancient precedent for this doctrine. In particular he advances an interpretation of the Secret Doctrine of the *Theaetetus* that would support this denial and so credits Protagoras as an adherent. But as Burnyeat (1982) argues, the claim to ancient precedent is spurious, and the denial is distinctly modern. Berkeley maintains that the object of perception depends upon the perceiving subject. Indeed, the being of color wholly consists in its being seen. But, according to the Secret Doctrine of Protagoras, the perception itself depends upon its objects. Protagoras is represented as positing a mutual dependence between perception and object perceived. Sense and sensibilia are correlatives in a way that Berkeley never conceives of them.

In addition, instead of rejecting either (1) or (2), one may propose an alternative reconciliation, one not involving the assimilation of effluences. Instead of the perceiver assimilating material effluences, perhaps perception can be understood in terms of the perceiver emitting them. Thus Aristotle attributes to Empedocles and Plato in the *Timaeus* accounts of perception that involve the eye's emission of fiery effluences. And within the distinct tradition of geometrical optics, thinkers such as Euclid, Hero, Galen, and Ptolemy, used lines determined by visual rays emitted from the eye as the basis of geometrical reasoning in offering explanations of reflection, the variation in apparent size with distance, and the rudiments of perspective. Moreover, such reasoning possibly had effective military application,

if stories about Archimedes' burning mirror are to be believed. Effluences or visual rays emitted by the eye reconcile the ingestion model with sensible objects being remote by themselves being a kind of extended ethereal touch. Emission would be a means of reaching out so as to grasp the sensible object. On this alternative, sight is conceived the way Diderot's blind man conceives of it: "This blind man's only knowledge of objects is by touch. ... Sight, he therefore concludes, is a kind of touch which extends to distant objects" (Diderot, "Letter on the Blind for the Use of Those Who See"; Jourdain 1916, 72). Aristotle will rightly complain that this extended ethereal touch is not well explained and so could not be understood as the mode of perceptual apprehension that its advocates present it as being.

Aristotle clearly accepts (1)—that the objects of color perception are qualities of external particulars located at a distance from the perceiver. Importantly, this is the result, in part, of some fundamental commitments that Aristotle undertakes with respect to the nature of our perceptual capacities and their objects. Moreover, when combined with the Empedoclean principle, to be perceptible is to be palpable to sense, it generates precisely the puzzlement that the theory of effluences is designed to resolve. However, Aristotle rejects Empedocles' theory of effluences. And with no viable alternative reconciliation to hand, Aristotle is committed to rejecting (2).

The nature of Aristotle's case is our present topic. First, we will discuss the fundamental commitments about our perceptual capacities and their objects that underly Aristotle's acceptance of (1)—that the objects of color perception are qualities of external particulars located at a distance from the perceiver. Second, we will discuss Aristotle's argument against (2)—the Empedoclean principle that to be perceptible is to be palpable to sense. As we shall see, according to Aristotle, not only is the Empedoclean principle an overgeneralization from a paradigm case, but a misconception of it as well. Third, Empedoclean puzzlement, in its most general form, survives the rejection of the principle that to be perceptible is to be palpable to sense. There thus remain unanswered questions in rejecting (2). Moreover, these questions partly set the agenda in Aristotle's discussion of perception (the present essay, as a whole, constitutes an argument for this latter claim).

2.1 The Sensible Qualities of Remote External Particulars

Color perception involves the visual presentation of qualities of remote external particulars. The particulars are external in that they exist and have their natures and powers independently of the perceiver. The relevant sense of independence may guarantee that the perceiver and the particular are spatially non-coincident

(since two bodies cannot occupy the same space at the same time), but it does not guarantee that they are non-contiguous. Spatially non-coincident bodies may yet be in contact with one another. Thus talk of remote external particulars is not redundant. Their remoteness consists in the non-contiguity of the perceiver and external particular.

In this section we shall discuss the general reasons that underly Aristotle's commitment to three claims:

- (1) The objects of perception are external;
- (2) The objects of perception are particulars and their qualities;
- (3) The objects of perception are remote.

Taken together they explain Aristotle's commitment the objects of color perception being qualities of external particulars located at a distance from the perceiver. It is the conjunction of this commitment and the Empedoclean principle that generates the puzzlement that Empedocles' theory of effluences was designed to resolve.

2.1.1 External

Sensible qualities inhere in external particulars. They are external in that they exist and have the natures and powers they do independently of being perceived. The relevant sense of independence is usefully highlighted by contrasting Aristotle's position with Protagoras'.

Protagoras notoriously claims that man is the measure of all things. According to Plato's *Theaetetus* and Aristotle's *Metaphysica* Γ, Protagoras' measure doctrine is supported by an account of perception where neither the perceptual experience nor the object of perception takes precedence over one another. Perception and the object of perception, so understood, are correlatives. Moreover, this account of the relation between perception and its object is meant to have the startling consequence that nothing we perceive exists prior to our perception. Perhaps surprisingly, Aristotle accepts that perception and its object are correlatives. Nevertheless, on his own account of relatives, the startling Protagorean consequence is avoided. Indeed, consistent with perception and the perceptible being correlatives, Aristotle maintains that the perceptible is prior to perception, the sensible is prior to sensation.

In *Categoriae* VII, Aristotle defines *relatives* as follows:

We call *relatives* all such things as are said to be just what they are, *of* or *than* things, or in some other way *in relation to* something else. (Aristotle, *Categoriae* VII 6^a37; Ackrill in Barnes 1984b, 11)

So understood, relatives are not relations, but relational categories—categories that only apply because some relation obtains. They are ways for things to be that wholly depend upon a thing's relations. Being related to something else is what it is to be relative to that thing. Thus to be a perception is for the perceiver to be perceptually related to an object of perception. And for something to be an object of perception is for it to be what the perceiver is perceptually related to. Thus a perception is in this sense relative to its object and the object of perception is relative to the perception whose object it is. Aristotle further holds that “All relatives are spoken of in relation to correlatives that reciprocate” (*Categoriae* VII 6^b28; Ackrill in Barnes 1984b, 11) provided that they are properly given (*Categoriae* VII 7^a22–23). Thus the larger is larger than the smaller and the smaller is smaller than the larger. Aristotle explains the constraint that correlatives that reciprocate be properly given as follows:

For example, if a wing is given as *of a bird*, *bird of a wing* does not reciprocate; for it has not been given properly in the first place as wing of a bird. For it is not as being a bird that a wing is said to be of it, but as being a winged, since many things that are not birds have wings. Thus if it given properly there is reciprocation; for example, a wing is wing of a winged and a winged is winged with a wing. (Aristotle, *Categoriae* VII 6^b38–7^a5; Ackrill in Barnes 1984b, 12)

A bird is a winged, but the relative that reciprocates is only properly given in terms of the relevant underlying relation. To be a wing is to be related in a certain way to something as its wings, that is to say, to a winged—something considered only in so far as it bears the winged relation to a wing. A bird does not reciprocate a wing since there are things with wings that are not birds. Being a bird does not wholly consist in having wings as parts and so is not a correlative.

According to Aristotle, sense and sensibilia, perception and the perceptible, are correlatives, as are knowledge and the knowable. Perceptual and epistemic correlatives differ from other correlatives in two important ways, however. First, Aristotle observes that: “knowledge is called knowledge *of* what is knowable, and what is knowable knowable *by* knowledge; perception perception *of* the perceptible, and the perceptible perceptible *by* perception” (*Categoriae* VII 6^b28–36; Ackrill in Barnes 1984b, 11–12). Knowledge and perception are alike in that each takes an object, and they differ in this way from other correlatives, such as the larger and the smaller, the wing and the winged.

Second, Aristotle argues that the perceptible must be prior to perception:

The perceptible seems to be prior to perception. For the destruction of the perceptible carries perception to destruction, but perception does not carry the perceptible to destruction. For perceptions are to do with

body and in body, and if the perceptible is destroyed, body too is destroyed (since body is itself a perceptible), and if there is not body, perception too is destroyed; hence the perceptible carries perception to destruction. But perception does not carry the perceptible. For if animal is destroyed perception is destroyed, but there will be something perceptible, such as body, hot, sweet bitter, and all the other perceptibles. Moreover, perception comes into existence at the same time as what is capable of perceiving—an animal and perception come into existence at the same time—but the perceptible exists before perception exists; fire and water and so on, of which an animal is itself made up, exist even before there exists an animal at all, or perception. Hence the perceptible would seem to be prior to perception. (Aristotle, *Categoriae* VII 7^b35–8^a13; Ackrill in Barnes 1984b, 13–14)

Perception and the perceptible, sense and sensibilia, may be correlatives, but that is consistent with the following asymmetry—the perceptible can exist prior to perception and so does not depend upon perception the way perception depends upon its object. Aristotle gives two arguments: (1) that perception existentially depends upon the perceptible, and (2) that the perceptible does not existentially depend upon perception. Taken together (1) and (2) entail that the perceptible is existentially prior to perception.

The argument for (1) takes an interesting and perhaps unexpected form. One might have expected Aristotle to argue that since perception essentially takes an object there must be something that the perception, or perhaps the perceiver, is perceptually related to. Thus if the perceptible, understood as potential *relata* of the perceptual relation, does not exist, neither does any perception of them. But that is not, in fact, how Aristotle argues. Aristotle emphasizes, instead, that perceptions are the exercises of perceptual capacities possessed by certain natural bodies, namely, animals. These bodies—the bodies that possess perceptual capacities, capacities whose proper exercise consists in the presentation of their primary objects, color for sight, sound for hearing—are themselves perceptible. So if nothing perceptible exists, nothing in fact has the capacity to perceive. And if nothing has the capacity to perceive, there are no perceptions.

The argument for (2) is more straightforward but retains the focus on certain natural bodies, animals, understood as the possessor's of perceptual capacities. Suppose there are no animals. Then nothing possesses the capacity to perceive. And if nothing has the capacity to perceive, there are no perceptions. Nevertheless, consistent with the absence of perceivers, the perceptible would persist. An Extinction Level Event may destroy all animal life, and, hence, all perceivers, on Earth, but things would remain white, or hot, or bitter. Things would continue to be the way they are in observable respects even in the absence of perceivers.

Towards the end of the passage from the *Categoriae*, Aristotle adds a third claim: (3) Not only is the perceptible existentially prior to perception, but the perceptible is temporally prior as well. And again, there is a focus on certain natural bodies that possess perceptual capacities. Animals, natural bodies with perceptual capacities, have an elemental composition. Animals are composed of the so-called elements, such as fire and water. Fire and water, like the animals that are composed of them, are perceptible. Before the animal is composed of its elements, and so comes to possess perceptual capacities and so perceive, the elements out of which the animal is composed would exist and be the potential objects of perception. And so Aristotle concludes that the perceptible is not only existentially prior to perception but temporally prior as well.

The arguments in the *Categoriae* for (1)–(3) all emphasize that perception, though it may involve the presentation of the perceptible in sense experience, is nevertheless to be understood as the exercise of a capacity possessed by certain animate natural bodies, animals if not plants. The corresponding arguments in the *Metaphysica* will themselves emphasize that perception is the exercise of a capacity possessed by animals. However, in the *Metaphysica*, there is a crucial shift of focus. While in the *Categoriae*, Aristotle emphasizes the way in which the natural bodies that possess perceptual capacities, and the elements that compose these bodies, are themselves perceptible, in the *Metaphysica*, however, Aristotle emphasizes instead the kind of capacity involved in perceiving the environment. Specifically, sensory capacities are a mode of sensitivity to sensible aspects of the natural environment. As such they are reactive capacities, they only ever act by reacting to the presence, in their environment, of the sensible object. So there is a shift of focus from certain natural bodies possessing perceptual capacities to the objects that trigger the exercise of these capacities.

That the objects of perception are independent of perceivers perceiving them is brought out clearly in one of a battery of arguments that Aristotle brings to bear against Protagoras in *Metaphysica* Γ:

And, in general, if only the sensible exists, there would be nothing if animate things were not; for there would be no faculty of sense. Now the view that neither the sensible qualities nor the sensations would exist is doubtless true (for they are affections of the perceiver), but that the substrata which cause the sensation should not exist even apart from sensations is impossible. For sensation is surely not the sensation of itself, but there is something beyond the sensation, which must be prior to the sensation; for that which moves is prior in nature to that which is moved, and if they are correlative terms, this is no less the case. (Aristotle, *Metaphysica* Γ 5 1010^b30–1011^a2; Ross in Barnes 1984a, 55–56)

Aristotle's target is the claim that only the sensible exists, a doctrine that Aristotle

ascribes to a number of early thinkers but sees exemplified by Protagoras' measure doctrine.

In the initial portion of the passage, the claim that nature is restricted to its sensible aspects is subject to a *reductio ad absurdum*. If only what can be perceived exists, then if no animals existed, nothing would be perceived, since animals are the only natural bodies that possess the capacity to perceive. From which it is meant to follow that nothing could exist. Whether the conclusion follows depends on the sense of the thesis assumed for the sake of *reductio*. How are we to understand the claim that only the sensible exists? The conclusion of the *reductio* would follow from the principle that:

If something exists, then it is perceived

since a world without animals is a world without perception. Perhaps the claim that only the sensible exists can be understood in terms of the weaker principle:

If something exists, then it is possible that it is perceived

Would the conclusion of the *reductio* follow from the weaker principle? Whether it does depends on the sense of possibility involved. In a world without perceivers, given how things are in such a world, it is not possible for anything to be perceived. In order for something to be perceived, there must be perceivers, but there are none. The weaker principle, understood in terms of this sense of possibility, would suffice for the conclusion of the *reductio*. Nevertheless, in a world without perceivers, there is another reasonable sense in which it is possible for something to be perceived. Even if no perceivers existed for the rest of eternity, the particulars in the natural environment could be of such a nature, or possess such a power, that had there been perceivers, they could have been perceived. This latter thought is no aid to the Protagorean, however. Aristotle thinks that the envisioned possibility is only intelligible against the background of a realist metaphysics. Aristotle concedes to Protagoras that neither sensible qualities nor perceptions would exist if no perceivers exist. There certainly would be no sensible qualities as Protagoras conceives of them, at least if he is a perceptual relativist. But even if no perceivers exist, there would remain a "substrata" which retains the power to cause perceptions in animals with suitable sensory capacities.

Aristotle provides metaphysical and phenomenological grounds for the existence of such substrata. The metaphysical grounds turn on the kind of capacity perceptual capacities are, reactive capacities, at least if perception is a mode of sensitivity to the sensible aspects of the natural environment. If perception is a mode of sensitivity, as it must be if it is to be perception at all, the objects of perception must exist independently of perception and be the potential cause of perception. A reactive capacity only acts by reacting. The possessor of the reactive capacity must be acted upon before their reactive capacity can be exercised.

And what acts upon the possessor of the reactive capacity must exist prior to the reaction it elicits. Not only does Aristotle provide metaphysical grounds for the existence of substrata, arguably at least, he provides phenomenological grounds as well:

For sensation is surely not the sensation of itself, but there is something beyond the sensation, which must be prior to the sensation. (*Metaphysica* Γ 6 1011^a1; Ross in Barnes 1984a, 56)

Given the phenomenology of our perceptual experience, perception seems to present us with objects that exist independently of perception. Our sense experience seems to present us something beyond the sensation. Moreover, it does so by presenting itself as a mode of sensitivity to how things are, in sensible respects, independently of the perceiver.

It is unclear what Aristotle means by “substrata”. Does he mean persisting particular bodies like artifacts and natural objects? Or does he mean something broader in this context, broad enough to include not only external particulars but their qualities as well? Just because particulars must be independent causes of perception, it does not follow that they possess their sensible qualities independently of perception, or that their qualities can themselves be the cause of perception. If, on the other hand, in the argument against Protagoras, “substrata” is meant to include not only external particulars but their sensible qualities, then external particulars possess their sensible qualities independently of being perceived.

Can sensible qualities, or at least their instances, cause perception? If so, they are among the substrata that exist independently of perception. If colors exist independently of being perceived, this is strong *prima facie* evidence that Aristotle is committed to the kind of color realism that the early moderns, such as Descartes, Boyle, and Locke, rejected. There are other passages, however, that can seem to conflict with this interpretation. Whether Aristotle is, in fact, a color realist, and in what sense, will be determined later.

The discussion in *Metaphysica* Δ suggests this broader interpretation.

Similarly, sight is the sight of something, not ‘of that of which it is the sight’ (though of course it is true to say this); in fact it is relative to color or to something else of the sort. But according to the other way of speaking the same thing would be said twice—‘the sight is of that of which it is’. (Aristotle, *Metaphysica* Δ 15 1021^a34–1021^b3; Ross in Barnes 1984a, 76)

Perception is relative to its object, in the case of sight, it is relative to the perceived color. In order for sight to be relative to color, in the sense in which it is, color must exist and have a nature independently of being perceived. The thought is that the

relation must be grounded: In order for the underlying relation to obtain the *relata* must exist and have a nature independently of being so related.

Benacerraf (1965) will appeal to this principle two millennia hence to argue that there are no natural numbers, non-reductively conceived. Our concept of number determines only that the natural numbers, if they exist, stand in certain arithmetical relations. But objects must exist and have a nature independently of being so related. Any reductive candidate, a progression of sets, say, will exist and have a nature independently of instantiating the arithmetical structure, but their nature as sets outstrips what is given by our concept of finite cardinal number. As long as we restrict ourselves to what is given by the concept of finite cardinal number, the arithmetical relations are ungrounded if they are understood to obtain of *sui generis* numbers.

If color were not independent of being perceived, then the claim that sight is relative to its object would amount to the triviality: the object of perception is whatever it is that is perceived. But the Protagorean claim that color is relative to perception is meant to be a substantive thesis. Aristotle's underlying suggestion is that Protagorean relativism is not an intelligible alternative. If perception is relative to its object, its object must exist and have a nature independently of being perceived. Since color is the proper object of sight, a color must exist and have a nature independently of the presentation of that color in the animal's perceptual experience of it.

2.1.2 Particular

The objects of perception are external particulars and their sensible qualities:

Actual sensation corresponds to the stage of the exercise of knowledge. But between the two cases compared there is a difference; the objects that excite the sensory powers to activity, the seen, the heard, &c., are outside. The ground of this difference is that what actual sensation apprehends is individuals, while what knowledge apprehends is universals, and these are in a sense within the soul itself. That is why a man can think when he wants to but his sensation does not depend upon himself—a sensible object must be there. (Aristotle, *De Anima* II 5 417^b18–26; Smith in Barnes 1984b, 31)

This passage is part of an extended comparison of perception and knowledge. It makes two related points. Not only does perception and knowledge differ in object, but they are the exercise of different kinds of capacities as well. Moreover, this latter difference is partly explained in terms of the former. The overall lesson will be: Perceptual capacities would not be the kind of capacities that they are—they

would not be a mode of sensitivity—unless perception takes as its object an external particular.

Let us begin with the difference in object. Whereas as the objects of perception are particulars, the objects of knowledge are universal. So whereas one may see the sun as it is at the moment of perception, burning white say, what one sees is a particular. But particulars, according to Aristotle, are not known. The objects of knowledge are universal in a way that precludes their being particulars. To say that the objects of knowledge are universal is not to identify them with universals but rather only to accord them universal status. They are universal in that they are predicated of many things (*De Interpretatione* VII 17^a37–38). They are said of a subject but are not in any subject (*Categoriae* II 1^a20–1^b9). It is not just knowledge whose objects are universal, this is a general feature of our cognitive capacities. When one thinks that the sun is burning white, one thinks that thought not with the whiteness with which the sun actually burns but with a whiteness that the sun may share with the son of Diaries, at least when viewed from a distance. Aristotle's claim that perception and knowledge can be distinguished, in this way, by the nature of their objects is echoed Prichard:

There seems to be no way of distinguishing perception and conception as the apprehension of different realities except as the apprehension of the individual and the universal respectively. Distinguished in this way, the faculty of perception is that in virtue of which we apprehend the individual, and the faculty of conception is that power of reflection in virtue of which a universal is made the explicit object of thought. (Prichard, 1909)

(For contemporary discussion of particularity and the content of perception see Brewer 2008, Martin 2002, Soteriou 2000, 2005, and Travis 2005.)

The objects of perception are particulars in the way that the objects of knowledge are not. Color is the object of perception. Indeed it is the primary object of sight. Sight just is the power or potentiality to present color in the awareness afforded by visual experience. If color is the primary object of sight, and the objects of perception are particulars, then the colors that animals see are the colors that inhere in external particulars arrayed in their natural environment. Looking up, you are dazzled by the whiteness of the late morning sun. Your visual experience presents you with the sun's brilliant whiteness. That is to say, it presents you with the whiteness that inheres in that heavenly body. The color that you see, the brilliant whiteness of the sun, is not a universal but the actual instantiation of a chromatic quality by a particular. In the present instance, the color that you see is the whiteness actually manifest by the sun on that late morning encounter with that heavenly body.

Here is an admittedly speculative rationale for the claim that the objects of perception are particulars. Perhaps the background thought is that presentation in sensory experience is a kind of encounter and that one can only encounter particulars. To grasp something and thereby perceive it by tactile means is for the perceiver to encounter something distinct from themselves. That is the primitively compelling and phenomenologically vivid experience that leads the Giants to insist that only what can be handled and offers resistance to touch is real. If one can only encounter particulars, then one cannot encounter the attribute of whiteness, being a nonparticular, at least not directly. Instances of whiteness, manifestations of that quality in particulars in which it inheres, are, however, are encounterable particulars. So one can encounter nonparticulars, such as the attribute of whiteness, at best indirectly, by encountering particular instances of it. (Compare Aristotle's claim that while qualities do not directly admit of motion—understood as change quite generally—nevertheless, qualities can be said to indirectly move since they are related to things which are capable of directly moving, the particulars in which they inhere; see chapter 3.2 for further discussion.) If this admittedly speculative rationale is behind Aristotle's twin commitments to colors being the objects of perception and to the objects of perception being particulars, then it is the most likely source of Cook Wilson's (1926, 336) doctrine that one can only apprehend universals *in rebus* (perceptual encounters, for Cook Wilson, are a species of apprehension).

Not only does perception and knowledge differ in object, they are the exercise of distinct kinds of capacities. Perception may be the exercise of the perceiver's sensory capacities in a way that corresponds to the exercise of knowledge, but sensory capacities are capacities of a distinctive kind. In Nietzsche's (1887) terminology, they are reactive capacities. Sensory capacities only act by reacting to the presence of the sensible particular. Aristotle made this point earlier by means of an analogy with combustion:

Here arises a problem: why do we not perceive the senses themselves, or why without the stimulation of external objects do they not produce sensation, seeing that they contain in themselves fire, earth, and all the other elements, of which—either in themselves or in respect of their incidental attributes—there is perception? It is clear that what is sensitive is so only potentially, not actually. The power of sense is parallel to what is combustible, for that never ignites itself spontaneously, but requires an agent which has the power of starting ignition; otherwise it could have set itself on fire, and would not have needed actual fire to set it ablaze. (Aristotle, *De Anima* II 5 417^a3–10; Smith in Barnes 1984b, 29)

The presence of the sensible particular ignites sensory consciousness. Perception is essentially a reactive capacity, otherwise it would not be a mode of sensitivity to external particulars and their qualities.

Perception and knowledge are the exercise of different kinds of capacities. Our epistemic capacities, and cognitive capacities more generally, are not reactive capacities like our sensory capacities. Their exercise does not require the presence of any particular. One can think of the sun burning white even when night has fallen and the sun is absent. Our epistemic and cognitive capacities are thus not modes of sensitivity to external particulars and their sensible qualities, at least not in the way that our perceptual capacities are. Our epistemic and cognitive capacities do not act by reacting. They are active, not reactive. Whereas we can choose to exercise our knowledge in a given circumstance, we are subject to what we perceive.

At first, it might seem that Kant (1781) would describe this difference between perception and knowledge as a difference between the exercise of receptivity and spontaneity. A doubt arises, however, when we attend to what Aristotle has in mind by the exercise of our knowledge. Consider a geometer—understood as one who possesses geometrical knowledge—and a non-geometer—understood as one who lacks such knowledge—looking at a diagram (see Figure 2.1). The geometer can recognize the diagram as a proof of the Pythagorean theorem in a way that the non-geometer could not. What makes for this difference is the geometer's possession of geometrical knowledge and their application of it to the presented diagram. In recognizing a diagram as a proof, the geometer exercises their geometrical knowledge. Notice that this pertains to the application of knowledge, not its acquisition. But what is distinctive of Kant's position is the activity of the understanding in the acquisition of knowledge.

This element of Kant's thought, however, is not without precedent in Aristotle. In Book III of *De Anima*, Aristotle claims that just as perception is the assimilation of sensible form, the passive intellect is the assimilation of intelligible form. Moreover, just as the assimilation of sensible form requires a medium, so too does the assimilation of intelligible form. Specifically, Aristotle claims that it is the activity of the active intellect that functions as the medium through which intelligible forms may be assimilated. So the acquisition of knowledge, as Aristotle conceives of it, involves the activity of the understanding—a mode of spontaneity that makes possible the reception of intelligible form.

According to Aristotle, the difference in object between perception and knowledge explains why perception and knowledge are the exercise of different kinds of capacities. Since the objects of perception are external particulars, our perceptual capacities are only ever exercised in the presence of such particulars. In this way, perception is a mode of sensitivity to particulars in the natural environment that not only exist independently of being perceived but whose natures and powers

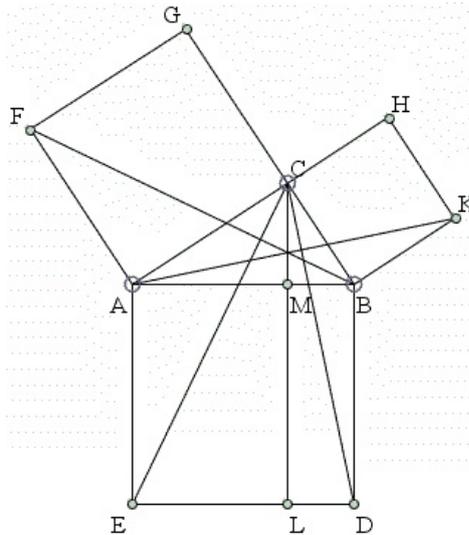


Figure 2.1: Euclid's proof of the Pythagorean Theorem

obtain independently of being perceived as well. But since the objects of knowledge, and cognition more generally, are universal, the exercise of our epistemic and cognitive capacities need not be constrained in this way by the particular case.

2.1.3 Remote

There are two senses in which the objects of perception may be remote:

- (1) The object of perception may be remote from the perceiver
- (2) The object of perception may be remote from the organ of sensation

These claims are logically distinct. Only the latter is a direct challenge to the Empedoclean principle, to be perceptible is to be palpable to sense. Suppose as Aristotle claims, that the object of perception must be remote from the organ of sensation. The object of perception may yet be in contact with the perceiver.

In some passages, the remoteness of perceptual objects is understood one way, but not in all passages. When Aristotle criticizes the Empedoclean principle, he has in mind the remoteness of the object of perception from the organ of sensation. When Aristotle distinguishes touch and taste as operating by contact in contrast with the distal senses such as sight and audition which operate not through direct contact but through an intervening medium, he has in mind the remoteness of the object of perception from the perceiver. Indeed there are correlative notions of a medium. When the remoteness at stake is the remoteness of the object of perception from the sense organ, this will notoriously lead Aristotle to maintain

that the perceiver's flesh is a medium through which the tangible qualities of bodies are felt. But when the remoteness at stake is the remoteness from the perceiver, this will lead to Aristotle distinguishing touch and taste from sight and audition as not requiring a medium for their operation.

There is no inconsistency here. Touch and taste are distinguished from sight and audition in that only the latter require the existence of an external medium for their operation. But this is consistent with touch and taste requiring, at the same time, an internal medium for their operation. Indeed, it is Aristotle's opposition to the Empedoclean principle that makes it possible for him to use contact to distinguish kinds of sensory modalities. If all sensation operates by contact with its object, as Empedocles maintains, then it would be impossible to distinguish the contact senses and the distal senses in the way that Aristotle recommends. The Aristotelean distinction between the contact senses and the distal senses presupposes and relies upon Aristotle's cases against the Empedoclean principle, to be perceptible is to be palpable to sense.

The distinction between the contact and distal senses having been made, Aristotle will argue that the distal senses are essential for animals with the capacity for locomotion:

Both these senses [the contact senses, touch and taste], then, are indispensable to the animal, and it is clear that without touch it is impossible for an animal to be. All the other senses subserve well-being and for that very reason belong not to any and every kind of animal, but only to some, e.g. those capable of forward movement must have them; for, if they are to survive, they must perceive not only by immediate contact but also at a distance from the object. (Aristotle, *De Anima* III 12 434^b22–25; Smith in Barnes 1984b, 62)

In animals capable of locomotion, since nature distributes capacities in a purposive manner (*De Anima* III 12 434^a81–82), there is also the capacity to perceive at a distance so that the animal may move towards vital sources of nourishment, say. If animals capable of locomotion lacked the capacity to perceive at a distance they would not survive since they lack, as well, the capacity to draw nourishment from where they are rooted like plants and stationary animals. They must move towards their nourishment and flee from their predators. The capacity to perceive at a distance is necessary for our well-being and continued existence.

2.2 Against the Empedoclean Principle

In its original form, Empedoclean puzzlement about the sensory presentation of remote objects is generated by a general conception of sensory awareness—the

ingestion model. Specifically, given the ingestion model, a question arises about how to coherently combine the distal character of the objects of sight with a key feature of that model, the principle that to be perceptible is to be palpable to sense. A cogent argument against that principle would undermine whatever puzzlement that it generates.

Aristotle believes that a simple empirical observation constitutes such an argument:

If what has colour is placed in immediate contact with the eye, it cannot be seen. (Aristotle, *De Anima* II 7 419^a13–14; Smith in Barnes 1984b)

If a colored particular's being in contact with the eye blinds the perceiver to its color, then the colored particular must be at a distance from the perceiver if its color is to be seen. And if the colored particular is remote from the perceiver, an intervening medium is necessary in order for the the organ of sight to be acted upon, as it must be if it is to be a mode of sensitivity:

Colour sets in movement what is transparent, *e.g.* the air, and that, extending continuously from the object of the organ, sets the latter in movement. Democritus misrepresents the facts when he expresses the opinion that if the interspace were empty one could distinctly see an ant on the vault of the sky; that is an impossibility. Seeing is due to an affection or change of what has the perceptive faculty, and it cannot be affected by the seen colour itself; it remains that it must be affected by what comes between. Hence it is indispensable that there be something in between—if there were nothing, so far from seeing with greater distinctness, we should see nothing at all. (Aristotle, *De Anima* II 7 418^b13–22; Smith in Barnes 1984b, 33–34)

While Empedocles is not mentioned in this passage, Democritus instead being singled out for criticism, when this issue is raised again in *De Sensu*, the connection with Empedocles is made explicit:

To say with the ancients that colours are emanations, and that the visibility of object is due to such a cause, is absurd. For they must, in any case, explain sense-perception through touch; so that it were better to say at once that visual perception is due to a process set up by the perceived object in the medium between this object and the sensory organ; due, that is, to contact, not to emanations. (Aristotle, *De Sensu* III 440^a16–21; Beare in Barnes 1984b, 9)

Aristotle is making negative and positive claims in these passages. The negative claim is that an object's contact with the eye is incompatible with its being seen.

The positive claim is that the eye is acted upon not by the object seen but by the intervening medium. By Aristotle's lights, Democritus and Empedocles make distinct, if related mistakes. Each fail to appreciate the necessity of a medium acting upon the organ of sight, but they do so for different reasons. Whereas Democritus is committed to the denial of the positive claim, Empedocles is committed to the denial of the negative claim.

First, consider the positive claim that the existence of a suitable medium is necessary for sight. This is meant to follow from the conjunction of the negative claim and a thesis about the nature of perceptual capacities. Specifically, perceptual capacities are a mode of sensitivity. They are reactive capacities. As such, they are only ever exercised when acted upon by something external. Since contact with a colored particular precludes perception of the particular and its color, the eye cannot be acted upon by the colored particular. But the eye must be acted upon if the colored particular is to be seen. Only the intervening medium could act upon the organ of sight in the requisite manner. In the absence of an intervening medium, nothing would act upon the eye, and nothing would be seen.

Democritus is thus insensitive to the way in which sight is a reactive capacity. Since sight is a reactive capacity, the organ of sight must be acted upon if the subject's potential for sight is to be actualized. But the void that Democritus postulates precludes there being anything that could act upon the eye, the organ of sight. Democritus is thus committed to denying the positive claim that in seeing a colored particular the intervening medium acts upon the organ of sight.

Second, consider Aristotle's negative claim that a particular's contact with the eye is incompatible with seeing its color. We can distinguish specific and more general versions of the negative claim. Whereas the specific claim is about color, the more general claim is about the objects of sense more generally, and thus holds of sound and smell as well:

- (1) A colored particular is imperceptible if it is in contact with the organ of sight;
- (2) A sensible particular is imperceptible if it is in contact with the relevant sense organ.

Consider first the specific claim about color. Here the thought is that in order to have a colored particular in view the perceiver must have a view on that colored particular. A colored particular's contact with the eye, the organ of sight, would preclude a point of view on that particular and its color. It is a necessary condition for a perceiver to have a point of view on a particular and its color that the particular be at a distance from the perceiver. To have a point of view on something is for that thing to be remote from one.

The specific claim about color is echoed in Aristotle's criticism of the likeness theory. According to the likeness theory, perception is to be explained in terms of

the similarity of the elements with which the sense organ and the object of sense are composed. The likeness theory is subject to a range of criticisms especially in the first book of *De Anima*; however, in *De Sensu*, Aristotle writes:

For certainly it is not true that the beholder sees, and the object is seen, in virtue of some merely abstract relationship between them, such as that between equals. For if it were so, there would be no need that either should occupy some particular place; since to the equalization of things their being near to, or far from, one another makes no difference. (Aristotle, *De Sensu* III 446^b10–13; Beare in Barnes 1984b, 20)

Aristotle's complaint, here, is that equality, understood as complete compositional similarity of the sense organ and the object of sense, does not afford the perceiver with a point of view. The perceiver's point of view on a particular depends upon that particular being at some distance from the perceiver. Moreover, that point of view varies as the object of sense is near or far. However, compositional similarity does not determine that the object of sense is any particular distance from the perceiver and hence fails to determine a point of view on that particular.

At least with respect to color vision, then, Aristotle's rejection of the Empedoclean principle, to be perceptible is to be palpable to sense, is unequivocal. Far from being a necessary condition on sight, contact with a colored particular blinds us to that particular and its color. Consistent with that denial, the Empedoclean principle may nevertheless be true of other objects of sense, such as taste and touch. A more thoroughgoing rejection of the principle, then, would regard the specific claim about color as an instance of the more general claim about the objects of sense. An object being in contact with the relevant sense organ, far from being a necessary condition for sensing that object, precludes it from being the object of sensation. The claim here is general, applicable to all objects of sense—contact precludes sensation, to be palpable is to be imperceptible.

While Aristotle at least makes the specific claim about color, his complete case against the Empedoclean principle, to be perceptible is to be palpable to sense, may involve the more general claim. The distinction between the specific and more general claim is relevant not only to the depth of Aristotle's case against the Empedoclean principle, but the distinction is relevant as well as to the relative plausibility of these claims. Even if the more general claim should prove to be false—of taste or touch, say—the specific claim about color may yet be true. It could turn out that vision is distinctive in being a sensory mode of presentation of the qualities of remote objects. Thus, for example, Broad (1952) claims that a comparative phenomenology of our sensory capacities supports this view (even if he thinks that our phenomenology is misleading in this regard, and that the distinctive phenomenological character of vision is ultimately undermined by the common causal mechanisms underlying all of our sensory capacities). Indeed, Broad might fairly point

out that the rationale so far offered for the specific denial about color appeals to a feature specific to vision, that in order to see something, the subject must have a point of view on it.

Aristotle's discussion of the special senses makes plain that he endorses the more general claim that contact precludes perception, that to be palpable is to be imperceptible:

The same account holds also of sound and smell; if the object of either of these senses is in immediate contact with the organ no sensation is produced. In both cases the object sets in movement only what lies between, and this in turn sets the organ in movement: if what sounds or smells is brought into immediate contact with the organ, no sensation will be produced. The same, in spite of all appearances, applies also to touch and taste ... (Aristotle, *De Anima* II 7 419^a26–34; Smith in Barnes 1984b, 34)

And later, in a discussion of why humans can only smell when they inhale, the general denial of the Empedoclean principle is invoked as a constraint on an adequate explanation:

... it is common to all not to perceive what is in immediate contact with the organ of sense ... (Aristotle, *De Anima* II 9 421^b16–18; Smith in Barnes 1984b, 38)

Indeed, Aristotle's conviction that to be palpable is to be imperceptible drives him to deny that flesh is the organ of touch:

In general, flesh and the tongue are related to the organs of touch and taste, as air and water are to those of sight, hearing, and smell. Hence in neither the one case nor the other can there be any perception of an object if it is placed immediately upon the organ, e.g. if a white object is placed on the surface of the eye. This again shows that what has the power of perceiving the tangible is seated inside. (Aristotle, *De Anima* II II 423^b18–23; Smith in Barnes 1984b, 42)

This is a surprising claim. One may be forgiven for thinking that Aristotle has taken his opposition to the Empedoclean principle too far. But let us see what can be said on behalf of it.

First, consider the following examples of Dennett's:

Blindfold yourself and take a stick (or a pen or pencil) in your hand. Touch various things around you with this wand, and notice that you can tell their textures effortlessly—as if your nervous system had sensor

out at the tip of the wand. ... For an even more indirect case, think of how you can feel the slipperiness of an oil spot on the highway under the wheels of your car as you turn a corner. The phenomenological focal point of contact is the point where the rubber meets the road, not any point on your innervated body, seated, clothed, on the car seat, or on your gloved hands on the steering wheel. (Dennett, 1993, 47)

These are nice examples of artificially extending tactile consciousness beyond the limits of the perceiver's innervated body. We feel the texture at the end of the pen, but not by feeling the pen in our hand. If we accept Dennett's description of these cases, then contact with flesh is not necessary for something to be the object of tactile awareness. While a good objection to the conjunction of Empedoclean principle and the claim that flesh is the organ of touch, this is too weak to establish Aristotle's counterprinciple, to be palpable is to be imperceptible. Contact with the organ of touch may not be necessary for something to be the object of tactile awareness, but that is consistent with contact being sufficient for tactile awareness. Nevertheless, Dennett's examples remove an important obstacle to the acceptance of Aristotle's position. They make vivid the possibility of tactile awareness through a medium of objects remote from the organ of touch.

Aristotle's bold thought is that we are always already in the position described by Dennett. When we feel the texture of a body with our fingertips, the phenomenological point of contact is remote from the organ of touch, no less than when we feel the texture of that same body with a pen. Like the pen, the flesh of our fingertips is not the organ of touch but the medium through which the texture of the body is felt. Aristotle's conception of touch is an internalization of the model provided by Dennett's examples. Just as the phenomenological point of contact can be extended from the sense organ by means of an external medium, the phenomenological point of contact is always already extended from the sense organ by means of an internal medium. The perceiver's flesh is an internal medium, the organ of touch residing within. Indeed, Aristotle appeals to the internalization of an external medium to motivate the claim that flesh is not the organ of touch but its medium:

To the question whether the organ of touch lies inward or not (i.e. whether we need look any farther than the flesh), no indication can be drawn from the fact that if the object comes into contact with the flesh it is at once perceived. For even under present conditions if the experiment is made of making a sort of membrane and stretching it tight over the flesh, as soon as this web is touched the sensation is reported in the same manner as before, yet it is clear that the organ is not in this membrane. If the membrane could be grown on to the flesh, the report

would travel still quicker. (Aristotle, *De Anima* II II 422^b34–423^a6; Smith in Barnes 1984b)

If Aristotle's counterprinciple, to be palpable is to be imperceptible, can be sustained in its fully generality, then the Empedoclean principle, to be perceptible is to be palpable to sense, not only involves an overgeneralization from a paradigm case but a misconception of it as well. According to Aristotle, the principle fails even of touch. The tangible is not palpable to touch. The apparent aporetic character of this doctrine, perhaps unsurprisingly, elicits in Derrida (2005, 6) the following Joycean play: "one keeps asking oneself ... above all what an 'intangible' accessible to touch is—a still touchable un-touchable. How to touch the untouchable?" The tangible is merely palpable to the internal medium, the perceiver's flesh, the organ of touch residing within, at or near the heart. That the Empedoclean principle not only involves an overgeneralization from a paradigm case but a misconception of it as well is philosophically significant. Specifically, it bears on the significance of the tactile metaphors with which we unselfconsciously characterize sensory presentation. Grasping may be a paradigm case of sensory presentation. This is why the Giants are literally grasping rocks and trees as they are strenuously affirming their case. And Aristotle agrees that felt resistance to touch is primitively compelling. Without touch it is not possible for an animal to exist, whereas the distal senses are for the animal's well-being (*De Anima* III I3 433^b31–434^a10). According to Aristotle, touch is primitively compelling because of its existential character. Grasping may be a paradigm case of sensory presentation, but not because it involves an object being in contact with the sense organ, as the ingestion model would have it, but because objects grasped are presented to us in a primitively compelling manner. Phenomenologically vivid and primitively compelling instances of grasping are paradigms of sensory presentation not because the object grasped is palpable to the organ of touch, but because it is precisely the presentation of the object grasped. However, as we shall see in the next section, this just raises the generalized form of Empedoclean puzzlement: What could sensory presentation be if it is not just being palpable to sense?

Can Aristotle's counterprinciple, to be palpable is to be imperceptible, be sustained in its full generality? Aristotle's empirical argument consisted in the observation that a colored particular is not seen when placed upon the eye. He varies this argument with some of the other sensory modalities. He thus offers variants of this argument for audition and smell. A sounding object placed upon the ear is not heard, nor is a pungent object smelled when in contact with the organ of smell. However, no such argument is offered for touch. So Aristotle's empirical argument, even if conceded to be a good argument for the specific claims about color, sound, and smell, is insufficient to establish the more general claim. This weakness of his argument has been well observed by previous commentators. What is less well ap-

preciated, I think, is the dialectical constraints that Aristotle is operating within. Specifically, he simply could not offer a tactile variant of the empirical argument. After all, whether in grasping the object grasped is in contact with the sense organ is precisely what is at issue between Aristotle and his opponents. But any tactile variant of the empirical argument must at least implicitly rule on this matter in the very description of the case. So Aristotle is debarred from offering the tactile variant of the empirical argument. Within these constraints, Aristotle has offered variants of the empirical argument for non-tactile sensory modalities with the hope that they display sufficient regularity to be projected onto the tactile case. Even so understood, Aristotle's case for his counterprinciple, to be palpable is to be imperceptible, is subject to criticism. In smelling an odor, particulate matter is in contact with the nasal membrane, and audible vibrations may be transmitted via contact with the tympanic membrane. Moreover, the claim about color received what support it did from a feature specific to vision—that in order to see something, the perceiver must have a view on it. In the end, it must be conceded that Aristotle has a better case for the more specific claim about color than for the more general claim.

There may, however, be a further aspect of Aristotle's case. Aristotle's belaboring and not always completely resolving the puzzling and aporetic character of touch can be read as an attempt to undermine the Empedoclean principle (compare Derrida 2005, "When our eyes touch ..."). If to be perceptible is to be palpable to sense, then all sensation is a kind of touch. Conceiving of non-tactile modes of sensory awareness on the model of touch will seem explanatory insofar as touch is antecedently understood to be an unproblematic mode of perception. Thus Lindberg (1977, 39) observes that in the ancient world "the analogy of perception by contact in the sense of touch seemed to establish to nearly everybody's satisfaction that contact was tantamount to sensation, and it was not apparent that further explanation was required." The *aporiai* concerning touch undermine that assumption. And if further explanation is required, then we can no longer simply assume that contact is tantamount to sensation.

Even if Aristotle's cases against the Empedoclean principle does not have the depth that it aspires to, even if Aristotle has not established his counterprinciple, to be palpable is to be imperceptible, as long as the specific claim about color is true, as long as contact with a colored particular precludes perception of the particular and its color, then the falsity of the Empedoclean principle, to be perceptible is to be palpable to sense, is established. What is more, Empedoclean puzzlement, in its original form, arose specifically about color vision. Sight seems to present the perceiver with the colors of remote external particulars, but how could this be if what it is for something to be perceptible is for it to be palpable to sense? Showing that the Empedoclean principle fails of color perception is philosophically

significant, since Empedoclean puzzlement, in its original form, arises from color perception presenting itself as a mode of awareness of the colors of remote external particulars.

Even if Aristotle has not established his counterprinciple, to be palpable is to be imperceptible, if his empirical argument involving colored particulars succeeds, if he has established that a colored particular's contact with the eye blinds the perceiver to the particular and its color, then the Empedoclean principle, to be perceptible is to be palpable to sense, is false. But if sensory presentation is not contact with the perceptive part of the soul located within, then what is it? An why does it remain apt to think of color perception as mode of assimilation, as visually taking in the colors arrayed in the scene before one? While Empedoclean puzzlement, in its original form, may have been dispensed with, the questions that subsequently arise are grounds for residual puzzlement.

2.3 The Generalized Form of Empedoclean Puzzlement

In its original form, Empedoclean puzzlement about the sensory presentation of remote objects consists in the apparent tension between two claims:

- (1) The objects of color perception are qualities of external particulars located at a distance from the perceiver.
- (2) *The Empedoclean principle*: To be perceptible is to be palpable to sense—in order for something to be the object of perception it must be in contact with the relevant sense organ.

Aristotle response to the initial form of Empedoclean puzzlement is to reject the Empedoclean principle, to be perceptible is to be palpable to sense. In its stead he proposes the Aristotelian counterprinciple—to be palpable is to be imperceptible.

Even having rejected the ingestion model, it remains natural to think of seeing as taking in the external scene before one. Thus, Aristotle retains a conception of perception as a mode of assimilation even as he rejects the ingestion model. This gives rise to a residual puzzlement. How can one take in what remains external? And if one can, what could taking in mean, here, such that one could? Empedoclean puzzlement, in its most general form, consists in the persistence of this latter question. How does Aristotle's account address this generalized form of Empedoclean puzzlement? Reflection on the specific way in which the residual puzzlement arises for Aristotle provides some evidence.

Aristotle in rejecting the ingestion model denies that perception is the mode of assimilation of anything material. But there are distinguishable senses of material

in play both in the ingestion model and Aristotle's argument against the Empedoclean principle. First, material might mean physical or physical matter more narrowly (fields are physical but not matter). Second, material might mean matter in Aristotle's technical sense associated with his hylomorphic theory. Chromatic effluences assimilated by the organ of sight are material in both senses. Chromatic effluences are physical matter, they at least have elemental composition. And chromatic effluences are in-formed matter, at least by Aristotle's lights. The distinctive magnitudes of chromatic effluences are the forms enmattered by them. So too with the colored object blinding the subject to its color when placed upon the eye. The colored object is both physical matter and in-formed matter. The colored object has an elemental composition. Moreover, the color of the object is a sensible form enmattered in the object.

These distinct senses of material provide distinct potential grounds for rejecting the Empedoclean principle. They thus also provide distinct potential contrasts with Aristotle's alternative conception of perception. First, consider the distinct potential grounds for rejecting the Empedoclean principle, to be perceptible is to be palpable to sense. Is what precludes perception contact with physical matter or in-formed matter? If we confine our attention to Aristotle's case, the colored object blinding the subject to its color when placed upon the eye, then Aristotle need not choose between them. Contact with physical matter and contact with in-formed matter may both be sufficient to preclude perception. But if we look forward to Aristotle's definition of perception as the assimilation of the form without the matter of the perceived object, then it is compelling to understand the contrast in terms of in-formed matter.

This is weak indirect evidence that Aristotle's definition of perception as the assimilation of sensible form without the matter of the object of perception is meant to address the generalized form of Empedoclean puzzlement. It is meant to be the sense in which the subject takes in the scene before them. More specifically, it is meant to be the sense in which the subject takes in what remains external. The subject assimilates the sensible form of the object while leaving its matter in place. Aristotle's definition, so interpreted, as addressing the generalized form of Empedoclean puzzlement, is making an important metaphysical claim about the nature of sensory presentation.

Chapter 3

Transparency

3.1 Motive and Method

Let us turn now to the transparent. In so doing we are jumping into the middle of things—both in the order of Aristotle’s exposition, but also in that transparency is a common nature or power of the external medium that separates the perceiver and the remote object of vision.

There are philosophical reasons for considering the nature of the transparent.

First, Aristotle defines color in terms of the transparent. Specifically, in *De Anima* II 7 418^{a-b} Aristotle defines color as the power to move what is actually transparent. Our understanding of color is incomplete if we do not understand the state of the external medium, such as air or water, which is a precondition for the activity of color. The effect of this incomplete understanding ramifies given Aristotle’s avowed strategy of explaining perceptual capacities in terms of perceptual activities that are their exercise and to explain perceptual activities in terms of the objects of those activities (*De Anima* II 4 415^a 14–22).

Second, given that color is the power to move what is actually transparent, there is an alteration that the external medium undergoes when in a transparent state as a result of the activity of color. Suppose the alteration that the external medium undergoes when in a transparent state is imparted to the internal medium—the transparent medium that constitutes the interior of the sense organ, in the case of the eye, the vitreous humor. Then we would have in place an important piece of the puzzle involved in interpreting the assimilation of sensible forms. Moreover, progress can be made here while forestalling the controversies, which must eventually be faced, surrounding the metaphysics of *De Anima* II 5.

Third, external particulars remote from the perceiver are arrayed in an external medium through which, when transparent, they appear. Empedoclean puzzlement highlights the way in which this is a remarkable fact. Attending to the details

of Aristotle's discussion of transparency we may gain insight into his reaction to Empedoclean puzzlement about the sensory presentation of remote objects.

It is worth enumerating the reasons for considering Aristotle's discussion of transparency given its reception. Some commentators suggest that Aristotle's discussion of transparency is of antiquarian interest only. Others have expressed incredulity at the way Aristotle's account conflicts with the manifest facts of experience. While leaving open the possibility of errors and omissions, we should try to understand Aristotle's account by attending to the phenomena as we understand it to be and by asking how that phenomena might have appeared as Aristotle describes it. As a methodology, this is little more than a minimal exercise of charity. However, it is worth stating explicitly if only because it has been routinely flouted. Adhering to this precept yields an understanding of transparency that is sensible, phenomenologically adequate, and a reasonable approximation of the truth. It is also a philosophically revealing exercise since to interpret Aristotle in this way is to use Aristotle's text as a means of attending to the phenomena under investigation.

3.2 Transparency in *De Anima*

In *De Anima*, Aristotle defines the transparent as follows:

... by 'transparent' I mean what is visible, and yet not visible in itself, but rather owing its visibility to the colour of *something else*. (Aristotle, *De Anima* II 7 418^b 4–6; Smith in Barnes 1984b, 32)

First, one might be surprised that Aristotle defines transparency in terms the manner of its visibility, or the way in which it appears in perceptual experience. Is it not more natural to think of transparency in terms of that through which remote objects appear—that is to say, not in terms of the manner of its visibility, but in terms of its being a condition on the visibility of other things? We will return to this issue.

The second thing to remark about Aristotle's definition is the nature of the intended contrast between something being visible in itself and something owing its visibility to another thing. Aristotle does not have in mind here what he elsewhere calls incidental perception (*De Anima* II 6 418^a 20–23). Seeing the transparent medium by seeing colors arrayed in it is not like seeing the son of Diares (a distant ancestor of Orcutt, Quine 1956) by seeing a white speck. Being the son of Diares is not sensible the way being transparent is (*De Anima* II 6 418^a 23–26).

Third, once we recover from our initial surprise at Aristotle defining transparency in terms of the manner of its visibility, and we consider the plausibility of that claim, quite apart from its status as a definition, we discover a potential insight. I, at least, have the corresponding intuition about illumination. I believe

we see the character of the illumination by seeing the way objects are illuminated. The former is a state of the external medium whereas the latter is a property of a particular arrayed in that medium (though, of course, a property that the particular could only have given the state of the medium). So when viewing a brightly lit pantry, one sees the the brightness of the pantry by seeing the brightly lit objects arranged in it. Hilbert makes a similar phenomenological observation:

Do we see how an object is illuminated or do we see the illumination itself? On phenomenological grounds the first option seems better to me. What we see as changing with the illumination is an aspect of the object itself, not the light source or the space surrounding the object. (Hilbert, 2005, 150–151)

At the very least, then, the phenomenological claim enshrined in Aristotle's definition of transparency receives indirect support from the plausibility of the corresponding claim about illumination.

Finally, a question may be raised about the adequacy of Aristotle's definition. While the phenomenological claim enshrined in Aristotle's definition may be plausible, it may be an inadequate definition of transparency if things other than the transparent are visible, though not visible in themselves, but owing their visibility to the colors of other things. Consider Parmenides' striking description of the moon's reflectance:

Night-shining foreign light wandering round earth. (Parmenides, DK 28B14; McKirahan 1994, 156)

The moon is visible, but not by virtue of its own color, but by virtue of the color of the foreign light with which it shines. So the moon, as described by Parmenides, satisfies Aristotle's purported definition of transparency, but the moon is not transparent. The problem is general and does not depend on the veracity of Parmenides' description of the moon's reflectance (on the astronomical significance of this fragment see Popper 1998). Consider any highly reflective surface, a mirror, say. A mirror is visible, though not in itself, but owing its visibility to the colors of other things, the things whose colors are reflected therein. But mirrors are not transparent. Aristotle's claim about the manner in which the transparent is visible—that it owes its visibility to the colors of other things—may be true, and yet fail as a definition of transparency because it fails to provide a sufficient condition for something to be transparent. The phenomenological claim is plausibly true not only of the transparent but of reflections as well.

Transparency is a nature or power common to different substances. It is shared by liquids, like air and water, and certain solids and is incidental to the nature of each (*De Anima* II 7 418^b7–9). A medium is actually transparent not due to its nature

but due rather to the contingent presence of the fiery substance (*De Anima* II 7 418^b11–13). The fiery substance is a substance, but insofar as it pervades a material medium, such as a body of air or water, it could not itself be a body, since two bodies cannot occupy the same space (*De Anima* II 7 418^b19). The continual presence of the fiery substance is required for the transparency of the medium to persist. Suppose I light a fuse with a cigar. Prudence counsils that I should remove myself from the scene. Should I be enjoying the cigar I might take it with me. But while the fuse would remain lit even when the cigar is removed, the air would not remain transparent when the fiery substance is removed. When the fiery substance is removed, darkness supervenes (*De Anima* II 7 418^b18–21; *De Sensu* III 439^a18–21).

Not only does the persistence of transparency depend upon the continual presence of the fiery substance, but, arguably at least, it depends as well upon its continual activity (*pace* Sambursky 1958, Burnyeat 1995, 424). That some states require continual activity to sustain them should be no surprise. Consider Ryle's, (1949, 149), example of keeping the enemy at bay, or the connection between heat and molecular motion. That the persistence of transparency depends upon the continual activity of the fiery substance may be taken to be implied by Aristotle's claim that light is the activity of the transparent *qua* transparent (*De Anima* II 7 418^b 9–10). Since transparency just is the presence of the fiery substance, the activity of the transparent *qua* transparent just is the activity of the present fiery substance.

A more speculative reason concerns the nature of fire. In the *Theaetetus* Plato writes:

... being (what passes for such) and becoming are a product of motion, while not-being and passing-away result from a state of rest. There is evidence for it in the fact that heat or fire, which presumably controls everything else, is itself generated out of movement and friction—these being motions. ... Moreover, the growth of living creatures depends upon these same sources. (Plato, *Theaetetus* 153^{a-b}; Levett and Burnyeat in Cooper 1997, 70)

Here, Socrates is summarizing Heraclitus' view (on Cosmic Fire in Heraclitus see Wiggins 1982). The first line is a general thesis of Heraclitean metaphysics. Fire and living creatures are cited as examples meant to illustrate and motivate the more general thesis. The being and continued existence of fire depends upon its activity. Fire burns. Burning, here, is not restricted to the burning of grosser forms of sub-lunary fire familiar from sensory experience. Rather, burning is the most general activity of fire, even in its rarer forms. So understood, should fire cease to burn, it would cease to be. Similarly, to be a living creature is to act or, at the very least, to have a capacity to act. Should a living creature lose its capacity to act altogether, it would cease to be. While Aristotle denies the general claim that what passes for being is the product of motion (as well the claim that fire controls all), he can

nevertheless accept the description of the examples that illustrate and motivate the more general claim. Thus, it is arguable that the passage contains the germ of his conception of a living being as refined and elaborated throughout *De Anima*. If that is right, then it is at least open, in principle, for Aristotle to accept the corresponding claim about fire. That the being of fire depends upon its distinctive activity, that a fire would cease to be should it cease to burn, is anyway, a *prima facie* plausible and phenomenologically compelling claim. So conceived, however, the presence of the fiery substance will depend upon its continued activity. Given the nature of fire, the continued presence of the fiery substance just is its continued activity. Thus if the transparency of a medium depends upon the continued presence of the fiery substance, it will depend, as well, upon its continued activity.

Suppose that Heraclitean metaphysics is right to the extent that for fire, at least, to be is to burn. Putting this together with Aristotle's denial that the fiery substance is a body, we arrive at a conception of the fiery substance as an incorporeal activity. The presence of the fiery substance in a potentially transparent medium, be it air or water, just is the occurrence of this incorporeal activity, a kind of rarefied burning that instantaneously pervades the medium insofar as it is a unity.

That the presence of the fiery substance depends upon its activity provides Aristotle with the resources to explain the directionality of light. That light has direction is vividly manifest in elementary facts about occlusion, reflection, and shadow and is fundamental to geometrical optics. If the presence of the fiery substance did not depend upon its activity, then Aristotle would be hard pressed to explain the directionality of light in terms of the mere presence of the fiery substance, as Sorabji, echoing Philoponus, observes:

Mere presence is not enough to explain the directionality of light. Why, for example, are there any shadows at all, including the shadows that constitute night, and lunar eclipse? For the sun and other fire-like stuff is present in the universe surrounding the earth, a surrounding all of which is transparent. The requirement of presence does not explain why there is not light round the corners. (Sorabji, 2004, 132)

So understood, Aristotle's conception of light would be an inadequate foundation for a geometrical optics. Given the empirical fecundity of that discipline, Aristotle's theory, in contrast, would seem to be of antiquarian interest only. And given the vividness of elementary facts about occlusion, reflection, and shadow, Aristotle's conception, in leaving the direction of light out of account, would seem to be poorly observed as well. However, if the presence of the fiery substance were constituted by its activity, if the being of fire consisted precisely in its burning, then, since activity can have a direction of influence, the direction of light could be explained in terms of the direction of the activity of the fiery substance that

constitutes its being and continued existence. Light has a direction even though, being a state, it could not travel. Light has a direction that it inherits from the direction of influence of the fiery substance whose activity constitutes its being and continued existence.

The present understanding of the fiery substance echoes important aspects of Philoponus' discussion of light and vision. In an extended *theôria* (*On De Anima* 325 1—341 9) following a comment on *De Anima* 11 7 418^b 9—10, Philoponus argues for lines of influence directed from the colored object to the perceiver. He presents this as an interpretation of Aristotle. And while he sometimes presents his own views as interpretations of Aristotle, and while the exposition of the *theôria* extends the *De Anima* discussion, I believe that Philoponus was both sincere and insightful in claiming to make explicit what was merely implicit in Aristotle. Sambursky (1958) does not understand the presence of the fiery substance in terms of its activity. He thus attributes to Aristotle a purely static conception of light, a conception he takes Philoponus to be criticizing, offering instead a kinetic conception of light. Sorabji (1987, 26–30) takes a more accommodating view. While light does not move, Aristotle has a conception of the direction of light. Thus he gives the correct explanation of the lunar eclipse as the Earth's shadow cast upon the moon as opposed to the moon's occlusion by a third opaque body (*Analytica Posteriora* 11 8 93^a 29—93^b 3). But how could there be cast shadows unless light had direction? And Aristotle describes reflection not as the reflection of visual rays (the usual model of perception underlying ancient geometrical optics such as Euclid's or Galen's), but as the reflection of the colored object's movement of a unified medium (*De Anima* 111 12 435^a 5—10). But such movement must have direction if it is to be thus reflected. While Sorabji acknowledges that Aristotle recognizes the directionality of light, he claims that Aristotle lacks the means to explain it and sees Philoponus' *theôria* as providing the wanted explanation. The present interpretation is more accommodating still. Light is a state of a potentially transparent medium and does not move but is constituted by the presence of the fiery substance. The being of the fiery substance consists in its incorporeal activity. This incorporeal activity has a direction of influence, a direction that the state of illumination determined by it inherits. Philoponus is perhaps more concerned than Aristotle to provide an alternative foundation for geometrical optics (see especially *On De Anima* 331 1ff). But even here the roots of his strategy can be found in *De Anima*. Whereas in Euclid's geometrical optics, the lines that are subject to geometrical reasoning are determined by visual rays emitted by the eye, Philoponus understands them instead as lines of influence proceeding from the perceived colored object. But that was implicit in Aristotle's remark about reflection (*De Anima* 111 12 435^a 5—10). While there are novel elements of Philoponus' *theôria* (such as the thermal effects of light, that light propagates in stages, and the application to incorporeal activity of concepts

from his genuinely paradigm-shifting dynamics, on this last see Kuhn 1962; Wolff 1987), he is elaborating upon core ideas genuinely to be found in *De Anima* (on the differences between Philoponus and Aristotle see Christensen De Groot 1983).

Light is a state that the medium is in when it is actually transparent. Aristotle denies that light is fire, or a body, or an effluence (*De Anima* II 7 418^b13–18). He denies as well that light moves, otherwise its motion would be visible as it travels from East to West (*De Anima* II 7 418^b21–27). These claims are puzzling if by light Aristotle means, at least approximately, what we mean by light. But why assume that?

Begin by focusing on Aristotle's claim that light is a state (*hexis*, *De Anima* III 5 430^a15) that a medium is in when it is actually transparent. Light could not be a body since the medium is a body and two bodies cannot occupy the same space (*De Anima* II 7 418^b19). As Burnyeat (1995) has emphasized, state is really the wrong ontological category for light as we presently understand it to be. But now, in line with our avowed methodology, let us ask whether there could be a state that we can recognize on our present understanding that could reasonably be what Aristotle had in mind when he speaks of light? With the question so framed the resolution of our difficulties should be obvious. What state is a medium in when it is actually transparent, and where the persistence of this state depends on the continual presence and activity of a fiery substance? When it is illuminated, of course. By light, Aristotle means a state of illumination (see Thorp 1982, 122, for a similar interpretation). And that a medium when it is actually transparent is in a state of illumination sustained by the presence and activity of a fiery substance strikes me as a not unreasonable approximation of the truth. Moreover, it coheres well with the phenomenology of illumination. Consider what must have been the familiar experience of lighting an oil lamp to illuminate a room.

What about Aristotle's claim that light does not move? There are distinguishable aspects to Aristotle's overall case. That light moves is contrary both reason and the observed facts (*De Anima* II 7 418^b23).

Begin with light as conceived by Aristotle's opponents—as fire, body, or material effluence. With light so conceived, Aristotle's case is straightforwardly empirical. To conceive of light as fire, body, or material effluence is to conceive of light as being capable of locomotion—as potentially changing its location over time. However, we do not see light from a morning sunrise moving from East to West. And while movement across short distances may be too quick to be visible, Aristotle maintains that the corresponding claim is implausible given the magnitude of the distance involved. In this way is the hypothesis that light moves contrary to the observed facts. Though Aristotle's empirical argument fails (given his overconfidence in there being some magnitude over which motion would be perceptible, no doubt abetted by his conviction that every magnitude is perceptible at some distance),

it remains an honorable failure. Aristotle's remarks, here, are best understood set against the Milesian tradition of preferring first-hand experience to the deliverances of authority (even where, as in the present case, the relevant authorities are not Hesiod and Homer, but Empedocles and Plato).

Not only is there an empirical argument that light—conceived as fire, body, or material effluence—does not move, but there is a distinct metaphysical argument that light—conceived instead as a state (*hexis*)—cannot move. This latter argument is not empirical. Rather, reflection on the nature of a state reveals that it precludes space-occupancy. And if states do not occupy space, then they cannot change their locations over time and so are not susceptible to motion and indeed change more generally. In this way it is contrary to reason to suppose that light, conceived as a state of illumination, moves.

Aristotle distinguishes two ways in which something may move:

There are two senses in which anything may be moved either indirectly, owing to something other than itself, or directly, owing to itself. Things are indirectly moved which are moved as being contained in something which is moved, e.g. sailors, for they are moved in a different sense from that in which the ship is moved; the ship is directly moved, they are indirectly moved, because they are in a moving vessel. (Aristotle, *De Anima* 1 3 406^a3–8; Smith in Barnes 1984b, 9)

According to Aristotle's metaphysical argument, then, states, such as being illuminated or possessing the attribute of whiteness, are not directly susceptible to motion.

States and the bodies whose states they are differ in being:

Whiteness will be different from what has whiteness. Nor does this mean that there is anything that can exist separately, over and above what is white. For whiteness and that which is white differ in definition, not in the sense that they are things which can exist apart from each other. (Aristotle, *Physics* 1 3 186^a27–31; Hardie and Gaye in Barnes 1984b, 6)

The state, possessing the attribute of whiteness, differs in being from that in which the whiteness inheres, an opaque surface of a solid material body, say. Whiteness could not exist apart from something in which it inheres. But the attribute of whiteness and that in which it inheres have different modes of being. This difference is spatially manifest. States differ in being from the bodies whose states they are in that states do not occupy space the way that bodies do.

States do not occupy space. They lack location and are thereby not directly susceptible to motion understood as locomotion or change in position. Indeed,

states are not directly susceptible to motion even when understood more generally. In *De Anima*, motion, *kinēsis*, is Aristotle's general term for change of any kind. Each of the four varieties of change that Aristotle acknowledges (locomotion, alteration, growth, and decay) requires space occupancy for something to be subject to them (*De Anima* I 3 406^a12). Since states do not occupy space, they are directly susceptible to neither locomotion nor motion more generally:

But if the essence of soul be to move itself, its being moved cannot be incidental to it, as it is to what is white or three cubits long; they too can be moved, but only incidentally—what is moved is that of which white and three cubits long are the attributes, the body in which they inhere; hence they have no place: but if the soul naturally partakes in movement, it follows that it must have a place. (Aristotle, *De Anima* I 3 406^a14–21; Smith in Barnes 1984b, 9)

Bodies occupy space. They have location and are thereby directly susceptible to locomotion and motion more generally. But a state of a body, such as possessing the attribute of whiteness, does not occupy space the way a body does, not even the space occupied by the body whose state it is. Since states do not occupy space, they lack locations and thus are not directly susceptible to locomotion and motion more generally. They are susceptible to locomotion or motion, at best, indirectly. States inhere in things capable of motion. Moreover, states, though incapable of direct motion, can inherit motion from the bodies whose states they are and so indirectly move. States are passengers, and the bodies whose states they are the ships that carry them (though, as Witt 1995, 174, observes: “Here the relationship is not one of parts to wholes, or contents to containers, but rather of inherent to subject”; *Categoriae* I^a24–5).

States differ in mode of being from that in which they inhere. The distinctive mode of being of states precludes space occupancy and hence being directly susceptible to locomotion and motion more generally. Since light is a state of illumination, light, so conceived, is precluded by its very nature, by being the kind of thing that it is, a state of a medium, from space occupancy, and, hence, locomotion. Light, conceived as a state of illumination, could not move, at least not directly. Burnyeat (1995, 430 n29; appendix) tries to make vivid the madness of these claims by quoting, at length, Prichard echoing them:

I once made what I thought the unquestionable remark to a German mathematician who was also a physicist that only a body could move—so that, for example, the centre of gravity of a body or of a system of bodies, which is a geometrical point, could not move. He as I rather expected, thought I was just mad. In this case I should certainly have said I was certain that a centre of gravity could not move, and I think he

would have said he was certain that it could. Here I personally should assert he could not possibly have been more that uncertain that it could not, and that, if he had thought a bit more, he would have been certain that it could not; you cannot make a man think, any more than you can make a horse drink. (Prichard, 1950b, 99; this is just the initial paragraph of the material that Burnyeat quotes)

At least in my case, however, Burnyeat's (1995, 430 n29) rhetorical strategy backfired. Far from recognizing "an eccentricity from the home of lost causes" that "would meet with Aristotle's approval", I instead heeded Prichard's advice. And having thought a bit more, I now regard Aristotle's claim about states and space-occupancy to be *prima facie* plausible, if controversial, in a way that his claim about the empirical significance of our failure to observe the motion of light no longer could be.

To fix ideas consider the following simple example. Consider walking down a corridor where the sole source of illumination is an oil lamp that you are carrying. Suppose the oil lamp is sufficiently bright to illuminate only a portion of the transparent medium that pervades the corridor, one third, say. At the beginning of your journey the first third of the corridor is illuminated, at the middle the second third, and the end only the final third of the corridor remains illuminated. As you travel over time different regions of the corridor are illuminated. But the illuminated region of the medium changing over time does not consist in a change in the position of the state of illumination. Rather, things with different positions, different regions of the transparent medium that pervades the corridor, are illuminated at different times. (Prichard 1950b, 99, makes parallel remarks about wave movement.) A change of state and travel are different (*De Sensu* VI 446^b28).

One potential problem for the claim that states do not occupy space concerns the colors themselves. This would be ironic since one of Aristotle's own examples, possessing the attribute of whiteness, may itself be a counterexample to the claim that states lack location and hence are not directly susceptible to locomotion. Being white, possessing the attribute of whiteness, is a state potentially had by at least some opaque surfaces (as presented by the son of Diates, at least when viewed from a certain distance) and some radiant objects (such as the sun). But, it may be objected, being white is located, indeed, located in the opaque surface or radiant light source in which it inheres. Moreover, colors seem essentially extended. Only spatial magnitudes are colored. If something possesses the attribute of whiteness, then that state necessarily extends across some region—that part of the surface in which the whiteness inheres, say. However, it is possible to capture the intuitions that motivate these claims consistently with the denial that states occupy space. Thus colors are located only indirectly, in the sense that the particulars in which the colors inhere are located. When we ascribe location to a color we are merely

representing the location of the particular, or at least that part of the particular that instantiates the color. It is the particulars that instantiate the colors and not the colors that are located. And colors are essentially extended only indirectly, in the sense that the particulars in which the colors inhere are extended. Colors are only instantiated by spatial magnitudes. It is the particulars that instantiate the colors and not the colors themselves that are essentially extended.

Prichard mentions, without directly addressing, another potential counterexample. A center of gravity is a state of at least some particulars. But the center of gravity of a body, or a system of bodies, has a definite location. Prichard's silence is not an expression of embarrassment in the face of recalcitrant evidence. It has another, rhetorical function. But consider how this potential counterexample might be explained away. Identifying the center of gravity of a body, or system of bodies, with some definite point within the interior is both vivid and informative. But it is in one way misleading. The center of gravity is a state of the entire body, or system of bodies, and not a proper part of it, and is explanatorily relevant to the entire body's, or system's, capacity for locomotion. Identifying the center of gravity with a point in the body's, or system's, interior is merely a representation of global state of the body, or system of bodies. Identifying the center of gravity of a body, or system of bodies, as a point in its interior may be vivid and informative, but that is consistent with the represented global state, a state enjoyed by the entire body, or system, not being the kind of thing that so much as could occupy space.

Light is a state that a potentially transparent medium is in due to the contingent presence and activity of the fiery substance. Light, as conceived by Aristotle, is a state of illumination. Being a state, light is not directly located. Light is, however, indirectly located in the transparent medium whose state it is, understood as a particular body of water or air. Light, lacking location, does not move. Similarly, the determinant of light, the form-giving fiery substance, does not propagate through the potentially transparent medium. Though the medium is extended, it is illuminated all at once. Aristotle will make this commitment explicit in *De Sensu*:

But with regard to light the case is different. For light is due to the presence of something, but it is not a movement. And in general, even in qualitative change the case is different from what it is in local movement. Local movements, of course, arrive first at a point midway before reaching their goal (and sound, it is currently believed, is a movement of something locally moved), but we cannot go on to assert this in like manner of things which undergo qualitative change. For this kind of change may possibly take place in a thing all at once, without one half of it being changed before the other; e.g. it is possible that water should be frozen simultaneously in every part. (Aristotle, *De Sensu* VI 446^b28-447^a3; Smith in Barnes 1984b, 63)

Change of state and travel are different. Light from a radiant light source can pervade the whole of a transparent volume without first reaching a midway point. This would be problematic if light were due to the presence of the fiery substance and the fiery substance were a body. Such a body would have to travel at infinite speed to instantaneously traverse an extended region. Once the fiery substance is understood as an incorporeal activity, there no longer is any obstacle to thinking of this activity as occurring all at once throughout an extended region. Indeed, Philoponus takes this behavior as proof of the incorporeal nature of the fiery substance:

If it were a body, again, how would it be possible for the movement of a body to occur thus all at once? For the sun comes above the horizon, and at that moment suddenly in no time at all the whole hemisphere above the earth has been lit up. And if I cover a lamp and bring it into the house and then take it out of the covering, the whole house is lit all at once. How could a body move thus in no time at all? (Philoponus, *On De Anima*, 327 3-7; Charlton 2005, 11)

The fiery substance, being incorporeal, can instantaneously illuminate entire transparent regions insofar as they are a unity. Being incorporeal, it does not travel, and so does not have to travel at infinite speeds to illuminate the unified whole all at once. The incorporeal activity of the fiery substance, a kind of rarefied burning, can, nevertheless, have a limited sphere of influence. Aristotle and Philoponus speak of the sun illuminating the sky, and Philoponus speaks of a lamp illuminating a house. But if that same lamp were taken out into a large enough field at night, while it would illuminate a region immediately surrounding the lamp, most of the field would remain in darkness. That observation is available to Aristotle, maintaining, as he does, that we can see distant fires in the dark (*De Anima* II 7 419^a23-24). If light were a body that travelled, light's limited sphere of influence might be explained in terms of the resistance the medium offered to the propagation of light. But the supposition that light is a body is unnecessary for such an explanation. Aristotle acknowledges that a dense medium (*Meteorologica* I 5 342^b5-8), such as a fog or cloud of smoke (*De Sensu* III 440^a10-11), can result in a reduction of brilliance. A dense medium can result in a reduction of brilliance because it is not wholly receptive to activity of the fiery substance, when particles of earth are suspended in it, say. The fiery substance's limited sphere of influence need not be thought on the model of an increasing impediment to its propagation, light slowing and becoming weaker as it penetrates the dense darkness until it can no more. The fiery substance illuminates the entire region to the extent that it does all at once. Given the direction of influence of the incorporeal activity and decreased receptivity to its activity, the limited and variably illuminated sphere is instantaneously determined with need of neither propagation nor travel.

The metaphysical argument that states, such as being illuminated or being white, do not occupy space and so are not directly susceptible to motion and change more generally is philosophically significant when read in light of Empedoclean puzzlement about how the colors of remote external particulars could be present in visual consciousness. If colors are conceived as material effluences with distinctive magnitudes, then they occupy space and so may be in contact with the organ of sight. Recall one problem with Empedocles' theory of color vision was that colors, conceived as material effluences, are bodies, and body is really the wrong ontological category for chromatic attributes. If the color of a particular is not a body but instead a state, then since states lack location, it could not be in contact with the organ of sight. The colors of things are at best indirectly located, inheriting their location from the particulars in which they inhere. So the colors of things could at best be indirectly in contact with the sense organ, by the colored particular being in contact. But contact with a colored particular blinds the perceiver to the particular and its color. To be palpable is to be imperceptible.

The colors of things, being states of particulars, preclude, by their very nature, contact with the organ of sight. The colors of things, beings states, also preclude, by their very nature, not only the necessity of travel, but its possibility. On Empedocles's conception of color perception, the color of a distant particular travels to the perceiver so that it may be assimilated and so be made palpable to the organ of sense. That the colors of remote external particulars travel to the perceiver was the resolution of Empedoclean puzzlement, a resolution that is not a genuine metaphysical option if the colors of things are states.

From the perspective of the metaphysical argument that states do not occupy space and so are not directly susceptible to locomotion and change more generally, effluences are not genuine candidates for being the colors since they belong to the wrong ontological category. Moreover, as we have seen, the problem that the identification of colors with effluences is meant to resolve is not genuine, since the color of a particular, being a state, could be in contact with nothing, at least not directly.

Progress is made with Empedoclean puzzlement when we recognize that an object's being white is not located, not even where the object's white parts are. For if the color of an object is not located, it need not, indeed could not, travel to act upon the organ of sight so that it may be seen. In *Leviathan*, in a chapter approvingly cited by Burnyeat (1992, 26 n7), Hobbes (1651) writes:

But the Philosophy-schools, through all the Universities of Christendome, grounded upon certain Texts of *Aristotle*, teach another doctrine; and say, For the cause of *Vision*, that the thing seen, sendeth forth on every side a *visible species* (in English) a *visible shew*, *apparition*, or *aspect*, or a *being seen*; the receiving whereof into the Eye, is *Seeing*. ... I say not

this, as disapproving the use of Universities: but because I am to speak hereafter of their office in a Common-wealth, I must let you see on all occasions by the way, what things would be amended in them; amongst which the frequency of insignificant Speech is one. (Hobbes, *Leviathan* I.I)

That doctrine may have been taught in Philosophy schools in Universities throughout all of Christendom, and it may have been grounded in certain texts of Aristotle's (at least on a reading of them), but it is not Aristotle's doctrine. The color of an external particular, like the illumination of a transparent medium, is a state of that particular. It thus enjoys a mode of being that precludes space-occupancy and so could not be sent forth on every side.

3.3 Transparency in *De Sensu*

In *De Anima*, Aristotle defines the transparent as that which is visible, though not visible in itself, but owing its visibility to the color of another thing (*De Anima* II 7 418^b 4–6). I have remarked that it might seem more natural to characterize transparency, not in terms of the manner of its visibility, but in terms of its being that through which remote objects appear—as a condition on the visibility of other things. However, this latter conception is not entirely absent in Aristotle. It is at least implicit in the corresponding discussion of color and transparency in *De Sensu*.

In *De Sensu* Aristotle sets out to explain what each of the sense objects “must be in itself, in order to produce actual sensation” (*De Sensu* III 439^a11; Beare in Barnes 1984b, 7). This is a further inquiry, not directly addressed by *De Anima*. Unsurprisingly, then, there are novel elements to the *De Sensu* discussion. Thus, novel claims that emerge include, for example, that color resides in the proportion of transparent that exists in all bodies, and an account of the generation of the hues in terms of the ratio of black and white in a mixture. Given these novel elements, the question arises whether *De Sensu* represents an extension of the doctrines of *De Anima*, or a change of mind. While there is some evidence that Aristotle has not completely harmonized new ideas with old, I believe that Aristotle meant to be offering an extension of the *De Anima* account, and not a substantive revision of it. Or at any rate, this will be my working hypothesis (see Kahn 1966 for discussion; see also Caston 2005, 291 Nussbaum and Putnam 1995, 37).

One novel element is the characterization of color as “the limit of the transparent in determinately bounded body” (*De Sensu* III 439^b11; Smith in Barnes 1984b, 8). This prompted the Renaissance commentator Jacopo Zabarella (1605) to complain that Aristotle has defined color twice over (Broackes, 1999). However, there is no evidence in the text that Aristotle regarded this claim as a definition. Rather, it appears as the conclusion of an argument (Broackes, 1999, 65). In that argument,

Aristotle explains that color inheres not only in unbounded things, such as air and water, but in bounded things as well. What is the distinction between the bounded and the unbounded? The examples of the transparent are restricted in *De Sensu* to air and water. On this basis, it might be thought, naturally enough, that that the distinction is between transparent liquids, like air and water, and opaque solid objects (Broackes 1999, 59, Sorabji 2004, 131). To describe liquids as unbounded is to highlight their lack of fixed boundaries. However, I doubt that is what Aristotle had in mind. In *De Anima*, Aristotle claims that not only are liquids such as air and water transparent, but so are certain solid objects. He does not himself give examples of transparent solids. But glass, ice, crystals, tortoise shells, and certain animal horns would do, and we can be confident that Aristotle had first hand experience with at least some of these. It would do no good to object, as Sorabji (2004, 131) does, that the glass, say, that Aristotle would have encountered would not have been perfectly transparent. In *De Sensu*, Aristotle emphasizes that transparency comes in degrees. The problem, then, is that any such example would possess fixed boundaries and yet would remain transparent, but the transparent is meant to be unbounded.

What could the unbounded be if it is not simply the lack of fixed boundaries? I believe that good sense can be made of Aristotle's distinction if we understand it in phenomenological terms. Nontransparent bodies, such as opaque solids, are perceptually impenetrable. Unlike transparent bodies you cannot see in them or through them. Their surface is the site of visual resistance. Perceptual impenetrability determines a visual boundary through which nothing further can appear. Transparent bodies, in contrast, are perceptually penetrable. One can see in them and through them. The particulars arrayed in a transparent medium appear through that medium. The transparent is unbounded since it offers insufficient visual resistance to determine a perceptually impenetrable boundary. And this is true of transparent solids such as crystals and tortoise shells as well as transparent liquids such as air and water.

The transparent is unbounded since it offers insufficient visual resistance to determine a perceptually impenetrable boundary. Which is not, of course, to say that the transparent can offer no visual resistance. In *De Sensu*, Aristotle emphasizes that transparency comes in degrees. When Aristotle speaks of color as the limit of the transparent in bounded bodies, he has in mind surface color. But he also speaks of the color of transparent media:

Air and water, too are evidently coloured; for their brightness is of the nature of colour. But the colour which air or sea presents, since the body in which it resides is not determinately bounded, is not the same when one approaches and views it close by as it is when one regards it from a distance. (Aristotle, *De Sensu* III 439^b1-3; Beare in Barnes 1984b, 7)

Air and water, when transparent, are bright. And brightness, Aristotle claims, is of the nature of color. The attribution of brightness, however, requires attributing no particular hue to the medium. If the medium is perfectly transparent, then the only visible hues will be the colors of bounded particulars arrayed in that medium. But the next line contains the suggestion that imperfectly transparent media, while remaining perceptually penetrable to some degree, may themselves have a particular hue—in modern parlance, not a surface color but a volume color. From a cliff overhanging the sea, the sea may appear a clear blue even as one sees rocks lying below its surface. But, if enticed by the sea, one were to descend to the beach and examine a handful of sea water, it would not be blue at all, but transparent. Similarly, looking up at the sky on a clear autumn afternoon, one sees an expanse of blue. But if one were to travel to that region of the sky, by helicopter, say, nothing blue would be found. The implicit thought is that the visual resistance of an imperfectly transparent medium increases with an increase in volume. The further one sees into a transparent medium, the more resistance that medium offers to sight. And volume color is the effect of this resistance. Aristotle is explicit about the effects of such resistance in *Meteorologica*: “For a weak light shining through a dense medium ... will cause all kinds of colours to appear, but especially crimson and purple” (*Meteorologica* 1 5 342^b5–8; Webster in Barnes 1984b, 8–9).

Aristotle’s insight, here, reveals one respect in which Broad’s (1952) description of vision as “saltatory” is inapt. According to Broad, vision is saltatory in that it seems to leap the spatial gap between the perceiver and so reveal shapes and colors confined to a spatial region remote from the perceiver. Broad is emphasizing just the feature of color vision that generates Empedoclean puzzlement, that vision seems to present us with the colors of remote external particulars. However, sight does not leap the spatial gap between the perceiver and the color’s instantiation, so much as the perceiver sees through the spatial gap. The colored particular’s distance from the perceiver and the density of the intervening medium could only make a difference to visual appearance if the perceiver were seeing through the medium to the distal particular. Broad is right to emphasize the distal character of the objects of vision, but his description of vision as saltatory is inapt since it fails to heed the perceptual penetrability of the intervening medium. Vision does not leap the gap between the perceiver and distal color. Rather, by means of it, the perceiver may peer through the intervening medium if it is transparent at least to some degree.

Sorabji (2004, 130–131) offers a different interpretation of the color of the sea. The color of the sea is a *borrowed* color, due to reflection. The color of the sea is borrowed in the sense that the source of its color lies not within itself but in another thing, the sky whose color is reflected therein. Sorabji’s suggestion, whether or not it is of genuine Aristotelian provenance, is at least endorsed by Al-Kindī in a work

overtly influenced by Aristotle:

We say: we find that water is free from impurities takes on every colour adjacent to it. Since it is transparent, it has no colour. If the colours sensed along with it [sc. the water] belonged to it, then it would not change its colour to the colour of what is adjacent to it, whenever something is adjacent to it. Therefore it [sc. the water] shows us whatever is adjacent to it, since the body of [the water] is neither acting as a screen, nor does it have colour. (Al-Kindī, *On the Body that by Nature Brings Colour and is One of the Four Elements, and which is the Cause of the Colour in Things other than Itself*, 11; Adamson and Porman 2012, 138)

This interpretation has the virtue of cohering with what we know about the color of large bodies of water, that their chromatic appearance is affected by the color of the sky reflected in them. However, if generalized to Aristotle's other examples of the transparent, it does less well—the color of the sky is not itself explained in terms of reflection, unless reflection is understood liberally enough to include diffraction (and, indeed, Al-Kindī provides an alternative explanation of the blue of the sky in terms of particles of earth suspended in the air, *On the Cause of the Blue Colour that is Seen in the Air in the Direction of the Sky, and is Thought to be the Colour of the Sky*, Adamson and Porman 2012, 139–143; On color and Al-Kindī see Adamson 2006). In support of this interpretation, Sorabji (2004, 130) refers us to *Meteorologica* 1 5 and III.2–6 where “Aristotle cites reflection as the cause of various colours in the clouds as well as of such other optical effects as rainbows, haloes, mock suns, and rods.” However, in *Meteorologica* 1 5 Aristotle distinguishes two causes of color: (1) the visual resistance offered by an imperfectly transparent medium and (2) reflection. It is both weak light shining through a dense medium and air when it acts as a mirror that causes all kinds of colors to appear. And while the colors of clouds as well as other optical effects such as rainbows, haloes, mock suns, and rods may, by Aristotle's lights, be explicable in terms of reflection, this goes nowhere towards showing that Aristotle thought that the color of the sea is due to reflection. He never explicitly says that it is, but he does explicitly link the color of the sea to the visual resistance it offers both in *De Sensu* and in *Meteorologica*. Lying behind this disagreement is a disagreement about how to understand the unbounded. Sorabji (2004), like Broackes (1999), understands the unbounded as the lack of fixed boundaries rather than being perceptually penetrable. This is manifest in the difficulty Sorabji (2004, 131) finds in reconciling his interpretation with Aristotle's claim that sea color varies with distance because it is unbounded, a difficulty that is avoided if the unbounded is instead understood in perceptual terms as I recommend.

The color of an imperfectly transparent medium does not occlude the bounded particulars arrayed in it. But the color of the transparent medium may affect their

color appearance. Thus the sun, which in itself appears white, takes on a crimson hue when seen through a fog or cloud of smoke (*De Sensu* III 440^a10–11; *Meteorologica* I 5 342^b18–21). This might be what Aristotle has in mind when he claims that bounded particulars have a fixed color unless affected by atmospheric conditions (*De Sensu* III 439^b5–7). The color of a bounded particular will affect the medium differently depending on its degree of perceptual penetrability and resulting volume color. Notice, considered in and of itself, this claim implies at most that the color of the sun appears differently when obscured by a fog or cloud of smoke. There need be not commitment to the sun changing color from white to red when so obscured, nor its appearing to so change. Aristotle's position allows for the possibility of a variation in color appearance without a variation in presented color. Notice the thought that the state of a medium can alter the appearance of a sensible object without a variation in the object of sense is what animates Austin's (1962) use of the Platonic example of a straight stick looking bent in water (Plato, *Republic* x 602^c–603^a; on Austin see Kalderon and Travis forthcoming and Martin 2000; on Austin and the argument from conflicting appearances see Burnyeat 1979).

This is potential evidence about Aristotle's attitude towards the argument from conflicting appearances. While the argument from conflicting appearances is discussed in *Metaphysica* Γ, discussion of it is largely absent in *De Anima* and *De Sensu*. While largely absent from *De Anima* and *De Sensu*, it is not entirely absent, and I believe we have an important point of contact here. Looking up from a battlefield one sees the sun burning white. As smoke from the battle obscures the sun, it takes on a crimson hue. Nothing can be red and white all over at the same time. Supposing, as is plausible, that the smoke from the battle did not alter the sun's color so that the color of the sun remains constant through the variation in its appearance, it might seem as if at least one of these appearances were illusory. However, if there can be a variation in color appearance without a variation in presented color, then the white and red appearances do not conflict. The color of the sun does not appear to change from white to red. Red is simply the way radiant white things appear when viewed through smoke filled media (just as bent is the way that straight things look when viewed through refracting media—see Plato, *Republic* x 602^c–603^a; Austin 1962).

In *Metaphysica* Γ Aristotle expresses a complementary attitude:

Again, it is fair to express surprise at our opponent's raising the question whether magnitudes are as great, and colors are of such a nature, as they appear to people at a distance, or as they appear to those close at hand and whether they are such as they appear to the healthy or to the sick, and whether those things are heavy which appear so to the weak or those which appear so to the strong, and those things which appear to the sleeping or to the waking. For obviously, they do not think these to

be open questions. (Aristotle, *Metaphysica* Γ 5 1010^b3–9; Ross in Barnes 1984a, 55)

Color appearance can vary with viewing distance. But the variable color appearances evidently do not conflict. If the variable color appearances were in conflict then it would make sense to ask which, if any, of these conflicting appearances are veridical. Aristotle denies, however, that this is an open question. And Aristotle's denial, here, is the expression of his conviction that the variable appearances do not genuinely conflict. Suppose color can appear differently when seen near and when seen far. These variable color appearances would not conflict if the difference in appearance were not a matter of what is presented in sensory experience. Suppose, instead, the difference in appearance were just the same color appearing differently. In seeing the color near and far, the subject perceives the color, it is present in their visual experience. It is just that the color is presented differently in the different circumstances of perception. Seen near, it is presented one way, seen far, it is presented another. If the difference were a matter of the presentation of incompatible colors, there would be a conflict between appearances. So the difference must be understood in some other way, not a difference in the object of sensory experience so much as a difference in the way that object is presented in sensory experience. Aristotle's example in *Metaphysics* Γ is a case of color constancy, just as Plato's example of the straight stick looking bent in water is a case of shape constancy. Aristotle's insight, echoed by Austin in *Sense and Sensibilia*, is that the variable appearances in cases of perceptual constancy are incapable of genuine conflict. (Further evidence about Aristotle's views on perceptual constancy will be discussed in chapter 6.1.2.)

I have argued that the color of the transparent medium may not occlude the colors of the particulars arrayed in it though it may affect their color appearance. Against the present interpretation it might be objected that Aristotle makes a claim about the color of the transparent that conflicts with it. Thus Aristotle claims that the transparent lacks color and so is receptive to color (*De Anima* II 7 418^b26–29). The force of this objection is mitigated somewhat by the recognition that Aristotle seems to make inconsistent claims about the color of the transparent. Thus he claims that:

- (1) Light, or brightness, is the color of the transparent. (*De Anima* II 7 418^b11–12; *De Sensu* III 439^b1–2)
- (2) The transparent is seen to have different colors when near and far. (*De Sensu* III 439^b2–3)
- (3) The transparent lacks color and so is receptive to color. (*De Anima* II 7 418^b26–29)

How might (1)–(3) be interpreted so as to be consistent? We have already observed that the attribution of brightness requires attributing no particular hue to the transparent medium. Moreover, since the medium is transparent, the color of the remote particular appears through that medium. This may even be so in an imperfectly transparent medium, one such that owing to the resistance it offers to vision itself appears a certain volume color. The color of a remote particular may appear differently when viewed through perfectly and imperfectly transparent media, but the volume color, if any, of the transparent medium does not occlude the surface color of the remote bounded particular. But so long as the surface color of the remote bounded particular is not occluded by varying the color of the medium as it volume varies, the transparent medium remains receptive of that color. If, however, the medium were to become perceptually impenetrable and so take on a surface color, the color of the remote bounded particular would be occluded and the medium would no longer be receptive to color. The denial in (3) is the denial of surface color to transparent media, but that is consistent with imperfectly transparent media, such as the sea and the sky, having volume color. Properly interpreted, (1)–(3) are consistent.

There is thus a progression of qualitative states from the perfectly transparent to the colored and opaque. The qualitative states in the progression are ordered by their decreasing degree of perceptual penetrability culminating in the perceptual impenetrable. It is thus a progression to a limit. We can envision the progression from perfect transparency in the following manner. Consider a tank of clear water into which is poured a blue dye. Suppose the absorption rate of the dye is too quick to be visible. So we do not see clouds of blue dye propagating through the clear liquid; rather, we see the volume taking on the blue and become increasingly opaque. At the end of this progression, the tank is surface blue—no thing can appear in it or through it. Color, that is surface color, is in this sense the limit of the transparent—it is the terminal qualitative state of a progression of qualitative states ordered by decreasing degree of perceptual penetrability.

One may be forgiven for thinking that Aristotle has fallen into a category mistake in speaking of color as the limit of the transparent (Broackes, 1999, 65). He seems, on the surface, to be making an identification, but color is a quality in the way that a limit could not be. However, on the interpretation that I have been urging, Aristotle is not identifying color qualities with limits. Rather, in the progression of qualitative states from the perceptually penetrable to the perceptually impenetrable, color (that is, surface color) is the terminal qualitative state. This is one way of understanding Aquinas, in his commentary on *De Sensu*, when he writes:

Thus color is not in the category of quantity—like surface, which is the limit of a body—but in the category of quality. The transparent is also in the category of quality, because *a limit and that of which it is the*

limit belong to one category. [my emphasis] (*Sententia De Sensu Et Sensato* v, commentary on *De Sensu* III 439^b11 in White and Macierowski 2005)

In *De Sensu*, Aristotle not only speaks of the limit of the transparent but also of the limit of a body: The limit of a body is its external surface, a bulgy two-dimensional particular, in Sellars' (1956, IV 23) apt phrase. Sellars (1956, IV 23) explains that it is two-dimensional in the sense that "though it may be *bulgy*, and in *this* sense three-dimensional, it has no *thickness*". Color lies at the limit of the body, and this, Aristotle claims, encouraged the Pythagoreans to call the surface of a body its color. In so doing, however, the Pythagoreans undertook a further commitment: Color not only lies at the limit of a body, but color is itself the limit. In calling the surface of a body its color, the Pythagoreans identify color with the limit of the body. However, while color may lie at the limit of the body, color is not itself the limit:

For [colour] is at the limit of the body, but it is not the limit of the body; but the same natural substance which is coloured outside must be thought to be so inside too. (Aristotle, *De Sensu* III 439^a32–439^b35; Beare in Barnes 1984b, 7)

Aristotle's opposition to the Pythagorean conception of color is elaborated by Sellars two millennia hence:

Certainly, when we say of an object that it is red, we commit ourselves to no more than that it is red "at the surface". And sometimes it is red at the surface by having what we would not hesitate to call a "part" which is red through and through—thus, a red table which is red by virtue of a layer of red paint. But the red paint is not itself red by virtue of a component—a 'surface' or 'expanse'; a particular with no thickness—which is red. (Sellars, 1956, IV 23)

It is thus misleading, I believe, for Silverman (1989) to liken colors, as conceived by Aristotle, to Sherwin-Williams paint.

Does the consideration that tells against color being the limit of the body tell equally against color being the limit of the transparent? Not obviously. Opaque solids are perceptually impenetrable, and their perceptual impenetrability determines a visual boundary through which nothing further can appear. That is what their opacity consists in. This visual boundary coincides with the limit of the body. This could only seem inconsistent with the claim that the same nature which exhibits color outside also exists within if one ignored Aristotle's reminder at the opening of *De Sensu* that "each of them may be spoken of from two points of view, i.e., either as actual or as potential" (*De Sensu* III 439^a12–13; Beare in Barnes 1984b, 7). Aquinas insightfully heeds this reminder. In his commentary on *De Sensu* he

writes that “bodies have surface in their interior in potentiality but not actuality” (*Sententia De Sensu Et Sensato* v, commentary on *De Sensu* III 439^b11 in White and Macierowski 2005). When the perceptually impenetrable is actually resisting sight a visual boundary is determined at the limit of the opaque body. But that a portion of the interior of such a body offers no such visual resistance in being occluded from view is consistent with its being perceptually impenetrable, with its potentially determining such a visual boundary.

Another consideration is relevant here. The limit of the transparent is a qualitative state. However, as Aquinas observed, the limit of a body is not a qualitative state; the limit of a body belongs, rather, to the category of quantity (compare *Metaphysica* Δ 13, 17). An argument to the conclusion that color is not a species of quantity—in the present instance, the limit of a body—does not by itself constitute an argument against the claim that color is a qualitative state distinguished by its place in an ordering of qualitative states.

In his discussion of the unbounded, then, there are thus two notions of limit in play. Aristotle distinguishes:

- (1) the limit of the transparent
- (2) the limit of a body

These are distinct limits. Whereas the former is qualitative, the latter is quantitative. However, importantly they coincide. A bounded body, in being perceptually impenetrable, determines a visual boundary that coincides with the limit of the body. Moreover, Aristotle’s claim, that Zabarella mistakes for a definition, that color is the limit of the transparent in a determinately bounded body gives expression to just this coincidence. Color, that is, surface color, is the limit of the transparent in being the terminal qualitative state in a progression of qualitative states ordered by decreasing perceptual penetrability. A determinately bounded body is one such that, being perceptually impenetrable, determines a visual boundary through which nothing further may appear. This visual boundary is spatially coincident with the limit of the body and is where the body’s surface color is seen to inhere.

Aristotle’s discussion of transparency and the unbounded is evidence that, despite his defining transparency in terms of the manner of its visibility, he retains a conception of the transparent as that in which and through which remote objects may appear, as a condition on the visibility of other things. That conception, in the guise of perceptual penetrability, is central to Aristotle’s understanding of the unbounded. Two observations are relevant. First, given our working hypothesis that *De Sensu* is to be read as an extension of the *De Anima* account and not a substantive revision of it, we can assume that this conception is meant to be at least consistent with the *De Anima* definition. Second, Empedoclean puzzlement about

the sensory presentation of remote objects highlights the way in which perceptual penetrability of transparent media is a remarkable fact. It is a remarkable fact. Moreover, in not defining transparency as that in which and through which remote objects may appear, Aristotle arguably acknowledges that it is. That the colors of remote objects are seen through transparent media is a fact to be explained. And if the nature of the transparent is to play a role in that explanation, the transparent must be defined in some way other than as being a condition on the visibility of remote objects. The explanation is given in *De Anima*—in terms of the way in which color alters the transparent and the role that alteration plays in the exercise of our perceptual capacities.

Chapter 4

Color

4.1 Aristotle's Explanatory Strategy

At the opening of *De Anima* II 4, Aristotle describes an explanatory strategy to be pursued in his subsequent discussion of the special senses including color vision:

It is necessary for the student of these forms of soul first to find a definition of each, expressive of what it is, and then to investigate its derivative properties, &c. But if we are to express what each is, viz. what the thinking power is, or the perceptive, or the nutritive, we must go farther back and first give an account of thinking or perceiving; for activities and actions are prior in definition to potentialities. If so, and if, still prior to them, we should have reflected on their correlative objects, then for the same reason we must first determine about them, i.e. about food and the objects of perception and thought. (Aristotle, *De Anima* II 4 415^a14–22; Smith in Barnes 1984b, 26)

Perceptual capacities are to be understood in terms of perceptual activities that are their exercise and what they are the potential for. Thus sight is the perceiver's potential for seeing. In seeing the perceiver exercises their capacity for sight. Moreover, seeing is what sight is the potential for. Sight is for the sake of seeing. Aristotle's thought here is that potentialities are individuated by what they are the potential for, that for the sake of which the perceiver has the relevant capacity. Just as perceptual capacities are understood in terms of perceptual activities, perceptual activities are themselves to be understood in terms of their object. More specifically, perceptual activities are to be understood in terms of their primary object. The primary object of a given sensory modality must be perceptible to that sense alone and about which no error is possible, at least about its presence. The presentation of the primary object in sense perception is what a sensory capacity

is the potential for. Sight is, by its very nature, the potential to bring the colors of remote external particulars into view when it is light and to bring “fiery or shining” (*De Anima* II 7 419^a1–2) things into view when it is dark. Not every object of perception is a primary object. We can see motion and feel motion. But Aristotle maintains that we see motion only incidentally. His thought seems to be that sight is the potential for seeing colors in light and the fiery or shining in dark. This capacity enables us to see a variety of other objects as well. But sight is not for the sake of seeing motion or magnitude. Sight is for the sake of seeing color in light and the fiery or shining in dark. The non-primary objects of sight are incidental in the sense of being incidental to the nature of sight. The nature of sight as a potentiality is wholly determined by what it is a potential for, to present in visual consciousness colors in light and the fiery or shining in dark.

4.2 The Objects of Perception

Among the objects of perception, Aristotle distinguishes three kinds (*De Anima* II.6):

- (1) Primary objects of sense
- (2) Common sensibles
- (3) Incidental sensibles

Not only is color an object of sight but it is a primary object of sight as well. According to Aristotle’s avowed explanatory strategy, the primary objects of perception enjoy a certain explanatory priority. Once we better understand the sense in which color is a primary object of perception, we will better understand color’s explanatory role—an explanatory role that, as we shall see, places a substantive constraint on a coherent interpretation of Aristotle’s definition of color.

The primary objects of sense must meet two conditions:

- (1) A primary object of a sense must be perceptible to that sense alone;
- (2) No error is possible about a primary object of sense.

Both conditions, but especially the second, require elaboration.

First, a primary object of sense must be perceptible to that sense alone. This condition has two parts: (1) the primary objects of sense are perceptible to that sense; (2) they are perceptible to that sense alone—they are available to no other sensory modality. Thus Aristotle claims that colors can only be seen, sounds can only be heard, and flavors can only be tasted. Common and incidental sensibles differ from the primary objects of sense—each fails one part of this condition on

being a primary object. Incidental objects of perception are not perceptible in themselves, at least in the circumstances of perception, but are perceptible only in the sense that they are incidentally related to something that is perceptible. Thus one can see the son of Diares by seeing a white speck in the distance, but being the son of Diares is not sensible in these circumstances the way that whiteness is. Since incidental sensibles are not perceptible in themselves, at least in the given circumstances of perception, they fail the first part of the condition on being a primary object of perception. Common sensibles, unlike incidental sensibles, are perceptible in themselves. They thus satisfy the first part of the condition on being a primary object. However, they fail to satisfy the second. We can see the motion of a sensible particular and feel that motion. Common sensibles are common precisely in being perceptible to more than one sense.

Aristotle inherits this first condition on being a primary object—that it be perceptible to one sense alone—from Plato’s discussion of perception in the *Theaetetus*:

SOCRATES: And are you also willing to admit that what you perceive through one power, you can’t perceive through another? For instance, what you perceive through hearing, you couldn’t perceive through sight, and similarly what you perceive through sight you couldn’t perceive through hearing?

THEAETETUS: I could hardly refuse to grant that. (Plato, *Theaetetus* 184^e8–185^a3; Levett and Burnyeat in Cooper 1997, 204)

Notice that Plato links objects being perceptible to one sense alone to a conception of the senses as powers or capacities. Two thoughts seem to be at work here: (1) that powers or capacities are individuated by their proper exercise, and (2) that the proper exercise of sensory capacities is the presentation of its primary object in sensory awareness. These two claims in conjunction with specific claims about the primary objects of vision and audition imply that sight just is the capacity to see color, and audition just is the capacity to hear sound. If that is right, then, at least in broad outline, the avowed explanatory strategy of *De Anima* II 4 has its roots in Aristotle’s reading of the *Theaetetus*. Of course, Aristotle departs from Plato in crucial ways. Plato seems to limit sense perception to the presentation of the primary objects in sensory awareness. However, Aristotle allows the senses to present objects common to other sensory modalities, though this is incidental to their nature, a nature that wholly consists in their potential to present their proper objects. In allowing the senses to take as their object proper and common sensibles, Aristotle is conceiving of the senses as powers or capacities that can have different exercises—seeing motion is the exercise of the perceiver’s capacity for sight just as seeing color is (see Freeland 1986). Their being as potentialities, however, depend solely on their proper exercise, the sensory presentation of their proper object. Plato, in contrast, maintains that perceptual capacities have as their exercise only

the presentation of their proper objects maintaining that what is “common” to the objects of the senses—that they are each the same and different from the others—is determined by cognitive, not perceptual, capacities (*Theaetetus* 184). This is the basis for a further difference. Aristotle maintains that we can discriminate among the presented objects of sense and that this is the exercise of perceptual, not cognitive, capacities (*De Anima* III 2 426^b 9–16). For discussion of just how far Aristotle extends the perceptual domain as Plato conceives of it see Sorabji 2003 as well as his earlier discussion Sorabji 1971.

Second, not only must proper objects be perceptible to one sense alone, but about their presence no error is possible. No error may be involved in a color being present in sight, though one may be mistaken about the location of the presented color. One striking thing about this second condition is its negative characterization. This is potentially philosophically significant since there are two ways to understand this denial. No error may be possible either in the sense that:

- (1) Perceptions of primary objects are always true or correct; or
- (2) Perceptions of primary objects are not the kind of thing that can be true or false, correct or incorrect.

If the perception of primary objects were always true or correct, then no error would be possible, at least about their presence. If, however, the perception of primary objects were not the kind of thing that so much as could be true or false, correct or incorrect, no error would be possible, but in a difference sense. The sensing of primary objects would be impervious to error not because of some guarantee that the primary objects of a sense falls within its ken but because the sensing of a primary object fails to be evaluable as correct or incorrect. This latter thesis is put forward by Kant in the *Critique of Pure Reason*:

Truth or illusion is not in the object, in so far as it is intuited, but in the judgment about it, in so far as it is thought. It is therefore correct to say that the senses do not err—not because they always judge rightly but because they do not judge at all. (Kant, 1781, A294/B350)

While Aristotle’s usual formulation in Book II of *De Anima* is that no error is possible about the presence of primary objects, he does sometimes say, especially in Book III that the perception of primary objects is always true. This provides *prima facie* support for the first interpretation. On this interpretation, sense perception has something like an intentional or representational content; it is at least evaluable as true or false, correct or incorrect. Against this suggestion, an advocate of the second interpretation might claim that, by itself, this leaves unexplained what needs explaining—Aristotle’s apparent preference for the negative characterization in Book II. Aristotle’s preference for the negative characterization is well

explained by the second interpretation. On that interpretation, the denial of the possibility of error is not consistent with perceptions being always true, and so the condition could only be expressed by the negative characterization. The problem for the second interpretation is the potential embarrassment of explaining away the claim that the perception of primary objects is always true as merely loose talk if not indeed a slip on Aristotle's part.

We can decide between these rival interpretations by considering Aristotle's account of error (*De Anima* III 3 428^b17-26, 430^a27-430^b5). According to Aristotle, error requires a certain kind of complexity, a complexity that the sensory presentation of the primary objects lacks. Specifically, only with combination is error possible:

... where the alternative of true or false applies, there we always find a sort of combining of objects of thought in a quasi-unity. As Empedocles said that "where heads of many a creature sprouted without necks" they afterwards by Love's power were combined, so here too objects of thought which were separate are combined ... (Aristotle, *De Anima* III 6 430^a27-32; Smith in Barnes 1984b, 54)

For falsehood always involves a combining; for even if you assert that what is white is not white you have combined not-white. (Aristotle, *De Anima* III 6 430^b1-3; Smith in Barnes 1984b, 54)

The simple presentation of the white of the sun, when not combined with other sensible elements of the scene, is not in error. But not because of any guarantee that color perception is always true. Rather, it is only when sensible objects are combined that the senses may mislead. We cannot be mistaken about the presence of the sun's whiteness upon seeing it, but we can be mistaken about the location of the whiteness, when we combine whiteness, a primary object, with other sensibles, such as location, in this case, a common sensible. Since the sensory presentation of primary objects does not involve combination, and combination is necessary for error, then no error is possible about the presence of these sensory objects in the strong sense that their perception is not the kind of thing that so much as could be evaluable as true or false, correct or incorrect. In sensory consciousness we simply confront the primary object of the given modality. We cannot be confronted truly or falsely, correctly or incorrectly. We simply confront what is presented to us in sensory consciousness.

This is the basis for the second contrast that Aristotle draws between perception and understanding in the following passage from Book III of *De Anima*:

That perceiving and understanding are not identical is therefore obvious; for the former is universal in the animal world, the latter is found in only a small division of it. Further, thinking is also distinct from

perceiving—I mean that in which we find rightness and wrongness—rightness in understanding, knowledge, true opinion, wrongness in their opposites; for perception of the special objects of sense is always free from error, and is found in all animals, while it is possible to think falsely as well as truly, and thought is found only where there is discourse of reason. (Aristotle, *De Anima* III 3 427^b7–15; Smith in Barnes 1984b, 49)

All animals perceive, but not all animals are rational. Rational activity, such as thinking, is evaluable as correct or incorrect. But perceptions of primary objects, being simple presentations of these sensory objects, are insusceptible to error in this way. The line of reasoning behind this way of contrasting perception and understanding can be found in the *Theaetetus*, on at least some interpretations (see Cooper 1970 and Burnyeat 1990). So it is possible that the second condition on being a primary object itself derives from Aristotle's reading of the *Theaetetus* as well.

The primary object of sight is the visible. What is visible is either color or “a certain kind of object which can be described in words but which has no single name” (*De Anima* II 7 418^a26). So color is a primary object of sight not the primary object of sight (though see Polansky 2007, 252 for a denial of the claim that that which has no name is a primary object of sight). That a sense can have a plurality of primary objects is consistent with Aristotle's two defining conditions on being a primary object—that it be perceptible to one sense alone and about whose presence no error is possible. Distinct kinds of objects can each satisfy these conditions. So it does not follow from Aristotle's definition of primary objects that for each sense there is exactly one primary object. If there is a problem, especially if, as in the case of touch, there are too many primary objects, this must be due not solely to the definition of primary object but must involve as well further explanatory assumptions. As we shall see, any difficulty posed by a plurality of primary objects is due less to the definition of primary object than to the explanatory role they play in Aristotle's avowed strategy of explaining perceptual capacities in terms of perceptual activities and explaining perceptual activities in terms of their primary objects.

Colors depend upon light for their visibility. But not everything depends upon light for their visibility. That which has no name does not so depend:

Some objects of sight which in light are invisible, in darkness stimulate the sense; that is, things that appear fiery or shining. This class of objects has no simple common name, but instances of it are fungi, horns, heads, scales, and eyes of fish. In none of these is what is seen their own proper colour. Why we see these at all is another question. (Aristotle, *De Anima* II 7 419^a2–7; Smith in Barnes 1984b, 33)

Philoponus, in his commentary on *De Anima*, reports a slightly different list of examples:

... glow worms, heads of fish, fish scales, eyes of hedgehogs, shells of sea-creatures, which things are seen not in light but in dark. (Philoponus, *On De Anima* 319 25–27; Charlton 2005, 3)

That which has no name possess qualities visible in the dark and not the light and differ from the proper colors of these same things which are visible in the light and not the dark. This is most likely the source of Austin's example from *Sense and Sensibilia* (an appropriately Aristotelian title, at least in the present context):

Suppose ... that there is a species of fish which looks vividly multi-coloured, slightly glowing perhaps, at a depth of a thousand feet. I ask you what its real colour is. So you catch a specimen and lay it out on deck, making sure the condition of the light is just about normal, and you find that it looks a muddy sort of greyish white. Well, is *that* its real colour? (Austin, 1962, lecture VII, 65–66)

In the darkness, at the depth of a thousand feet, the fish may look vividly multi-colored and slightly glowing, but on the sun drenched deck they look a muddy sort of greyish white. Aristotle would contend that only the latter is the creature's proper color, the former being an instance of that which has no name. Austin is, of course, making a different point with the Aristotelian example, that the "real" color of a thing may depend on the practical point of attributing color to it in the circumstances of saying.

There is a question about how broadly the domain of that which has no name extends. Some commentators have suggested that shining be interpreted as reflective highlights. So fish scales, having a highly reflective surface, can produce highlights discernible even in conditions of very low illumination resulting in a shimmering effect set amidst the surrounding darkness. This interpretation is suggested by Aristotle's remarks in *De Sensu*:

Things which are smooth have the natural property of shining in darkness, without, however, producing light. ... For it is in the dark that that which is smooth, e.g. the heads of certain fishes, and the sepia of the cuttle-fish, naturally shines ... (Aristotle, *De Sensu* II 437^a 31–437^b 5; Beare in Barnes 1984b, 4)

The trouble with this interpretation is that it does not fit all of Aristotle's examples—fungi lack smooth, reflective surfaces and so give rise to no reflective highlights. One plausible thought, supported by Philoponus' additional example of glow worms,

and exploited by Austin in his appropriation, is that these are examples of bioluminescence. One minor problem with this interpretation is that the eyes of hedgehogs glowing in a dark field—assuming, for the moment, that Philoponus' example is of genuine Aristotelian provenance—are not radiant light sources the way that they appear to be and the way that cases of bioluminescence genuinely are. Rather, they are reflecting ambient light in circumstances of low illumination, say, from a lantern of shaved horn held by an ancient spectator traversing the field at night. All of Aristotle's examples are biological, but the claim that that which has no name is visible in the absence of light suggests a generalization. After all, there are mineral deposits, of phosphorus, say, whose glow can only be seen in the absence of competing illumination. So perhaps that which has no name includes not only the bioluminescent, but the luminous more generally. Philoponus suggests this broader interpretation and provides the nice example of starlight, visible only in the absence of the sun's light (*On De Anima* 347 11).

It may be tempting to think that the difference between color and the luminous as Aristotle conceives of it is the difference between, as we might put it, surface color and the color of radiant light sources. But this would be a mistake. Among the examples that Aristotle gives of colored particulars are radiant light sources, prominently, the sun. Moreover, if the defining feature of the luminous is its visibility in darkness, then, as our discussion has made clear, the luminous should include not only radiant light sources but reflections as well. The contrast between color and the luminous is not the contrast between surface color and radiant color, but the contrast between light and dark as conditions on the visibility of distinct kinds of objects.

Suppose then, that the two species of the visible are to be understood in this way. Whereas color is visible in the light, the luminous is visible in the dark. One problem with Aristotle's view, so interpreted, is that the contrast does not constitute a partition and so could not demarcate two exclusive species of *visibilia*. Some things are visible in the light and the dark, as Philoponus observes:

For some of them are super-shining, some are dimly shining, and some middling. Those that are dimly shining are seen only at night, such as glow-worms and fish scales and the like; for their shining does not appear by day, being overcome by a greater. And also a majority of stars. Those that are middling are seen both at night and by day, such as the moon and some of the stars, for instance the Morning Star when the sun is near the horizon and the Morning Star itself is near its perigee. Fire also. For this perfects air so as to show also the colours that are in it, but in the rest it shows itself, indeed, but does not bring transparency to that part to actuality. Hence we see itself when we are a long way off in the dark, but none of the colours around us. By day, again, fire appears

as something shining, but not as doing anything to the air because that is already affected by a greater shining, and then it appears in a way like the other colours, but more in the way of the shining of the moon also, because it is not too dim, appears by day; so also with the shining of fire, when it is shown not far away and it is light. But the super-shining are seen only by day, viz. the sun, since indeed it is the cause of day and of light. (Philoponus, *On De Anima* 347 7–24; Charlton 2005, 32)

It is hard to know how Aristotle would address this difficulty since he gives no explanation for how the luminous may be visible in the dark. Recall, against Democritus, Aristotle argues, on general grounds (*De Anima* II 7 418^b13–22), that remote objects of perception require a medium if they are to act upon the perceiver's sense organ, which they must do since sensation is a mode of sensitivity, a reactive capacity. There is no action at a distance. Action, or at any rate immediate action, requires contact. But the remote objects, being remote, are not in contact with the perceiver's sense organ. But this is consistent with them acting upon the perceiver's sense organ mediately, by acting upon something else which is in contact, that is to say, by acting upon an intervening medium. The reasoning here is sufficiently general to hold true, as well, of seeing the luminous set amidst the surrounding darkness. Moreover, just as in the case of color vision, the medium is transparent, the difference being that the medium, be it air or water, is potentially if not actually transparent. Exactly how, though, the luminous acts upon the potentially if not actually transparent, Aristotle declines to say, simply dropping the matter. Indeed, he proceeds to speak as if color were the sole primary object of sight. But exactly how the luminous acts upon the potentially if not actually transparent medium is an essential part of the explanation for how the luminous may be visible in the dark. In the absence of such an explanation, there is no saying what Aristotle might say about the formal difficulty raised by Philoponus' observation. Aristotle must have been apprised of this difficulty since he makes the crucial observation himself:

Fire on the other hand is seen both in darkness and in light; this double possibility follows necessarily from our theory, for it is just fire that makes what is potentially transparent actually transparent. (Aristotle, *De Anima* II 7 419^a23–24; Smith in Barnes 1984b, 34)

Though Aristotle makes the crucial observation upon which the apparent difficulty turns, he nonetheless expresses confidence that the difficulty is merely apparent. That fire is visible in the light and dark is somehow meant to follow from the fact that it is fire that makes the potentially transparent actually transparent, though he never gives the relevant explanation.

Earlier I observed that a plurality of primary objects is consistent with Aristotle's two defining conditions on being a primary object of sense. If a difficulty

is posed by a plurality of primary objects, this must be due to further explanatory assumptions, indeed assumptions linked to Aristotle's avowed explanatory strategy (*De Anima* II 4). However, understood in this light, there is less a difficulty about the plurality of primary objects, nor even about their being large in number, than about their diversity. It is a lack of unity among a plurality of primary objects that is potentially puzzling in the context of Aristotle's explanatory strategy.

This is what underlies Aristotle's contrasting attitudes towards vision and touch. The proper object of vision is the visible, and there are two species of visibilia. About this Aristotle is apparently sanguine, if not terribly forthcoming. But when it comes to the plurality of primary objects of touch, Aristotle remarks that this is a source of puzzlement (*aporia*). The difference concerns the unity displayed by the visible and the diversity displayed by the tangible.

Color is visible in the light and the luminous is visible in the dark. Light is a fundamental condition for the visibility of color, just as dark is a fundamental condition for the visibility of the luminous. So understood light and dark are states of potentially transparent media such as air and water, light being the state of the medium when it is actually transparent and dark being the state of the medium when it is not actually but only potentially transparent. There is a related sense in which light and dark are visible qualities of these states. Air and water, when actually transparent, is light or bright, just as it is dark when it is not actually but only potentially transparent. Light or brightness is the color of the actually transparent (*De Anima* II 7 418^b 11-12; *De Sensu* III 439^b 1-2); and so dark is the color of what is not actually transparent. Moreover, so understood, light and dark are themselves united as opposing contraries. Contrast sensible qualities from different opposing pairs of contraries, light and loud, say. Furthermore, the opposing pair of contraries, light and dark, have a common determinant, the presence or absence, respectively, of the fiery substance in a potentially transparent medium. So conceived, the visible displays a kind of unity. Moreover, the "kinship" between color and the luminous is metaphysical and not, or not primarily, phenomenological, as Sorabji (1971, 63) suggests.

The tangible, in contrast, is remarkable and potentially puzzling because of the diversity of its objects. "Touch, indeed discriminates more than one set of different qualities" (*De Anima* II 6 418^a 14; Smith in Barnes 1984b, 32). The tangible comprises a variety of opposing pairs of sensible qualities, including hot and cold, dry and wet, hard and soft, and so on. And it is the apparent lack of unity among these opposing pairs of contraries that is the source of puzzlement. Aristotle illustrates this apparent lack of unity by contrasting the tangible with the audible. There are a plurality of opposing pairs of contraries that qualify the audible—sharp and flat, loud and soft, smooth and rough, and so on—but these are all intelligible qualities of a single substrata, sound. "Nevertheless we are unable clearly to detect in the

case of touch what the single subject is which corresponds to sound in the case of hearing” (*De Anima* II II 422^b31–32; Smith in Barnes 1984b, 40). We need not suppose that the requisite unity necessarily takes the form it does in the case of audibilia, that the plurality of opposing pairs of contraries are united by a common substrata. After all, the unity of the visible was not achieved in this way. All that is required is that the plurality of primary objects be united in a manner sufficient to discharge their explanatory role. So what is puzzling is not the plurality of primary objects of touch, nor their being large in number, but the apparent lack of unity displayed among the primary objects of touch.

The diversity of the tangible is puzzling when set in the context of Aristotle’s avowed explanatory strategy. Aristotle is seeking definitions of each of the soul’s capacities, such as an animal’s cognitive, perceptual, and nutritive capacities, that are “expressive of what it is”. Capacities are a species of potentiality. What a capacity is depends upon what it is a potential for. What makes sight sight is that it is a potential for seeing. Given the special nature of perceptual and epistemic activities—they each take an object—a definition of perceptual activity expressive of what it is would make essential reference to its object. Seeing is sensory awareness of color just as hearing is sensory awareness of sound. And it is their primary objects that distinguish these perceptual activities. If the primary objects of sense are to play this explanatory role, if perceptual activities are to be understood in terms of the presentation of these objects, and perceptual capacities are to be understood in terms of the perceptual activities that are their proper exercise, then primary objects of a given sense, if they constitute a plurality, must display sufficient unity to play this explanatory role. Diversity among them would, within this framework, naturally lead one to wonder whether there really was one sensory modality at work here rather than many. Why should there be a single sense that affords awareness of hot and cold, wet and dry, hard and soft, rather than there being separate senses of temperature, moisture, and texture? This is precisely the puzzlement that inaugurates Aristotle’s discussion of touch in *De Anima* II II.

The unity of the visible bears on the significance of Aristotle’s declining to explain the visibility of the luminous. In a cynical mood, it is tempting to understand Aristotle’s begging off as the expression of embarrassment at not having an adequate explanation. On this understanding, it is at least an open question whether there is an adequate explanation to be had. However, the unity of the visible makes it possible to understand Aristotle’s declining to explain the visibility of the luminous in a different way. Rather than an expression of embarrassment, Aristotle’s begging off is the expression of confidence that an explanation of the visibility of the luminous, consistent with the general principles at work in his explanation of the visibility of color, is possible. And it is the unity of the visible, that which unites color with the luminous, being qualities whose visibility is determined by

the presence or absence of the fiery substance in potentially transparent media, that is the grounds of such confidence. Aristotle's habit of speaking as if color is the sole primary object of sight can be understood as the expression of this confidence, grounded in the unity displayed by the plurality of the visible. Without pausing to consider further whether this confidence is misplaced, we shall follow Aristotle in speaking as if color were the sole primary object of sight.

4.3 The Definition of Color

Aristotle's explanatory strategy also importantly constrains the interpretation of his definition of color. Color is the primary object of sight. Given, Aristotle's avowed explanatory strategy, color, so understood, must be defined independently of color perception.

Before we consider Aristotle's definition, let us first briefly consider a small puzzle about the order of Aristotle's exposition of the special senses. Aristotle's usual method of exposition would be to discuss the more fundamental of the special senses first. And touch is fundamental in the sense that it is essential to all animals. Not all animals see, but all animals have the sensory capacity for touch. So on the usual method of exposition, one would expect Aristotle to begin his discussion of the special senses, not with sight and color as he does, but with touch and the tangible. Why does Aristotle depart from the usual method of exposition? What is its significance? One idea is that Aristotle discusses the distal sense of sight first to motivate the need for an intervening medium before controversially arguing that a medium is in play in touch as well. That idea is plausible, so far as it goes, but it gains significance once we realize that Aristotle's order of exposition is dictated by his response to Empedoclean puzzlement. It is our perception of the colors inhering in remote external particulars that is the original source of such puzzlement. Color perception is meant to be problematic in the way that touch could not be. The departure from the usual method of exposition is the result of the consequent focus on color perception, and Aristotle will argue that touch, and not color perception, is the puzzling sensory modality.

Aristotle defines color as the power to move what is actually transparent (*De Anima* II 7 418^a31–418^b33; II 7 419^a10–12). Aristotle's definition, despite its brevity, has several distinguishable components. Specifically, in his definition, Aristotle distinguishes:

- (1) a power to effect change—color
- (2) a patient of change, that which color acts upon—transparent media
- (3) a change that colors effect when acting upon transparent media—unspecified

- (4) a condition on the media being acted upon by color—that the media be actually transparent

Let me make some preliminary remarks about each of these components. Some of these are observations, while others have a more aporetic character, raising issues or difficulties, directly or indirectly related to color's explanatory role given Aristotle's avowed explanatory strategy, in *De Anima*, of explaining perceptual capacities in terms of the perceptual activities that are their proper exercise, and explaining perceptual activities that are the proper exercise of our perceptual capacities in terms of the presentation of primary objects.

- (1) First, color is a power of external particulars, a power that is exercised in moving what is actually transparent. A particular may possess this power even when it is not exercised—when the medium is potentially but not actually transparent, say, or when the particular is occluded from view by being an interior part of a body. It is thus a kind of potentiality, or at least the grounds for one. This is metaphysically significant since it implies that particulars retain their colors even when they are unseen, when in the dark or occluded from view, say. As I argued in chapter 2, Aristotle uses the actual/potential distinction to sustain a perceptual realism. Aristotle's definition would be the basis for distinguishing actual and potential color, potential color being the power to move what is actually transparent and actual color being that power's exercise, the moving of what is actually transparent. And indeed Aristotle is keen to distinguish actual and potential color. We have already seen an example of this in the *De Sensu* discussion of opacity (chapter 3.3). Moreover, towards the end of an important passage (*De Anima* III 2 426^a2–26), Aristotle criticizes “earlier students of nature” for failing to distinguish actual and potential color. It is only in failing to distinguish actual and potential color that they maintain that without sight there is no color. Among the earlier students of nature, Aristotle thus undoubtedly has Protagoras in mind. However, in Book III, actual colors are the colors seen. The actual/potential contrast as drawn by Aristotle's Book II definition is between the power to move what is transparent and its exercise. But color can move what is actually transparent and, in so moving, be visible in that medium and yet not be seen because there is no suitably placed, awake, and attentive perceiver. This need not be a problem. After all the actual and potential are said of in many ways. But it does raise a question about how Aristotle is understanding actual and potential color. Moreover, if, as the criticism of the earlier students of nature can seem to suggest, colors are most fully actual when perceived, it is at least not obvious that the colors are independent of perception in the way that is required by Aristotle's avowed explanatory strategy.
- (2) Second, color is the power to move what is actually transparent. It is illumi-

nated media that color acts upon. Color could not act upon the perceiver's organ of sight, at least not directly, since contact precludes sensation, to be palpable is to be imperceptible. Thus was the moral of Aristotle's criticism of the Empedoclean principle. While colors could not act upon the perceiver's sense organ, at least not immediately, they can nevertheless act upon the sense organ mediately, by acting upon an intervening medium. So this aspect of Aristotle's definition of color, that color acts upon an intervening medium as opposed to the organ of sight, is a direct consequence of his case against Empedocles. The contrast is usefully, if anachronistically, brought out as follows. Colors are powers. At least in this abstract regard, they are like Lockean secondary qualities, on one philosophically influential interpretation. However, whereas Lockean secondary qualities are powers to elicit ideas in perceivers, colors, as conceived by Aristotle, are powers not to affect perceivers, but to affect something else, an illuminated medium, itself disposed to affect perceivers. So conceived, colors may be powers, but they are less like Lockean secondary qualities than they are like, in the traditional post-Lockean vocabulary, tertiary qualities. Locke characterizes these qualities as follows:

The *Power* that is in any Body, *by Reason* of the particular Constitution of *its primary Qualities*, to make such a *change* in the *Bulk, Figure, Texture and Motion of another Body*, as to make it operate on our Senses differently from what it did before. (Locke, 1706, 11.8.23)

Locke's (1706, 11 8 23) own examples of tertiary qualities are "the Sun has a Power to make Wax white, and Fire to make Lead fluid". If colors were powers to affect illuminated media, then colors would be Lockean tertiary qualities, at least on a reasonable generalization of that notion. Color, so conceived, would be the power of external particulars, by reason of their particular elemental composition, to make such a change to the illuminated medium so as to make it operate on our sense of sight differently from what it did before. ("Before", here, should be understood as a temporal metaphor for a modal claim—the illuminated medium affected by the color of a particular operates on color vision differently from the way it would if it were not affected by that particular's color.) Colors, as conceived by Aristotle, are ways of affecting light.

- (3) Third, as Hicks (1907, 367) observes, by motion Aristotle does not mean locomotion or change in position. Rather, in *De Anima*, *kinēsis* is Aristotle's general term for change of any kind. Thus motion in Aristotle's definition means productive of change rather than productive of spatial movement, more narrowly. Frustratingly, Aristotle does not directly specify the nature of the change color induces in the transparent medium it acts upon. Indeed, in *De Anima* 11 7 the only effect of color discussed is the effect in terms of which the transparent is

defined—the transparent is not visible in itself, but owing its visibility to the color of another thing. Is this change, the rendering visible of the transparent, sufficient to understand Aristotle's definition? If it were, this would explain Aristotle's apparent silence about the nature of the change induced in the transparent by color—he merely says nothing further, having already specified the nature of the change in his definition of the transparent. Is this credible? What are the alternatives?

- (4) Fourth, the medium must meet a certain condition for color to act upon it—it must be actually transparent. A doubt may be registered about the occurrence of transparency in Aristotle's definition given his avowed explanatory strategy. Color is a proper object of sight, and, as such, partly defines the nature of sight. It might reasonably be thought that color could only play a role in defining sight if it had a nature independent of sight. But defining color in terms of the power to move what is actually transparent potentially threatens this order of explanation given the definitional connection between transparency and visibility. It is on these grounds that Zabarella (1605) rejects Aristotle's definition (see Broackes, 1999, for discussion).

Begin with the one known effect that color has on what is actually transparent, the rendering visible of the transparent. What is actually transparent is illuminated by the presence and activity of the fiery substance. Aristotle's idea is that we see the illuminated media by seeing the colored particulars arrayed in it. In chapter 3, I motivated Aristotle's idea by comparing it to the perception of the illuminant. We see the character of the illuminant by seeing the way objects are illuminated. Thus we see the brightness of the pantry by seeing the brightly lit objects arranged in it. Similarly we see what is actually transparent, the external medium illuminated by the presence and activity of the fiery substance, by seeing the colors of external particulars arrayed in that medium. How do colors render visible what is actually transparent? Presumably by the colors of external particulars appearing through the illuminated medium. The illuminated medium is visible because the colors of external particulars arrayed in that medium are visible.

Given his avowed explanatory strategy, color needs to be defined independently of the perceptual activity that takes color as its object. Is this sufficient to rule out this change, the rendering visible of the transparent, from being the way that color acts upon transparent media in Aristotle's definition? Not obviously. Visibility is a matter of perceptual availability, not perception. Right now, in my empty flat in Blackheath, an Eames chair is visible, but it is not seen since there is no one there to see it. So in the context of Aristotle's explanatory strategy the definition, understood in terms of the rendering visible of the transparent, is not flatly circular—the change may occur without actual perception. However, to the skeptically inclined, the definition understood in terms of the rendering visible of the transparent may

yet give the appearance of “a closed curve in space” to borrow Quine’s (1951) apt phrase. For what is it to be visible if not to be potentially perceived?

What are the alternatives?

Perhaps color colors the transparent. The present suggestion claims of the external medium what Slakey (1961), Sorabji (1974), and Everson (1997) claim of the internal medium, the water of the eye, that it takes on the color of the perceived particular. The suggestion can be understood in a number of ways.

Color could not color the transparent, if coloring involves the external medium taking on a surface color. Surface color is the limit of the transparent, it is perceptually penetrable to the zeroeth degree. It is perceptually impenetrable, defining a visual boundary in which and through which nothing further may be seen. If the external medium took on surface color as the result of the color of the remote external particulars arrayed in it, then it would no longer be actually transparent. A particular could not be seen through an opaque colored medium even if it is like-colored and is the agent of the chromatic change, the medium’s taking on that surface color.

Perhaps in being colored, the transparent takes on, not a surface color, but a volume color. So understood, the medium would be, if not perfectly transparent, then imperfectly transparent—objects could appear in it and through it, at least to some degree. This effect thus has the virtue of at least being consistent with the actual transparency of the external medium. However, it runs afoul of the directionality of the visible, that the perceptual availability of a particular’s color depends in part upon the perceiver’s point of view (a point upon which Aristotle crucially relies in his case against the Empedoclean principle). If the external medium takes on a volume color corresponding to the surface color of an external particular residing within it, then that volume color could be observed even from an angle where the particular is no longer in view. Suppose that the region between the perceiver and the remote external particular takes on the volume color corresponding to the surface color of that particular. Another perceiver, looking at the scene side on, would observe the volume color of that region of the external medium, even if the colored particular was slightly out of view from their current vantage point (see Burnyeat 1995, 425). But we normally observe no such thing. The problem with color coloring the transparent is that it is inconsistent with the way that colors are perceptually available in the external medium: Either by being inconsistent with the medium being actually transparent or by being inconsistent with the directionality of the visible.

Sorabji (2004) has made a further important suggestion as to how color might color the transparent. The color of the particular colors what is actually transparent, the illuminated medium, by that medium borrowing the color of that particular. To say that the illuminated medium borrows its color from a particular is to

say that the source of the medium's color lies not within itself but in the particular. For the medium to take on a surface color is for it alter in such a way that it takes on the power the possession of which is the source of that medium's color. If the medium's colored is borrowed, however, its source lies not within itself but in another thing; specifically, in the power of a particular to alter the illuminated medium in a certain way. Though metaphysically distinct, it faces a parallel difficulty.

Sorabji (2004) cites reflection as a case of borrowed color. But reflection is a source of occlusion. The reflection in a window can prevent a suitably placed perceiver from seeing what lies behind it. In *The Problems of Philosophy*, Russell writes:

Although I believe that the table is “really” of the same colour all over, the parts that reflect the light look much brighter than the other parts, and some parts look white because of the reflected light. (Russell, 1912, 2)

Specular highlights may look brighter than the rest of the surface, but does that part of the surface corresponding to the specular highlight itself look brighter than the rest of the surface? Is it even seen? Or is that part of the surface rather occluded by a white specular highlight? The whiteness would then be the color of the reflected light and not, as Russell suggests, the surface. If the white of the specular highlight occludes the brown of the surface, then that part of the surface corresponding to the specular highlight does not appear white—it does not even appear! If you were interested in some detail of that part of the surface corresponding to the specular highlight, you would need to change the viewing geometry (either by altering your position relative to the object or by altering the object's position relative to the illuminant) to get that detail into view.

Parmenides' reflective moon provides an analogous case (DK 28B14). If the moon shines at night with the color of a foreign light, then we see not the moon's color but the color of the foreign light with which it shines. Similarly, the surface of a silver plate seen under intense illumination may be obscured by the glare, as when a distant compatriot in the desert uses the plate as a makeshift signal. Light can not only reveal the scene before us, but, if it is particularly intense, it can also blind us to that scene (*De Anima* II 12 424^a29–34).

The problem, then, is that a particular could not be seen through the color that the medium reflects even if it is like-colored and is the source of that reflection's color. Thus a medium could not at the same time borrow color in the manner of reflection and be actually transparent. Recall this was the problem with Aristotle's definition of transparency (chapter 3.2). The transparent is visible, though not visible in itself, but owing its visibility to the color of another thing. While a highly reflective surface, such as a mirror, may be visible, it owes its visibility to the colors reflected therein. But reflection, being a source of occlusion, is not transparent.

Sorabji understands borrowing color as a particular kind of material change that differs metaphysically from the material change a thing undergoes when it takes on a surface color. The metaphor can be understood in a different way. On this alternative understanding, borrowing is less a material change, at least in the first instance, than a psychological change. We behold the crimson sun setting over the Aegean sea. The transparent medium, the air at dusk, appears a certain way. The way that the illuminated medium appears is due to the way that the particulars in that scene—the crimson sun, the Aegean sea—appear through that medium. The source of the medium's appearance is the appearance of the particulars arrayed in it. Perhaps what is borrowed is not color but color appearance. Understood in this way, Sorabji's metaphor gives expression to the phenomenological intuition that motivates Aristotle's definition of transparency (discussed in chapter 3.2). Moreover, so understood, it is not a genuine alternative to the rendering visible of the transparent.

Observing that the one known effect of color, the rendering visible of the transparent, is psychological and rejecting the claim that color colors the transparent, Burnyeat suggests instead that color's effect on what is actually transparent is no real alteration, but a quasi-alteration:

When the medium is actually transparent (*diaphanēs*), i.e. when the medium is such that colours can appear through it (*phainesthai dia*), they do appear through it. At the same time, the transparent itself, the light, becomes visible in a way and coloured in a way—without being really coloured and, in consequence, without undergoing real alteration. This non-real alteration—a quasi-alteration I shall call it—of the transparent consists in the fact that colours appear through it.

Here is a little experiment to help you understand the idea of quasi-alteration. Fill a transparent glass with water and put it on a table. Hold a red object a short distance away from the glass and look at it through the water. The water in the glass is now serving as a medium *within* another medium (the surrounding air). You will see a red coloration in the water. But unlike the coloration that ensues if you pour red ink into the water, this coloration is not visible to other observers from other angles of vision. Now let the glass expand in your imagination to meet your eye, on one side, and the red object on the other. The water will become the sole medium and you will see the red object directly through it. (Burnyeat, 1995, 425)

Color's effect on the illuminated medium is no real alteration. The only effect that color has on the illuminated medium is that it appears through it. But the color in appearing through the illuminated medium does not materially alter that medium, the medium merely undergoes a relational change. The medium may undergo this

relational change without itself altering. In this way, quasi-alteration is akin to Geach's (1969, 71–72) Cambridge change.

Both quasi-alteration, and the rationale offered on behalf of it, is surprisingly Protagorean. Thus consider the reasoning that Socrates attributes to Protagoras in the *Theaetetus*:

SOCRATES: Well now, supposing such things as size or warmth or whiteness really belonged to the object we measure ourselves against or touch, it would never be found that this object had become different simply by coming into contact with another thing and without any change in itself. ... As it is, you see, we may easily find ourselves forced into saying the most astonishing and ridiculous things, as Protagoras would point out or anyone who undertook to expound the same views. (Plato, *Theaetetus* 154^b; Levett and Burnyeat in Cooper 1997, 171)

Here we have a Protagorean *reductio* of the claim that sensible qualities inhere in external bodies. Suppose, for the sake of *reductio*, that whiteness inheres in the external body that we perceive, the late morning sun, say. If whiteness inheres in the sun, it could not differ in color without changing. But the sun does become different without changing when measured by sight, or so Protagoras insists. Thus whiteness does not inhere in the external body, but is constituted, in part, by an animal's perceptual relation to it. Similarly, Burnyeat is asking us to suppose, for the sake of *reductio*, that color's effect on the illuminated medium is a material alteration and so something that inheres in that medium. If it were, the illuminated medium, when acted upon by color, could not become different without changing. But the illuminated medium does become different without changing when acted upon by color, or so Burnyeat insists is Aristotle's view. The effect is no genuine alteration of the illuminated medium but is constituted by the color's appearing through that medium.

The Protagorean character of quasi-alteration and the rationale Burnyeat offers on behalf of it makes me hesitant to attribute the view to Aristotle. It seems inconsistent with Aristotle's insistence (*Metaphysica* Δ 15 1021^a34–1021^b3) that relations must be grounded: In order for a relation to obtain the *relata* must exist and have a nature independently of being so related (discussed in chapter 2.1.1). By that principle, if the transparent medium is being appeared through, it must be some way in order for this to be so. The insistence that relations be grounded may be dialectically ineffective against a committed Protagorean, but it should give us pause in attributing Protagorean quasi-alteration to Aristotle. Fortunately, the attribution is unnecessary. Consider how Burnyeat argues for the relational character of color's effect on illuminated media. Burnyeat asks us to suppose, for the sake of argument, that color colors the transparent in the sense that the illuminated medium

takes on a volume color of the same hue as the opaque colored particular that appears through it. The problem, according to Burnyeat, is that this runs afoul of the directionality of the visible: “unlike the coloration that ensues if you pour red ink into the water, this coloration is not visible to other observers from other angles of vision.” The appearance of a color through the illuminated medium is relative to a point of view, a perspective that a suitably awake, attentive perceiver could adopt. And Burnyeat invites us to conclude that not only is this relativity inconsistent with the illuminated medium taking on a volume color but with its undergoing any substantive change at all. The argument may rest upon an insight, the directionality of the visible, but the reasoning remains invalid. Color may alter the material state of the illuminated medium, and so undergo a substantive change that is not only consistent with, but explanatory of, the directionality of the visible.

To see this, first begin with an observation we made earlier. Light is a state, the state of illumination. The character of that state depends upon the contingent presence and activity of the fiery substance. The character of the state of illumination depends upon the amount of the fiery substance present or, if this does not come to the same thing, its extent and degree of activity. Since light depends upon the activity of the fiery substance, and activity can have a direction of influence, light inherits its direction from the direction of influence of the fiery substance whose activity constitutes its being and continued existence. So there is nothing in light being a stable state that is inconsistent with its having a direction. Light, understood as a state of illumination, may have a direction it inherits from the fiery substance, but, for all that has been said, this may not be the directionality of the visible. To see that it is, we must first consider how color may affect light.

What material effect might color have on what is actually transparent? Color is the power to move what is actually transparent. What is actually transparent is illuminated by the presence and activity of the fiery substance. So color is a power of particulars to alter the character of the illuminated medium in which they are arrayed. The qualitative character of the illuminated medium is determined by the presence and activity of the fiery substance. So in order to act on the character of the illuminated medium, color must somehow act on the fiery substance either by affecting the amount present in that medium or by promoting or restricting its activity to some degree. If, as I have suggested, for fire, to be is to burn, these alternatives turn out to be equivalent—the amount of the fiery substance present just would be the extent and degree of its activity. The different colors will thus affect the illuminated medium differently, by differently affecting the amount of the fiery substance present in that medium or differently promoting or restricting its degree of activity. The present suggestion is consistent with the actuality of the transparent. The contingent presence and activity of the fiery substance is what makes the potentially transparent actually transparent. And being actually transparent is

materially sufficient for the perceptual availability of the colors of remote external particulars arrayed within the external medium. Moreover, the present suggestion is not only consistent with the directionality of the visible, but provides the basis for its explanation. The being of fire consists in its burning. Burning is an activity. And, as such, it has a direction of influence. That the perceptual availability of a color depends upon the perceiver's point of view is due, in part, to the direction of influence that results from that particular's color altering the activity of the fiery substance. So *contra* Burnyeat, an illuminated medium may be materially altered, by altering the amount of the fiery substance present or by promoting or restricting its activity to some degree, and this is not only consistent with the directionality of the visible but provides an explanation for it.

Finally, not only can the present suggestion explain the directionality of the visible, but it is also consistent with Aristotle's avowed explanatory strategy. Given that strategy, color must be defined independently of the perceptual activity that takes color as an object. Defining color as the power to alter the character of the illuminated medium by altering the presence and activity of the fiery substance within that medium makes no reference to perception whether in actuality or potentiality. Nevertheless, the character of the illuminated medium being altered in this way is a material condition on the perceptual availability of the color to a suitably placed, awake, and attentive perceiver given the direction of influence of the fiery substance as affected by the chromatic power of the remote external particular.

A technical qualification is in order about the sense of alteration in play. Let light and dark be states of a potentially transparent medium, light being the state that the medium is in when it is actually transparent and dark being the state that it is in when it is potentially if not actually transparent. Since actual transparency is due to the contingent presence and activity of the fiery substances, the transition from light to dark is no qualitative alteration. Light and dark may be inconsistent states, but they are not contraries from a common genus the way they would be if the transition were a genuine case of qualitative alteration. Rather, the transition is a kind of privation. When the fiery substance is removed, darkness supervenes. (As we shall see, an important consequence of this is how mixture so much as could be understood in Aristotle's theory of the generation of the hues, chapter 6.1.4.) There is, however, a different though related sense of light and dark. On this understanding, light and dark are not so much the state of being actually transparent and the state of being potentially though not actually transparent but rather their qualitative character. Thus what is actually transparent is bright or light and darkness is the sensible aspect of the absence of fire. The transition from light to dark, so understood, is a qualitative alteration. Light and dark, understood as the sensible aspects of states of potentially transparent media, are contrary qualities drawn

from the same range of qualities. Indeed they are opposites. Light and dark are opposites in that they are at the extreme ends of this ordered range of qualities. When a color affects light, this motion involves form and privation, light being the form determined by the presence and activity of the fiery substance and darkness being the privation of the light-giving fiery substance. Color's effect on light thus involves form and privation—the activity of the form-giving fiery substance is promoted or restricted at least to some degree. But affecting light in this way itself constitutes a qualitative alteration—promoting or restricting the activity of the fiery substance alters the qualitative character of the illuminated medium, by replacing one quality with a contrary from a common genus. (We shall return to such qualifications when we discuss *De Anima* II 5 in chapter 8)

If we set aside the suggestion that color colors the transparent, and that color's effect on illuminated media is a quasi-alteration, then we are left with three candidate effects:

- (1) The rendering visible of the transparent—making the transparent medium perceptually available.
- (2) The rendering visible of colored particulars arrayed in the transparent medium—making the colored particulars perceptually available.
- (3) Affecting the fiery substance by affecting the amount of it in the transparent medium or, if this does not come to the same thing, promoting or retarding its activity to some degree, or otherwise affecting its direction of influence as in cases of reflection or refraction.

(1) is the only effect explicitly described in *De Anima* II 7. (2), while not explicitly described in *De Anima* II 7, is arguably presupposed by the one known effect—we see the transparent by seeing the colors of remote external particulars through it. (3) was elaborated only with resources available to Aristotle and while there is good reason to think that Aristotle is committed to this effect, he fails to make this commitment explicit. (1) and (2) concern something becoming perceptually available. They are psychological effects at least in the extended sense that they concern potential psychological change—perceptual availability is, or at least involves, potential perception. (3) however is not psychological even in this extended sense but is, rather, a material change. These psychological and material changes need not be inconsistent. They may be part of formal and material explanations of one and the same phenomenon. The visibility of color and the transparent, their perceptual availability, raised an issue about whether the definition could be understood in terms of these effects given Aristotle's avowed explanatory strategy. Understanding Aristotle's definition in terms of (3) avoids this issue.

Before coming to a judgment about which, if any, of the three candidate effects Aristotle's definition of color should be understood in terms of, we need to consider

how this issue arises with another aspect of Aristotle's definition of color. Specifically, this issue arises not only with the effects of color on the illuminated medium but also with the condition on the medium being acted upon by color. External media are only receptive to the influence of color if they are actually transparent. It is a necessary condition on the activity of color that the patient of this activity, the external medium, be in a certain state—that the medium be actually transparent. Recall, Aristotle defines the transparent as that which is visible, though not visible in itself, but owing its visibility to the color of another thing (*De Anima* II 7 418^b 4–6). Given the definitional connection between transparency and visibility, an issue arises as to whether this is consistent with Aristotle's avowed explanatory strategy. Given that strategy, color needs to be understood independently of perception, but its definition specifies that the patient of its activity, the external medium, be visible, that is, potentially perceived. Is potential perceptibility occurring in the definition in this way inconsistent with color, so defined, being independent of perception? That is the question that Zabarella (1605) has bequeathed to us.

In order to address Zabarella's question, we need first to get clearer about the actual and the potential as applied to color and color perception. Recall, according to Aristotle's definition, potential color is the power to move what is actually transparent and actual color is its exercise, the moving of what is actually transparent. In Book III, however, actual colors are the colors seen. It is a persistent theme of Aristotle's that the actual and potential are said of in many ways. So this need not be inconsistent, nor a change in view. But it does raise a question about how Aristotle is understanding these ways of being actually or potentially colored. Moreover, if the colors are most fully actual when perceived, as the Book III doctrine can seem to suggest, then it is at least not obvious that colors are independent of perception in the way that is required by Aristotle's avowed explanatory strategy.

Begin with this latter issue. As we shall see it is intimately connected with the former. If color were most fully actual when perceived, then how could color be independent of perception in the manner required by Aristotle's avowed explanatory strategy? Any apparent inconsistency, here, is merely apparent. Aristotle is not claiming that a ripened tomato, say, is not actually red unless it is seen. That was the mistake made by the "earlier students of nature" such as Protagoras. Rather, the doctrine is that the tomato does not appear red unless it is seen (see Burnyeat 1982, 29, Ganson 1997). When the tomato ripens it becomes actually red. What is actualized in perception is that redness appearing, the manifestation of the red of the tomato in sensory consciousness.

There are thus two contrasts between the actual and the potential here. Let "*c*" be a color, then:

- (i) A particular is actually₁ *c* when it possesses the power to alter the illuminated media (in a manner characteristic of *c* as opposed to some other color, *c'*).

- (2) A particular is actually₂ *c* when it appears *c* in the perceiver's perceptual experience of it (as opposed to appearing *c'*, or not at all).

Notice that, though he does not deploy this vocabulary to describe the present case, this corresponds to Aristotle's distinction between first and second actuality:

Now there are two kinds of actuality corresponding to knowledge and to reflecting. It is obvious that the soul is an actuality like knowledge; for both sleeping and waking presuppose the existence of soul, and of these waking corresponds to reflecting, sleeping to knowledge possessed but not employed, and knowledge of something is temporally prior. (Aristotle, *De Anima* II I 412^a24–26; Smith in Barnes 1984b, 21)

First actuality corresponds to the possession of knowledge, second actuality corresponds to its exercise. In *De Anima* II 5, Aristotle will claim that the acquisition of knowledge, coming to know something, is a particular kind of change. The transition from ignorance to knowledge is a sort of alteration of the rational animal insofar as one state of the animal has been replaced by another inconsistent with it. Similarly, the ripening tomato in becoming red undergoes an alteration. Unripened, it was green but potentially red. Ripened, this potentiality is actualized. The ripened tomato is red and not green. The potentiality actualized by the tomato, its becoming red, consists in the tomato acquiring a particular power to affect illuminated media. This is the first actuality of color. Notoriously, Aristotle denies that the exercise of knowledge is an alteration, at least in the sense that becoming knowledgeable or red is:

Also the expression 'to be acted upon' has more than one meaning; it may mean either the extinction of one of two contraries by the other, or the maintenance of what is potential by the agency of what is actual and already like what is acted upon, as actual to potential. (Aristotle, *De Anima* II 5 417^b2–5; Smith in Barnes 1984b, 30)

The exercise of knowledge is not a destruction of something by its contrary like the chromatic change the ripening tomato undergoes. In exercising knowledge, that knowledge is preserved. The subject does not become ignorant in exercising their knowledge, and so retains that knowledge in its exercise. Moreover, there is a sense in which that knowledge is not only preserved but actualized in its exercise. A subject realizes their nature as knowledgeable about a certain topic by applying their knowledge of it in a reasonable manner given the practical circumstances. So, for example, Theaetetus realizes his nature as a geometer by recognizing a diagram as a proof. (Exactly what Aristotle means, here, will be discussed in chapter 8.) So a transition to second actuality is not an alteration the way a transition to first actuality is. Moreover, this claim in *De Anima* II 5 is made in the context of an extended

comparison of knowledge and perception. Perceptual activity such as seeing, the exercise of the perceiver's capacity for sight, is a second actuality the way that the exercise of knowledge is. Seeing is more than a destruction of something by its contrary. It is the preservation and actualization of a potentiality. In seeing a colored particular, a perceiver exercises their capacity for sight and so realizes their nature as a perceiver. So a perceiver coming to see a colored particular does not undergo an alteration, at least not merely. So, presumably, the color of the particular coming to appear in the perceiver's experience of is no mere alteration either.

So in possessing a power to alter illuminated media, a particular is actually colored—it actually has the color constituted by the power to affect light in that way. Coming to possess this power is an alteration, and the possession of this power is a first actuality. This first actuality of color is itself a potentiality since the power either is, or is the principle that grounds, a potentiality, the potential of that particular to affect light in a certain way. In acquiring the power to affect light in a certain way, the colored particular also acquires the derived power to mediate affect organs of sensation sensitive to such alterations in illuminated media. When the particular alters the illuminated medium, and there is a suitably placed, awake perceiver who is attentive to the sensitivity of their eyes to such alterations, the color appears in their experience of that particular. This is the second actuality of color. The second actuality of color is triggered by the exercise of the power to mediate affect the eye that derives from a power to affect the intervening medium. This more fundamental power is a power that a particular may have even in the absence of perceivers. The colors are not most fully real when seen. This was the mistake of the “earlier students of nature”. What is actualized in perception is the presentation of color in sensory consciousness. If a particular is actually colored merely by possessing the power to affect illuminated media in a certain way, then Aristotle's doctrine is consistent with the explanatory demand that color be understood independently of perception.

As Burnyeat (1982, 29, n13) observes, this doctrine is supported by “Aristotle's central claim ... that the sensible object must already be in actuality what prior to the act of perception, the sentient subject is potentially.” Thus Aristotle writes:

As we have said, what has the power of sensation is potentially like what the perceived object is actually; that is, while at the beginning of the process of its being acted upon the two interacting factors are dissimilar, at the end the one acted upon is assimilated to the other and is identical in quality with it. (Aristotle, *De Anima* II 5 418^a3–6; Smith in Barnes 1984b, 31)

In what sense sensation is like the perceived object actually is may at this point be unclear. This is the sense in which the perceiver assimilates sensible form. In

assimilating the sensible form without the matter of the remote external particular, the perceiving subject, or at least their perceptual experience, becomes like the sensible particular. In a sense that I will explain in chapter 9, color shapes sensory consciousness. What is presently important, however, is Aristotle's requirement that the remote external particular be actually colored prior to the perceiver's experience of it. And as we saw in chapter 2, Aristotle advances a battery of arguments for this claim in *Metaphysica* Γ, and it is central to his perceptual realism.

Finally, consider Aristotle's criticism of the "earlier students of nature":

The earlier students of nature were mistaken in their view that without sight there was no white or black, without taste no savour. This statement of theirs is partly true, partly false: 'sense' and 'the sensible object' are ambiguous terms, i.e. may denote either potentialities or actualities: the statement is true of the latter, false of the former. This ambiguity they wholly failed to notice. (Aristotle, *De Anima* III 2 426^a24–26; Smith in Barnes 1984b, 46–47)

According to the "earlier students of nature", without sight there is no white or black. Aristotle's response parallels his response to Protagoras in the *Metaphysica*. He is at once concessionary but concludes as well that these concessions are only intelligible given a background realist metaphysics. Here, Aristotle claims that the "earlier students of nature" are partly right and partly wrong, owing to the ambiguity of "sense" and "sensible object". Aristotle claims that both "sense" and "sensible object" can be understood either as potentialities or actualities. Moreover, as we have seen, the actual and the potential are themselves said of in many ways, adding further scope for ambiguity. Aristotle claims that the doctrine of the "earlier students of nature"—that without sight there is no white or black—is true of actualities, but false of potentialities. What is the sense of actual upon which this doctrine comes out true? Attending to context helps. Aristotle's criticism of the "earlier students of nature" occurs at the end of an extended passage where the actuality of color is understood as the actualization of that color in perception, its presentation in visual consciousness. Correspondingly, the actuality of sight must be understood as the seeing of that color. So understood, the doctrine of the "earlier students of nature" is that no colors are present in visual consciousness unless they are actually seen. However, this carries with it no commitment to Protagorean metaphysics. So understood, the doctrine is consistent with a perceptual realism where colors actually inhere in external particulars prior to being perceived. Not only is this doctrine consistent with perceptual realism it is only intelligibly sustained against the background of a realist metaphysics. If a color's presentation in visual consciousness is the effect, at least in part, of a colored particular acting upon an illuminated medium, then the particular must actually be colored prior to its actualization in perception, prior, that is, to the perceiver's experience of

it. It is not true that without the capacity for sight, there are no visible qualities, that is, qualities that are potentially seen. White and black things are of such a nature that had their been suitably placed, awake, attentive viewers in an illuminated environment, they could have been perceived.

If the colors are not most fully real when seen, as the “earlier students of nature” maintained, then why describe the presentation of the colors in visual consciousness in terms of actuality? Allow me to make a conjecture. As we shall see in chapter 8.3, the transition to second actuality is a kind of perfection or realization of a thing’s nature. Color is a species of the visible. Not the only species. Color is visible in the light, and the luminous is visible in the dark. As a species of *visibilia*, a particular’s color being seen might reasonably be understood as a perfection of its nature. If the visible is to be seen, then colors in being seen realize their nature as *visibilia* and so are perfected.

We are now in a position to provide a provisional answer to Zabarella’s question. Given the definitional connection between transparency and visibility, how can transparency figure in Aristotle’s definition of color consistent with his avowed explanatory strategy of explaining perceptual capacities in terms of perceptual activities, and explaining perceptual activities in terms of their objects? In having visibility figure in the definition of color, has Aristotle failed to specify the object of color perception independently of that experience? There is no inconsistency here. For something to be visible is to have such a nature that a suitably placed, awake, attentive, viewer in an illuminated environment could see that thing. A visible thing possesses such a nature prior to being seen and would retain that nature even when shrouded in darkness, or occluded from view, or in the absence of suitably placed perceivers, or when suitably placed perceivers are asleep or otherwise inattentive, or even if there were no animals with the capacity for sight. As Aristotle argues in *Metaphysica* Γ, to be visible, to be potentially perceived, is to possess a “*substrata*”, understood broadly enough to include natures and powers, prior to perception.

Aristotle leaves unspecified color’s effect on illuminated media. Setting aside color coloring the transparent and quasi-alteration, we saw that three candidates remain:

- (1) The rendering visible of the transparent—making the transparent medium perceptually available.
- (2) The rendering visible of colored particulars arrayed in the transparent medium—making the colored particulars perceptually available.
- (3) Affecting the fiery substance by affecting the amount of it in the transparent medium or, if this does not come to the same thing, promoting or restricting

its activity to some degree, or otherwise affecting its direction of influence as in cases of reflection or refraction.

(1) and (2) are psychological at least in the broad sense of involving potential perception. (3) is not psychological, even in this broad sense, but material. Aristotle's avowed explanatory strategy puts pressure on the psychological alternatives since the definition of color formulated in terms of either, while not flatly circular, at least appears like "a close curve in space". We have seen, however, that there is a sense of potential perception whose definitional connection with color would be consistent with Aristotle's avowed explanatory strategy. This sense of potential perception is inconsistent with a Protagorean metaphysics, and involves the material nature of what is potentially perceived. This understanding of visibility is not only consistent with a material change in illuminated media but it requires the existence of an underlying material nature as a "substrata" and agent of that change. While (1) and (2), so interpreted, would be consistent with Aristotle's avowed explanatory strategy, interpreting Aristotle's definition of color in terms of (3), understood in such a way as to be not only consistent with, but explanatory of, the psychological effects (1) and (2), would provide the best overall coherence. The idea would be that colored particulars have a material nature required to ground a power to affect the amount, activity and direction of influence of the fiery substance in illuminated media. And in so affecting the fiery substance, the particular, or at least its color, is perceptually available—or would be to suitably placed, awake, and attentive viewers. While there are internal pressures that support this interpretation, an important question remains: What is the material nature the possession of which underlies a particular's power to affect the amount, activity, and direction of influence of the fiery substance in illuminated media? Aristotle is silent on this matter, and this issue remains unaddressed in *De Anima*.

If this were the end of the matter, much of the foregoing would be purely speculative. Arguably, however, this unfinished business is addressed by the *De Sensu* doctrine that color resides in the proportion of the transparent that exists in all bodies. It is the possession of the proportion of the transparent that exists in all bodies that endows a remote external particular with the power to affect the amount, activity, and direction of influence of the fiery substance in illuminated media. And in so affecting the fiery substance, the particular, or at least its color, is perceptually available—or would be to suitably placed, awake, and attentive viewers. So the possession of the proportion of the transparent that exists in all bodies is the material nature that underlies a colored particular's visibility, a material nature the particular may possess even in the dark or in the absence perceivers.

4.4 Color and Transparency

One of the novel claims of *De Sensu* is that color resides in the proportion of transparent that exists in all bodies. To allow for the possibility of utterly non-transparent bodies this claim must be understood in such a way that having no transparency counts as a proportion of the transparent, though obviously this would be a limiting case.

The proportion of the transparent that exists in all bodies is meant to ground a particular's power to affect illuminated media, which itself grounds the derived power to affect sense organs sensitive to such alterations in illuminated media. It is in these terms that Aristotle explains the exercise of the reactive capacity for sight. Given Aristotle's avowed explanatory strategy, transparency, here, is not understood in terms of visibility, at least not primarily. Rather, the *De Sensu* claim should be understood rather in terms of the material basis of visibility. If the presence and activity of the fiery substance is what makes the potentially transparent actually transparent, thus rendering visible the particulars arrayed in it, then we can understand the transparent as that which is receptive to the illuminating activity of the fiery substance. More specifically, something is transparent to the degree to which it is receptive to the presence and activity of the fiery substance.

Once the *De Sensu* claim is understood in terms of the material basis of transparency, then it is itself susceptible to further material explanation. If the degree of transparency of a body is understood as the degree to which it is receptive to the illuminating activity of the fiery substance, then a body's degree of transparency can be explained in terms of its elemental composition (and, indeed, ultimately, in terms of the primary opposites, Hot and Cold, Dry and Wet). Thus, for example, earth resists fire. So a body with a high proportion of earth in its elemental composition will be, to that extent, less transparent than a body with a lower proportion of earth.

That color resides in the proportion of the transparent that exists in all bodies is connected with another novel claim of *De Sensu*, that the chromatic hues are a proportion of light and dark (discussed in chapter 6). The presence of the fiery substance illuminates the potentially transparent medium. White corresponds to the presence of this determinant of what is actually transparent. Conversely, black corresponds to its absence. White and black are thus associated with a fundamental condition on the visibility of remote external particulars. No doubt in part because of this Aristotle attempts to explain the other hues in terms of the ratio of light and dark. So if a particular, such as a ripened tomato, has the surface color red, this is because there is in its surface a proportion of light and dark characteristic of red things. Moreover, this proportion or ratio of light and dark is determined by the degree of transparency of the tomato as determined by its elemental composition (and ultimately in terms of the primary opposites). Color resides in the

proportion of the transparent that exists in all bodies since color is determined by a proportion of light and dark itself determined by the colored particular's degree of transparency. (We shall discuss the further philosophical significance of this explanation in chapter 6.2.)

A particular's color is its power to affect illuminated media. This power is grounded in its degree of transparency, understood in terms of the degree to which it is receptive to the presence and activity of the fiery substance and where a particular's degree of transparency is in turn determined by its elemental composition. A puzzle arises about opaque bodies of chromatic hues. The ripened tomato is both red and opaque. You cannot see the seeds lying within the tomato's interior—they do not appear in the fruit's flesh when viewing the whole and intact tomato from without. Nor can anything appear through the tomato. The tomato's surface determines a visual boundary in which and through which nothing further may appear. Being thus opaque it is not transparent. But in being red it is transparent at least to some degree, the degree that determines the ratio of light and dark characteristic of red things.

The puzzle is merely apparent. Its proper resolution emphasizes the need to understand the *De Sensu* claim that color resides in the proportion of the transparent that exists in all bodies in terms of the material basis of transparency. The red ripened tomato is opaque in that it determines a visual boundary at the surface of the body through which and in which nothing further may appear. Here transparency, or rather the lack of transparency, is understood in psychological terms, at least in the weak sense of involving potential psychological change. Something is transparent if it is possible to see in it or through it, otherwise not. Suppose that Aristotle is right that the weak psychological sense of transparency is susceptible to material explanation. Something is transparent if within it there is sufficient amount of the fiery substance. But that is consistent with a body being receptive to the fiery substance to some degree, but not to a degree sufficient for something to appear in it or through it. Once transparency is understood in terms of its material basis, the degree to which a body is receptive to the presence and activity of the fiery substance, the problem does not arise so long as we suppose that there is a threshold of the amount of the fiery substance or the extent and degree of its activity that makes for transparency phenomenologically understood. So the surface of the tomato is receptive to the fiery substance to a certain degree, a degree that determines a ratio of light and dark characteristic of red things. It is just that this ratio of light and dark does not reach the threshold necessary for other bodies to appear in it or through it.

There is a residual puzzle for Aristotle here, though not the one with which we began. An opaque body with a surface color and an imperfectly transparent medium with a volume color may both share the same hue. Each may be blue, say.

But if a ratio of light and dark both makes for the hue and meeting a threshold makes for transparency phenomenologically understood how could this be? Both enjoy the same hue and so both must participate the same ratio of light and dark. But the threshold, if there is one, is met in the case of the imperfectly transparent medium but is not met in the case of the opaque body. There is a potential tension, then, on the theoretical uses to which the fiery substance is being put, as jointly determining the hue of a body and its degree of phenomenological transparency. (For a contemporary echo of this issue see Johnston's 2007, 263 argument that hues are not properties. According to Johnston, a surface color, understood as a color presented as pervading a surface, and a volume color, understood as a color presented as pervading a volume, are different properties but they can nevertheless share the same hue.)

Chapter 5

Light and Dark

5.1 Chromatic Harmony

The presence of the fiery substance illuminates the potentially transparent medium. White (*leukon*) corresponds to the presence of this determinant of what is actually transparent. Conversely, black (*melaton*) corresponds to its absence. The absence of the fiery substance darkens the potentially transparent medium. White and black are thus associated with a fundamental condition on the visibility of remote external particulars. No doubt in part because of this Aristotle attempts to explain the other hues in terms of the ratio of white and black. He considers three such accounts, in terms of (1) juxtaposition, (2) overlap, and (3) mixture, advocating the third. On all three accounts chromatic hues are determined by white and black in various ratios, the accounts differing only in how these ratios are implemented.

The fundamental idea common to all three accounts can seem surprising. How can the ratio of white and black result in something appearing red? Would it not instead appear gray? Thus Hett (1936, 210) writes that Aristotle's "doctrine could hardly have survived a few experiments with pigments". If Aristotle's account were disconfirmable by elementary experiments with pigment mixtures, then why did he not investigate the matter? Was it merely to avoid Plato's charge of impiety?

There will be no difficulty in seeing how and by what mixtures the colors derived from these are made according to the rules of probability. He, however, who should attempt to verify all this by experiment would forget the difference between human and divine nature. For God only has the knowledge and also the power which are able to combine many things into one and again resolve the one into many. But no man either is or ever will be able to accomplish either the one or the other operation. (Plato, *Timaeus* 68^d; Jowett in Hamilton and Cairns 1989, 1192)

The impiety of mixture will be echoed by Plutarch in the first century AD:

Mixing produces conflict, conflict produces change, and putrefaction is a kind of change. This is why painters call a blending of colours a ‘de-flowering’ and Homer calls dyeing ‘tainting,’ and common usage regards the unmixed and pure as virgin and undefiled. (Plutarch, *Moralia*, Table-Talk (*Quaestiones convivales*) VIII 5 725^{c-d}; Minar in Minar et al. 1961, 155–157)

Aristotle’s account of the generation of the hues may be surprising, but it would be wrong to prematurely dismiss it. The first thing to observe is that *leukon* and *melaton* are better understood as light and dark, rather than white and black. There is a general tendency in Greek color vocabulary to classify colors in terms of relative brightness rather than hue (see Gladstone, 1858; Platnauer, 1921; Osbourne, 1968; Lloyd, 2007). Traces of such a usage exist in English. Thus we speak of white wine and white people, though neither are white in hue. Similarly neither black people nor black grapes are black in hue. This usage in English, however, does not seem to be perfectly general but is rather lexically determined. It is not the case that “white” can be interpreted in terms of relative brightness instead of hue when applied to just any noun. The availability of such an interpretation seems to be limited to the adjective’s application to certain nouns. The more general usage in Greek is philosophically significant, for it transforms Aristotle’s claim. Aristotle is not claiming that the hues are determined by the ratio of white and black, but that they are determined by the ratio of light and dark. Experiments with pigment mixtures are irrelevant to the truth of this latter claim. Thus, Aristotle need not have risked Plato’s charge of impiety as Hett recommends. Not only is the thought that the hues are determined by the ratio of light and dark not disconfirmable by impious experimentation, it is independently plausible. (Indeed, as I will argue in chapter 6.3, it is an ancient prefiguration of modern reflectance theories, see Hilbert 1987.)

Two further considerations are relevant. First, there are a range of observable phenomena that support Aristotle’s fundamental claim that a ratio of white and black or light and dark can give rise to chromatic appearances. Importantly, Aristotle himself provides an example. Second, Aristotle’s account has ancient precedent. Thus when Theophrastus discusses Democritus’s view that there are four primary colors (understood as simple colors in terms of which all other colors are to be explained), he contrasts it with the then dominant view that white and black are the two primary colors:

But first of all, his increase of the number of primaries presents a difficulty; for the other investigators propose white and black as the only simple colours. (Theophrastus, *De Sensibus* LVIX; Stratton 1917, 137)

It is reasonable to suppose that Aristotle’s account of the generation of the hues draws on this pre-Democritean tradition. Before discussing Aristotle’s account

of the generation of the hues, then, I will review some empirical support for its central idea, and will discuss the precedent for this doctrine in Parmenides and Empedocles.

5.2 Empirical Support

In 1894, an English toy maker, Charles Benham, devised a top adorned with a black and white pattern (see Figure 5.1). Sold through Messrs. Newton and Co., an announcement of the “Artificial Spectrum Top” was published in *Nature*:

The top consists of a disc, one half of which is black, while the other half has twelve arcs of concentric circles drawn upon it. Each arc subtends an angle of forty-five degrees. In the first quadrant there are three such concentric arcs, in the next three more, and so on; the only difference being that the arcs are parts of circles of which the radii increase in arithmetical progression. Each quadrant thus contains a group of arcs differing in length from those of the other quadrants. The curious point is that when this disc is revolved, the impression of concentric circles of different colors is produced upon the retina. If the direction of rotation is reversed, the order of these tints is also reversed. (Anon., 1894)

Specifically, if rotated clockwise, the innermost arcs form reddish rings, the next greenish rings, the next light blue rings, and the outermost arcs form violet rings. If rotated counterclockwise, the pattern is reversed with the innermost arcs now forming violet rings and the outermost reddish rings. The apparent colors of Benham’s spinning disk are the “subjective colors” first described by (Fechner, 1838) and, hence, are also sometimes described as “Fechner-Benham colors”.

Consider a puzzling aspect of the subjective colors of the Benham disk. Each of the spinning arcs reflect light with the same spectral content and with equal average luminance. In advance of observing the spinning disk, one might reasonably expect the spinning arcs to appear as gray rings of equal brightness. Why, then, do the rings appear reddish, greenish, light blue, and violet? The subjective colors of the Benham disk are not completely understood (for a review of some of the color science see von Campenhausen and Schramme, 1995). However, this much is clear: The innermost ring appearing reddish is the result of the visual system integrating temporal inhomogeneities presented by the spinning disk. Presentations of black and white stimuli altering at a particular temporal ratio elicits a chromatic response in normal human perceivers.

This basic principle was used in a prototype of color television (Butterfield, 1968, 1970). Developed by James F. Butterfield (who studied philosophy at the

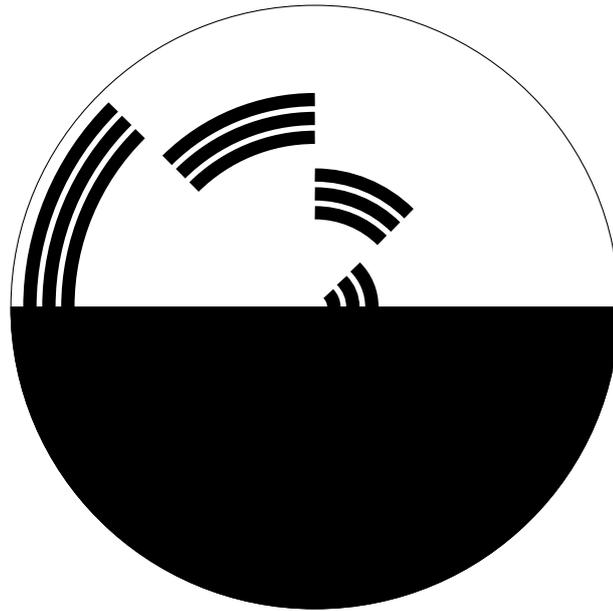


Figure 5.1: The Benham Disk or “Artificial Spectrum Top”

University of Chicago as an undergraduate), the broadcasting system consists of the Butterfield color encoder that produces a monochromatic signal that when broadcast and displayed on a black-and-white monitor presents a chromatic appearance. The Butterfield encoder extracts a monochromatic signal from the colored scene by passing the light from the scene through cyan, magenta, and yellow filters. The filters themselves are arranged in, what is in effect, a modified Benham Disk (see Figure 5.2). The bottom half of the filter is opaque with the colored filters fanned across the top half. The filters thus form a disk which is rotated. A colored object will appear black when seen through a filter of a complementary color. This and the opaque half of the rotating disk produces a pulsed black-and-white signal that elicits a chromatic response in normal human perceivers. The system produced good skin tones but unmixed hues, especially red, tended to flicker. The initial public demonstration was, by all accounts, startling:

When electronic color was first publicly demonstrated in the Los Angeles area over KNXT, no prior announcement had been made at the request of a soft-drink manufacturer sponsoring the test. The beverage firm wanted its color commercials to be a complete surprise to viewers of black-and-white receivers. And, the telecasts were that, to say the very least. Within hours of the electronic-color broadcast, thousands of viewers began asking the same question, “What happened? Did I

really see color on my black-and-white receiver? Or am I having hallucinations?" (Griffin, 1968)

The power to demand such attention did not go unnoticed. The final public demonstration was an Eva Perón political advertisement.

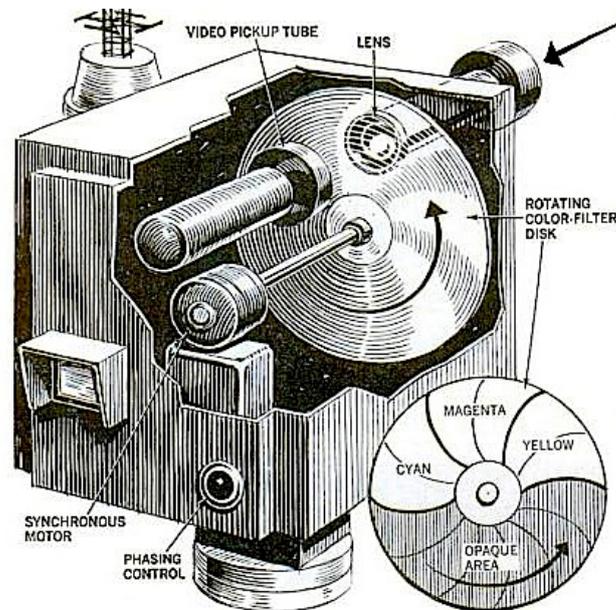


Figure 5.2: Butterfield color encoder (Shatavsky, 1968)

That the pulsed black-and-white signal produced by the Butterfield color encoder gives rise to a chromatic appearance is once again the result of the visual system integrating temporal inhomogeneities. However, these temporal inhomogeneities are not the result of spatial movement of the object of perception, but rather due to the qualitative alterations over time of a stationary object. Each involves the presentation of white and black stimuli altering at a particular temporal ratio eliciting a chromatic response in normal human perceivers. They differ in how that temporal ratio is implemented—by the motion of an object whose parts qualitatively differ or by the qualitative alteration over time of a stationary object.

Stated so abstractly it is easy to see that there is a third possibility. If the temporal ratio that determines a given chromatic appearance can be implemented by the motion of a black and white object, the perceivers motion relative to a black and white object should do so as well. And indeed it can. Our eyes constantly scan the scene with involuntary saccades. Scanning a stationary black and white object can give rise to chromatic appearance (Hardin, 1993, 72). Thus Sorabji claims that contemporary art provides an example:

I also wrote about colour and vision in the 1970s. At Cornell, I had heard Edward Land, the inventor of the polaroid camera, lecture on his discovery that Newton's theory of colour is wrong. The eye responds not to absolute wavelengths of light, but to the more complicated property of reflectance, which involves the proportions among wavelengths in the available scene. Land was able to cast on the screen at Cornell a slide showing all the colours of the garden, yet he was using wavelengths only from within the yellow waveband. I was intrigued that Goethe had also rejected Newton's theory of colour, and praised Aristotle for his theory that the other hues are produced by combinations of the brightest and the darkest. This, according to Goethe, is the theory that any painter would accept. We had a reproduction in our hallway of a painting by Bridget Riley consisting of wavy black and white stripes. Some of our guests saw brilliant colours in it. Others merely felt giddy. I wrote to ask Bridget Riley what she thought of Goethe and Aristotle, but this time I did not get an answer. (Sorabji 2005, 13; see also Sorabji 1972, 295)

The chromatic appearances that Riley's painting give rise to (see Figure 5.3) are the result of the visual system integrating temporal inhomogeneities that result from the eye involuntarily moving across a stationary black and white object.

These examples involve artifacts and technology unavailable at Aristotle's time. And while they may make plausible for *us* that ratios of white and black can, sometimes at least, give rise to chromatic appearances, they could not have done so for Aristotle. What empirical observation available to Aristotle could have made vivid for him the possibility that chromatic appearances are the result of the ratio of light and dark in the perceived scene? An example discussed in the last chapter could give rise to the relevant experience. The sun is white, but it appears red when seen through fog or a cloud of smoke (*De Sensu* III 440^a10–11). The white sun, when superimposed by black particles suspended in the intervening transparent medium, looks red. The reduction of the sun's brilliance by the intervening particulate matter of the smoke results in the sun's crimson appearance. In his *Theory of Colors*, Goethe repeats and elaborates Aristotle's example:

The highest degree of light, such as that of the sun, of phosphorus burning in oxygen, is dazzling and colourless; so the light of the fixed stars is for the most part colourless. This light, however, seen through a medium but very slightly thickened, appears to us yellow. If the density of the medium be increased, or if its volume become greater, we shall see the light gradually assume a yellow-red hue, which at last deepens to a ruby-colour. (von Goethe, 1810, I.10 150)

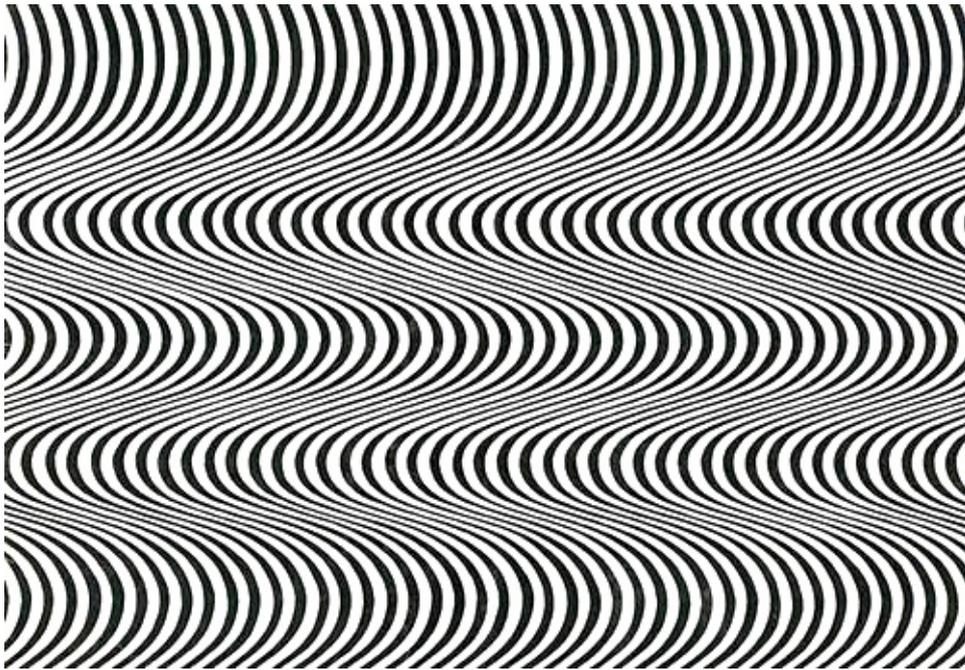


Figure 5.3: Bridget Riley, *Current*

The sun seen through a certain degree of vapour appears with a yellow disk; the centre is often dazzling yellow when the edges are already red. The orb seen through a thick yellow mist appears ruby-red (as was the case in 1794, even in the north); the same appearance is still more decided, owing to the state of the atmosphere, when the scirocco prevails in the southern climates: the clouds generally surrounding the sun in the latter case are of the same colour, which is reflected again on all objects.

The red hues of morning and evening are owing to the same cause. The sun is announced by a red light, in shining through a greater mass of vapours. The higher he rises, the yellower and brighter the light becomes. (von Goethe, 1810, I.10 154)

What is presently important is a general feature of Aristotle's example: that a reduction of an object's brilliance can result in a chromatic appearance. That provides direct partial support for the claim that a proportion of light and dark can give rise to a chromatic appearance.

5.3 Parmenides

Theophrastus (*De Sensibus* LVIX) alludes to a pre-Democritean tradition according to which white and black are the primary colors, the colors in terms of which all other colors are to be explained. While Theophrastus does not name any particular thinker belonging to this tradition, one may reasonably speculate. In his notorious study, among the five “signs of the immaturity” of the Homeric color scheme, Gladstone cites the following:

The vast predominance of the most crude and elemental forms of colour, black and white, over every other, and the decided tendency to treat other colours as simply intermediate modes between these two extremes. (Gladstone, 1858, 458)

One can reasonably accept Gladstone’s observation about the structure of the Homeric color scheme, while bracketing any conclusions about relative deficiencies in the Greek’s capacity to discriminate color or about their taste in color composition. Amusingly, Platnauer 1921, 162, while tempted by Gladstone’s diagnosis of color blindness among the ancient Greeks, accuses them instead of having bad taste in being insensitive to “the qualitative differences of decomposed and partially absorbed light”. If we bracket such judgments, then arguably the pre-Democritean tradition that Theophrastus alludes to has Homeric roots. Let us selectively examine this ancient tradition by attending to two key figures familiar to Aristotle, Parmenides and Empedocles (though the inclusion of the latter is controversial).

In the prologue to his poem, the goddess promises to reveal to Parmenides two things, the Way of Truth and the Way of Mortal Opinion. The doctrines of the latter she assures him are false; nevertheless, Parmenides must learn these too (DK 28B1.31). The Way of Mortal Opinion is an account of the world “as it appears” (DK 28B8.60; McKirahan 1994, 155), and the goddess presents it to Parmenides “so that no mortal opinion may ever overtake” him (DK 28B8.61; McKirahan 1994, 155). The Way of Mortal Opinion is a cosmology in the Milesian tradition, though Parmenides is not expounding the views of any particular Milesian cosmologist (on Parmenides and Milesian cosmology see Kahn, 1994). Rather, he is presenting what is, by his lights, the best account that can be given along those lines. Traditional Milesian cosmologies tend to be monistic, but the Way of Mortal Opinion posits two fundamental and irreducible principles that stand in opposition, Fire and Night or light and dark (DK 28B8.53–61, 28B9). The thought seems to be this. Having shown, in the Way of Truth, that monism is inconsistent with appearances, the Way of Mortal Opinion must posit a plurality of principles in opposition, if it is to accommodate the plurality and opposition encountered in the world as it appears in sensory experience. Or at least, this is the interpretation that Aristotle recommends:

... but being forced to follow the phenomena, and supposing that what is is one in formula but many according to perception, he now posits two causes and two principles, calling them hot and cold, *i.e.* fire and earth. (Aristotle, *Metaphysica* A 986^b31; Ross in Barnes 1984a, 12)

The two principles, Fire and Night, of the Way of Mortal Opinion, have attributes called “signs”:

For they made up their minds to name two forms,
Of which it is not right to name one—in this they have gone astray—
And they distinguished things opposite in body, and established signs
Apart from one another—for one, the aetherial fire of flame,
Mild, very light, the same as itself in every direction,
But not the same as the other; but that other one, in itself
Is opposite—dark night, a dense and heavy body.
I declare to you all the ordering as it appears,
So that no mortal opinion may ever overtake you.

But since all things have been named light and night
And the things which accord with their powers have been assigned to
these things and those,
All is full of light and obscuring night together,
of both equally, since neither has no share.
(Parmenides, DK 28B8.53–9.4; McKirahan 1994, 155)

Like Fire and Night themselves, the attributes of these principles stand in opposition. Fire is bright, Night is dark; Fire is rare, Night is dense, and so on. These attributes are sensible qualities arrayed in opposing contraries. Due to Parmenides’s use of ambiguity—the signs of Fire and Night have multiple senses—Mourelatos (2008, 244–245) argues that the system of sensible contraries is complex and one many. In contrast, the attributes of the one being of the Way of Truth are not sensible (*aistheton*) qualities arrayed in a system of contraries but intelligible (*noeton*) properties (such as limit or unity). Fire and Night may have further attributes not listed here; much of the Way of Mortal Opinion is missing. A sense of its scope and ambition, however, is provided by Plutarch:

But Parmenides ... has actually made a cosmic order, and by blending as elements the light and the dark produces out of them and by their operation the whole world of sense. Thus he has much to say about earth, heaven, sun, moon, and stars, and has recounted the genesis of man; and for an ancient natural philosopher—who has put together a book of his own, and is not pulling apart the book of another—he has

left nothing of real importance unsaid. (Plutarch, *Adversus Colotem* 1114 b–c; Einarson and De Lacy 1967, 231)

Arguably, the cosmology of Fire and Night posited by the Way of Mortal Opinion is prefigured in the prologue of the poem. On his journey to meet the goddess, Parmenides, escorted by the daughters of the Sun, travels from Night to Day:

... the daughters of the Sun
Were hastening to escort <me> after leaving the house of Night
For the light, having pushed back the veils from their heads with their
hands.

(Parmenides, DK 28B1.8–10; McKirahan 1994, 151)

But before they can meet the goddess they must pass through the gates of the roads of Night and Day:

There are the gates of the roads of Night and Day,
And a lintel and a stone threshold contains them.
High in the sky they are filled by huge doors
Of which avenging Justice holds the keys that fit them.

(Parmenides, DK 28B1.11–13; McKirahan 1994, 151)

Why must Parmenides first pass through these gates before gaining an audience with the unnamed goddess? The significance of the gates can be brought out by considering the identity of Justice who holds their keys. According to the Way of Mortal Opinion, at the center of the cosmos is a goddess “that governs all” (DK 28B12) Aëtius reports that this goddess is none other than Justice from the prologue:

The middlemost of the mixed rings is the [primary cause] of movement and of coming into being for them all, and he calls it the goddess that steers all, the holder of the keys, Justice and Necessity. (Aëtius, DK 28A37; McKirahan 1994, 151)

While the intelligible world of the Way of Truth pertains to being, the sensible world of the Way of Mortal Opinion pertains to becoming. Justice governs all change in the sensible world by governing alternations in the mixture of Fire and Night. Parmenides in passing through the gates of the roads of Night and Day leaves the sensible world governed by alternations of Fire and Night, to the intelligible world where a goddess awaits to reveal to him the one being of the Way of Truth. Parmenides travels from the sensible world to the intelligible world, from the world of becoming to the world of being.

If, according to the Way of Mortal Opinion, the “the whole world of sense”—in which appear “earth, heaven, sun, moon, and stars”—is ultimately explained in

terms of light and dark in opposition, then the qualities of material objects that appear in sensory experience are themselves to be explained in these terms. Since colors are qualities of material objects that appear in sensory experience, they are themselves to be explained in terms of the “blending” of light and dark. Whether or not Theophrastus had Parmenides in mind, Parmenides straightforwardly belongs to the pre-Democritean tradition that postulates white and black or light and dark as the primary colors.

5.4 Empedocles

It is arguable that Theophrastus did in fact have Empedocles in mind when alluding to this pre-Democritean tradition. Despite extensive discussion of Empedocles’ views about sensory experience and its objects, Theophrastus does not make the parallel charge against Empedocles that he makes against Democritus (*De Sensibus* LVIX; DK 68A135; Stratton 1917). Moreover, as we have seen, Theophrastus complains that while Empedocles has explained the perception of white and black he has failed to explain the perception of the other hues (*De Sensibus* XVII; Stratton 1917). This is strong defeasible evidence that Theophrastus took Empedocles to be among the thinkers who take white and black or light and dark as the primary colors (albeit with limited success, at least by Theophrastus’ lights).

In contrast with Parmenidean monism, Empedocles postulates the existence of four “roots” or elements—water, earth, air, and fire—and two principles—Love and Strife. Whereas Love, the principle of harmony, has the power to unite, Strife, the principle of disorder, has the power to divide. According to Empedocles, things are colored because of the combination of elements that result from Love overcoming Strife to the extent that it does:

And if, concerning these things, your conviction is in any way wanting,
as to how from the blending of water and earth and aither and sun
the forms and colours of mortals came to be,
which have now come to be, fitted together by Aphrodite. (Empedocles, DK 31B71; Inwood 2001, 74 249)

The forms and colors of objects we encounter in sensory experience are to be explained in terms of the combination of the elements that result from Love’s influence counteracting the operation of Strife.

Wright (1981, 222) suggests that the reference to form and color is a deliberate echo of an earlier fragment:

As when painters adorn votive offerings,
men well-learned in their craft because of cunning,

and so when they take in their hands many-coloured pigments,
 mixing them in harmony, some more, others less,
 from them they prepare forms resembling all things, making trees and
 men and women
 and beasts and birds and water-nourished fish
 and long-lived gods, first in their prerogatives.
 In this way let not deception overcome your thought organ
 that the source of mortal things, as many as have become obvious—
 countless—is anything else,
 but know these things clearly, having heard the story from a god.
 (Empedocles, DK 31B23; Inwood 2001, 27 231)

However, the two fragments seem to be making different points. Empedocles in this earlier fragment describes the generation of the objects we encounter in the sensible world by analogy with painting. Just as painters can represent everything in the sensible world by combining pigments in various proportions, Love and Strife can generate everything in the sensible world by combining the elements in various proportions. However, unlike the later fragment (DK 31B71) no specific mention is made about the colors of the generated objects or how they are the result of the combination of elements. Whereas the earlier fragment (DK 31B23) claims that a combination of a few colors suffice to represent the forms and colors encountered in the sensible world, the latter fragment (DK 31B71) claims that a combination a few elements suffice for the forms and colors encountered in the sensible world.

The painting analogy remains instructive, however. Specifically, it sheds light on the sense in which the combination of a few colors suffice to represent all the colors that appear in sensory experience. This is important since in the context of Empedocles' analogy, this is the sense in which the elements combine. And given the latter fragment (DK 31B71), the elements when combined in this sense suffice for the form and color of all things. First, observe that, despite their manifest plurality, the “roots” or elements are otherwise Parmenidean beings—they do not admit of alteration, growth, or decay. Change as we experience it is the result of different combinations of these unchanging elements:

I shall tell you something else. There is no growth of any or all mortal
 things
 nor any end in destructive death,
 but only mixture and interchange of what is mixed
 exist, and growth is the name given to them by men.
 (Empedocles, DK 31B8; Inwood 2001, 21 221)

So for the analogy to hold, the painter's combination cannot be understood as a blending or mixture (on the model of mixing oil paint on a palette, or dissolving

sugar in water). If when the elements combine they do so in a mixture, then the elements would no longer be distinguishable in the compound. But this is inconsistent with their status as Parmenidean beings. So a negative lesson, then, is that the combination as it figures in the analogy cannot coherently be understood as blending or mixture.

If combination, here, cannot coherently be understood as mixture, how, then, is it to be understood? Recent commentators have made the important suggestion that combination as it figures in the analogy should be understood in terms of the actual practices of fifth century BC painting (Wright, 1981; Mourelatos, 1987; Ierodiakonou, 2005). However, this yields two distinct models, and as a consequence, I am less certain about the positive lessons that the analogy affords us.

Consider what is arguably the most important development of fifth century BC painting, the development of *chiaroscuro* or *skiagraphia* (see Bruno, 1977; Keuls, 1975; Pemberton, 1976). In archaic Greek painting, figures appear outlined and uniformly colored in a two-dimensional pictorial plane. Moreover, the color of the figures tended to complement and support the overall two-dimensional composition. However, in the fifth century BC, the “shadow painters” came to emphasize, instead, lightness and darkness in organizing their compositions. There was less reliance on outlining, figures were no longer uniformly colored as primitive methods of shading were developed, and as a result, the figures began to emerge from the two-dimensional pictorial plane. To emphasize the importance of relative brightness in their composition, the shadow painters worked with a limited palette. Nevertheless, they were able to produce the appearance of a variety of colors by combining the colors of this limited palette. Importantly, there were two techniques for combining the few colors, corresponding to different periods in the development of *skiagraphia*.

In *De Gloria Atheniensium*, Plutarch attributes the invention of fifth century BC *chiaroscuro* to Apollodorus. In seeming contradiction to Plutarch’s testimony, Quintilian claims that a student of Apollodorus, Zeuxis, invented the law of light and shadow. Bruno (1977, 27–29) reconciles these apparently conflicting claims by arguing that they are in fact describing distinct dramatic episodes or turning points in the development of fifth century BC *chiaroscuro*:

The Apollodorian accomplishment and that artist’s importance in the art-historical record as it has come down to us from ancient times can only be explained if he was somehow able to synthesize earlier, less successful attempts, so that a systematic relationship between *chiaroscuro* and color was established in some consistent manner. Such an accomplishment and nothing less (when we consider the rather late fifth-century dates we must assume for the career of this artist) might have struck the imagination of the ancient viewer as anything so dramatic

as an “invention”. Then Zeuxis, who “walked through the doors” that his teacher, Apollodorus, had opened, must have been able to develop more sophisticated variations of the earlier methods. In his own mature work, he must have departed in some striking manner from the system of shading that had characterized his master’s pictures; the likelihood is that Zeuxis invented a kind of chiaroscuro in which the relationship of color to dark and light was definitely altered, in which shading assumed a more dominant role and the nuances of coloring and brushwork became more and more complex, perhaps more “painterly”. (Bruno, 1977, 29)

What is presently relevant is that different methods of color combination are associated with these distinct dramatic episodes in the development of fifth century BC chiaroscuro. (For criticism of Bruno see Gage 1993; none of Gage’s criticisms, however, are relevant to our present purposes.)

In *De Gloria Atheniensium*, not only does Plutarch attribute the invention of *skiagraphia* to Apollodorus, but also the invention of a method of color combination. Specifically, working with a limited palette, Apollodorus would produce novel colors by overlaying washes of different colors. A four-color palette was common in the fifth century BC and Pliny reports that it reached its finest expression in fourth century BC painting:

Four colours only—white from Melos, Attic yellow, red from Sinope on the Black Sea, and the black called “atramentum”—were used by Apelles, Aetion, Melanthios and Nikomachos in their immortal works. (Pliny, *Historia Naturalis* 35 50; Jex-Blake et al. 1896, 97)

The Alexander mosaic depicting the Battle of Issus is a Roman work from the first century BC that is a copy of a Greek four-color painting. Pliny (*Historia Naturalis* 35 110; Jex-Blake et al. 1896, 143) attributes the original four-color painting to Philoxenos of Eretria “who painted for king Kassander the battle between Alexander and Dareios, a picture second to none.” The Alexander mosaic gives us a sense of the naturalistic skin tones that could be achieved with four-color painting (see figure 5.4). However, being a mosaic, it is in this respect misleading—the fundamental method of color combination in mosaics is the juxtaposition of differently colored tiles as opposed to the overlaying of differently colored washes (though of course these methods can be combined). Sellers suggests that for a better sense of what can be accomplished with only four colors we need only consider Titian’s “Christ crowned with thorns” in the Louvre (see figure 5.5; Jex-Blake et al. 1896, 97 note; for a revealing if idiosyncratic account of the Greek four-color palette and Venetian painting see Pavey 1956). So one way of combining colors is by overlaying differently colored washes, that is, by overlap.



Figure 5.4: Detail of the Alexander Mosaic, 1st century BC



Figure 5.5: Titian, "Christ Crowned with Thorns", 1570

We have seen Bruno (1977, 29) claim that in the sophisticated chiaroscuro inaugurated by Zeuxis “shading assumed a more dominant role and the nuances of coloring and brushwork became more and more complex, perhaps more ‘painterly.’” A sense of this more “painterly” style can be seen, according to Bruno, in the figure of Rhadmanthys painted on the facade of the tomb of Lefkadia (see figure 5.6):

A dark is not just an area of darker pink or brown flesh tones; it has blues and greens running through it and a complex system of overlapping tones in which every individual stroke is a slightly different color. Color accidents, produced by quick, overlapping brushstrokes, abound throughout the work and are accidents upon which the artist relied. (Bruno, 1977, 25)

In the late development of fifth century BC chiaroscuro, as light and dark come to further dominate the compositional scheme, the relationship between form and color became complicated. Whereas earlier forms of chiaroscuro would use one color for shaded parts of a figure, later forms would use a variety of colors, their choice controlled more by relative brightness than hue. The effect of this more complicated scheme may without too much risk of anachronism be described as proto-impressionistic. However, *pace* Keuls (1975), I do not think that the literary and archeological evidence supports the attribution of nineteenth century “divisionist” technique to fifth century BC painters (see Pemberton, 1976). However, there need be no ancient predecessor of Suerat in fifth century BC painting for there to be a method of color combination that involved not the overlap but the juxtaposition of color.

We have seen that combination in Empedocles’ painting analogy cannot be understood in terms of mixture. If the sense in which painters combine colors in various proportions to represent the forms of all things is analogous to the sense in which the opposing forces of Love and Strife combine the elements in various proportions, then the metaphysical status of the elements rules out understanding the combination as mixture, since the elements would be indistinguishable in the compound. Fifth century BC painting, however, provides us with two further models. Perhaps the combination could be understood, not in terms of mixture, but in terms of overlap or juxtaposition.

In *De Generatione et Corruptione*, Aristotle claims that the Empedoclean elements combine by means of juxtaposition and compares the compound to a brick structure:

For how is the manner of their coming-to-be to be conceived by those who maintain a theory like Empedocles? They must conceive it as *composition*—just as a wall comes-to-be out of bricks and stones: and the ‘Mixture’, of which they speak, will be composed out of the ‘elements’,

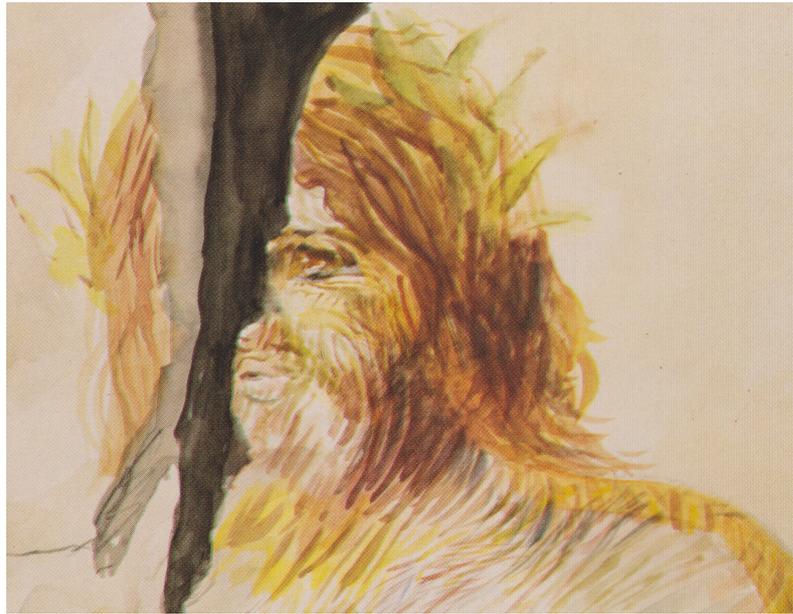


Figure 5.6: Victor Bruno’s watercolor sketch of Rhadamanthys at the tomb of Lefkadia

these being preserved in it unaltered but with their small particles juxtaposed. (Aristotle, *De Generatione et Corruptione*, II 7 334^a26–30)

The Aristotelian interpretation is supported by Galen’s testimony:

For Empedocles says that we, and all the other earthly bodies, are generated from the same elements assumed by Hippocrates, and these elements are not combined with each other, but, as small pieces, stand next to each other, touching. (Galen, *Hippocratis De Naturis Homina Commentaria* XV 49; DK 31A43)

And Galen compares the combination of Empedoclean elements to a powder consisting of finely ground metals (*Hippocratis De Naturis Homina Commentaria* 15 32; DK 31A34). Further support for the Aristotelian interpretation comes from an Empedoclean metaphor. Thus he speaks of Love’s influence in combining the elements as “the divine glues of harmony” (DK 31B96; Inwood 2001, 62 245). The metaphor of gluing suggests that the elements “are not combined with each other, but, as small pieces, stand next to each other, touching”.

If we accept the Aristotelian interpretation, then the combination of the elements should be understood on the model of juxtaposition. So, for the analogy to hold, the painter’s method of combining colors must itself be understood on the model of juxtaposition, a method arguably associated with the late chiaroscuro

inaugurated by Zeuxis and whose influence can be seen in the tomb of Lefkadia. However, Zeuxis' achievement is too late—it arguably post-dates the composition of Empedocles poem(s). Wright (1981, 38–39), following Guthrie (1965, 148), associates the painter's combining of colors with Apollodorus and Greek four-color painting. Wright proposes to understand the painter's combining the colors in various proportions with the technique of color combination associated with Greek four-color painting, but that technique works by overlap, not juxtaposition. It is this mismatch that makes me uncertain what positive lessons Empedocles' analogy can provide us about the painter's method of combining colors. It is possible that Aristotle and Galen are right that the Empedoclean combination of elements should be understood on the model of juxtaposition *and* that Guthrie and Wright have correctly interpreted the painter's combination of colors in terms of overlaying washes of different colors. In which case, the analogy, considered by itself, could serve only to establish the original negative lesson. The combination of the elements is like the combination of the colors in that neither should be understood in terms of blending or mixture. Rather, as it turns out, they work on the models of juxtaposition and overlap, respectively.

How does the combination of elements in various proportions result in the colors of things as they appear in sensory experience? According to Aëtius, four colors—white, black, red, and yellow (the Greek four-color palette)—are assigned to the elements, though Aëtius does not say which color belongs with which element. Partly on this basis some commentators attribute to Empedocles the view that the four elements have four unique colors (Cherniss 1935, 217, Siegel 1959, 152–3). This would be the basis of the desired explanation if the colors of compound bodies were explained in terms of the colors of their constituent elements. Notice that, on such an explanation, white, black, red, and yellow would be the primary colors—the view that Theophrastus criticizes Democritus for holding (modulo the substitution of yellow for green). However, the fragments as they come down to us provide no direct support for this interpretation (see Ierodiakonou, 2005). While Empedocles claims that fire is white and water is black, no specific colors are associated with the other elements.

I believe that it is more likely that Empedocles is following Parmenides in taking white and black or light and dark as the primary colors. As we will see, this interpretation coheres well with Theophrastus' account of Empedocles' theory of color vision. To illustrate this alternative, let us consider three fragments where Empedocles' associates white with fire and black with water.

Aristotle (*De Anima* 15 410^a1) cites the following Empedoclean fragment to illustrate the way in which compound bodies do not merely consist in their constituent elements, but must be combined in a certain proportion:

And pleasant earth in her well-built channels

received two parts of gleaming Nestis out of the eight
and four of Hephaistos; and they become white bones
fitted together with the divine glues of harmony.
(Empedocles, DK 31B96; Inwood 2001, 62 245)

Nestis is a Sicilian water-goddess, and Hephaistos is associated with fire. Thus, according to the fragment, bone is the result of Love's combining four parts fire with two parts earth and two parts water. Though some commentators take Nestis to refer to water and air, perhaps under the influence of the general conviction that all four elements are present in every compound body (Wright, 1981, 209 n2). On this alternative interpretation, the proportion of elements in bone is four parts fire, two parts earth, one part water, and one part air. On either interpretation, Empedocles seems to be explaining the whiteness of bones in terms of the preponderance of fire in their constituent elements. If we combine this thought with the answer in the style of Gorgias presented in the *Meno*, then the idea would be that bone, due to the preponderance of fire in its composition, gives off a fiery effluence. This fiery effluence, due to its distinctive magnitude, enters the fire passages in the membrane of the eye and so is made palpable to sight. In this way the whiteness of the bone is manifest in sensory experience.

That the color of fire is white is further confirmed by a fragment according to which the sun is white or bright while rain is black or dark:

But come! Gaze on this witness to my previous words,
if anything was in my previous [remarks] left wanting in form:
the sun, bright to look on and hot in every respect,
and the immortals which are drenched in heat and shining light,
and rain, in all things dark and cold;
and there flow from the earth things dense and solid.
(Empedocles, DK 31B21 1-6; Inwood 2001, 26 1-6, 229)

Not only then is fire, in the guise of the sun, light, but the fragment associates another element with a specific color: The water which composes the rain is dark.

That fire and water are the elemental equivalents of light and dark is further confirmed by a fragment cited by Plutarch:

And in the depths of the river a black colour is produced by the shadow,
and in the same way it is observed in cavernous grottoes.
(Empedocles, DK 31B94; Inwood 2001, 105 261)

The fragment only explicitly claims that the depths of the river is black, but Plutarch cites the fragment in answer to the question "Why does the surface of the water look white and the depths look black?":

Is it because the depth is the mother of blackness inasmuch as it blunts and weakens the sun's rays before they can get to it? But since the surface is immediately affected by the sun, it is reasonable that it receives the gleam of light. (Plutarch, *Historia Naturalis* 39; Inwood 2001, CTXT-87 137–138)

If we accept Plutarch's attribution of this explanation to Empedocles, this supports the elemental equivalence of fire and water with light and dark. It also strikingly prefigures the central thought of Aristotle's account of the generation of the hues. Water is by nature black. However, the color that water appears to have can change depending on whether and to what degree it is illuminated. The surface of water looks white, at least in the shifting pattern of reflective highlights. The water near to the surface, where it is not as brightly illuminated, looks blue. And the depths of the river, where the sun's rays fail to penetrate, looks black. (Compare Aristotle's claim that the sea is an imperfectly transparent medium that appears differently near or far *De Sensu* III 439^b1–3 and his claim that water looks darker the deeper and less transparent it is *De Generatione Animalium* v 779^b27–33, 780^b8.) The different colors—white, blue, and black—are due to different proportions of fire and water. In the shifting pattern of reflective highlights, there is a preponderance of fire and this results in a brilliant appearance; whereas, in the depth of the river, there is a preponderance of water (and perhaps no fire at all) and this results in a dark appearance. In the shallows of the river, due to a more equitable combination of fire and water, a blue appearance is manifest.

Accepting Plutarch's attribution, and generalizing it, thus results in the following picture: White and black, like hot and cold, are sensible qualities paired with their contrary. And like hot and cold, white and black are the endpoints of an ordered range of sensible qualities. That the range is ordered as a continuum is a further claim. Aristotle, for one, denies it (*De Sensu* VI). Blue is a sensible quality located somewhere between the extremes of white and black as is every other color. Blue is perhaps more dark than light just as yellow is more light than dark. In this regard, Empedocles' theory shares a feature with the Homeric color scheme of which Gladstone (1858, 458) complained, namely, "the decided tendency to treat other colours as simply intermediate modes between these two extremes", that is, "the crude and elemental forms of colour, black and white". Moreover, the relevant proportion of light and dark is determined by the substance's elemental composition. The proportion of light and dark that results in the blue of the river's shallows is determined by the proportion of fire and water in its composition. Specifically, the fiery emission of the sun penetrates to some degree the shallows of the river, and it is the resulting proportion of fire and water that determines the proportion of light and dark of which the shallows partake.

This constitutes a means for addressing one of Theophrastus' complaints. Theo-

phrastus concedes that on Empedocles' account, the perception of white and black is relatively straightforward. In the membrane of the eye there are alternating passages of fire and water. White effluences emitted from distal objects are assimilated by fire passages, black effluences are assimilated by water passages, and so each is made palpable to the organ of sight. But how, on this model, is the perception of the chromatic hues to be explained? Theophrastus complains that Empedocles owes us an explanation but has failed to provide one:

Now since, for him, the eye is composed of fire and of its opposite, it might well recognize white and black by means of what is like them; but how could it become conscious of gray and the other compound colours? For he assigns <their perception> neither to the minute passages of fire nor to those of water nor to others composed of both these elements together. Yet we see the compound colours no whit less than we do the simple. (Theophrastus, *De Sensibus* xvii; Stratton 1917, 81)

The elemental composition of a distal object, specifically, its proportion of fire and water, determines the amount of fiery and watery effluences it emits. Fiery effluences are white. Watery effluences are black. A purely white object, such as a noon sun on a clear summer's day, emits only fiery effluences. A purely black object, such as the river's depths, emits only watery effluences. Objects with chromatic hues emit a proportion of fiery and watery effluences corresponding the proportion of fire and water in its elemental composition. Thus the river's shallows emits a proportion of fiery and watery effluences (the fiery effluences being the sun's contribution in penetrating the river). These fiery and watery effluences are assimilated, respectively, by the fire and water passages in the membrane of the eye. And, arguably at least, it is the proportion of fire and water assimilated that gives rise to the perception of blue.

Theophrastus complained that Empedocles assigns the perception of compound colors "neither to the minute passages of fire nor to those of water nor to others composed of both these elements together." It is true that the perception of blue is not assigned to the fire passages in the eye's membrane, nor to its water passages. Whether it is explained in terms of "others composed of both these elements" depends on what exactly Theophrastus means here. Perhaps he means that just as there are fire and water passages in the membrane of the eye, there are other passages, as well, that are commensurate with effluences compounded out of fire and water. So understood, Theophrastus is right not attribute this doctrine to Empedocles. However, there is another alternative. The passages in the membrane of the eye consist solely of alternating fire and water passages. There are no other kinds of passages to be found. A chromatic hue is just the proportion of fiery and watery effluence emitted by a distal object, and its perception is the resulting proportion of assimilated fire and water being made palpable to the organ of sight.

Like all things on earth and in heaven, at least in a certain stage of the cosmic cycle, the chromatic hues and their perception are the result of Aphrodite's Love, the principle of harmony, counteracting the operation of Strife.

Chapter 6

The Generation of the Hues

6.1 Aristotle's Three Models

That white and black, or, better yet, light and dark, are the primary colors, the colors in terms of which all other colors can be explained, is an ancient doctrine arguably of Homeric roots. As presented by Parmenides, in the *Way of Mortal Opinion*, Fire and Night are cosmic principles standing in opposition whose attributes consists of sensible qualities arrayed in pairs of contraries. Brightness and darkness as they appear in sensory experience are one such pair of attributes. Brightness is an attribute of Fire just as darkness is an attribute of Night, and the opposition of these cosmic principles is partly manifest in this pair of sensible qualities being contraries. Empedocles shares Parmenides' conception of light and dark as contrary sensible qualities. According to Parmenides, brightness is an attribute of Fire. It has others. Fire must then be independent of brightness, in some appropriate sense. In seeing the sun burning bright, what one sees is a manifestation of the operation of the cosmic principle of Fire. It is the activity of the fiery principle that explains the brightness of distal objects. Empedocles also takes over from Parmenides this explanatory priority. White or light is explained in terms of the element of fire composing the effluences emitted from distal objects themselves composed of a preponderance of fire. In contrast, black or dark is explained in terms of the element of water composing the effluences emitted from distal objects themselves composed of a preponderance of water.

Empedocles, however, makes two important contributions (at least on my partial and selective account of this ancient tradition). First, not only are the sensible qualities, light and dark, conceived as contraries, but, like hot and cold, as endpoints of an ordered range of sensible qualities. The chromatic hues are the sensible qualities intermediate between the extremes of light and dark. Second, on Parmenides' account, the chromatic hues that objects appear to have, as well as

“the whole world of sense”, are the result of “blending” Fire and Night (Plutarch, *Adversus Colotem* IIIA^{b-c}). However, the Way of Mortal Opinion, at least in the fragmentary state in which it has come down to us, does not elaborate how the blending of Fire and Night results in the appearance of chromatic hues in our sensory experience. Empedocles second contribution is that it is the *proportion* or *ratio* of Fire and Night, or in terms of his own cosmology, the “roots” or elements fire and water, that gives rise to the appearance of chromatic hues in our sensory experience of the natural environment. It is plausible that neither contribution is original to Empedocles. Thus, for example, Gladstone (1858) discerns the former in the Homeric color scheme. Moreover, the emphasis on the proportion or ratio of Fire and Night is arguably implicit in the Parmenidean fragments: Justice governs the sensible world presumably by governing the changing proportions of Fire and Night in the cosmic mixture.

Much of Empedocles work is an attempt to reconcile putative Parmenidean insights with the way things appear in our sensory experience. Empedocles accepts the central lesson of the Way of Mortal Opinion that one must posit a plurality of principles in opposition if one is to accommodate the plurality and opposition encountered in sensory experience and so abandon’s Parminedes’ monism (though his “roots” or elements are in effect Parmenidean beings despite their plurality since they are insusceptible to alteration, growth, or decay). Aristotle too wishes to save the phenomena while preserving the insights of his predecessors, Parmenides and Empedocles prominent among them. Indeed he is the great defender of the manifest image in the classical world. Moreover, Aristotle takes over from Empedocles the general idea that the chromatic hues result from the proportion or ratio of light and dark. Aristotle provides an extended discussion of how these ratios might be implemented. First, he offers three accounts, in terms of (1) juxtaposition, (2) overlap, and (3) mixture, opting for the third. Second, he provides an account of what the chromatic proportions or ratios are, and makes some important related claims about the ordering of sensible qualities between the extremes of light and dark.

6.1.1 Juxtaposition

Aristotle presents the first account as follows:

We must now treat of the other colours, reviewing the several ways in which they can come about. It is conceivable that the white and the black should be juxtaposed in quantities so minute that either separately would be invisible, though the joint product would be visible; and that they should thus have the other colours for resultants. Their product could, at all events, appear neither white nor black; and, as it must have some colour, and can have neither of these, this colour must be

of a mixed character—in fact, a species of colour different from either. Such, then, is a possible way of conceiving the existence of a plurality of colours besides the white and black; (Aristotle, *De Sensu* III 439^b18–28; Beare in Barnes 1984b, 8)

Aristotle asks us to imagine a visible compound composed of white and black parts, themselves too small to be visible. Since the compound is visible it must have some color. Since the white and black parts are too small to be visible, the color of the compound could not be either of these. So the compound must have some other kind of color. And it is the proportion of white and black components that determines the given chromatic hue. The remainder of the passage develops this suggestion.

Familiarity with pointillism and color halftone printing can obscure for us the real achievement in Aristotle's entertaining the possibility that the color of a compound can differ from the color of its parts. Pointillist paintings and color halftone prints have minute parts that differ in color from the painting or print as a whole at least when viewed from a suitable distance. Michel Eugène Chevreul, a French chemist appointed by Louis xvii as the director of the dye department of Manufacture Royale des Gobelins, upon receiving complaints that the black dyes they produced looked different when used alongside blue dye, investigated the matter and discovered the phenomena of simultaneous color contrast—that the appearance of a color can vary as the color of the surrounding scene varies. Chevreul (1855) reported his findings in his book, *The Principles of Harmony and Contrast of Colours and Their Application to the Arts*, a book that influenced the work of the French painter Georges-Pierre Seurat. Fascinated by the appearance of a color being influenced by adjacent colors, Seurat eventually paints the pointillist masterpiece, “Un dimanche après-midi à l'Île de la Grande Jatte” in 1884–6 (see figure 6.1). Using only primary unblended pigments, including the newly available zinc yellow, these were distributed in small dots across the surface of the canvas giving rise to the appearance, at an appropriate distance, of a differently colored scene of Parisian suburbanites relaxing by the river Seine. The analogy is imperfect, however, in that the minute parts of the painting and print are merely too small to be seen from a suitable distance, whereas the white and black parts of Aristotle's compound are too small to be seen at any distance.

Notice that on the proposed account color is not dissective in something like Goodman's (1951, 53) sense of the term. A property *p* is *dissective* just in case if *p* is instantiated by a whole, *p* is instantiated by each of its parts. (Dissectivity is a broader notion than being homoeomerous since the latter is restricted to substance kinds, *De Generatione et Corruptione* I 10 328^a6ff.) So if color were dissective, then the color of the whole would be the color of its parts. The color of a whole may be a function of the color of its parts, a point on which Aristotle and Goodman agree,



Figure 6.1: Georges-Pierre Seurat, “Un dimanche après-midi à l’Île de la Grande Jatte”

but that does not mean that the function will determine color to be dissective:

Different perceptible parts of any object may be differently colored even if the object itself is uniform and unvarying in color. This is no more paradoxical than the fact that a single object contains spatiotemporally different parts. As the self-identical object is a function of its parts, so the single unchanging color of the object is a function of the colors of its parts. The nature and interrelation of the lesser elements that make up the whole determine what kind of thing the whole is: the kind and arrangement of the colors exhibited by these various parts determine what color the whole is said to have. (Goodman, 1951, 130)

On the present account, we can see the blue of the sea even though we fail to see its white and black parts since they are too small to be seen. A consequence of the juxtaposition model is that it is possible to see the color of a whole without seeing the distinct colors of the parts that compose it. That thought, however, is only intelligible set against a background conception of perception as providing a *partial* perspective on the natural environment. The partiality of perception has recently been defended by Hilbert (1987), but it has ancient roots as well—arguably, Heraclitus is an advocate (see Burnyeat, 1979; Calderon, 2007). Not only is perception partial in the sense that there are properties of an object not perceptually available (objects may have unobservable aspects), not only is perception partial in the sense that some sensible qualities of an object may be occluded from view (the backs of objects are colored as well), but perception is also partial in the sense there are sensible qualities of an object that are not determined by a given perception. If one can see the color of a whole while failing to see the distinct colors of its parts, then one can see some if not all of an object's chromatic features. One sees the blue of the sea but not that it is partly white and partly black. This is only possible if perception is partial in something like the sense described above.

I am uncertain whether Aristotle genuinely subscribes to some version of this doctrine. While it is a commitment of the juxtaposition model, this is a model that he rejects. However, while a commitment of the juxtaposition model, the partiality of perception is not itself committed to that model. Doubts about the juxtaposition model need not undermine the partiality of perception. Earlier we registered a disanalogy between the juxtaposition model, on the one hand, and pointillism and color halftone printing, on the other. While the latter involves parts too small to be seen from a certain distance, the former involves parts too small to be seen at any distance. The partiality of perception is manifest in viewing the color of a pointillist painting—one sees the color of the whole without seeing the colors of its parts. Moreover, this is consistent with the Aristotelian denial of invisible magnitudes. So even if there are no parts too small to be seen from any distance, this would not, by itself, cast doubt on the partiality of perception. If

Aristotle does indeed retain some, perhaps attenuated, version of this doctrine, this would go some way towards explaining his sanguine attitude towards putative cases of conflicting appearances (on how the partiality of perception can help dissipate some appearances of conflict see Kalderon, 2007).

Aristotle rejects the juxtaposition model partly on the grounds that it posits colored objects too small to be seen (*De Sensu* III 440^a21–25). Such parts would have magnitude and yet would be invisible. But, according to Aristotle, there are no invisible magnitudes. Every magnitude is visible from some distance. And while the color of some wholes dissolve upon closer inspection, such as Seurat's masterpiece (figure 6.1) or the color halftone printing of the Marvel Comics of my childhood (figure 6.2), not all do. There are some surfaces that retain their color no matter how closely we look (compare *De Sensu* III 440^b16–18 discussed further in the next section 6.1.2). So the juxtaposition model is implausibly revised to claim instead that the colors of compounds are determined by the juxtaposition of minute white and black parts that are normally not visible. It is open to ready empirical disconfirmation when we fail to discover these black and white parts despite our best efforts.



Figure 6.2: Detail of Wolverine from *X-Men*, 1963

In his initial presentation of the juxtaposition model, Aristotle considers a case involving the spatial juxtaposition of white and black parts. He also considers a variant of this model, where the white and black things are not spatially juxta-

posed but are instead temporally juxtaposed. Set in the context of the theory of effluences, the idea is that the temporal juxtaposition of the white and black effluences assimilated by the organ of sight gives rise to a chromatic appearance. Just as spatial inhomogeneities of the compound body composed of white and black parts determines a proportion or ratio of light and dark characteristic of say, blue, it is the temporal inhomogeneities of the assimilated effluences—now white, now black—that determines a proportion of light and dark characteristic of blue. In this regard, the temporal variation of the juxtaposition model is analogous to the way in which Benham's spinning disk can give rise to chromatic appearances.

The temporal variant of the juxtaposition model faces a parallel problem as the spatial variant. Just as the spatial variant of the juxtaposition model was committed to imperceptible spatial magnitudes, the temporal variant is committed to imperceptible temporal magnitudes and for much the same reason:

If we accept the hypothesis of juxtaposition, we must assume not only invisible magnitude, but also imperceptible time, in order that the arrival of the movements may be unperceived, and that the colour may appear to be one because they seem to be simultaneous. (Aristotle, *De Sensu* III 440^a20–25; Beare in Barnes 1984b, 9)

Consider alternating assimilations of white and black effluences by the organ of sight occurring in a certain temporal ratio. The pattern of alternating assimilations is perceptible. The pattern at least determines the experience of a chromatic hue. But our experience of a color of a particular is not the experience of a succession of light and dark. So the assimilation of white and black effluences must occur too quickly to be individually perceptible. However, if temporally juxtaposed in the right proportion, the temporal compound, the pattern of alternating assimilations, would be perceptible. Indeed, it would be the perception of the chromatic hue. Unfortunately, just as Aristotle rejects imperceptible spatial magnitudes, he also rejects imperceptible temporal magnitudes and with it the temporal variant of the juxtaposition model.

6.1.2 Overlap

On the first model, chromatic hues are determined by a proportion of light and dark that arises from light and dark objects being temporally or spatially juxtaposed. The second model that Aristotle considers works not by means of juxtaposition, but by means of overlap:

Another is that the black and white appear the one through the medium of the other, giving an effect like that sometimes produced by painters overlaying a less vivid upon a more vivid colour, as when they desire to

represent an object appearing under water or enveloped in a haze, and like that produced by the sun, which in itself appears white, but takes a crimson hue when beheld through a fog or a cloud of smoke. On this hypothesis, too, a variety of colours may be conceived to arise in the same way as that already described; for between those at the surface and those underneath a definite ratio might sometimes exist; in other cases they might stand in no determinate ratio. (Aristotle, *De Sensu* III 440^a7–15; Beare in Barnes 1984b, 8–9)

Perhaps colors are not so much juxtaposed as they are overlapping. The overlapping colors, however, are importantly perceptually penetrable at least to some degree—they appear through one another. Suppose one color overlays another color. If the overlaying color is perceptually impenetrable, if it determines a visual boundary through which nothing further could appear, the underlying color would be occluded, and this would not be a method of color combination since only the overlaying color could be seen. If overlaying and underlying colors are genuinely combined by overlap, then at least the overlaying color must be perceptually penetrable at least to some degree. Moreover, it cannot be perfectly transparent. If the overlaying color were perfectly transparent, it would be wholly receptive of the underlying color, and, again, this would not be a method of color combination since only the underlying color could be seen. For the overlap model to work, at least the overlaying color must be imperfectly transparent. The overlaying color's contribution to the resulting chromatic appearance consists, in part, in the visual resistance it offers:

... the stimulatory process produced in the medium by the upper colour, when this is itself unaffected, will be different in kind from that produced by it when affected by the underlying colour. Hence it presents itself as a different colour, i.e. as one which is neither white nor black. (Aristotle, *De Sensu* III 440^a24–28; Beare in Barnes 1984b, 9)

Moreover, the ratio of the overlapping colors that results in the novel color is partly determined by the degree of visual resistance offered by the imperfectly transparent overlaying color.

The painting analogy is arguably a deliberate echo of Empedocles (DK 31B23). As in the Empedoclean fragment, the method of color combination deployed by the painters is overlaying semi-transparent colored washes—the method that Plutarch attributes to Apollodorus and is characteristic of Greek four-color painting more generally. Aristotle's choice of depicted content further emphasizes this: He draws our attention to how a painter might depict something appearing through water or mist by overlaying a wash of some appropriate color. Here perceptually penetrable washes of pigment are the means of representing something that is itself

perceptually penetrable—the water or mist through which the object appears. He draws our attention to the imperfectly transparent subject matter as a way of emphasizing the imperfectly transparent means of representing that subject matter. The painting analogy thus further confirms that at least the overlaying color must be imperfectly transparent.

The sun seen through a fog or cloud of smoke is Aristotle's second analogy. The sun is white, and the smoke is black. And yet when the cloud of smoke is superimposed over the sun, it gives rise to a crimson appearance. If the black of the smoke were perceptually impenetrable, if it determined a visual boundary through which nothing further could appear, then the white of the sun would have been occluded by the black of the smoke, and a method of color combination could not be understood on this analogy since only the overlaying color could be seen. If on the other hand, the smoke were perfectly transparent, it would be wholly receptive to the white of the sun and, again, a method of color combination could not be understood on this analogy since only the underlying color could be seen. For the analogy to work, the smoke must be imperfectly transparent, the blackness of the smoke contributes to the resulting chromatic appearance, in part, by the visual resistance it offers. Though it remains receptive of the white of the sun, otherwise it would be opaque, the darkness of the smoke resists perceptual penetration insofar as it can. The resulting proportion of light and dark presented to the organ of sight is determined in part by the degree of perceptual penetrability of the smoke. And it is the ratio of light and dark that determines the sun's crimson appearance when obscured by smoke from a battle. So for the analogy to hold, on the overlap model, it is the ratio of light and dark that results from overlap that determines the chromatic hues.

The overlap model postulates neither invisible magnitudes nor imperceptible time, and so is not subject to the difficulties facing the juxtaposition model. Moreover, it retains what is by Aristotle's lights the salutary doctrine that chromatic hues are determined by a ratio of light and dark. However, Aristotle rejects the overlap and juxtaposition models in favor of a model that works by mixture. What's wrong with the overlap model? Aristotle writes:

It is plain that when bodies are mixed their colours also are necessarily mixed at the same time; and that this is the real cause determining the existence of a plurality of colours—not superposition or juxtaposition. For when bodies are thus mixed, their resultant colour presents itself as one and the same at all distances alike; not varying as it is seen nearer or farther away. (*De Sensu* III 440^b16–18; Beare in Barnes 1984b, 10)

This can initially strike one as an odd response. Indeed, the complaint seems best directed at an alternative to the juxtaposition model that does not posit invisible magnitudes, but rather magnitudes too small to be seen in normal circumstances.

Think again of pointillist painting and color halftone printing. The color of the painting or the print only seems uniform at a suitable distance but dissolves into differently colored parts when near at hand. But not all visible particulars are like that. A laurel leaf will look green no matter how close you look at it and still count as looking. What is puzzling is how this objection could get a grip on the present model. How can the variability of color with distance arise by means of overlap?

Consider the sun seen through a cloud of smoke. The dark smoke overlays the sun burning bright. The reduction of the sun's brilliance results in its crimson appearance. This is due to the black particulate matter of the smoke suspended in the transparent medium, in the present case, the air. Suppose the black particulate matter is uniformly distributed in the region of the cloud. Then the degree to which the sun's brilliance is decreased will depend on the depth of the intervening region. Holding fixed the density of the particulate matter, understood as the number of particles per unit volume, then a greater region of smoke will result in a greater reduction in the sun's brilliance than would result had the sun been seen through a smaller region. A smaller region of smoke, with the same density, while dark, would not be as dark as the greater region. And the sun seen through the smaller region would be brighter than the sun seen through the darker region. Indeed, seen through the smaller region of smoke, the sun would not appear crimson, but orange, say. But this is just the variability of color with distance that Aristotle objects to.

Aristotle's complaint is that "colour presents itself as one and the same at all distances alike; not varying as it is seen nearer or farther away." There are two ways to understand this objection. On the first understanding, what is uniform is the color appearance presented by the particular when viewed from all distances. On the second understanding, what is uniform is the color the particular appears to have at all distances from which its color can be seen.

On the first understanding, there are at least some particulars whose chromatic appearance is relatively uniform at any distance from which its color can be seen. On the first understanding of the objection, then, the overlap model is at best an overgeneralization of a special case. The chromatic appearance of at least some particulars are relatively uniform at any distance. The example of the laurel leaf looking green no matter how close you look at it and still count as looking may encourage this thought. It is true that proximity to the laurel leaf does not reveal it to be partly white and partly black. But that is not to say that the green of the leaf appears the same way at every distance from which it can be seen. Indeed, it is unobvious that there are such particulars. The son of Diaries looks like a white speck when seen from a distance in the way that he does not closer up. Moreover, even particulars with a relatively stable chromatic appearance in a range of familiar circumstances can be affected by atmospheric conditions. Think of blue moun-

tains. The problem with the present understanding is not just that it seems false, but that it can be seen to be false by reflecting on Aristotle's own examples.

On the second understanding, what remains uniform is the perception of the particular's color despite that color's appearance varying with the distance from which it is viewed. On this understanding, that the color of a particular seems uniform at all distances just is seeing the constant color of the particular at any distance at which it is visible despite its appearance varying with the circumstances of perception. On this second understanding of the objection, then, the overlap model is inconsistent with an aspect of color constancy. On the overlap model, color varies with distance. But one can at least sometimes see that a particular has an unchanging color despite its color appearance changing with the distance from which it is viewed. There can be variation in color appearance without a variation in presented color. If color varies with distance, then one cannot perceive a particular to have an unchanging color even as its appearance changes with viewing distance.

The fundamental problem with the present account is that it too closely models color combination in terms of the appearance of a color through an imperfectly transparent medium with a given volume color. The surface color a figure can be seen through water or mist, just as the radiant color of the sun can be seen through fog or a cloud of smoke. In seeing a colored particular through a colored medium, the resulting chromatic appearance is partly due to the surface or radiant color of the particular and partly due to the volume color of the medium. But this is at best an account of how colors jointly combine to determine a chromatic appearance, and not an account of color combination. The way in which the overlap model runs afoul of color constancy is a symptom of this. That color appearances vary with distance was mistaken for the colors themselves varying with distance. Once the mistake is made, there is no color that persists as the object of visual awareness throughout the flux of sensory appearances that arise through changing one's point of view.

6.1.3 Mixture

The juxtaposition and overlap models may be subject to the difficulties describes above, but larger philosophical concerns are at work in Aristotle's claim that it is the ratio of light and dark in a *mixture* that determines chromatic hues. Specifically, Aristotle's views about elemental composition prompt this view of chromatic composition.

According to Empedocles, the combination of the "roots" or elements operates on the model of juxtaposition. The divine glues of harmony bind the elements not by mixture, but as small pieces standing next to each other touching (DK 31B96). It is in these terms that Empedocles sought to explain the growth and decay of compound bodies. What mortals describe as "growth" and "decay" are really the

result of the combination and separation of unalterable, ungenerated, and imperishable elements (DK 31B8). While Empedocles resisted in this way the full thrust of Parmenidean skepticism about generation and corruption, the concessions he makes to Parmenides distinguishes his view from sixth century BC thinkers as yet untouched by Parmenidean doubts. Thus Kahn remarks:

The Parmenidean attack on generation and corruption dominates the entire development of natural philosophy in the fifth century. At the same time, it signifies a radical break with the older point of view. ... That “coming-to-be” and “perishing” played an essential role in all previous doctrines is the natural conclusion to be drawn from a reading of his poem; and this view is fully confirmed by the fragments of Xenophanes and Heraclitus. In contrast to the denial of Parmenides, Anaxagoras, and Empedocles these earlier men speak unhesitatingly of “generation,” “growth,” and “death.” The fundamental difference between the sixth and fifth centuries lies not in the abandonment of monism for plurality, but in the passage from a world of birth and death to one of mixture and separation. (Kahn, 1994, 154–155)

Aristotle’s preferred account of the generation of the hues is modeled on his preferred account of elemental composition, itself a return to the sixth century BC view.

On Aristotle’s view, the Empedoclean tetrad—water, earth, air, and fire—are only elements so-called. Strictly speaking, elements are the simple primary ingredients of a compound (*Metaphysica* Δ 3 1014^a26ff). So understood the real elements are the primary opposites: Hot, Cold, Dry, and Wet. The so-called elements, water, earth, air, and fire, are the result of the combination of these opposing principles. Thus water is Cold and Wet, earth is Cold and Dry, air is Hot and Wet, and fire is Hot and Dry. Since the Empedoclean tetrad are only elements so-called, they are subject to a cycle of transformation familiar from ancient times.

In a passage self-consciously recounting the older view, Plato describes the cycle of elemental transformation thus:

In the first place, we see that what we just now called water, by condensation, I suppose, becomes stone and earth, and this same element, when melted and dispersed, passes into vapor and air. Air, again, when inflamed, becomes fire, and, again, fire, when condensed and extinguished, passes once more into the form of air, and once more air, when collected and condensed, produces cloud and mist—and from these, when still more compressed, comes flowing water, and from water comes earth and stones once more—and thus generation appears to be transmitted from one to the other in a circle. (Plato, *Timaeus* 49^{b-c}; Jowett in Hamilton and Cairns 1989, 1176)

For the most part, the cycle of elemental transformation seems phenomenologically apt, at least with respect to the grosser forms of the so-called elements that we encounter in sensory experience. Moderns may struggle, however, to understand how earth and stones could be the result of water compacting (or, at least, those moderns unafflicted by London limescale). If one thought that ice is the result of water compacting with the increase in cold, this would at least leave you open to the idea that compacting water can result in solid bodies with fixed boundaries. However, the passage does not mention ice, and it can still seem mysterious how compacting water can result in solid bodies composed of earth and stone. What experience, available to the ancients, could be vivid enough to elicit conviction in this elemental transformation? Consider a river destroyed by drought, a fearful and ruinous experience for agrarian societies. An ancient spectator to this tragedy would watch as the river contracted, day after day, leaving in the end, nothing but the sun parched stones and earth that once constituted the river's bed. Such an experience, I conjecture, would be vivid and significant enough to produce cosmic conviction. The desalination of brine in salt production, a procedure dating back over eight millennia, is an equally marvelous, if less tragic, experience that might elicit conviction in this elemental transformation as well.

Aristotle regards the continuous transformation of the Empedoclean tetrad into one another as an established fact of observation. So conceived, they could not be the Parmenidean beings that Empedocles understands them to be. The combination of the so-called elements, is no longer understood in terms of the juxtaposition of unaltering, ungenerated, and imperishable beings. Water, earth, air, and fire transform into one another and in so doing interfuse. And it is complete interfusion that is mixture properly so-called. In a compound body composed of different items from the Empedoclean tetrad, the so-called elements combine by interfusing, that is, by blending or mixture. With respect to elemental composition, Aristotle's view thus represents a return to the sixth century BC world of birth and death.

Aristotle's preferred model of the generation of the hues should be understood set against this larger reaction to Parmenidean skepticism about growth and decay. It is because he regards combination and separation (understood on the model of juxtaposition) as an imperfect surrogate for growth and decay (*De Generatione et Corruptione* 1 10), that he understands elemental composition instead in terms of mixture. And it is natural, if not inexorable, that he should have a parallel understanding of chromatic composition. Aristotle's conception of color combination as mixture substantiates the grounds of Plato's charge of impiety (*Timaeus* 68^d). If colors are completely interfused when mixed, then no mortal possesses God's power to again resolve the one into many. But that, according to Plato, is what would be required to verify by experiment the ratio of primary colors combined in the

mixture.

That white and black, or light and dark, are the primary colors, the colors in terms of which all other colors are explained, is an ancient doctrine, arguably of Homeric roots, that Parmenides and Empedocles share. Aristotle follows them in this. Moreover, Aristotle takes over from Parmenides and Empedocles the idea that light and dark are contraries that constitute the extreme ends of an ordered range of sensible qualities. Moreover, he emphasizes Empedocles' contribution to this tradition in claiming that it is the ratio of light and dark when combined that determines an intermediary color. Aristotle, however, departs from Empedoclean doctrine precisely in the method of combination. Aristotle understands the combination of light and dark in terms of a conception of mixture at home in pre-Parmenidean natural philosophy, in the sixth century BC world of birth and death.

6.1.4 Two Puzzles about Mixture

While an intellectually satisfying narrative, I do not think that we can accept it without qualification. The claim that chromatic composition involves the mixture of light and dark faces two distinct though potentially related puzzles. Each puzzle concerns the kinds of things that admit of mixture. Their lesson might very well be: Chromatic composition involves the mixture of light and dark only in a Pickwickian sense of mixture.

Qualities are inseparable from the substances in which they inhere, but the ingredients of a mixture must admit of separation. Since qualities and states do not admit of separate existence, neither do they admit to mixture:

Now we do not speak of the wood as combined with the fire, nor of its burning as a combining either of its particles with one another or of itself with the fire: what we say is that the fire is coming-to-be, but the wood is passing-away. Similarly, we speak neither of the food as combining with the body, nor of the shape as combining with the wax and thus fashioning the lump. Nor can body combine with white, nor (to generalize) properties and states with things; for we see them persisting unaltered. But again white and knowledge cannot be combined either, nor anything else which is not separable. (Indeed, this is a blemish in the theory of those who assert that once all things were together and combined. For not everything can combine with everything. On the contrary, both of the constituents that are combined must originally have existed in separation; but no property can have separate existence.) (Aristotle, *De Generatione et Corruptione* I 327^b12–22; Joachim in Barnes 1984a, 30–31)

Qualities and states do not mix with the things whose qualities and states they are. Nor can qualities and states mix with other qualities and states. Only that which admits of separate existence can be combined in mixture but qualities and states are inseparable from the things whose qualities and states they are. The argument, here, is the basis for rejecting Empedocles' conception of the cosmic cycle. The world, as we experience it, is in an intermediate stage of the cosmic cycle, where neither Love nor Strife dominate. At times in the cosmic cycle Strife dominates, and everything is scattered. At others Love dominates, and everything is combined in perfect Parmenidean sphere. But, according to Aristotle, the latter is not possible since not everything can be combined in the envisioned manner. Only what admits of separate existence may be combined, but not every category of being admits of separate existence. Even the divine glues of harmony could not bind what what does not admit of separate existence. There are limits, apparently, to even Aphrodite's Love. While Empedocles is the plausible target of criticism here, Aristotle's argument would also be the basis for rejecting the Way of Mortal Opinion. According to the Way of Mortal Opinion "the whole world of sense" in which appear "earth, heaven, sun, moon, and stars" is the result of the "blending" or mixture of light and dark. But since light and dark do not admit of separate existence, there could be no such "blending".

The first puzzle, then, is this. The colors are inseparable from the particulars in which they inhere. But only that which can exist separately may be combined in a mixture. So the setting sun's crimson hue could not be a mixture of white and black, or light and dark, at least not literally.

We have remarked how Aristotle's account departs from Empedocles in the method of color combination. Aristotle contributes to this ancient tradition in a further way. Parmenides and Empedocles both explain brightness in terms of the presence of fire, an explanation that Aristotle himself echoes. However, whereas Parmenides and Empedocles posit positive determinants for darkness (Night and water, respectively), Aristotle explains darkness in terms of the absence of the fiery substance. There is no positive determinant, be it a cosmic principle or an element, for darkness. This is partly a manifestation of Aristotle's insight concerning the connection between illumination and visibility. The fiery substance illuminates the transparent medium and only thus are the particulars arrayed in that medium visible. If the fiery substance is removed, darkness supervenes.

Aristotle's contribution has an additional source in the general metaphysics of change presented in Book 1 of *Physica*. All change involves opposition, but the general form of opposition involved in all change involves form and privation. One may wonder how these claims could be true together. Consider a kind of substance. The generation of a kind of substance involves form and privation, but as substances have no opposites, there is no opposition. Form and privation seems to

be a more general distinction than the distinction between opposites. There may be more to opposition than form and privation, but opposition itself involves form and privation. Thus Aristotle understands the traditional opposites, discussed by Parmenides and Empedocles among others, in terms of form and privation. In the opposition of light and dark, light is the form determined by the presence and activity of the fiery substance and darkness is the privation of the light-giving fiery substance.

That darkness is determined by the absence of the fiery substance rather than the presence of Night or water, raises the second puzzle about the sense of mixture involved in the generation of the hues. If darkness is the sensible aspect of the absence of fire, then in what sense can brightness be mixed with darkness? Perhaps by mixture of light and dark Aristotle just means relative brightness, but that would be a Pickwickian sense of mixture.

The lesson of the first puzzle is that qualities and states cannot be combined in a mixture. But suppose that a quality or state is determined by the presence and activity of something that admits of separate existence. While qualities such as light and dark could not mix, perhaps the determinants of these qualities mix, at least if they admit of separate existence.

The lesson of the second puzzle is that absences do not mix. But while you cannot mix an absence, you can mix things which are more or less resistant to the illuminating presence and activity of the fiery substance. Earth resists the presence and activity of the fiery substance, just as air is receptive to it. You cannot mix absences, but you can mix something which will preclude the presence of the fiery substance or at least retard its activity. That is to say you can mix things which differ in the degree of their transparency, the degree to which they are receptive to the illuminating presence and activity of the fiery substance.

Read in light of the *De Sensu* doctrine that color resides in the proportion of the transparent that exists in all bodies, the lessons of our two puzzles might be jointly satisfied in the following manner. Consider mixing two ingredients with different degrees of transparency that result from their different elemental compositions. Prior to the mixture, the ingredient with a greater degree of transparency will be brighter in color than the ingredient with a lesser degree of transparency which will be darker. Combining these ingredients in a mixture results in a mixed body with an intermediate degree of transparency and hence a color intermediate between the lighter and the darker. But it is not light and dark that are mixed but elemental compounds with different degrees of transparency. Thus the lesson of the first puzzle is satisfied. And it is not the presence and absence of the fiery substance that is mixed but, again, elemental compounds with different degrees of transparency, different degrees to which they are receptive to the presence and activity of the fiery substance. Thus the lesson of the second puzzle is satisfied. Moreover, jointly

satisfying the lessons of our two puzzles in this way also provides an interpretation for why mixing bodies involves mixing color (*De Sensu* III 15–16).

While I believe that this is the best way to understand (or perhaps develop) Aristotle's account of the generation of the hues in terms of mixture, a residual doubt remains.

On the present development of Aristotle's model, chromatic composition is understood in terms of mixing ingredients whose elemental compositions determine their different degrees of transparency. When ingredients combine in a mixture, they alter one another. But what makes for chromatic composition is that the ingredients in the mixture are altering one another's degree of transparency, the degree to which they are receptive to the illuminating presence and activity of the fiery substance. But not every mixture of bodies results in mutually altering their degree of transparency in proportion with the corporeal mixture. There are certain colors that artists cannot achieve by mixing pigments (*Meteorologica* III 2 372^a2–9). When the proportion or ratio of bodies mixed does not correspond to the degree to which the mixed bodies altered one another's degree of transparency this is due to a kind of material recalcitrance. The possibility of material recalcitrance establishes that not every combining of bodies in a mixture is a combining of their color in that mixture. Only certain bodily mixtures are color combinations, properly so called. Only bodily mixtures where the proportion or ratio of bodies mixed correspond to the degree to which they alter one another's degree of transparency are genuine methods of color combination.

The juxtaposition and overlap models each provided explanations (ultimately unsatisfactory, at least by Aristotle's lights) for the ratio of light and dark that determines the resulting color. But the claim that a mixture is only a method of color combination if the ingredients in the mixture mutually alter their degrees of transparency in proportion with the corporeal mixture comes perilously close to assuming what the other models explain. After all, to say that in the case of color combination ingredients mutually alter their degree of transparency, the degree to which they are receptive to the illuminating presence and activity of the fiery substance, is just to say that they determine a ratio of light and dark. But that just is the Pickwickian sense of mixture. So understood, the mixture of light and dark just is relative brightness. The remaining residual doubt consists in this apparent explanatory deficit.

6.2 Chromatic Ratios of Light and Dark

While Aristotle sometimes departs from Empedoclean doctrine, at others, he elaborates it. Specifically, Aristotle provides the beginnings of an account of the proportions or ratios of light and dark that determine the chromatic hues.

The ordering of the intermediate colors between the extremes of light and dark is not structured as a continuum. This is a general thesis about sensible qualities. All sensible qualities are understood to be ordered in a range of contrary qualities between opposites. And Aristotle maintains that there are only ever finitely many species from a given range (*De Sensu* VI 445^b21–446^a19).

Specifically, there are seven species of color:

Savours and colours contain respectively about the same number of species. For there are seven species of each, if, as is reasonable, we regard grey as a variety of black (for the alternative is that yellow should be classed with white, as rich with sweet); while crimson, violet, leek-green, and deep blue, come between white and black, and from these all others are derived by mixture. (Aristotle, *De Sensu* IV 442^a20–442^a25; Beare in Barnes 1984b, 12)

Three of these are the colors of the rainbow—crimson, violet, and leek-green, though some report yellow coming between crimson and leek-green (*Meteorologica* III 2 372^a8–10). In the passage, Aristotle regards gray as an achromatic hue, indeed it is a kind of black, presumably because it is less bright than white and so reckoned a privation the way black is. In other works, its achromatic character is overlooked, gray counting as an intermediary color just as much as yellow (*Categoriae*, x 12^a18; see also *Topica* I 15 106^b5, *Metaphysica* I 1056^a27).

So there are seven species of color—white, yellow, crimson, violet, leek-green, deep blue, and black. Corresponding to the five intermediate species are simple ratios of light and dark. So far we have, in line with ancient tradition, two primary colors, white and black, or better yet, light and dark. The two primary colors are opposites at the extreme ends of an ordered range of colors. In addition to the two primary colors there are five intermediate colors that are the result of mixing the primary colors light and dark in simple ratios. Following Sorabji (1972, 297) call these the secondary colors. In addition to primary and secondary colors, Aristotle seems to recognize a third group of colors. Moreover, these seem to be the result of mixing secondary colors: “crimson, violet, leek-green, and deep blue, come between white and black, and from these all others are derived by mixture” (*De Sensu* IV 442^a25; Beare in Barnes 1984b, 12). So the tertiary colors are all the colors other than the primary and secondary colors and are the result of a mixture of secondary colors.

The Aristotelian color scheme raises a number of questions.

First, if the mixture of light and dark in simple ratios determines the secondary colors whose mixture in turn determines the tertiary colors, is it possible to determine the tertiary colors directly in terms of non-simple ratios of light and dark? There should be no mathematical obstacle to this. Does Aristotle’s failure to describe the direct determination of the tertiary colors by non-simple ratios of light

and dark read in light of the claim that he does make, that the tertiary colors are a mixture of secondary colors, suggest, instead, that he believed that there was no such direct determination? Given the mathematical possibility, that the tertiary colors are not actually determined in this way could be evidence for a kind of material recalcitrance at work in chromatic mixture.

Second, a question arises concerning the number of tertiary colors. From the fact that they correspond to non-simple ratios of light and dark it does not follow that for every non-simple ratio of light and dark there exists a tertiary color. So we cannot assume that there are infinitely many. Just as there are finitely many primary colors and finitely many secondary colors, perhaps there are finitely many tertiary colors. Aristotle in the passage, however, declines to directly say. This issue must be settled by appeal to more general considerations.

Third, in speaking of the secondary colors as species, is Aristotle allowing for the possibility that different colors might each be members of the same chromatic species the way different individual animals—a pair of hogs, say—may each be members of the same species. This bears on how we are to think of the ordering of the colors. The intermediate secondary colors are ordered between the extremes of light and dark in part because of the similarities and differences they bear to these opposites. However, there are similarities and differences between members of a species. This hog has greater magnitude than that hog, and yet both protest when hungry. By analogy, there would be similarities and differences between colors that are members of the same chromatic species. Perhaps there are discriminable shades of crimson. Each is recognizable as belonging to the relevant chromatic species, crimson, but being discriminable, there are visible differences between them. Indeed, Aristotle gives just such an example. Shades of black and shades of gray are members of the same chromatic species, they are each black, or better yet, dark, but there are visible differences between them. If that is right, then the ordering of the intermediate secondary colors between the extremes of light and dark, while a similarity ordering determined by a decreasing proportion of light, is not a complete similarity ordering. There will be color similarities and differences—the similarities and differences between members of the chromatic species—not captured by that ordering. In modern parlance, the incomplete ordering would be determining color determinables and not determinate colors. (On the determinable–determinate distinction see Johnson 1921. For a contemporary defense of the idea that we perceive determinable qualities see Allen 2010; Stazicker 2011.)

Fourth, and finally, that there are discriminable shades of color that belong to the same chromatic species bears on the question of cardinality. Is the question whether there are finitely many species of color? Or is it rather whether there are finitely many discriminable shades of color? There could be finitely many chro-

matic kinds and infinitely many discriminable shades (especially if we bear in mind that a discriminable shade is only potentially discriminated, in some potential circumstance of perception, not necessarily the actual one).

To get a better sense of the mathematical content of Aristotle's theory, let us begin with the simple ratios in terms of which the five intermediate secondary colors are understood. Aristotle first introduces this idea in the context of explaining the juxtaposition model, an account of the generation of the hues that he rejects. In fact, Aristotle introduces two distinct ideas, only one of which reemerges in his discussion of chromatic mixture:

Such, then, is a possible way of conceiving the existence of a plurality of colours besides the white and black; and we may suppose that many are the result of a ratio; for they may be juxtaposed in the ratio of 3 to 2, or of 3 to 4, or in ratios expressible by other numbers; while some may be juxtaposed according to no numerically expressible ratio, but according to some incommensurable relation of excess or defect; and, accordingly, we may regard all these colours as analogous to concords, and suppose that those involving numerical ratios, like the concords in music, may be those generally regarded as most agreeable; as, for example, purple, crimson, and some few such colours, their fewness being due to the same causes which render the concords few. The other compound colours may be those which are not based on numbers. Or it may be that, while all colours whatever are based on numbers, some are regular in this respect, others irregular; and that the latter, whenever they are not pure, owe this character to a corresponding impurity in their numerical ratios. This then is one way to explain the genesis of intermediate colours. (Aristotle, *De Sensu* III 439^b26–440^a6; Beare in Barnes 1984b, 8)

The first idea then involves the application of musical intervals to colors. On this idea, the secondary colors are like consonances. Consonant notes blend when played simultaneously and are pleasant to listen to. Just like concords, the secondary colors are more agreeable than the tertiary colors. Consonant notes stand in certain intervals that can be represented by simple numerical ratios. Given the empirical success of ancient theories of acoustics in developing a mathematical account of these intervals, the suggestion is that these theories, or theories of their type, may be extended to other sensible objects, in the present case, color. So some colors are the result of simple numerical ratios that correspond to consonant musical intervals, whereas other colors cannot be expressed as rational numbers. The analogy Aristotle draws between color theory and acoustical theory proved influential. Even Newton accepted the analogy. Newton, like Aristotle, believed that colors have consonances just as pitches do, and he divided the spectrum into seven

divisions (excluding white and black, *pace* Aristotle) corresponding to the seven notes of the just diatonic scale (see Shapiro 1994, 619).

The second idea is like the first, except that all colors are represented by rational numbers, each are determined by a numerical ratio of light and dark, it is just that some are regular and some are irregular. The colors associated with regular ratios are pure, with irregular ratios impure. Ross (1906, 155-156) makes the plausible suggestion that the impurity of the tertiary colors determined by irregular ratios is a chromatic desaturation. The secondary colors are more saturated than the tertiary colors which are unsaturated to varying degrees. No doubt it is, in part, the increase in saturation that makes the secondary colors more pleasant to behold and so chromatic consonances.

This second idea is only entertained in the context of the juxtaposition model. Aristotle probably does not accept it. At any rate, when we come to Aristotle's account of the generation of hues in terms of the mixture of light and dark, he endorses only the first idea:

Colours will thus, too be many in number on account of the fact that the ingredients may be combined with one another in a multitude of ratios; some will be based on determinate numerical ratios, while others again will have as their basis a relation of quantitative excess. And all else that was said in reference to the colours, considered as juxtaposed or superposed, may be said of them likewise when regarded as mixed. (Aristotle, *De Sensu* III 44^a18-23; Beare in Barnes 1984b, 10)

This is less an account than the beginnings of one. Aristotle never specifies which intermediate secondary color goes with which simple ratio, such as 3 to 2, or 3 to 4. Nor does he explore to what extent ancient acoustical theory may be extended to the colors in the way that he envisions (much to his detriment, see Sorabji 1972). Nor are we ever told how, exactly, the intermediate secondary colors are ordered. Given its candidacy for being included in the extreme chromatic species, white or light, yellow, understood as a distinct intermediary, is the brightest of the secondary colors. But the ordering of the rest of the intermediate secondary colors is left unspecified. This is less a theory, than a research program. Given the empirical success of ancient acoustical theory, the role of ratio or harmony in the respected opinions of the wise, and his own experience gleaned from dialectical engagement with the *endoxa*, Aristotle most likely felt that there were good reasons to believe that this research program could in fact be carried out. But the *De Sensu* account is not the result of that program but merely its statement.

Let us return to the question of cardinality. Aristotle claims that there are finitely many sensible qualities in an ordered range between opposites. But in what sense does he intend this claim? Is it that there are only finitely many sensible species in the range? Or if distinct sensible qualities may be members of the same

sensible species (such as gray and black seem to be), is Aristotle claiming, in addition, that sensible species only have finite members? To resolve these issues, we turn to an important if difficult passage from *De Sensu* VI:

For in all classes of things lying between extremes the intermediates must be limited. But contraries are extremes, and every object of sense-perception involves contrariety; e.g. in colour, white and black; in savour, sweet and bitter, and in all the other sensibles also the contraries are extremes. Now, that which is continuous is divisible into an infinite number of unequal parts, but into a finite number of equal parts, while that which is not per se continuous is divisible into species which are finite in number. Since then, the several sensible qualities of things are to be reckoned as species, while continuity always subsists in these, we must take account of the difference between the potential and the actual. It is owing to this difference that we do not see its ten-thousandth part in a grain of millet, although sight has embraced the whole grain within its scope; and it is owing to this, too, that the sound contained in a quarter-tone escapes notice, and yet one hears the whole strain, inasmuch as it is a continuum; but the interval between the extreme sounds escapes the ear. So, in the case of other objects of sense, extremely small constituents are unnoticed; because they are only potentially not actually visible, unless when they have been parted from the wholes. So the foot-length too exists potentially in the two-foot length, but actually only when it has been separated from the whole. But increments so small might well, if separated from their totals, be dissolved in their environments, like a drop of sapid moisture poured out into the sea. But even if this were not so still, since the increment of sense-perception is not perceptible in itself, nor capable of separate existence (since it exists only potentially in the more distinctly perceivable whole of sense-perception), so neither will it be possible to perceive its correlatively small object when separated in actuality. But yet this is to be considered as perceptible: for it is both potentially so already, and destined to be actually so when it has become part of an aggregate. Thus, therefore, we have shown that some magnitudes and their sensible qualities escape notice, and the reason why they do so, as well as the manner in which they are still perceptible or not perceptible in such cases. Accordingly then, when these are so great as to be perceptible actually, and not merely because they are in the whole, but even apart from it, it follows necessarily that their sensible qualities, whether colours or tastes or sounds, are limited in number. (Aristotle, *De Sensu* VI 445^b22-446^a19; Beare in Barnes 1984b, 18)

Some commentators see in this passage a contrast between the motion involved in a spatial magnitude changing position over time and the motion involved in qualitative alteration. The motion of a body through space is continuous. The path it travelled from the starting point to its resting place is divisible into an infinite number of unequal parts but a finite number of equal parts. In contrast the motion of a body through the process of qualitative alteration is not continuous. The path it traveled through the quality space is not divisible into an infinite number of unequal parts. Indeed, as Sherry (1986, 395-396) observes, it is no path at all. If a body were to alter its color from the extremes of light to dark, throughout that process it would take on the finitely many intermediate colors. White (2002, 128-129), however, fails to discern the intended contrast between spatial magnitudes and qualities in this passage. Rather, Aristotle is stressing their analogy.

Like Aristotle's resolution of Zeno's paradox, distinguishing between the actual and the potential is meant to resolve an *aporia*: The several sensible qualities are reckoned to be finitely many species and yet "continuity always subsists in these". The distinction between the actual and the potential is supposed to explain how this may be so.

Begin with the case of spatial magnitude. When we actually divide the path that the body travelled, we only ever do so finitely many times. We only ever actually mark the path into finitely many stages. Moreover, when we actually divide a homeomerous body this only ever results in finitely many parts (think of a butcher dividing a carcass). Corresponding to marking the path into stages, or carving the body into parts, there are different stages that a body undergoes in the process of qualitative alteration. Thus between the extremes of light and dark the body must pass through intermediary stages. During that process it comes to have a color intermediate between the opposite extremes. Whereas, in the case of spatial magnitudes, the path was marked by some action of ours, our dividing it, in the case of chromatic qualities, the path through the quality space was marked by some action of ours, our discriminating that intermediary color from the lighter color that preceded it. While the path that the body travelled is only actually divided finitely many times, it remains true that it is infinitely divisible. The path is infinitely divisible in that there are within it an infinite number of unequal potential divisions. Similarly while the path that the body travelled through color space as it changed from light to dark is only actually divided finitely many times, by our finite color discriminations in the give circumstance of perception, it remains infinitely divisible. There are an infinite number of potential perceptual discriminations, though perhaps not all possible relative to the same point of view. On this understanding, perceptual discrimination imposes a discontinuous chunking on a sensible continuity. In making finitely many actual discriminations we reckon finitely many sensible species, but a continuity always subsists in these since there

are infinitely many potential discriminations to be made, perhaps in other, more fortuitous, potential circumstances of perception.

Sorabji (1976) offers a different interpretation. While the ordering from light to dark is discontinuous, comprised as it is of finite species of color, it is, nonetheless, derivatively continuous. Sorabji (1976, 80) elaborates this idea by modifying a musical example of Aristotle's: "What Aristotle seems to have in mind is that a change to the next discriminable pitch, in the discontinuous series of discriminable pitches, may be produced by a continuous movement of a stopper along a vibrating string." The discontinuous series of qualitative states passed through in the process of qualitative alteration are determined by a continuous change in its underlying material cause. Thus the diminution of the activity of the fiery substance reflected from an opaque surface of a darkening body may be continuous, but the body undergoes a discrete series of qualitative transitions in the process. The problem is that Aristotle does not talk about continuous change in an underlying material cause for the motion of qualitative alteration. So it is difficult to understand the notion of derivative continuity as offering a resolution of the *aporia* with which we began.

The discussion of the two paragraphs that preceded this passage supports, instead, the present interpretation (*De Sensu* VI 445^b7–20). There are no imperceptible magnitudes. That was the general principle that ruled out the spatial and temporal variants of the juxtaposition model (chapter 6.1.1). And that every magnitude is perceptible, at least in some potential circumstance, is linked with an infinite number of potential perceptual discriminations (*De Sensu* VI 445^b7–10). Moreover, having established that link, Aristotle goes on to argue directly against the possibility of imperceptible magnitudes, as if to reinforce the claim that there are an infinite number of perceptual discriminations, the source of continuity that subsists in sensibilia. The sensible is not derivatively continuous, in the sense that motion of qualitative alteration has an underlying continuous material cause. Rather the sensible is continuous in the sense that there are infinitely many potential discriminations to be made. And this is consistent with our only ever actually making finitely many perceptual discriminations that determine finitely many sensible species.

Let us consider just one of Aristotle's arguments here, because it is interesting in its own right, and revealing about the metaphysics of color:

Since if it were not so, we might conceive a body existing but having no colour, or weight, or any such quality; accordingly not perceptible at all. For these quantities are the objects of sense-perception. On this supposition, every perceptible object should be regarded as composed of non-perceptible parts. Yet it must be really composed of perceptible parts, since assuredly it does not consist of mathematical qualities. (Aristotle, *De Sensu* VI 445^b11–15; Beare in Barnes 1984b, 18)

The most likely target here is Plato's cosmology in the *Timaeus*. Plato describes how geometrical particles, imperceptible magnitudes, give rise to perceptible elements which in turn constitutes the whole world of sense (*Timaeus* 53c-61c). Plato thus claims to do what Parmenides claimed could not be done. In what is perhaps the first instance of the explanatory gap, Parmenides complains of his predecessors that they infer sensible body from extension. But there is no valid inference from intelligible form to sensible form. Becoming pertains to the sensible, and the one being of the Way of Truth has only unchanging intelligible form (see Guthrie 1965, 49). Aristotle is echoing this Parmenidean complaint. But instead of eliminating the sensible from the true account of the world as the unnamed goddess recommends, Aristotle retains the sensible and eliminates explanatorily otiose imperceptible magnitudes. It is noteworthy, in this regard, that the primary opposites—Hot and Cold, Dry and Wet—are sensible qualities. Instead of positing fundamental explanatory properties that would pose an explanatory gap problem for the sensible world, Aristotle seeks within the manifest image of nature for the explanatory resources that he needs.

This historical debate bears on how the metaphysics of color should be conceived and conducted. In the terms of the debate between Parmenides, Plato, and Aristotle, the metaphysics of color is a special case of the problem of the manifest, as it was for Empedocles as well. The task is to determine whether chromatic form may intelligibly be instantiated, as our experience of nature presents it to be, consistent with our best scientific understanding of nature. The *De Sensu* doctrines that every body participates in the transparent to some degree and that this determines a ratio of light and dark that in turn determines that body's chromatic hue, is an attempt, on Aristotle's part, to resolve the problem of the manifest as it arises from our experience of the colors of remote external particulars (see chapter 4.4).

6.3 Assessment

What are we to make of this ancient tradition, elaborated by Aristotle, that understands the chromatic hues in terms of a combination of light and dark?

Any assessment does well to distinguish the separable strands of thought to be found in this tradition. Let me here focus exclusively on two:

- (1) Lightness and darkness constitute a dimension of similarity along which all chromatic hues are aligned;
- (2) Lightness and darkness are explanatory determinants of the chromatic hues.

Whereas the first strand cannot survive given what we now know about colors and their perception, arguably at least, the second strand survives, *inter alia*, in modern reflectance theories.

According to the ancient tradition, colors are subject to a unidimensional similarity ordering that includes white and black as the extreme endpoints. The first problem arises from the fact that the colors participate in a multidimensional similarity ordering. There are a plurality of dimensions along which the different colors are more or less similar. There are different models of the multidimensional color space that are responsive to different practical needs. Most philosophers are familiar with thinking of color similarity in terms of a three-dimensional space—a nineteenth century innovation—one dimension each for hue, saturation, and brightness. The incompleteness of the three-dimensional color space can be directly observed, however. Where on the three-dimensional color space is metallic green? More advanced models provided by colorimetrists typically posit more than three dimensions. It is an open empirical question just how many dimensions there are to color similarity (and one that may lack content independently of the practical need underlying the given metric). However, the inadequacy of the unidimensional model posited by the ancients is easily established: There are distinct hues of equal brightness. An ordering of the colors by brightness is incomplete. It is not the case that colors can be identified by their place in the ordering from light to dark. Colors of distinct hues may be equally bright. A complete color similarity ordering is multidimensional.

The second problem concerns how the endpoints of the ordering are conceived. The ancient tradition conceives of these endpoints as included in the similarity ordering. However, the endpoints of the brightness dimension are not included in the ordering so much as they are a limit to which colors in that ordering may approach. There is no black darker than any other black, nor any white lighter than any other white. There is rather an approach to a limit. By including the endpoints in the similarity ordering, the ancient tradition obscures this.

The third problem is one of omission. Aristotle and the ancient tradition fail to properly distinguish between chromatic brightness understood as a dimension of color similarity and brightness understood as an increase in the amount of light. The distinction is difficult to directly observe without some means of measuring light. It is natural to think that an increase in the amount of light reflected from a surface would produce a chromatically brighter appearance. Unfortunately these distinct senses of brightness can come apart. Consider viewing a page of black print on white paper, first indoors under artificial illumination, then outside in natural daylight. The intensity of the light reflected by the white area of the page indoors is approximately the same as the intensity of the light reflected by the black print in sunlight (Kaiser and Boynton, 1996, 199). Despite being equally bright, in the sense that the reflected light is equally intense, the apparent colors differ in chromatic brightness—the surrounding white when viewed indoors seems brighter than the black print when viewed in daylight. So not only are these distinctions

conceptually distinct (one speaks of color the other speaks of light), but they are extensionally distinct as well (surfaces can reflect the same amount of light and yet differ in chromatic brightness). This omission is related to a problem raised earlier in chapter 4.4. Recall, an opaque body with a surface color and an imperfectly transparent medium with a volume color may both share the same hue. But if the amount of light both determines the hue and the degree of transparency how could this be? Both enjoy the same hue and so both must participate the same ratio of light and dark. But the threshold, if there is one, that makes for transparency is met in the case of the imperfectly transparent medium but is not met in the case of the opaque body. The problem arises from the theoretical uses to which the fiery substance is being put, as jointly determining the hue of a body and its degree of transparency. The problem thus arises by not recognizing that brightness understood as a dimension of color similarity and brightness understood as the amount of light can come apart.

A final problem concerns a commitment specific to Aristotle. The juxtaposition, overlap, and mixture models are meant to be formally equivalent in the sense that the same proportions of light and dark are determined, at least in principle. The discovery by von Helmholtz (1852a) of subtractive and additive color mixing processes provides the means of establishing their nonequivalence. Thus color mixing that results from mixing pigments is a subtractive process. As is the color mixing that results from overlaying filters. However, color mixing that is the result of juxtaposition, such as the pointillist technique involved in Seurat's masterpiece, is an additive process. And what Helmholtz showed was that not every color determined by an additive process can be matched with a color determined by a subtractive process. So there are colors determined by juxtaposition that could not be determined by overlap or mixture. The three models are not formally equivalent the way that Aristotle supposed.

I suspect that skepticism about this tradition, when not due to bad ethnolinguistics, is due in large part to an intuitive recognition of its empirical inadequacy as an account of color similarity. Given what we know about the colors, it strikes us as manifestly false. While, its central claims about color similarity are known to be false, this is insufficient grounds for a dismissive attitude towards the ancients. After all, our knowledge about the colors and their perception is a significant historical achievement as yet unavailable to them. Thus Broackes (2010, 291) writes that "It is a topic on which psychologists, physicists, biologists, and neurophysiologists—not to mention paint manufacturers, dyers, and makers of photographic equipment—have reason to be proud and glad of the convergence of interests and views." If the mistakes of the ancients seem obvious to us, it is not, *pace* Platnauer (1921, 162), because we are more attentive than they were to "the qualitative differences of decomposed and partially absorbed light". Rather, we

are the beneficiaries of chromatic knowledge hard won by a variety of interested parties over the centuries. Moreover, this hard won chromatic knowledge includes knowledge of the phenomenological character of color perception. Phenomenology is something about which discoveries can be made. Thus opponent processing theory makes a number of important phenomenological predictions that have been verified by psychophysical experimentation. But the phenomenological commitments of opponent processing theory, if indeed true, are not obvious merely upon reflection on the character of color experience. Mistaken beliefs about phenomenology, even about the phenomenologically vivid facts of color similarity as experience presents it to be, require neither that the subject be insensitive to color similarity nor that they be inattentive to that sensitivity manifest in their color experience. (On the importance of psychophysics to phenomenological investigation see Hilbert 2005; Phillips 2012)

Fortunately, the ancient tradition does not consist entirely of claims about color similarity. At the heart of the ancient view is a claim about the explanatory priority of cosmic fire. According to the cosmology of the way of Mortal Opinion, Fire and Night are fundamental and irreducible principles standing in opposition. Fire is partly manifest in the sensible quality of brightness—it has other “signs” or attributes as well. Fire is a cosmic principle that is independent and explanatory of instances of its attributes. Thus the brightness of a particular is due to the presence and activity of the cosmic principle of Fire. Importantly, this is an explanatory claim about the determinants of brightness and not a claim about color similarity.

The doctrines of Empedocles and Aristotle echo, in their own way, the explanatory priority of cosmic fire. According to Empedocles, the brightness of bone is due to the preponderance of fire in its elemental composition (DK 31B96). And the blackness of the river’s depths is due to the presence of water (DK 31B94). It is because of the preponderance of fire in the bone’s composition that it gives off fiery effluences, and it is because of the preponderance of water in the river’s depths, that it gives off watery effluences. Elemental composition, for Empedocles, is a metaphysical determinant of the colors.

The presence and activity of the fiery substance makes a potentially transparent medium actually transparent. Insofar as actual transparency is materially sufficient for the visibility of colored particulars, this merely concerns the perceptual availability of the colors and not their constitution. However, fire plays a role in the determination of the colors as well. The presence and activity of the fiery substance explains the brightness of a transparent medium and brightness is of the nature of color (*De Sensu* III 439^b1). Brightness may be a color, but it is not the only color that fire helps to determine. One important contribution of Empedocles was to make explicit what was merely implicit in the Parmenidean fragments, at least as they have come down to us—that the chromatic hues are due to the ratio of light

and dark. This is manifest in Aristotle's account of the generation of the hues—that it is the ratio of light and dark in a mixture that determines the chromatic hue of a particular. Since light or brightness is determined by fire, then the presence of fire partly determines the ratio of light and dark in a mixture that itself determines the chromatic hue of the particular.

Aristotle's definition of color as the power to move what is actually transparent can be seen as an ancient prefiguration of modern reflectance theories. Thus Ross (1906, 23) writes "It is noteworthy that if one were to define black and white in the modern way as the capacity of a surface to reflect none or all of the light cast upon it, one could still describe the chromatic tints as intermediate between these, as diverse aptitudes for reflecting one portion and absorbing the rest of the total light." Consider the simplest form of the reflectance theory according to which a surface color is the disposition to reflect a certain percentage of light in each of the wavelengths of the visible spectrum (see Hilbert, 1987). This account can be extended to volume color and radiant color in the obvious ways. Thus volume color would be the disposition of a volume to transmit a certain amount of light in each of the wavelengths of the visible spectrum, and a radiant color would be the disposition of a light source to emit a certain amount of light in each of the wavelengths of the visible spectrum. Color, so understood, would be the power to affect light in a certain way. Only two claims separate the reflectance theory from Aristotle's definition. The first claim is a specification. In maintaining that surface color is a disposition to reflect, transmit, or emit a certain amount of light, modern reflectance theories specifies the way in which color affects light—by reflection, transmission, or emission. Moreover, the amount of light reflected, transmitted, or emitted just is the mixture of light and dark, in the Pickwickian sense of mixture to which Aristotle is committed. The second claim is that there are different kinds of light. Newton (1704) recognized the necessity of distinguishing different kinds of light in the way that Aristotle did not. Though von Goethe (1810) saw matters differently, the intrusion of the Newtonian distinction between kinds of light, while anachronistic, is nevertheless a consistent extension of Aristotle's metaphysics. Nothing Aristotle says is inconsistent with their being different kinds of light. A latter day Aristotelian could very well accept that there are consistent with their Aristotelianism. They might even retain the claim that the different kinds of light are both visible and structured as a continuum, so long as they were careful to attend to the actual and the potential and their various senses. Thus whereas the first claim—that color reflects, transmits, or emits a certain amount of light—was a specification of Aristotle's more general claim that color is power to affect light, the second claim—that there are different kinds of light that may be reflected, transmitted, or emitted—is a consistent extension of Aristotle's account. Conjoining the specification of Aristotle's definition with the Newtonian extension just is a statement of the simple

reflectance theory with which we began. That colors are ways of affecting light is an important genus in the metaphysics of color, one that Aristotle's definition of color belongs to, and it is arguable that Aristotle inaugurates this metaphysical tradition.

Newton's disagreement with Aristotle has less to do with there being different kinds of light, or even that these kinds of light constitute a continuum subject to a finite subdivision into seven chromatic consonances, but with a fundamental claim of the ancient tradition, that white and black, or rather, light and dark are the primary colors in terms of which all other colors are ultimately to be explained. White or light, instead of being mixed in various proportions to produce the chromatic hues, is now the mixture of all the spectral colors. Newton describes this as "the most Paradoxical of all my assertions, & met with the most universall & obstinate Prejudice" (Newton to Oldenburg, 7 December 1675, in Turnbull et al. 1959–1977, 385). This paradoxical assertion is nothing less than the demolition of the explanatory framework of the ancient tradition, and it is this which most likely drew Goethe's ire. Modern reflectance theories reject the framework within which Newton's paradoxical assertion was made, that determinate colors are associated with kinds of light in the spectral continuum (Hilbert, 1987). Indeed, reflectance theories were motivated, in part, by the criticism of Edwin Land, the inventor of the Polaroid, of Newton's theory (Land and McCann 1971, Land 1977).

Color is the power to affect light, understood as a state of illumination sustained by the contingent presence and activity of the fiery substance. Color affects light by affecting the extent and degree of the activity of the fiery substance, and in cases of reflection and diffraction, its direction of influence as well. From a modern perspective, one problem for Aristotle's version of the explanatory priority of cosmic Fire is the resulting conception of the fiery substance. Being fire, its being consists in its burning. But since it pervades bodies of air and water, it must be incorporeal. But an incorporeal activity that can instantaneously pervade a potentially transparent region insofar as it is a unity can strike us as queer. Fortunately, it was but one small step towards a better conception. Philoponus' elaboration of Aristotle's account, with the aid of concepts from his novel dynamics, is a step towards the wave conception of light (see Wolff 1987).

Aristotle's account of the generation of the hues is the culmination of an ancient tradition that understands the chromatic hues in terms of a combination of light and dark, an ancient tradition that has few adherents among moderns, Goethe notwithstanding. The largest obstacle moderns face in appreciating this ancient tradition, when not blindsided by bad ethno-linguistics, is incredulity at associated claims about color similarity. If this were all there were to this tradition, it would indeed be of antiquarian interest only. But this is not the case. Importantly, and more centrally, the ancient tradition makes claims about the explanatory deter-

minants of the colors. At the heart of this ancient tradition is a claim about the explanatory priority of cosmic Fire. And it is this which is of lasting significance.

Chapter 7

The Eye

7.1 The Soul of the Eye

Sight, Aristotle tells us, is the soul of the eye, or would be if it were an animal. This claim is made in the context of explaining what the soul of an animal is, and Aristotle proceeds by analogy with artifacts and parts of animals:

Suppose that a tool, e.g. an axe, were a natural body, then being an axe would have been its essence, and so its soul; if this disappeared from it, it would have ceased to be an axe, except in name. As it is, it is an axe; for it is not of a body of that sort that what it is to be, i.e. its account, is a soul, but of a natural body of a particular kind, viz. one having in itself the power of setting itself in movement and arresting itself. Next, apply this doctrine in the case of the parts of the living body. Suppose that the eye were an animal—sight would have been its soul, for sight is the substance of the eye which corresponds to the account, the eye being merely the matter of seeing; when seeing is removed the eye is no longer an eye, except in name—no more than the eye of a statue or of a painted figure. (Aristotle, *De Anima* II I 412^b12–22; Smith in Barnes 1984b, 22)

If an axe were a natural body, then what it is to be an axe would be both essential to the axe and its soul. If what it is to be an axe were somehow removed from a thing, then it would cease to be an axe. For a thing to have what it takes to be an axe is for that thing to possess a capacity for motion and rest characteristic of axes. Specifically, the thing must possess the capacity to cut in the manner of axes. If the thing had some other capacity, to join, for example, or if it cut in some other manner, then it would not be an axe, but a vice or a knife, say. Thus should a thing lose its capacity to cut, or to cut in that manner, it would cease to be an axe. It

would be an axe in name only. The capacity to cut in the manner of axes is the essential form and substance of an axe. If the capacity to cut in that manner is the form of an axe, then the material parts of the axe—the wooden shaft, the bronze head—constitute its matter.

In the quoted passage, Aristotle notes an important limitation of the analogy. “As it is, it is an axe.” The essence of an axe, what it is to be an axe, is not in fact a soul. To conceive of an axe as a natural being is not yet to conceive of it as a living being. But living beings are the only natural beings with souls. An axe is merely conceived as a natural body that contains within itself the power of motion and rest but not yet in the manner of a soul.

Aristotle’s account of the soul of an axe conceived as a natural body is the model for his account of the soul of an eye conceived as an animal. If an eye were an animal, then what it is to be an eye would be both essential to the eye and its soul. In supposing the eye to be an animal, a living being, the present analogy is not subject to the limitation of the previous analogy. If what it is to be an eye were somehow removed from a thing, then it would cease to be an eye. For a thing to have what it takes to be an eye is for that thing to possess the capacity for sight. Thus should a thing lose this capacity, it would cease to be an eye. It would be an eye in name only. A thing that lacks the capacity to see is like the eye of a statue, such as the drooping eye of King Seuthes III in the 4th century BC Thracian bronze portrait, the trace, perhaps of an old battle wound (see figure 7.1). The portrait is remarkably naturalistic, and the King’s gaze is arresting. The artist used glass paste of different colors to distinguish the white of the eye, the pupil, and the iris and used thin copper wire for the eyelashes. Despite the striking naturalism and the intensity of the King’s gaze, the drooping eye is, nonetheless, no real eye. Despite the naturalism and psychological expression achieved by the Thracian masterpiece, the colored glass paste, being opaque, lacks the capacity to see. The capacity to see is the essential form and substance of an eye. If the capacity to see is the form of the eye, then the material parts of the eye—the membrane, the interior water—constitute its matter.

If we suppose the eye to be an animal, perhaps it makes sense to think of the hypothetical creature as possessing the capacity to see. But if we relax that supposition, and consider an eye as it naturally occurs as part of an animal, then it would be wrong to think that an eye possesses the capacity to see. Plato makes this point by means of an analogy:

SOCRATES: Yes, my son. It would be a very strange thing, I must say, if there were a number of perceptions sitting inside us as if we were Wooden Horses, and there were not some single form, soul or whatever one ought to call it, to which all these converge—something *with* which, *through* those things, as if they were instruments, we perceive all that



Figure 7.1: Detail of 4th century BC Thracian bronze portrait of King Seuthes III

is perceptible. (Plato, *Theaetetus* 184^d; Levett and Burnyeat in Cooper 1997, 204)

The warrior senses confined within the Wooden Horse are like the eye conceived as an animal in that they possess the power to perceive. The senses are what sense—the eye sees, and the tongue tastes. This, at any rate, is a consequence of the Heraclitean conception of perception involved in the Secret Doctrine (see Burnyeat 1976, 30–31). Plato's point in this passage is that the Wooden Horse remains insensate despite being inhabited by warrior senses so conceived. If the senses make us sensate, then they could not themselves possess the power to perceive, rather they must endow the perceiver with that capacity. Thus his eyes may have endowed King Seuthes III with the capacity to see, at least when he was alive, but they did not themselves possess this capacity. Similarly amputated eyes, eyes separated from the animal in which they naturally occur as parts, neither possesses the capacity to see nor endow anything else with that capacity.

There are thus grounds for criticizing a commitment of Empedocles that arises in a passage that, as Wright (1981, 211) observes, Aristotle finds sufficiently interesting to cite three times (in *De Anima* III.6 430^a27, *De Caelo* III 2 300^b25, and *De Generatione Animalium* I 18 722^b17):

as many heads without necks sprouted up
and arms wandered naked, bereft of shoulders,
and eyes roamed alone, impoverished of foreheads
(Empedocles, DK 31B57; Inwood 2001, 64 245)

At a certain stage of the cosmic cycle, where Strife still dominates but whose influence is on the wane as Love grows stronger, the parts of animals arise spontaneously and in a disordered state. These combine to give rise to fantastical animals, some with clear mythological precedent:

Many with two faces and two chests grew,

oxlike with men's faces, and again their came up
 androids with ox-heads, mixed in one way from men
 and in another way in female form, outfitted with shadowy limbs.
 (Empedocles, DK 31B61; Inwood 2001, 66 247)

These animals tended not to survive. It is only when animal parts are combined in harmony, due to the increased influence of Aphrodite's Love, do the animals that we presently recognize emerge. Due to the harmony among their parts which fits them to a life in their natural environment, present animals not only survive but have the means of reproduction. Now consider the eyes roaming alone, impoverished of foreheads. Like amputated eyes, they are separated from animals in which they would harmoniously occur as parts. And like amputated eyes, they neither possess the capacity to see nor endow anything else with that capacity. Though eye-like in structure and composition, these are eyes in name only, at least by Aristotle's lights:

What a thing is is always determined by its function: a thing really is itself when it can perform its function; an eye, for instance, when it can see. When a thing cannot do so it is that thing only in name, like a dead eye or one made of stone, just as a wooden saw is no more a saw than one in a picture. (Aristotle, *Meteorologica* IV 12 390^a10-14; Webster in Barnes 1984b, 86)

The capacity to cut in the manner of axes is a power and potentiality. A thing may possess this power, and so retain the potential to cut in that manner, even when at rest, when it is not actually cutting anything. Similarly, the capacity to see is a power and potentiality. A thing may possess or endow this power, and so retain the potential to see, even when at rest, when it is not actually seeing anything, because of darkness or sleep, say. Aristotle also claims that, in general, matter is potentiality and that form is actuality. There is no inconsistency here as the actual and the potential are said of in many ways. A thing is actually an axe if it possesses what it takes to be an axe, the capacity to cut in the manner of axes, the form and substance of an axe. Moreover the material parts of the thing, the matter of the axe—the wooden shaft, the bronze head—are potentially an axe since they are capable of taking on the form of an axe. When the bronze is suitably fashioned, and honed, and securely fixed to the wooden shaft, the matter, in taking on the form that it does, in so acquiring the capacity to cut in the manner of axes, realizes this potentiality. But what it is to be an actual axe is itself a power and potentiality, the capacity to cut in the manner of axes, a potentiality actualized in so cutting. Similarly, a thing is actually an eye if it possesses what it takes to be an eye, the capacity to see, the form and substance of an eye. Moreover the material parts of the thing, the matter of the eye—the membrane, the interior

water—are potentially an eye since they are capable of taking on the form of an eye. When interior water is bound by the membrane and the other parts of the eye are suitably arranged, the matter in taking on the form that it does, in so acquiring the capacity for sight, actualizes this potentiality. What it is to be an actual eye is itself to possess or endow a power and potentiality, the capacity to see, a potentiality actualized in seeing.

The actual and the potential are said of in many ways. In his discussion of these analogies, Aristotle distinguishes two senses of the actual/potential distinction. There is an initial potentiality had by some matter. This potentiality is realized by that matter taking on a form. The taking on of the relevant form is the first actuality. However, in the cases at hand, the relevant form is understood as the possession, or perhaps the endowment of, a capacity. So the first actuality is itself a potentiality. The realization of this potentiality, the exercise of the capacity which is the form of the matter, is the second actuality. These distinctions are schematically represented in table 7.1

	<i>An Axe</i>	<i>An Eye</i>
<i>First Potentiality</i>	the matter of an axe	the matter of an eye
<i>First Actuality/Second Potentiality</i>	the capacity to cut	the capacity to see
<i>Second Actuality</i>	cutting	seeing

Table 7.1: Two senses of the actual/potential distinction

Eyes endow animals that possess them with the capacity to see. This is a capacity that animals enjoy even when asleep or inattentive. Endowing the perceiver with the capacity for sight is what the organ of sight is for. As Johansen (1997) argues, this further teleological claim motivates a certain explanatory strategy with respect to the anatomical structure of the eye, what he describes as a “top-down explanation”. Begin with what the organ of sight is for, to endow its possessor with the capacity to see. If the perceiver is endowed with this capacity, then the primary objects of sight, the colors of remote external particulars, potentially appear in the perceiver’s experience of them. In order for the colors of remote external particulars to appear in the perceiver’s experience of them, the organ of sight must be transparent. Sight is a reactive capacity, the organ of sight must be acted upon for sight to be exercised. And color only ever acts, even mediately, upon what is actually transparent. The eye has the structure and composition that it does to sustain the transparency necessary to endow the perceiver with the capacity for sight. So our initial discussion of transparency (chapter 3) was necessary not only to understand Aristotle’s definition of color (chapter 4) but also to understand Aristotle’s explanatory strategy with respect to the anatomical structure of the eye. And understanding Aristotle’s explanatory strategy, here, will yield insight into the significance of its limitations. Moreover, and importantly, understanding transparency

is necessary to understand the way that the organ of sight must be acted upon if its possessor may see by means of it.

7.2 Transparency and the Anatomy of the Eye

Why must the organ of sight be transparent?

Sight is a reactive capacity. It is a mode of sensitivity to the colors of remote external particulars. It only acts by reacting to the presence of a particular's color. Since sight is a reactive capacity, it must be acted upon in order for it to be exercised. That its exercise, an episode of seeing, just is being acted upon in this way is a further claim, that Aristotle denies, *De Anima* II 5. (For a contemporary defence of this denial see Travis 2009 and Kalderon forthcoming.) Color could not immediately act upon the eye, since contact would blind the perceiver to the particular and its color. Contact precludes sensation, to be palpable is to be imperceptible. Nevertheless, the color of a remote external particular can act upon the eye mediately, by acting upon the intervening medium. Thus was the moral of Aristotle's criticism of Democritus and Empedocles (chapter 2.2). The eye is itself affected by the color's effect on light. Since color is the power to alter what is actually transparent, the eye is affected by color's effect on transparent media by itself being transparent, at least in part. The eye is transparent, then, at least in part, so that the colors of remote external particulars may mediately act upon it. Which they must be capable of doing, since sight is a reactive capacity, a mode of sensitivity to the colors of remote external particulars arrayed in the natural environment.

Suppose that is right. Suppose that sight could only be the reactive capacity that it is, a chromatic sensitivity, if the organ of sight were transparent, at least in part. This would constrain its elemental composition. Whereas some elements are receptive to the presence and activity of the fiery substance, such as air and water, other elements, such as earth, exclude the fiery substance or at least retard its activity. Transparency is present only in matter with a certain elemental composition, one that allows for the presence and activity of the fiery substance.

That sight is a reactive capacity, a chromatic sensitivity, not only constrains the elemental composition of the eye, but it also constrains its structure. Transparency is a nature or power common to different substances such as water and air. So the requirement that the internal medium of the eye be transparent does not by itself determine whether an eye must have either elemental composition. Further material considerations determine that the internal medium be water:

True, then, the visual organ proper is composed of water, yet vision appertains to it not because it is water, but because it is transparent—a property common alike to water and to air. But water is more easily

confined and more easily condensed than air; it is that the pupil, i.e. the eye proper, consists of water. (Aristotle, *De Sensu* II 438^a13–18; Beare in Barnes 1984b, 5)

Air and water are liquids and so lack fixed boundaries. If the organ of sight is thus composed, at least in part, of the transparent, this liquid must somehow be confined to the organ of sight, by a fine membrane (like the membrane with which Aphrodite's Love enshrouds the primeval fire in the eye's interior, Empedocles DK 31B84). That this is more easily done with water than air favors the conclusion that the eye is composed, at least in part, of water. However, what is presently important is that reflection on the material constraints of sustaining an internal transparent medium not only determines the elemental composition of the internal medium but also significant anatomical structure, the existence of a membrane that confines and condenses the internal water.

That the eye is composed of water, at least in part, receives additional empirical support from gross anatomical observation. Water flows from decomposing eyes (*De Sensu* II 438^a17), and this water is remarkably cold and glistening when it flows from the eyes of embryos (*De Sensu* II 438^a18). Whereas in sanguineous animals, the eye contains fat and oil to prevent the water from freezing, the eyes of bloodless animals are covered for the the same reason (*De Sensu* II 438^a20–3).

Aristotle's anatomy of the eye recapitulates important aspects of the ingestion model, as presented in the answer in the style of Gorgias (*Meno* 76^{a-d}):

Now, as vision outwardly is impossible without light, so also it is impossible inwardly. There must, therefore, be some transparent medium within the eye, and, as this is not air, it must be water. The soul or its perceptive part is not situated at the external surface of the eye, but obviously somewhere within: whence the necessity of the interior of the eye being transparent, i.e. capable of admitting light. And that it is so is plain from actual occurrences. It is matter of experience that soldiers wounded in battle by a sword slash on the temple, so inflicted as to sever the passages of the eye, feel a sudden onset of darkness, as if a lamp had gone out; because what is called the pupil, i.e. the transparent, which is a sort of lamp, is then cut off. (Aristotle, *De Sensu* II 438^b7–15; Beare in Barnes 1984b, 6)

This passage is the culmination of a dialectic that began at *De Sensu* II 437^b11. An explanation of vision in terms of the eye's fiery emission, attributed to Empedocles and Plato in the *Timaeus*, is contrasted with the competing explanation of Democritus in terms of the eye's reflection. The passage presents a complex dialectical refinement of the *endoxa*. The explanations of Empedocles and Democritus are, of

course, rejected. Importantly, however, Aristotle retains elements of each of their explanations, even if these elements are fundamentally reconceived.

According to Aristotle, Democritus maintains that the eye sees because of its reflective surface, itself due to the smoothness of the eye and the presence of lachrymal fluid (*De Sensu* II 438^a5–12). Democritus is wrong in thinking that this was due to water’s capacity for reflection, and consequently wrong in taking the locus of sight to be on the surface of the eye. Specifically, Democritus’ account overgeneralizes—there are reflective things that lack the capacity for sight. Nevertheless, Democritus was right to link the eye’s capacity to see with the presence of water. However, it is not the reflectivity but the transparency of the eye’s water that is required to endow its possessor with the capacity to see.

This parallels the way that Empedocles accommodates the dominant medical opinion of his time (discussed in chapter 1.3). The presence of lachrymal fluid is both necessary for sight and necessary for the reflective appearance of the eye. This encouraged the opinion that the reflective appearance of the eye explained the eye’s receptivity to sight, and hence that the surface of the eye is the locus of sight. However, on the ingestion model, the assimilation of chromatic effluences is a material precondition for their presentation to the organ of sight. On the ingestion model, sight is located within. By conceiving of the receptors on the surface of the eye as water-bound passages to its interior, Empedocles reconciles the ingestion model with the dominant medical opinion of his time. Similarly, Aristotle asserts that “the soul or its perceptive part is ... obviously within” (*De Sensu* II 438^b9–10; Beare in Barnes 1984b, 6). And like Empedocles, Aristotle retains something of Democritus opinion. But not by finding a role for the surface of the eye in seeing, but by claiming that the eye is partly composed of water. Moreover, as we shall see, the transparent plays a role similar to the role played by ocular passages in Empedocles’s theory of vision.

Aristotle rejects the explanation of vision in terms of the eye’s fiery emission. While Aristotle attributes this view to Empedocles on the basis of the lantern analogy (DK 31B84; quoted in full at *De Sensu* II 437^b27–438^a3), he also writes:

Sometimes he accounts for vision thus, but at other times he explains it by emanations from the visible objects. (Aristotle, *De Sensu* II 438^a3–4; Beare in Barnes 1984b, 5)

As discussed in chapter 1.3, Aristotle thinks that Empedocles is potentially offering distinct explanations of color vision—one in terms of the eye’s emission of fiery effluence and the other in terms of the eye’s assimilation of chromatic effluences. While Aristotle rejects the explanation of color vision in terms of the eye’s fiery emission, he reinterprets Empedocles’ lantern analogy on the model of the answer in the style of Gorgias, though with crucial refinements.

While rejecting the explanation of vision in terms of the eye's fiery emission, nowhere does Aristotle directly deny the fundamental claim of Empedoclean anatomy that the eye is composed of "fire and its opposite" (Theophrastus, *De Sensibus*, xv). Perhaps, this is not an omission on Aristotle's part but intentional, for there is another way to understand Empedocles' talk of interior fire. If the eye's interior is composed of confined and condensed water in order to sustain its transparency, then the interior water, being transparent, is receptive to the presence and activity of the fiery substance. The external medium must be illuminated if the color of a remote external particular is to be visible in it. Similarly, for that color to be visible, the external light must be extended within. The transparent water of the eye's interior must itself be illuminated. And the internal medium is only illuminated by the presence and activity of the fiery substance. While seeing the white of the sun may not involve the assimilation of fiery effluences as Empedocles maintained, nevertheless, if the white of the sun is visible to the perceiver, this is due, in part, to the presence and activity of the fiery substance in the eye's interior. This is why Aristotle makes the deliberate allusion to Empedocles' lantern analogy (DK 31B84). Like Empedocles, Aristotle compares the eye to a lantern. But not because the eye emits fire the way a lantern does. But because the interior of the eye must be illuminated, the way the interior of a lamp is illuminated, if the external scene is to be visible. So not only does Aristotle retain the phenomenological insight of Empedocles, that seeing is a mode of assimilation, "the soul or its perceptive part" within. But Aristotle also retains the Empedoclean doctrine that the exercise of the capacity for sight involves fire in the eye's interior, understood as the fiery substance illuminating the internal medium.

Though Aristotle reinterprets Empedocles' lantern analogy on the model of the answer in the style of Gorgias, there are crucial refinements, as he rejects the theory of effluences.

According to Empedocles, what is assimilated is a material particular, a chromatic effluence, conceived as a fine body, composed of fire or water, with a distinctive magnitude. On Aristotle's reinterpretation of the lantern analogy, what is assimilated is not a material particular, but the state of the external medium, a state sustained by the illuminating presence and activity of the fiery substance. The state of the internal medium need not be the same as the state of the external medium. Internal and external media may differ in their degree of transparency, and so dark eyes may be illuminated to a lesser degree than the surrounding air. Nevertheless, the state of illumination of the interior water is determined by the amount of fiery substance encountered in the external medium and the degree of transparency of the internal medium, the degree to which it is susceptible to the illuminating presence and activity of the fiery substance.

Despite rejecting the theory of effluences, the transparency of interior water

plays, for Aristotle, a function that ocular passages play in Empedocles' theory of vision. Chromatic effluences, because of their distinctive magnitudes, are commensurate with ocular passages. As such, they can travel through such passages and so be palpable to the organ of sight. While a state lacks location, and so cannot travel, the external light is extended within, in the sense in which it can, so that the color of remote external particulars may be present in visual consciousness. It is thanks to the illuminated state of the eye's interior that the perceiver is able to assimilate the chromatic form of distal particulars in the natural environment. As I argued in chapter 1.2, the assimilation of chromatic effluences by the organ of sight is not, by itself, the sensing of colors. The assimilation of chromatic effluences is at best a material precondition for their sensing. Similarly, admitting light into the interior of the organ of sight is not, by itself, the sensing of colors. Interior illumination is at best a material precondition for their sensing. Sensing is the presentation of the color to the perceptive part of the soul, not by being palpable, but by the assimilation of chromatic form, by the color of remote external particulars shaping visual consciousness. However the doctrine of the assimilation of sensible form is to be understood, interior illumination is a material precondition for sensing, so understood. That the interior illumination takes on a character that depends on derives from the character of the exterior illumination may make the colors of remote external particulars perceptually available, but the perceptually availability of the colors only involves the colors being potentially perceived, not their actual perception.

The present understanding of Aristotle's deployment of the lantern analogy is further confirmed by the empirical evidence that Aristotle marshals at the end of this passage (*De Sensu* 438^b 12–15). That the eye must be "capable of admitting light ... is plain from actual occurrences", such as the blindness resulting from a wound sustained by a slash on the temple. Such a wound severs passages leading away from the eye and so impairs the eye's capacity to endow its possessor with sight. Though the wounded soldier's eyes are filled with light, since the passages leading within are severed, presumably, to a position at or near the heart, the colors of remote external particulars are no longer present in his visual consciousness. While they appear through the internal medium, being actually transparent, the colors of distal particulars are cut off from the perceptive part of the soul. The wounded soldier can no longer assimilate the chromatic form of remote material particulars.

We have here another significant part of the eye's anatomy, the passages from the eye leading within. One should not anachronistically assume that Aristotle has in mind the optic nerve. Given that the seat of sensation is at or near the heart, a better hypothesis would be that they are vessels leading to the heart. However, Aristotle's description of these passages underdetermines any such identification (see Lloyd, 1978). In fact, Aristotle seems only interested in this anatomical detail

insofar as these passages extend the transparent within. In extending the transparent within, the perceptive part of the soul becomes receptive to the direction of influence of the fiery substance. It is the presence and activity of the fiery substance that determines the sensible character of internal and external media. Moreover, the sensible character of transparent media is itself determined by the colors of the particulars that appear through that media. The precise content of the Aristotelian doctrine of the assimilation of sensible form remains, at this point, unclear. What is clear is that, first, it does not involve chromatic forms traveling in the manner of effluences, as Hobbes (1651, 11) imagined, and that second, the passages extending the eye's transparency within are necessary for the assimilation of chromatic form.

Not only does Aristotle's empirical example provide us with another significant part of the eye's anatomy, but it also further illustrates what Johansen (1997) describes as Aristotle's "top-down explanation". Sight is the soul of the eye, or it would be if it were an animal. Endowing its possessor with the capacity for sight is what the organ of sight is for. Consequently the organ of sight is understood to have the structure and composition required to endow this capacity. Evidently, passages extending the transparent within are necessary for the capacity for sight, since when they are severed, the victims of such wounds are blinded. We have an explanation from what the organ of sight is for—to endow the perceiver with the capacity for sight—to anatomically significant structure—passages leading away from the eye.

So far we have distinguished the condensed and confined water in the eye's interior, the membrane that confines it, the pupil, and passages leading away from the eye to some point in the interior, perhaps, at or near the heart. In addition, Aristotle distinguishes the dark of the eye from the light (*De Sensu* II 437^b1), understood as the iris and the white of the eye that surrounds the iris (Lloyd see 1978, 218, 231 n13). In sanguineous animals, the white is fat and oily to prevent the transparent water of the eye from freezing (*De Sensu* II 438^a20–3). The contrast must be with the dark of the eye, as opposed to the black, since Aristotle recognizes different colored irises: "In some it is black, in some distinctly blue, in some greyish-blue, in some greenish" (Aristotle, *Historia Animalium* I 10 492^a2–3; Thompson in Barnes 1984b, 13). Blue, grayish-blue, and greenish may be dark, at least when compared with the white of the eye, but they are not black. Further evidence, if any were needed, that *melaton* and its cognates should be understood as dark as opposed to black in the Aristotelian color scheme.

The Aristotelian anatomy of the eye is crude, even by ancient standards. Lloyd summarizes its limitations:

Yet no attempt is made to describe the structure of the eye as a whole, although this is, of course, complex. The three main parts Aristotle identifies quite incidentally in the course of this chapter, pupil, iris,

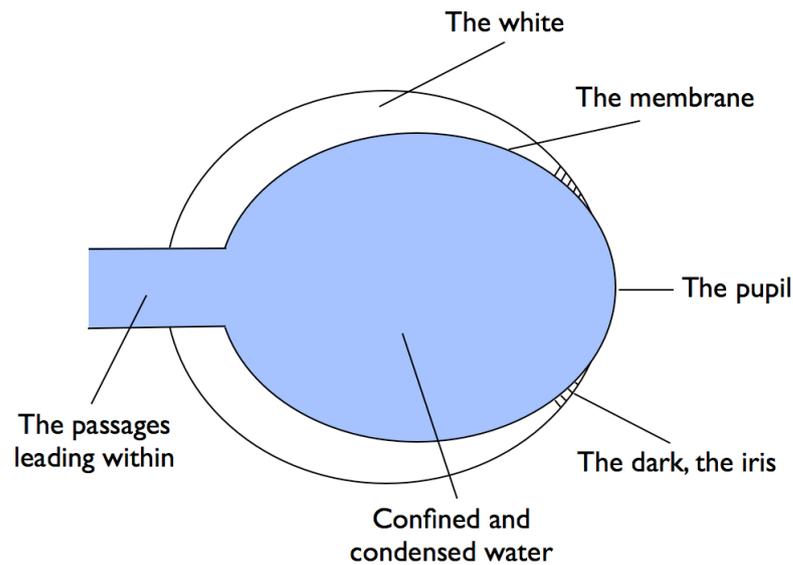


Figure 7.2: Aristotelian anatomy of the eye

white, relate primarily to the superficial appearance of the eye. Apart from the one reference to the membrane of the eye and the one reference to certain *poroi*, already mentioned, his remarks on the internal structure of the eye are confined to the point that the pupil, *kore*, consists of water. We may take it that this refers to the vitreous humour that occupies most of the bulb of the eye and which, in certain lesions, might produce a watery discharge. But there is no mention of the membrane enveloping the vitreous humour (retina, choroid, sclera), nor of the lens, nor of the anterior chamber between the cornea and the lens. There is, in fact, no mention of most of the parts that seem difficult to identify straightforwardly as water, and no systematic description of the internal structure of the eye as such at all. (Lloyd, 1978, 220–221)

While the Aristotelian anatomy of the eye can be further refined and extended (and was by the commentators—Philoponus recognized the anterior chamber between the cornea and the lens), important limitations will inevitably remain. The significance of these limitations should be judged in relation to the specific explanatory concerns Aristotle and the Peripatetic tradition were addressing in articulating the eye's anatomy. Lloyd (1978) takes Aristotle to be primarily addressing the problem of how to assign the four elements to the five senses. This is indeed a task of *De Sensu*. But, as I have argued, Aristotle has more specific explanatory concerns. The eye must have such a nature so as it may be mediately acted upon by color in order

to endow its possessor with the reactive capacity for sight. Taken by itself, this claim is the expression of a reasonable explanatory strategy. If Aristotle's anatomy of the eye strikes us as superficial or schematic, this is not due to this explanatory strategy alone, nor is it due to an abstract taxonomic concern with assigning elements to senses. Rather, two further claims are responsible for the limitations of Aristotelian anatomy: (1) that the eye can only be mediately acted upon if it is actually transparent, and (2) that the eye is only acted upon by altering the character of its interior illumination. Whereas (1) specifies a condition on the patient of change, (2) specifies the nature of the change. It is these further commitments that lead him to discern only those parts of the eye that might plausibly be said to play a role in sustaining the transparency of the internal medium.

7.3 Interior Illumination

The eye in seeing is like a lantern, not because it emits fire from its interior, but because in seeing the interior of the eye is illuminated. The confined and condensed water in the interior of the eye is transparent for the sake of receiving such illumination. It is only by being transparent that colors can mediately act upon the eye by acting upon the intervening medium. And since sight is a reactive capacity, a mode of chromatic sensitivity, the organ of sight must be acted upon if the capacity for sight is to be exercised in seeing the presented color.

What is the effect that the color produces in mediately acting upon the eye?

Since color acts upon the eye by acting upon the external medium, the effect on the internal medium should be of the same kind as the effect that color has on the external medium. Aristotle explicitly speaks of admitting light. Colors affect the character of the illuminated medium, so in admitting light, the transparent medium within the eye not only must be actually transparent, due to the illuminating presence and activity of the fiery substance, but it must also come to have a character that at least corresponds to the character of the external illuminated medium. The correspondence need not be identity. As we observed, internal and external media may differ in their degree of transparency, and so dark eyes may be illuminated to a lesser degree than the surrounding air. The light admitted by dark eyes, their interior illumination, will not be as bright as the exterior illumination. Nevertheless, the existence and character of the interior illumination depends upon and derives from the existence and character of the external illumination that immediately acts upon it.

This places an important metaphysical constraint on the character of the interior illumination. Whatever effect color has on the external medium, such as the surrounding air, the external medium has a corresponding effect on the internal medium. In chapter 4.3, we reviewed some candidate effects. Given the metaphys-

ical constraint, the candidate effects on the internal medium, the illuminated water in the eye's interior, correspond to these.

In chapter 4.3, I argued that color could not color external media since doing so would be inconsistent with the way that colors are perceptually available within them—either by being inconsistent with the medium being actually transparent or by being inconsistent with the directionality of the visible. The agent of a change must actually be the way that the patient potentially is. Insofar as the external medium acts upon the internal medium—light is admitted—the external medium is an agent of change, the internal medium the patient. Since the external medium could not be colored, in admitting light, the internal medium, the transparent water within the eye's interior, could not in turn be colored. This result is one of the advantages of the present mode of exposition, focused fundamentally on the nature of the transparent, that begins with color's effect on external transparent media before considering color's mediate effect on internal transparent media.

In chapter 4.3, I also rejected Burnyeat's suggestion that the illuminated medium is not genuinely altered but merely undergoes a quasi-alteration when acted upon by color. I argued that quasi-alteration was perhaps too Protagorean to be genuinely of Aristotelian provenance. It was, in any case, undermotivated. Burnyeat's case for quasi-alteration depended upon the thought that the medium could not be materially altered by the colors arrayed in it consistent with the perspective relativity of the perceptual availability of the colors. However, I argued that if color acts upon the illuminated medium by promoting or retarding the activity of the fiery substance illuminating it, then that medium undergoes a material change that is not only consistent with the directionality of the visible, but provides an explanation for it. The being of fire consists in its burning. Burning is an activity. And, as such, it has a direction of influence. That the perceptual availability of a color depends upon the perceiver's point of view is due, in part, to the direction of influence that results from that particular's color altering the activity of the fiery substance.

As before, three candidate effects remain:

- (1) The rendering visible of the transparent—making the transparent internal medium perceptually available
- (2) The rendering visible of colored particulars arrayed in the transparent external medium—making the colored particulars perceptually available
- (3) Affecting the fiery substance by affecting the amount of it in the internal medium, the water within the eye, or, if this does not come to the same thing, promoting or retarding its activity to some degree, or otherwise affecting its direction of influence

(1) follows from the *De Anima* (II 7 418^b4–6) definition of the transparent. It might seem odd to claim that the transparent water in the eye's interior is per-

ceptually available to us, even when illuminated. However, recall, by Aristotle's definition of transparency, the transparent appears to us by the colors of remote external particulars appearing through it. Since when we see the colors of remote external particulars, we see them through the transparent medium in the eye's illuminated interior, we see that medium as well. Of course, ordinarily we do not attend to the transparency of the eye's interior water until it is disrupted, when we see floaters, say. But, in seeing the colors, the internal medium must itself be perceptually available, at least in the manner of transparent things enshrined in the *De Anima* definition of transparency.

(2) is not only a consequence of the *De Anima* definition, but is a commitment of Aristotle's description of the wounded soldier. That the colored particulars arrayed within the transparent external medium are perceptually available within the water in the eye's interior is demonstrated by severing the illuminated interior from the perceptive part of the soul, located at or near heart. When the transparency in the eye's interior is no longer extended within, the passages leading from the eye having been severed by a sword's blow, the colors of remote external particulars are no longer perceptually available. The soldier has been blinded by his wound.

(3) not only draws upon materials available in both *De Anima* and *De Sensu*, but coheres well with the *De Sensu* project of explaining what each of the sense object must be to produce the sensation in full actuality. Moreover, (3) is directly involved in Aristotle's reinterpretation of Empedocles' lanterns analogy. The eye is like a lantern, not because it emits fire, but because its interior is illuminated. Not only does the potentially transparent water in the eye's interior become actually transparent, but it comes to have a character that at least corresponds to the character of the external illumination. The existence and character of interior illumination depends upon and derives from the existence and character of the external illumination that immediately acts upon it. Specifically, the existence and character of the interior illumination will depend upon the amount, degree of activity, and direction of influence of the fiery substance encountered in the external medium and the internal medium's degree of transparency, the degree to which it is receptive to the illuminating presence and activity of the fiery substance. So understood, (3) is not only consistent with, but explanatory of, (1) and (2). In becoming actually transparent, objects can be seen through that medium. Interior illumination is materially sufficient for the perceptual availability of the colors, even if only materially necessary for their perception. And since the colors are perceptually available, they can appear through the transparent medium within the eye's interior, the transparent medium is itself perceptually available, the transparent internal medium appears in the colors appearing through it. And this remains true even if the perceptual availability of the eye's water is rarely attended to.

Chapter 8

Two Transitions to Actuality

8.1 The Problem

The eyes, in seeing, are altered. They are filled with light. The existence and character of the interior illumination depends upon and derives from the existence and character of exterior illumination, itself affected by the colors of remote external particulars. Moreover, the eyes in seeing must be altered. The eyes are the organ of sight, and seeing is a reactive capacity. Sight only acts by reacting to the colors of remote external particulars. So the organ of sight must be acted upon in order to exercise the capacity for sight. Notoriously, however, Aristotle denies that the exercise of our capacity for sight, an episode of seeing, is itself an alteration. So the eyes, in seeing, must be altered, but seeing is not itself an alteration or, at least, it is not an alteration of the usual sort. What kind of change does a perceiver undergo when seeing?

The avowed task of *De Anima* II 5 is to say, in a preliminary fashion, what the senses are in general. A discussion of the special senses follows in subsequent chapters, and it is only in *De Anima* II 12 that Aristotle give the official definition of perception as the assimilation of sensible form without the matter of the perceived particular. Despite the avowed task of the chapter, most of the discussion is bound up with a number of careful distinctions, and we only get the general characterization of sensation at the end of the chapter.

8.2 The *Endoxa*

The chapter begins with a discussion of the *endoxa*:

Sensation depends, as we have said, on a process of movement or affection from without, for it is held to be some sort of change of quality.

Now some thinkers assert that like is affected only by like. In what sense this is possible and in what sense impossible, we have explained in our general discussion of acting and being acted upon. (Aristotle, *De Anima* II 5 416^b33–417^a2; Smith in Barnes 1984b, 29)

Aristotle is picking up on his previous discussion of the *endoxa* from *De Anima* I 5 410^a24–410^b14. That perception depends upon being moved and acted upon was attributed to previous thinkers in *De Anima* I 5 410^a25–26. That claim, at least in the present context, is importantly qualified. Perception is not identified with being moved and acted upon. It is only said to depend upon being moved and acted upon. Though perhaps a widely held opinion, not all previous thinkers assented to it. Notoriously, in the Secret Doctrine that Socrates attributes to Protagoras (*Theaetetus* 156^{a-c}), perception is represented as the outcome of active and passive forces in conflict and so no mere passive effect. And this is perhaps echoed in Plato's own account of perception as the outcome of emanations from the perceiver and the object perceived coalescing (*Timaeus* 45^b–46^a). In an earlier chapter, Aristotle suggested that perception was a qualitative alteration (*De Anima* II 4 415^b24). That claim reappears though again in qualified form. Smith translates the qualification as “some sort of change of quality”, but as Burnyeat (2002, 36–37) importantly points out, the qualification can also be understood as “a change of quality of a sort”, that is, as an alteration only in an etiolated sense. In the first line of the passage the claim that perception is a sort of alteration, or alteration of a sort, is offered as a justification for thinking that perception is a way of being moved and acted upon. That justification draws, implicitly, upon Aristotle's physics. In *Physica* VII 1 and VIII 4, Aristotle argues that every case of motion involves being acted upon, and in *De Generatione et Corruptione* I 6 323^a13–24 he argues that alteration always involves being acted upon. The attribution of the claim that perception is some sort of alteration, or alteration of a sort, to previous thinkers is doubtful, however, as it makes essential use of the classificatory scheme of the *Categoriae*. Here, as is not uncommon, Aristotle is endeavoring to understand the views of his predecessors in his own terms. Aristotle may be over-reading, or having dialectical rather than strictly historical concerns, but, to be fair, the connection with qualitative alteration is not far to seek insofar as previous thinkers maintained, as well, that like is affected only by like.

The like-by-like principle, that like is affected only by like, is more genuinely of pre-Aristotelian provenance. Empedocles, among others, is said to have held it (*De Anima* I 2 404^b7–15; though whether he actually held the like-by-like principle is controversial, see Kamtekar 2009). Concerning “in what sense this is possible and in what sense impossible”, Aristotle refers us to *De Generatione et Corruptione* I 7 (on Aristotle's use of cross-referencing in this chapter see Burnyeat 2002). There, Aristotle explains that there is a sense in which those who maintain that like is

affected by like and those who maintain, instead, that like is unaffected by like are both right. Each position, though seemingly contradictory, capture part of a more complex truth (*De Generatione et Corruptione* I 7 323^b15–324^a9). Consider the case of one thing acting upon another thus inducing a change of quality, say, fire heating a pot of cool water. (My choice of example, though drawn from *De Generatione et Corruptione*, is far from innocent—in *De Anima* II 12 Aristotle will contrast a plant being warmed with an animal’s sensation of heat.) At the start of the process, the agent and patient of the change, the fire and the water, have contrary qualities from the same range of qualities—the fire is hot and the water is cool and each is a quality of temperature. They are thus generically alike. Though they are generically alike prior to the alteration they are also unlike. The distinct qualities they possess from the same range are contraries. They need not be opposites, qualities at the extreme ends of an ordered range of qualities, they may be intermediate qualities from the same range, so long as they are contraries. Thus the fire and the water, while generically alike in being the kinds of thing that have temperature, are specifically unlike in possessing contrary qualities of temperature. When the fire comes into contact with the pot of water they interact in such a way that the water becomes hot and so like the way the fire was prior to the qualitative alteration. So the water was initially unlike the fire that heated it in being cool but became like that fire in becoming hot.

In *De Generatione et Corruptione* Aristotle argues against the like-by-like principle as follows:

Moreover, if like can be affected by like, a thing can also be affected by itself; and yet if that were so—if like tended in fact to act *qua* like—there would be nothing indestructible or immovable, for everything would move itself. (Aristotle, *De Generatione et Corruptione* I 7 323^b21–23; Joachim in Barnes 1984b, 23)

A variant of this argument occurs at this point in *De Anima* II 5 (discussed earlier in chapter 2.1.2):

Here arises a problem: why do we not perceive the senses themselves, or why without the stimulation of external objects do they not produce sensation, seeing that they contain in themselves fire, earth, and all the other elements, of which—either in themselves or in respect of their incidental attributes—there is perception? It is clear that what is sensitive is so only potentially, not actually. The power of sense is parallel to what is combustible, for that never ignites itself spontaneously, but requires an agent which has the power of starting ignition; otherwise it could have set itself on fire, and would not have needed actual fire to set it ablaze. (Aristotle, *De Anima* II 5 417^a3–9; Smith in Barnes 1984b, 29)

If the like-by-like principle were true, then the sense organ, being like itself—as, indeed, is everything else—would act upon itself. The exercise of the capacity for sight, which the eye endows its possessor with, would not require an external particular to activate it. However, as Polansky (2007, 226–227) observes, the argument, when restricted in this way to perception, accrues new significance. If the sense organ acts upon itself, then the exercise of the capacity it endows its possessor with would at best be a mode of self-consciousness. It would not be a mode of sensitivity to external particulars and their sensible qualities and thus could not be a mode of perception. The puzzle, as it arises in the context of *De Anima* II 5, thus concerns the very possibility of perception.

The puzzle about the like-by-like principle in the perceptual case is epistemically significant since it concerns the very possibility of perception. Perception must be a reactive capacity, if it is to be perception at all, otherwise it would not be a mode of sensitivity to remote external particulars arrayed in the natural environment. However, being a reactive capacity is merely a necessary condition for perception. The objectivity of perceptual content depends not only upon perception only ever acting by reacting to the presence of external particulars but also on the perceiver, or perhaps their perceptual experience, becoming like those external particulars actually are. Sheer receptivity is insufficient for sensory presentation. It requires, as well, the assimilation of the sensory object.

Not only does the puzzle about the like-by-like principle accrue new significance in *De Anima* II 5, but it is susceptible to a novel solution as well. Nowhere in *De Generatione et Corruptione* I 7 does Aristotle explicitly appeal to the distinction between the actual and the potential. But that distinction is essential to the present resolution of the puzzle. The lesson of the puzzle about perception raised by the like-by-like principle is that the capacity for sight, the form and substance of the eye, is a kind of potentiality, one that requires an external particular, the object of perception, to act upon the eye in order for that capacity to be exercised in seeing that object. It is like fuel which requires an external fire for it to ignite. Perception, as we have seen, is essentially a reactive capacity, one which requires an external object to ignite sensory consciousness.

Perception is a power or potentiality that requires an external particular for it to be realized. The exercise of perceptual capacities is, at least in this regard, like the case of motion, studied in *Physica*, since all motion requires a mover:

To begin with let us speak as if there were no difference between being moved or affected, and being active, for movement is a kind of activity—an imperfect kind, as has elsewhere been explained. Everything that is acted upon or moved is acted upon by an agent which is actually at work. Hence it is that in one sense, as has already been stated, what acts and what is acted upon are like, in another unlike; for

the unlike is affected, and when it has been affected it is like. (Aristotle, *De Anima* II 5 417^a15–21; Smith in Barnes 1984b, 30)

Aristotle invites us to speak as if being moved and acted upon, on the one hand, and perceptual activity such as seeing and hearing, on the other, were the same. He is not identifying perception with being moved or acted upon, but merely emphasizing the fact that, like the motion of natural bodies discussed in *Physica*, the activity of the senses depends upon an external cause—the external particular mediately acting upon the organ of sensation.

In *Physica* III I 201^a10–11, Aristotle defines motion as the actuality of the potential as such (see also *Metaphysica* κ 9 1065^b16). Against Parmenidean skepticism, Aristotle insists upon the reality of change. Becoming pertains to actuality, but, in a concession to Parmenidean skepticism, it does so in a qualified manner. Consider again our example of qualitative alteration, fire heating a pot of cool water. At the beginning of this process, the water is cool but potentially hot. At the end of this process, the water is no longer potentially but actually hot. When the process has finished and the water is actually hot, the water is no longer becoming hot. It is this transition from merely being potentially hot, possessed by the water prior to its contact with the heat of the flame, to being actually hot which is the motion of qualitative alteration. This is something that actually happens, hence the use of actuality in Aristotle's definition of motion. But throughout the process, until its termination, the water remains potentially hot. That is why motion is the actuality of the potential as such. When the water is actually hot it is no longer potentially hot. The alteration that the water undergoes is the actualization of its potentially being hot, a potentiality that is both realized and exhausted in the process. (That the relevant sense of potentiality is potential for being rather than changing see Kosman 1969; though see Heinaman 1994 for criticism.)

We are now in a position to understand the sense in which the motion involved in qualitative alteration is imperfect or incomplete. It is incomplete in the sense that when the terminal state has been reached, the process of alteration is no longer happening, and so long as it is happening, the terminal state has not been reached. The incompleteness of motion is linguistically manifest in our inability to simultaneously use present and perfect tenses to describe that motion. Having built a house, the builder is no longer building. And so long as the builder is building the house has yet to have been built (*Metaphysica* Θ 6 1048^b18–34). This would contrast with an activity whose end lies not without but is immanent in the activity itself. Aristotle marks such a contrast at the opening of the *Ethica Nicomachea* I I 1094^a3–5, and there is an extended discussion in *Metaphysica* Θ. Aristotle does not explicitly describe these activities as complete. However, if we follow the post-Aristotelian vocabulary, then complete activity, activity whose end is immanent in the activity itself, is linguistically manifest in the simultaneous availability of the present and

perfect tenses in describing that activity. Having seen the white of the sun, the perceiver may yet be seeing it still. And in seeing the white of the sun, the perceiver has seen it. One is enjoying and has enjoyed. The intelligibility of conjoining the present and perfect tenses indicates that the described activity is an end in itself, in contrast to the case of motion which is always progress towards an end that lies without.

At the end of the passage, Aristotle offers a resolution of the apparent conflict between those who maintain that like affects like and those who maintain that like is unaffected by like that echoes the resolution offered in *De Generatione et Corruptione* 1 7. There is a sense in which both opinions are correct. The water, at the beginning of the process, is cool and so unlike the heat of the flame. But when the process is completed and the water's potential for being hot is realized, the water is like the way the fire was prior to the alteration.

We have seen how perceptual activity is like qualitative alteration in that it requires an external object to act upon the sense organ to initiate that activity. The present resolution of the apparent conflict in the *endoxa* hints at a further analogy. Applying it to the case of perception yields the following result. Prior to seeing the brilliant white of the sun, the perceiver, or perhaps their perceptual experience, is unlike the sun. But in coming to see the sun's brilliant whiteness, the perceiver, or perhaps their perceptual experience, becomes like the way the sun was prior to seeing it. The perceiver, or their perceptual experience, is potentially like the sensible object, and when they undergo the perceptual experience of that sensible object their experience becomes actually like the way the sensible object was prior to perception. We have here an anticipation of the general characterization of perception that occurs at the end of *De Anima* 11 5 and the definition of perception that occurs in *De Anima* 11 12.

Aristotle's discussion of the *endoxa* provides insight into how he is understanding assimilation as it figures in his definition of perception. In cases of qualitative alteration, at the end of the process, the patient assimilates the qualitative character of the agent of that change. The assimilation, here, is no material assimilation. Contrast the Empedoclean story of the movement of effluences through passages. That is straightforwardly a case of material assimilation—a material body, an effluence, is received within another body through a fine passage. In the case of qualitative alteration, as Aristotle understands it, nothing material is assimilated. What is assimilated is not a body, but a quality or state. And as I have observed in chapter 3.2, whereas bodies have locations, qualities and states do not. We have here an important first step towards the resolution of Empedoclean puzzlement. Perceptual activity may not be an instance of qualitative alteration. Nevertheless, as in the case of alteration, the perceiver, or perhaps their experience, becomes like the way the perceived object was prior to perception. The perceiver, or their

experience, assimilates the sensible object in a manner necessarily distinct from the material assimilation of that object, since to be palpable is to be imperceptible.

8.3 Distinctions and Refinements

But we are getting ahead of ourselves. Before Aristotle offers the general characterization of perception, he undertakes to investigate the sense of potentiality involved in being a perceiver. Is the realization of this potential incomplete, in the way that alteration is? Or is the end of sight immanent in seeing? If the latter, then this would explain why perception is alteration of a sort, in an etiolated sense only. For while there would be significant analogies between qualitative alteration and perception—each involves an external cause and the assimilation of sensible form—if perceptual activity were complete, then it would not be a mode of alteration, even if it requires that the organ of sensation be acted upon to elicit that activity.

8.3.1 The Triple Scheme

As we have had occasion to remark, according to Aristotle, the actual and the potential are said of in many ways. In *De Anima* II 5 Aristotle distinguishes two senses of potentiality, and correspondingly, two senses of actuality. The distinction occurs earlier in *De Anima* II 1 412^a24–26 and occurs as well in *Physica* VIII 4 255^a30ff. However, in *De Anima* II 1 the emphasis is on the two corresponding senses of actuality whereas in *De Anima* II 5 the emphasis is instead on possibility. The reason for this shift of emphasis is that in *De Anima* II 5 Aristotle's real concern is with the nature of the transition to actuality in each case, that is, with the nature of the change involved. Given that Aristotle understands motion in terms of potentiality in *Physica*, it is natural for him to distinguish the relevant senses of potentiality and then distinguish the motions that correspond to these.

In *De Anima* II 5 the distinction is explained in terms of knowledge:

But we must now distinguish different senses in which things can be said to be potential or actual; at the moment we are speaking as if each of these phrases had only one sense. We can speak of something as a knower either as when we say that man is a knower, meaning that man falls within the class of beings that know or have knowledge, or as when we are speaking of a man who possesses a knowledge of grammar; each of these has a potentiality, but not in the same way: the one because his kind or matter is such and such, the other because he can reflect when he wants to, if nothing external prevents him. And there is the man who is already reflecting—he is a knower in actuality and in the most

proper sense is knowing, e.g. this A. Both the former are potential knowers, who realize their respective potentialities, the one by change of quality, i.e. repeated transitions from one state to its opposite under instruction, the other in another way by the transition from the inactive possession of sense or grammar to their active exercise. (Aristotle, *De Anima* II 5 417^a22–417^b1; Smith in Barnes 1984b, 30)

In the passage, Aristotle contrasts someone ignorant of some subject matter but educable with a learned person knowledgeable about that subject matter. The ignorant but educable person is a knower in the sense that they potentially know something. They do not, for example, know some particular point of grammar, but it is not beyond their ken, and they can be brought to know it through education. Being composed of the right matter, they have the capacity for knowledge. The learned person is a knower as well. They have mastered the relevant point of grammar and, having mastered it, can be said to know it in the way that the ignorant but educable cannot. And Aristotle maintains that this sense of being a knower is also a kind of potentiality. Specifically, to know something is to have the capacity to apply that knowledge in a reasonable manner given the practical circumstances. Thus to apply the grammatical knowledge is to deploy it in one's speech or writing or to recognize its significance in the speech or writing of others, by recognizing a letter as an alpha, say. In exercising their knowledge, they can be said to know as well but in a different sense from one who possesses this knowledge without exercising it. To possess grammatical knowledge, in the relevant sense, just is to have the potential to exercise that knowledge in a reasonable manner given the practical circumstances. But this is a distinct sense of potentiality than is involved in the ignorant but educable's potentially knowing that point of grammar. In the traditional, post-Aristotelian vocabulary, Aristotle is distinguishing between first and second potentiality and, correspondingly, between first and second actuality (schematically represented in table 8.1). The vocabulary is post-Aristotelian since while Aristotle does speak of first actuality he does not generalize the vocabulary in the obvious way.

<i>First Potentiality</i>	the capacity for knowledge	"is a knower"
<i>First Actuality/Second Potentiality</i>	knowing something	"is a knower", "knows"
<i>Second Actuality</i>	exercising that knowledge	"knows"

Table 8.1: The triple scheme

The ignorant but educable is a knower in that they potentially know something. This is the first potentiality. In coming to know something this potentiality is realized. In coming to know something they too are a knower, though in a different sense. This is the first actuality. The first actuality of knowledge is itself

a kind of potentiality since in knowing something the knower has the power or potentiality to exercise that knowledge in a reasonable manner given the practical circumstances. So, in the case at hand, the first actuality is also a second potentiality. In exercising that knowledge, in applying it in a reasonable manner given the practical circumstances, this potentiality is realized. This is the second actuality.

At the end of the passage, Aristotle draws our attention to a corresponding difference in the two transitions to actuality. The transition from first potentiality to first actuality is a form of qualitative alteration in the way that the transition from second potentiality to second actuality is not. Instead of being a change of quality, the transition to second actuality is described as a transition from an inactive potentiality to its active exercise.

Describing learning as qualitative alteration can sound odd to modern ears. In assessing the credibility of this claim we should bear two things in mind. First, for Aristotle, the fundamental explanatory properties—the primary opposites, Hot and Cold, Dry and Wet—are sensible qualities. It should be no surprise, then, that coming to know should be understood by him in terms of qualitative alteration. That may help us, to some degree, understand why Aristotle found this claim more natural than we perhaps do, but moderns may still protest incredulity. However, knowledge, even on a modern conception of it, is a state. In coming to know about some subject matter, a person while initially in a state of ignorance about that subject is no longer ignorant but knowledgeable. But the replacement of one state by another inconsistent with it might fairly be described as a case of alteration.

How might these distinctions apply to the case of perception? Seeing is the exercise of an animal's capacity for sight. An animal's capacity for sight is a power or potentiality. It need not be exercised—say, when the animal is asleep or in the dark (at least in the case of seeing color if not the fiery or shining, see chapter 4.2). It is natural, then, to understand second potentiality as the animal's possession of a perceptual capacity and second actuality as its exercise. Indeed, at the end of the passage, Aristotle makes this connection explicitly. It is both the inactive potential for knowledge and sense to their active exercise which is the transition to second actuality (*De Anima* II 5 417^b1; see also *De Anima* II 5 417^b19). In which case, the second potentiality of perception, the possession of a perceptual capacity, is also the first actuality (*De Anima* II 5 417^b17–19).

Here, however, we encounter a certain awkwardness. Coming to possess a perceptual capacity just does not seem analogous to learning a point of grammar. Indeed, insofar as animals are animate natural beings with perception—that is what distinguishes them from plants—as soon as an animal comes to be, it is endowed with perceptual capacities. So endowing a natural being with the capacity for perception seems more like generation than alteration. This is substantiated later in the chapter when Aristotle writes:

In the case of what is to possess sense, the first transition is due to the action of the male parent and takes place before birth so that at birth the living thing is, in respect of sensation, at the stage which corresponds to the possession of knowledge. (Aristotle, *De Anima* II 5 417^b17–19; Smith in Barnes 1984b, 31)

There remains, however, an important point of analogy. Recall, Aristotle's curious remark that the ignorant but educable has the capacity for knowledge because of their matter. On the hylomorphic theory, matter is a kind of potentiality, and form is a kind of actuality. As we have seen (chapter 7.1), the form of the eye, its actuality, is its capacity to see. And the matter of the eye—the internal water, the membrane—is the potential to have that capacity. In the epistemic and perceptual cases, then, first potentiality is associated with the potentiality of matter.

In the epistemic and perceptual cases, the transition to first actuality involves the actualization of the potentiality of matter. Even if a certain awkwardness remains, there is a sense in which the strength of the analogy does not matter. In the perceptual case, Aristotle's real focus is on the transition to second actuality. It is this which is relevant to the general characterization of perception described at the end of the chapter and the definition of perception given in *De Anima* II 12.

8.3.2 Destructive and Preservative Change

The acquisition of knowledge is an alteration, whereas the application of knowledge is a different sort of transition, from the inactive possession of knowledge to its active exercise. Just as the actual and the potential are said of in many ways, so too is being moved or acted upon:

Also the expression 'to be acted upon' has more than one meaning; it may mean either the extinction of one of two contraries by the other, or the maintenance of what is potential by the agency of what is actual and already like what is acted upon, as actual to potential. For what possesses knowledge becomes an actual knower by a transition which is either not an alteration of it at all (being in reality a development into its true self or actuality) or at least an alteration in a quite different sense. (Aristotle, *De Anima* II 5 417^b2–6; Smith in Barnes 1984b, 30)

Aristotle distinguishes two ways of being moved or acted upon. The first way is a destruction of something by its contrary. This contrasts with the preservation of that which is potential by something actual that is like it. This later is also described as something's development into its true self, a kind of perfection or realization of its true nature. The distinction between the destructive and preservative ways of being moved and acted upon immediately follows Aristotle's contrast between

the transition to first actuality and the transition to second actuality. Plausibly, it is an elaboration of how these transitions differ. Indeed, given that Aristotle understands motion in terms of potentiality in *Physica*, it is natural for him to first distinguish the relevant senses of potentiality and then distinguish the motions that correspond to these.

Recall the transition to first actuality, at least in the epistemic case in which it is introduced, was a kind of qualitative alteration. The motion involved in alteration involves a process whereby a thing's quality is replaced by another from the same range which is its contrary. Thus when the water is heated, it becomes hot and so is no longer cool. When a thing is altered, it becomes other than what it was, at least in the relevant qualitative respect. The motion involved in qualitative alteration, as Aristotle understands it, is thus aptly described as a destruction of something by its contrary. The cool of the water is destroyed and replaced by its contrary, heat. Ignorance is destroyed and replaced by knowledge.

It would be inapt, however, to describe the transition to second actuality as a destruction of something by its contrary. When a learned person applies their grammatical knowledge—by recognizing a letter as an alpha, say—they do not lose that knowledge. The learned person does not thereby become ignorant in applying their knowledge in a reasonable manner given the practical circumstances. The application of knowledge does not involve the destruction of that knowledge and its replacement by its contrary, ignorance. Rather, to possess such knowledge is to have the potential to exercise that knowledge in a reasonable manner given the practical circumstances. In exercising that knowledge, this potentiality is realized. There is also a difference in the potentialities involved in these transitions. In the destructive motion of qualitative alteration, the water's potential for being hot is exhausted when it becomes actually hot. However, in exercising knowledge in a given circumstance, the learned person's potential to apply that knowledge is not exhausted in this way, but is rather preserved. There is a further salient difference. In the case of alteration, something becomes unlike the way it was. The water is now hot and so unlike the way it was when it was cool. But in applying their knowledge, the learned person does not become unlike, in epistemic respects, the way they were before they applied that knowledge. They retain their grammatical knowledge in applying it. Finally, the application of knowledge is a kind of perfection. In applying their knowledge in a reasonable manner given the practical circumstances, the learned person realizes their nature as a knower. However, in the case of alteration, it is not water's true nature to be hot and so heating it is not a development into its true nature, it is not a process of perfection. Given these differences, Aristotle concludes that the transition to second actuality is either not an alteration, or an alteration in a different sense. This can be read as echoing the earlier qualification of alteration as applied to sensation, which Smith translates as

“a sort of change of quality”. If it is, then Burnyeat is right in suggesting that it is better understood as alteration of a sort, as alteration in an etiolated sense only.

Earlier, I mentioned modern reservations about thinking of the acquisition of knowledge as a kind of alteration. Another source of doubt is of more Aristotelian provenance. In straightforward cases of qualitative alteration of the kind discussed in *Physica*, the potential of the patient is exhausted in its realization. Recall, this is the sense in which the motion of alteration is incomplete. Such motion is the actuality of this potentiality, a potentiality that is exhausted upon its realization at which point the patient is no longer in motion. But is it really the case that a person’s potential to be knowledgeable about some subject matter is exhausted when they actually know about that subject matter? As I observed earlier, in learning we have a transition from one state to another that is inconsistent with it, and this may justify speaking of alteration here, at least in a loose sense. But there are differences. Like the acquisition of a habit or virtue, the acquisition of the excellence of knowledge requires repeated trials—not so with the heating of water. Moreover, in the case of the cool water becoming hot, we have one quality being replaced by another from the same range. But ignorance and knowledge, while inconsistent conditions, are not contraries drawn from a common genus. The present worry is perhaps an anticipation of further qualifications that Aristotle makes in *De Anima* II 5 417^b10–16 (discussed in the next section).

The transition to second actuality is either not an alteration or an alteration in a different sense. Aristotle immediately emphasizes this denial:

Hence it is wrong to speak of a wise man as being ‘altered’ when he uses his wisdom, just as it would be absurd to speak of a builder as being altered when he is using his skill in building a house. (Aristotle, *De Anima* II 5 417^b7–9; Smith in Barnes 1984b, 30)

A thinker does not cease to be a thinker when they think, just as a builder does not cease to be a builder when they build. Rather, they realize their nature as thinker and builder, respectively. The exercise of the builder’s capacity to build is not an alteration. And this remains true even if in order to exercise that capacity the object of the activity is altered. Thus, bricks are arranged. Moreover, the exercise of the capacity to build is not an alteration even if in order to exercise that capacity the builder themselves must undergo various alterations. Thus the location of their limbs alters over time, and building induces fatigue in the builder. Even in the more rarefied case of thinking, a thinker in thinking thoughts may become fatigued.

The point is usefully elaborated in terms of an example from *De Generatione Animalium*:

This is what we find in the products of art; heat and cold may make the iron soft and hard, but what makes a sword is the movement of the tools

employed, this movement containing the principle of the art. For the art is the starting-point and form of the product; only it exists in something else, whereas the movement of nature exists in the product itself, issuing from another nature which has the form in actuality. (Aristotle, *De Generatione Animalium* II I 734^b37–735^a4; Platt in Barnes 1984b, 38)

A swordsmith is one who possesses the art of making swords. The swordsmith imposes the form of the sword on the heated iron through motions of their hammer that embody that form. The form of the sword exists prior to the sword in the art or perhaps the soul of the person who possesses that art. This form guides the motions of the swordsmith. The motions of their hammer occur and occur in the way they do because of that form. Through this process, the iron which potentially has the form of a sword takes on that form in actuality and so becomes a sword. As with the thinker and builder, the swordsmith, in exercising their art, realizes their nature as an artisan of that kind. But this requires that they move the object of their activity by undergoing motions themselves, by swinging a hammer, say.

Suppose these reflections carry over to the case of perception. The exercise of an animal's perceptual capacities, their undergoing a perceptual experience, is not an alteration, or at best an alteration in a different sense. This would remain true even if in order to exercise that capacity, the perceiver must be materially altered. Indeed, as we have seen, they must. Perception is a reactive capacity. The organ of sensation must be acted upon in order to exercise that capacity. In seeing, the perceiver's eyes are filled with light. The eye's interior illumination is necessary to exercise the reactive capacity they endow the perceiver with. While Burnyeat (1992) is right in claiming that coming to perceive is a psychological rather than a material change, he goes too far in insisting that this precludes the perceiver being, at the same time, materially altered.

8.3.3 **Privative Change and Change to a Thing's Disposition and Nature**

Once someone genuinely possess knowledge no further teaching or learning is required for them to apply that knowledge in a reasonable manner given the practical circumstances. The transition to second actuality requires neither teaching nor learning. It thus does not seem to involve being moved and acted upon at least not in the way that fire moves and acts upon water in heating it. That much is clear from what has so far been said. But what about the transition to first actuality? This was earlier described as qualitative alteration. However, here, Aristotle seems to be claiming that it is not just the transition to second actuality that is dubiously described as alteration, but the transition to first actuality as well:

What in the case of thinking or understanding leads from potentiality to actuality ought not to be called teaching but something else. That which starting with the power to know learns or acquires knowledge through the agency of one who actually knows and has the power of teaching either ought not to be said ‘to be acted upon’ at all—or else we must recognize two senses of alteration, viz. the change to conditions of privation, and the change to a thing’s dispositions and to its nature. (Aristotle, *De Anima* II 5 417^b10–16; Smith in Barnes 1984b, 30–31)

We have already encountered a reason for this denial. The transition from ignorance to knowledge through teaching and learning is not the replacement of one quality by another from the same range of qualities. Though ignorance and knowledge are inconsistent states of a rational animal they are not contrary qualities from the same genus. Thus the ignorant but educable and the learned person are not generically alike the way they would be if the transition were a genuine case of qualitative alteration.

At the end of the passage Aristotle distinguishes two sense of alteration. A change to a thing’s privation and a change to a thing’s dispositions and nature. The transition from ignorance to knowledge, insofar as these are inconsistent states, can be described as movement to a condition of privation. In learning about some subject matter, a person is deprived of their ignorance. Privative change seems to echo Aristotle’s earlier notion of destructive change. The destruction of something by its contrary is a change to a condition of privation, on at least one reasonable understanding of that notion, perhaps not the only one. So when the cool of the water is replaced by heat, the process can be described as a movement to a condition of privation insofar as the water is deprived of its coolness. As the example makes clear, however, the destruction of something by its contrary may mean something more specific than privation. While a change to a condition of privation, it is also the replacement of one quality by another from a common genus.

The alternative is more revealing about the sense of Aristotle’s denial that learning is an alteration. A change to a thing’s disposition and nature can sound like an aspect of preservative change, being a development into its true self. However, the other aspects of preservative change—the preservation as opposed to the exhaustion of the relevant potentiality, and the way the potentiality is like its realization—are not mentioned in this passage. Moreover, if a change to a thing’s disposition and nature were identified with preservative change, Aristotle would lose the distinction between the transition to first and second actuality. A change to a thing’s disposition and nature must be understood in some other way.

How might a change to a thing’s disposition and nature be understood in such a way that (1) Aristotle retains the distinction between the transitions to first and second actuality and (2) and explains his denial that learning is an alteration? Ear-

lier, we acknowledged a certain awkwardness in describing the transition to first actuality as a kind of alteration since a natural body acquiring perceptual capacities seems more like a case of generation than alteration. Here, perhaps, Aristotle is acknowledging that the difference is less extreme than it initially appeared. Part of the effect of the male parent in the generation of the animal, and one that Aristotle draws our attention to, is the development of that animal's natural capacities, specifically, their natural capacity for perception. Perhaps a change to a thing's disposition and nature can be understood as the development of that thing's natural capacities. Knowledge is a natural capacity, at least for rational animals. It is also a dispositional state, and like the acquisition of habit and virtue, the acquisition of knowledge through teaching and learning requires repeated application. So understood, the parallel between the transition to first actuality in the epistemic and perceptual cases is reinstated. Each involves the development of a thing's natural capacities. Moreover, this seems distinct both from preservative change characteristic of the transition to second actuality and from qualitative alteration. Whereas a change to a thing's disposition and nature is the development of the thing's natural capacities, preservative change is the exercise of a thing's natural capacities. In this way, Aristotle retains the distinction between the transitions to first and second actuality. Moreover, the development of a thing's natural capacities is distinct from qualitative alteration. As we observed, at least in the perceptual case, the development of an animal's perceptual capacities is better described as generation rather than alteration. And in the epistemic case, whereas the transition to a state of knowledge about some subject matter may be a kind of privation—one state of a knower is replaced by another state inconsistent with it, this is not, however, the destruction of something by its contrary, understood as the replacement of one quality by a contrary quality from a common genus.

In the epistemic and perceptual cases, the transition to first actuality involves the development of the animal's natural capacities, and the transition to second actuality involves the exercise of these capacities. Neither are qualitative alterations, strictly speaking, though analogies remain which perhaps justifies talk of alteration in a more expansive sense. Thus the transition to first actuality in the epistemic case was initially described as an alteration no doubt in part because ignorance is replaced with knowledge. But, as I have emphasized, this is not qualitative alteration since ignorance and knowledge are not contrary qualities from a common genus. And in the perceptual case, the transition to second actuality is like qualitative alteration in that it requires an external cause. Perception is essentially a reactive capacity. It only acts by reacting. The sense organ must be acted upon if the perceptual capacity that it endows its possessor with is to be exercised. Only in this way is perception a mode of sensitivity or receptivity. But again, despite the testimony of the *endoxa*, the exercise of this capacity is not an alteration. The

transition to second actuality is not incomplete the way that the motion involved in qualitative alteration is. In perceiving the brilliant white of the sun, the perceiver is seeing and has seen. Perceptual activity is complete at every instant, and the transition to second actuality is an instance of preservative change rather than qualitative alteration.

8.4 The General Characterization of Perception

At the end of the chapter, Aristotle offers a general characterization of perception:

As we have said, what has the power of sensation is potentially like what the perceived object is actually; that is, while at the beginning of the process of its being acted upon the two interacting factors are dissimilar, at the end the one acted upon is assimilated to the other and is identical in quality with it. (Aristotle, *De Anima* II 5 418^a3-6; Smith in Barnes 1984b, 31)

Earlier, Aristotle distinguishes two sense of perception:

We use the word ‘perceive’ in two ways, for we say that what has the power to hear or see, ‘sees’ or ‘hears’, even though it is at the moment asleep, and also that what is actually seeing or hearing, ‘sees’ or ‘hears’. Hence ‘sense’ too must have two meanings, sense potential, and sense actual. Similarly ‘to be a sentient’ means either to have a certain power or to manifest a certain activity. (Aristotle, *De Anima* II 5 417^a10-13; Smith in Barnes 1984b, 19-30)

Perception is thus either the capacity to perceive or its exercise in perceptual experience. What is being characterized, here, is not the exercise of the capacity but the capacity itself. What has “the power of sensation” possesses that power even when asleep when that power remains dormant and so unexercised. So Aristotle is offering a general characterization of perception, understood not as perceptual experience but as the capacity to undergo such experiences.

Perception, here, is understood as a power or potentiality. Specifically, perception is the potential to become like the perceived object actually is as the result of that object acting upon the perceiver. As should by now be clear, had this characterization been given at the beginning of the chapter, it would be easy to misunderstand the perceived object acting upon the perceiver as a case of qualitative alteration. After all, cool water in a pot has the potential to be like the fire that heats it. Part of the point of the refinements and qualifications that proceed this characterization is to forestall such misunderstandings.

Perception is the potential to become like the perceived object. The emphasis on likeness in Aristotle's general characterization plays an important epistemic role (see Burnyeat 2002, 58). Assimilation, along with the reactive character of our perceptual capacities, is what underwrites his perceptual realism. If perception involves becoming like the perceived object actually is, then it is a genuine mode of awareness. One can only perceptually assimilate what is there to be assimilated. If perceptual experience is a mode of assimilation, then one could not undergo such an experience consistent with a Cartesian demon eliminating the object of that experience. If there is no external object, then there is nothing which the perceiver, or perhaps their experience, has become like. In perceptual experience we simply confront the primary object of the given modality. We cannot be confronted truly or falsely, correctly or incorrectly. We simply confront what is presented to us in sensory consciousness and so become like the way it is in actuality. As we shall see in chapter 9, the assimilation of sensible form underwrites a strong form of perceptual realism rejected by the early moderns. Thinkers as diverse as Galileo, Descartes, Hobbes, Locke, and Boyle were united in rejecting this premodern form of realism.

Aristotle does not elaborate the sense in which the perceiver, or perhaps their perceptual experience, becomes like the perceived object is in actuality. However, an important clue emerged earlier in the chapter. It involves the way likeness must be understood in preservative change. One way, not the only way, to motivate a literalist interpretation involves a particular understanding of what is required in saying that one thing is like another. On the literalist interpretation, in seeing a colored particular the perceiver's eye takes on that color (Slakey 1961; Sorabji 1974, 2003; Everson 1997). In seeing the brilliant white of the sun, the transparent medium within the eye itself becomes brilliant white. This would follow on a natural understanding of becoming like. On that understanding, if one thing is *F* and another thing becomes like it in the relevant respect, then it too is actually *F*. However, given that the potentiality involved in the transition to second actuality is like the actuality that realizes it, Aristotle is working with a broader understanding of likeness here. If the potentiality involved in possessing grammatical knowledge is already like its realization, there is no general requirement that if two things are alike in a certain respect they must actually have the relevant feature. The likeness involved in the general characterization of perception, understood as a sensory capacity, is not the likeness between that potentiality and its actualization, but the way in which the perceiver becomes like the object perceived. Nevertheless, the point is general. In order to sustain his judgment that the second potentiality of grammatical knowledge is like the second actuality that is its realization, Aristotle simply could not adhere to the principle that two things are only alike if they actually share the same feature. It is worth bearing in mind that Aristotle is working with a broader understanding of likeness when interpreting the doctrine of the

assimilation of sensible form.

The point may be elaborated with Aristotle's example of the swordsmith from *De Generatione Animalium*. In producing the sword, the iron becomes like the form of the sword contained in the soul of the person possessing that art. In the perceptual case, the perceiver assimilates the form of the perceived object. In the production of artifacts, the direction of assimilation is reversed. It is not a person assimilating the form of an external object, but an external object assimilating a form that is in some sense in the person. In the swordsmith's case, the iron assimilates the form contained in soul of the person possessing the relevant art. But there is no actual sword in the smith's soul. So, in perceiving the brilliant white of the sun, the perceiver may become like the sun actually is, but not by becoming brilliant white.

Even by the standards of *De Anima*, *De Anima* 11 5 is an unusually tortured chapter. Aristotle's evident hesitancy and incessant qualification makes the chapter difficult to read, and there is, quite rightly, substantive disagreement about how exactly all the qualifications hang together (see, *inter alia*, Burnyeat 2002, Heina-man 2007, and Bowin 2011). What is the significance of Aristotle's hesitancy and incessant qualification? Let me speculate about three potential sources.

First, there is not in Greek the vocabulary to mark the distinctions he needs to mark (nor in Persian, nor Egyptian, nor Aramaic, nor in any of the other ancient languages). Aristotle is engaged in conceptual innovation and so must explain, as best he can, his intended meaning in terms that are liable to be misunderstood. Hesitancy and qualification is what one would naturally expect from one engaged in such a project of conceptual innovation.

Second, there is a sense in which the hesitation and incessant qualification flows from the puzzling nature of the subject matter. According to the Heraclitean account of perception in the Secret Doctrine of the *Theaetetus*, perception is the outcome of active and passive forces in conflict. As the Secret Doctrine makes clear, there are active and passive elements in perception that must be carefully disentangled lest we lapse into a kind of Protagorean relativism. If realism about the manifest image of nature is to be sustained, then the interplay of active and passive forces in perception must be carefully understood. But it is easy to be puzzled about how, exactly the active and passive combine in perception. Consider being moved and acted upon in cases of qualitative alteration. Fire acts upon the pot of cool water and thus the water becomes hot. The power to become hot is a passive capacity of the water. Heating is something that the fire does and that the water merely undergoes. Similarly, in the perceptual case, the perceived object must act upon the perceiver, at least if perception is a mode of sensitivity as it must be if perception is so much as possible. But if perceiving were merely a passive capacity, then seeing would not be something that a perceiver does, but rather something done to the perceiver by the object of perception. But seeing is not something done

to the perceiver, even if the perceptual experience by which they see is something they undergo. Seeing is, rather, the exercise of the perceiver's capacity for sight. The chief virtue of the Nietzschean vocabulary of "reactive" capacities is that it makes clear that the capacity in question is not, or not merely, passive. A second potential source of Aristotle's hesitancy and incessant qualification, then, is as a reasonable response to a natural puzzlement about how to combine the active and passive elements in perception consistent with a realism about the manifest image of nature.

There is another potential source, this more controversial than the first two. Perhaps Aristotle, in this chapter, is straining against the limits of his physics. Physics, as Aristotle understands it, concerns the motion of natural bodies. Living beings are an important class of natural bodies, so it is plausible that the study of living beings takes place within the framework set out in *Physica* and *De Generatione et Corruptione*. However, there are elements of Aristotle's account of the soul that clearly fall outside of the purview of his physics. Thus the intellect is incorporeal and may be shared with divine beings that lack bodies. But the physics is the study of the motion of natural bodies. Perhaps the limitations of Aristotle's physics is met here too in *De Anima* II 5. Whereas the motion that is the subject matter of Aristotelian physics is incomplete, perceptual activity is complete at every instant. Aristotle might, nevertheless, be motivated to continue to work within the framework of his physics insofar as he can and eschew saying anything that may explicitly conflict with it, especially since his resolution of the *aporia* and thus the establishment of the very possibility of perception, depends upon that framework. Perhaps, then, this is the source of his hesitancy and incessant qualification: He is attempting to downplay the fact that he is moving beyond the framework of his physics.

This latter speculation is, as I have said, controversial. A commentator who sees Aristotle as rigidly adhering to the framework of his physics will differently interpret the various qualifications on offer than a commentator who sees Aristotle as straining against the limits of that framework. Moreover, I have given nothing like a full dress defense of the present interpretation against its competitors. However, for present purposes this is unnecessary. For if we are to understand Aristotle's definition of perception as the assimilation of sensible form our focus should be less on coming to perceive as an alteration of a sort than on the manner in which in perceiving, the perceiver, or perhaps their perceptual experience, becomes like the perceived object actually is.

Chapter 9

Form Without Matter

9.1 The Capacity to Assimilate

Color is the power to affect light. This power grounds the derived power to mediate affect sense organs sensitive to such alterations. The eyes in seeing are filled with light. It is only by being illuminated that the transparent medium within may be mediate acted upon by color. Extending the external light within triggers the reactive capacity for sight, the form and substance of the eye. In seeing the colors of external particulars arrayed in their environment the animal exercises their natural capacity to perceive and so realizes their nature as a perceiver. This is no alteration. The perceiver both sees and has seen, perceptual activity being complete at every instant. In seeing the color of an external particular the perceiver, or perhaps their experience, becomes like the object of their visual experience actually is. Perception is a mode of assimilation, though not as Empedocles conceived of it. On the ingestion model, assimilation is understood as a material mode of assimilation, the immediate object of sense, the emitted effluence, being literally taken within the sense organ so that it may be in contact with the perceptive part of the soul. Perceptual activity, for Aristotle, may not be an instance of qualitative alteration. Nevertheless, as in the case of alteration, the perceiver, or perhaps their experience, becomes like the way the perceived object was prior to perception. The perceiver, or their experience, assimilates the sensible object in a manner necessarily distinct from the material assimilation of that object, since to be palpable is to be imperceptible. What is this non-material mode of assimilation? And how does it help resolve the Empedoclean puzzlement with which we began? These questions structure the present and final chapter.

9.2 The Wax Analogy

The assimilation of sensible form without matter is explained in terms of an analogy with wax receiving the impression of a signet ring:

Generally, about all perception, we can say that a sense is what has the power of receiving into itself the sensible forms of things without the matter, in the way in which a piece of wax takes on the impress of a signet-ring without the iron or gold; what produces the impression is a signet of bronze or gold, but not qua bronze or gold: in a similar way the sense is affected by what is coloured or flavoured or sounding not insofar as each is what it is, but insofar as it is of such and such a sort and according to its form. (Aristotle, *De Anima* II 12 424^a18–23; Smith in Barnes 1984b, 42–43)

Aristotle is explicit that the analogy is meant to hold of perception generally, as opposed to just vision or audition, say. A sense is what has the power to assimilate the sensible form without the matter of a remote external particular. What does Aristotle mean by sense here? Does he mean the sense organ or the perceptual capacity the sense organ possesses, or at least endows the perceiver with? Given that Aristotle claims that a sense is what possesses this power, it is natural to understand him as having the sense organ in mind. So, for example, it is the eye that possesses the capacity to see, or at least endows their possessor with that capacity. In possessing or endowing the capacity to see, the eye potentially assimilates the color of remote external particulars.

Is the assimilation of sensible form a material change that the eye undergoes in seeing, or is it a psychological change, the exercise of sight in seeing? Though Aristotle rejects the answer in the style of Gorgias, an echo of the ingestion model remains in his optical anatomy. The eye in seeing is like a lantern, not because it emits fire from its interior, but because its interior is illuminated. The eye, being transparent, admits the external light within, in the sense in which it can, light being a state, the state of illumination, and not a material body. While a materially sufficient condition for the perceptual availability of a colored particular, it is merely a necessary condition for its perception. The wounded soldier's eyes are filled with light though he does not see since the passages leading within have been severed. While we have identified a material change that the eye undergoes in seeing—its interior is illuminated—it is merely a necessary condition for sight's realization in seeing. The assimilation of sensible form by the eye is the exercise of the capacity that it endows its possessor with. So understood, it is the psychological change that the eye makes possible, the perceiver undergoing an episode of seeing, that the assimilation of sensible form is meant to characterize.

While denying that perception involves the assimilation of material effluences, Aristotle retains Empedocles' conception of sensory awareness as a mode of assimilation, it is just that we assimilate form without matter. Indeed, this pattern of dialectical refinement continues in the very next line where Aristotle uses Plato's metaphor of wax receiving an impression, not to characterize judgment as Plato does in the *Theaetetus* 194^c–195^a, but to characterize the assimilation of sensible form in perception. The assimilation of sensible form is compared with the wax's reception of the impression sealed by a signet ring. The wax receives the form imposed upon it by the signet ring, but it does not receive any of the matter that composes the ring, be it bronze or gold, say. So, by analogy, when an animal perceives the white of the sun, they assimilate the chromatic form of the sun but none of its matter. Moreover, just as it is the form of the ring, and not its gold or bronze, that produces the sealed impression, its distinctive shape, it is the whiteness of the sun, and not its matter, that produces the sensory impression, the perceptual experience of the white of the sun. We shall consider these points separately in the following subsections.

9.2.1 Assimilation of Form

Aristotle's analogy is, significantly, of Platonic provenance. In the *Theaetetus*, Plato writes:

SOCRATES: You will think better of it when you hear the rest. To judge truly is a fine thing and there is something discreditable in error.

THEAETETUS: Of course.

SOCRATES: Well, they say the differences arise in this way. When a man has in his mind a good thick slab of wax, smooth and kneaded to the right consistency, and the impressions that come through the senses are stamped on these tables of the 'heart'—Homer's words hints at the mind's likeness to wax—then the imprints are clear and deep enough to last a long time. Such people are quick to learn and also have good memories, and besides they do not interchange the imprints of their perceptions but think truly. These imprints being distinct and well spaced are quickly assigned to their several stamps—the 'real things' as they are called—and such men are said to be clever. Do you agree?

THEAETETUS: Most emphatically.

SOCRATES: When a person has what the poet's wisdom commends as a 'shaggy heart', or when the block is muddy or made of impure wax, or oversoft or hard, the people with soft wax are quick to learn, but forgetful, those with hard wax, the reverse. Where it is shaggy or rough, a gritty kind of stuff containing a lot of earth or dirt, the impressions

obtained are indistinct; so are they too when the stuff is hard, for they have no depth. Impressions in soft wax also are indistinct, because they melt together and soon become blurred. And if besides this, they overlap through being crowded together into some wretched little narrow mind, they are still indistinct. All these types are likely to judge falsely. When they see or hear or think of something, they cannot quickly assign things to their several imprints. Because they are so slow and sort things into their wrong places, they constantly see and hear and think amiss, and say they are mistaken about things and stupid. (Plato, *Theaetetus* 194^c–195^a; Cornford in Hamilton and Cairns 1989)

Aristotle differs from Plato in:

- (1) what he uses the analogy for—to explain perception rather than judgment,
- (2) the details of the analogy—in particular, the nature of the agent acting upon the wax, a signet ring as opposed to a stylus, and
- (3) how to understand the analogy—the way in which perceptions are meant to be like sealed impressions is different from the way in which judgments are like impressions made by styli.

We shall consider these in turn. As will emerge, Aristotle's varying the agent acting upon the wax, his substitution of a signet ring for a stylus, importantly bears on how he understands that analogy.

Whereas Plato deploys the wax analogy to explain judgment, Aristotle does so to explain perception. This difference is most likely intentional and pointed. First, Aristotle is a keen student of the *Theaetetus* and discusses many of its arguments in a number of works. The variation is thus most likely intentional. But to what end? A second observation not only supports the first but sheds light on the significance of this variation. As we discussed in chapters 1.5 and 4.2, and as Sorabji (1971, 2003) emphasizes, Aristotle is extending the domain of perception as Plato conceives of it. Not only are the objects of perception no longer confined to the primary objects—we perceive common and incidental sensibles as well—but Aristotle also maintains that we can discriminate among sensory objects and that this is the exercise of our perceptual capacities. Plato, in contrast, maintained that what is “common” to the objects of sense—that they are each the same and different from the others—is determined by cognitive, not perceptual capacities. Aristotle underscores this extension of our perceptual capacities by his use of the Platonic analogy. Aristotle emphasizes the fact that he is assigning to perception some of the functions that Plato assigns to judgment by using the analogy that Plato used to explain judgment to explain perception instead.

Another, perhaps less salient, difference between the Platonic and Aristotelian analogies concerns the nature of the agent acting upon the wax. Whereas what makes an impression for Plato is a stylus, what makes an impression for Aristotle is a signet ring. Plato has in mind a wax tablet, used for writing, upon which characters are impressed with a stylus. Plato thus belongs to the Western tradition of using the then current writing technology as a model for the mind. Think of Locke's blank slate, or the functionalist slogan that the mind is the software of the brain, itself coinciding with the emergence of text-editing and word-processing. That thought has the grammatical structure of written language, developed in different ways by Ockham and Fodor, is a close variation. As is Lacan's claim that the unconscious is structured like a language, at least if we regard analysis as a discursive technology. Perhaps Nietzsche was right that our writing tools act upon our thoughts. They at least have a tendency to influence our philosophy of mind. Aristotle varies this aspect of the Platonic analogy. It is not a stylus on a wax tablet that creates the impression, it is a signet ring. Why the substitution? I believe the variation is intentional. Both a stylus and a signet ring are involved in the production of writing. The difference concerns their distinctive discursive roles. The significance of this discursive difference will emerge in sequel.

Not only does Aristotle deploy the Platonic analogy, varied in this way, to explain his conception of perception, but, importantly, he also transforms how the analogy is understood. Plato's explanation of the reliability of memory and judgment crucially relies on causal features of the situation. An objects' impression is the effect it has on the mind's wax. Importantly, however, Aristotle has in mind a non-causal sense of impression. As we shall see, the distinctive discursive role of signet rings will bear on the sense in which a ring's seal is an impression.

To get a sense of this contrast, first consider how Hume himself appropriates the Platonic analogy:

All the perceptions of the human mind revolves themselves into two distinct kinds, which I shall call IMPRESSIONS and IDEAS. The difference betwixt these consists in the degree of force or liveliness, with which they strike upon the mind, and make their way into thought and consciousness. (Hume 1739, *Treatise* I I I I)

Hume begs his reader's indulgence in taking liberty with the use of the terms "impression" and "idea" (Hume 1739, *Treatise* I I I n2) though he claims that it is at least a virtue of his regimentation that it "restore[s] the word, *idea*, to its original sense, from which Mr. *Locke* had perverted it, in making it stand for all our perceptions." Hume is presumably taking liberty with his use of the term "perception", as well. Locke perverts the use of "idea" by making it stand for all perceptions. But perception, here, is not a sensory experience, nor is it confined to the objects of sensory experience. By "perception" Hume means whatever is or could be the object of

the mind (in, admittedly, a post-Cartesian conception of mind unavailable to the ancients). The perceptions present to the human mind are either impressions or ideas, depending upon the force or liveliness with which they strike the mind. Impressions are the objects that are presented with “the most force and violence” (Hume 1739, *Treatise* 1.1.1.1). Concerning impressions, Hume further explains:

By the term *impression* I wou’d not be understood to express the manner, in which our lively perceptions are produc’d in the soul, but merely the perceptions themselves; for which there is no particular name either in *English* or any other language, that I know of. (Hume 1739, *Treatise*, 1.1.1.n2)

Consistent with this qualification, Hume is, nevertheless, operating with a causal notion of impression. The lively perceptions presented before the mind in viewing the streets of Edinburgh are themselves the effects of external causes. Inquiring after the manner in which such lively perceptions are produced in the soul does not, however, fall within the purview of Hume’s new science of human nature. It belongs, rather, to a particular branch of natural philosophy, speculative anatomy. The qualification is not the denial that impressions are effects. It rather signals Hume’s intention to confine himself to what might be described in a later terminology as the phenomenology, the intentional objects of consciousness, in particular, to the few regular principles that govern the persistent change among the perceptions present before the mind.

Like Aristotle, Hume is departing from Plato in using the analogy of impressions on wax to describe perceptual experience (and more besides, passions are impressions as well). But Hume retains a key feature of Plato’s original use of the analogy. Hume is still thinking of sensory impressions as the effects produced in the perceiver by external objects acting upon them. Is there an intelligible alternative? How else might talk of impressions be understood?

Consider the closely related metaphor of shaping. There is clearly a causal sense of shaping. When the stylus shapes the wax tablet it causes the wax to be modified in a certain way. The wax takes on the shape imposed upon it by the stylus. Similarly, Nazi bombing shaped the London skyline. It caused that skyline to be configured in a certain way, the way imposed upon it by the bombing. Importantly, however, there is another sense of shaping, not a causal sense, but a constitutive sense. Whereas Nazi bombing shaped the London skyline merely in a causal sense, St Paul’s constitutively shapes that skyline by being a contour of it. This is dramatically demonstrated in Herbert Mason’s iconic photograph (see figure 9.1). St Paul’s defiantly shapes the London skyline by being a part of it, despite the causal impact of Nazi bombing.

Humean sensory impressions are shaped by the environment merely in a causal sense. This is central to Hume’s use of the Platonic analogy. Just as a stylus im-



Figure 9.1: St Paul's 29 December 1940

pinging upon the wax causes an impression, the environment impinging upon a perceiver with the appropriate sensory capacities causes a sensory impression. How exactly such sensory impressions are produced is a matter for the speculative anatomist. Hume's new science of human nature confines itself to sensory impressions and the regularities that can be discerned in the flux of sensory experience. But sensory impressions, episodes in the sensory flux, remain effects, nonetheless. But perhaps perceptual sensitivity is more than the environment impinging upon the state of a conscious subject. Perhaps there is more to perception than objects eliciting a conscious modification of the perceiving subject. Perhaps the environment can shape sensory consciousness in a constitutive, rather than merely a causal, sense.

Before exploring this idea further, let us consider another important, and importantly related, aspect of Aristotle's use of the Platonic analogy. Earlier we observed that Aristotle varies the Platonic analogy by substituting a signet ring for Plato's stylus. What is the significance of this variation? Both are involved in the production of writing. The difference lies in their distinctive discursive roles. Caston observes that the impression produced by a signet ring is linked to that particular ring and, hence, metonymically at least, to the legitimate possessor of that ring:

A signet produces a sealing, an impression that establishes the identity

of its owner and consequently his authority, rights, and prerogatives. When a sealing is placed on a document, especially for legal or official use, it authorizes the claims, obligations, promises, or orders made therein. A sealing thus differs from other impressions in that it *purports to originate from a particular signet*. (Caston, 2005, 302)

The impression of a signet ring thus plays a similar role to signatures. Just as a signature is linked to the particular person whose signature it is, the impression sealed upon the wax by a signet ring is linked to the legitimate possessor of that ring. Moreover, signatures, like sealed impressions, carry a certain authority, the authority endowed by their legitimate possessors. Of course, signatures can be forged, as can signet rings, which can also be stolen, but these practices gain their point precisely by the link between a signature and sealed impression, on the one hand, and their legitimate possessors, on the other. Signet rings and styli thus have distinctive discursive roles. The impression made by a stylus is not linked to its legitimate possessor—one scribe may borrow another's stylus—the way an impression sealed by a signet ring is.

Taking this feature of the analogy seriously has an important consequence for how sensory impressions are individuated. Just as a forged signature is not my signature, an impression sealed by a forged ring, or by a stolen ring, is not the seal of the ring's legitimate possessor. Impressions are individuated by their legitimate sources. If this feature of the analogy carries over, then perceptions, conceived on the model of sealed impressions, are individuated by their objects which are their source. A perception of Castor and a perception of Pollux are different perceptions, no matter how closely the twins may resemble one another. Just as a forged seal is not my seal, a perception of Castor is not a perception of Pollux. A forged seal may be a perfect duplicate of a genuine seal but it is not the seal of the ring's legitimate possessor. Castor may be a perfect duplicate of Pollux, but my visual impression of Castor is not an impression of Pollux.

Notice that a causal understanding of sensory impressions, as merely the effects of causal shaping, does not have this consequence. If, as Hume maintained, cause and effect are contingently connected, the same effect, the same impression, could have been produced by a different cause. Sensory impressions, understood as the effects of causal shaping, are not individuated by their causes. If sensory impressions are individuated by their objects which are their sources, they cannot be understood as merely the effects of causal shaping. How else might they be understood?

If sensory impressions are individuated by their objects, perhaps these objects shape sensory consciousness not causally, or at least not merely. Perhaps in being individuated by their objects, these objects constitutively shape our sensory impressions of them (for contemporary discussion of this suggestion see McDowell

1998; Martin 2004; Fish 2009; Calderon 2011c). Looking up, you see the brilliance of the late morning sun burning white. The whiteness of the sun is a constituent of your experience. Sensory experience is an encounter with, at least, its primary objects. In sensory consciousness, we simply confront the primary object of the given modality. We cannot be confronted truly or falsely, correctly or incorrectly. We simply encounter what is presented to us in sensory consciousness. The whiteness of the sun is a constituent of your experience insofar as that experience involves the presentation of that whiteness in the visual awareness afforded you by your experience of the sun. And since your experience is constitutively linked to the whiteness of the sun, the sun's whiteness, whose brilliance can inspire both glory and terror, shapes the contours of your visual consciousness by being present in that consciousness. The whiteness of the sun shapes the contours of your visual experience in the way that St Paul's defiantly shapes the London skyline, the Shard notwithstanding, simply by being present. The whiteness of the sun is present in the awareness that sight affords you of the scene. That experience has a certain character. The character of that experience depends upon a derives from the character of the presented whiteness. Your experience, in this sense, becomes like the way the sun actually is, brilliant white. Just as what the London skyline is like depends, in part, upon what St Paul's is like, since the London skyline involves the presence of St Paul's as a part, what your experience of the sun is like depends, in part, upon what the sun's whiteness is like, since your experience involves the presentation in sight of that whiteness.

What the London skyline is like depends, in part, upon what St Paul's is like since the London skyline involves the presence of St Paul's as a part. But the way in which the brilliant white of the sun is present in your experience is not the way St Paul's is present in the London skyline. The brilliant white of the sun is not a part of your experience, though it may be a constituent. The white of the sun and St Paul's are present in different ways and this makes for a corresponding difference in the sense of likeness that their presence grounds. Thus the London skyline is actually like St Paul's in that it shares a common contour, say. But neither the perceiver nor their perceptual experience becomes actually white in assimilating the chromatic form of the sun. The perceiver, or the perceptual experience, may be like the way the sun actually is, brilliant white, but this does not require that they or their experience be actually white. Echoing Austin (1962) we might say, just because the perceiver, or their perceptual experience, becomes like the perceived object actually is does not mean that they become exactly like the perceived object. In seeing the white of the sun, the character of your perceptual experience depends upon and derives from the character of color presented to your point of view. But this requires neither that the perceiver nor their perceptual experience actually take on the color of the perceived particular.

Consider, again, assimilation as it figures, not in perception, but in the production of artifacts. In the perceptual case, the perceiver assimilates the form of the perceived object. In the production of artifacts, the direction of assimilation is reversed. It is not a person assimilating the form of an external object, but an external object assimilating a form that is in some sense in the person. The iron in being forged into a sword takes on or assimilates the form contained in the soul of the person possessing the art. But there is no actual sword in the smith's soul. So, in seeing the brilliant white of the sun, the perceiver may become like the sun actually is, but there need not be within them anything brilliant white.

Moreover, qualitative assimilation in the case of vision is relative to a point of view. But the qualitative alteration of natural bodies need not be relative in this way, and Aristotle's paradigmatic examples of alterations display no such relativity. That vision requires a point of view was the basis of Aristotle's case against the Empedoclean principle. One can only see from a given point of view, but this, in turn, requires that the object seen be distant from the perceiver. Moreover the directionality of the visible, at work in occlusion, shadow, and reflection, is determined, in part, by a point of view that a perceiver could occupy. The same sensory object may be presented to different point of views. In being presented to different points of view, the corresponding experiences would themselves differ in character. Thus the color a mountain presented through an imperfectly transparent sky may be seen from near and from far. Seen near the mountain looks one way, seen far it looks another. Do these appearances conflict? Aristotle expresses surprise that the question could even arise whether "colors are of such a nature such as they appear to people at a distance, or as they appear to those close at hand" (*Metaphysica* Γ 5 1010^b 4-5; Ross in Barnes 1984a, 55). The same color presented to different points of view will look different, but this difference in look or appearance is not explained by a difference in what is presented. The different look of the mountain's color seen near and far is its color being presented to different points of view. Crimson just is what white radiant light sources look like when seen through smoke-filled media, a look they do not have when seen, unobscured, from other points of view.

In chapter 4.3 we saw how this perspectival relativity can be explained consistent with color materially altering illuminated media. Suppose a Heraclitean metaphysics of fire were right to the extent that for fire, at least, to be is to burn. Then since the presence of the fiery substance makes a potentially transparent medium actually transparent, this is wholly due to the activity of the fiery substance. The being of the fiery substance consists in its burning, understood as the general activity of fire, and the specific way that it burns. A color's effect on the illuminated medium consists in the growth or diminution of the activity of the fiery substance. Activities, however, have a direction of influence. Since the illuminating activity of the fiery substance renders visible the colored particulars arrayed within the

transparent medium, the directionality of the visible is ultimately explained by the direction of influence of the fiery substance. Actual transparency, though a relatively stable state of the medium, may nevertheless have a direction it inherits from its determinant, the illuminating activity of the fiery substance.

Consider how the direction of influence of the fiery substance can help explain the variation of color appearance with distance. The mountain's color alters the imperfectly transparent medium by altering the extent and the activity of the fiery substance. The medium, in being imperfectly transparent, limits color's power, however. In an imperfectly transparent medium, color has a limited sphere of influence. Within that sphere, when the perceiver is near the colored particular, color alters the imperfectly transparent in such a way that it is visible within the medium. But outside that sphere, when the perceiver is too distant from the colored particular, the color of the particular does not alter the imperfectly transparent medium such that it is visible in that medium, at least not from the perceiver's point of view. Moreover, not only is color's power limited but within its limited sphere it is variable as well. Here, the directed influence of the fiery substance, its extent and degree of activity having been acted upon by the color, is impeded by the composition of the imperfectly transparent medium. Just as, in the case of the sun seen through a cloud of smoke, the influence of the sun's radiance is impeded by black particulate matter suspended in the air. And just as in the case of the sun, the impediment to incorporeal activity, a rarefied form of burning, posed by the imperfectly transparent medium affects the appearance of colors seen through it. Red is what radiant white things look like when seen through smoke-filled media, and blue is what mountains look like seen at a distance through an imperfectly transparent sky.

In perceiving the color of a remote external particular, the perceiver assimilates that particular's chromatic form. The proposal is that we understand the assimilation of chromatic form as the presented color's constitutively shaping visual experience. In being present in the awareness afforded by visual experience, the color constitutively shapes that experience. The character of that experience depends upon and derives from the character of the color presented to the perceiver's point of view. In this sense does color experience become like the presented color. And in this sense is the perceiver, or at least their perceptual experience, potentially like the colored particular actually is prior to perception.

9.2.2 Without Matter

In perception, not only do we assimilate the sensible form of the object of perception, but we do so without assimilating any of its matter. This is a direct consequence of Aristotle's case against the Empedoclean principle, to be perceptible is to be palpable to sense (discussed in chapter 2.2). If contact with the sense or

gan precludes sensation, then the assimilation of anything material by the organ of sensation would be incompatible with the exercise of our perceptual capacities. Concerning this, Aristotle uses the analogy to make two remarks:

- (1) that the wax takes on the impression of the signet ring without the bronze or gold, and
- (2) that the bronze or gold signet ring produces the impression, but not *qua* bronze or gold.

First, in sealing, the signet ring makes an impression upon the wax. The wax takes on the seal, the form imposed upon it by the signet ring. However, the wax does not take on any of the matter that composes the ring. The contribution of the ring to the sealed impression is exhausted by the form it imposes. The ring makes no further material contribution to the sealed impression. It leaves no deposits of gold. This feature of the analogy is the summation of Aristotle's case against the Empedoclean principle. Perception may be a mode of assimilation, but it is not the assimilation of anything material. In the case of qualitative alteration, as Aristotle understands it, nothing material is assimilated. What is assimilated is not a body, but a quality or state. And as I have observed in chapter 3.2, whereas bodies have locations, qualities and states do not. Perceptual activity may not be an instance of qualitative alteration, nevertheless, as in the case of alteration, the perceiver, or perhaps their experience, becomes like the way the perceived object actually is. The perceiver, or their experience, assimilates the sensible form of the perceived particular in a manner necessarily distinct from the material assimilation of that particular, since to be palpable is to be imperceptible.

Second, the bronze or gold signet ring produces the impression but not *qua* bronze or gold. Aristotle is characteristically brief in his statement of this claim, which requires some explanation. After all, it is not as if being made of bronze or gold has nothing to do with the power to produce impressions upon wax. As Plato's elaboration of the wax analogy makes clear, to impress a form upon the wax requires that the agent of this change be sufficiently hard and rigid. Styli and signet rings could not be composed of water, say, because water lacks fixed boundaries and so would lack the requisite rigidity. Let the capacity to impose a sealed impression upon wax be the form of a signet ring. There may be material constraints on sustaining that form. Perhaps only matter with certain elemental compositions could be signet rings. Consistent with this, Aristotle is making the further claim that when the bronze or gold signet ring acts upon the wax to produce the sealed impression, the ring is acting but not *qua* bronze or gold. Aristotle's idea seems to be this. Being made of bronze or gold may contribute to the requisite hardness and rigidity of a signet ring. But when that ring seals an impression upon the wax, the wax takes on the form it does, less because of the golden composition of the

ring, say, than because of its shape. To sustain that shape sufficient to impress a recognizable form upon wax may place material constraints on what the ring could be made of. A ring with the same shape could be made of iron or bronze, say, but not of water. But what explains the form that the wax takes on is primarily the shape of the ring that imposes that form.

How would this feature of the analogy carry over to the case of perception?

Vision is an encounter with the visible. Looking up you are momentarily dazzled by the brilliance of the late morning sun. In seeing the sun, you encounter the sun's brilliant whiteness. The sun's whiteness is the primary object of your visual experience. And it is for the sake of presenting the primary objects of vision—the visible, colors in light and the luminous in dark—that you possess eyes to see with. The sun's brilliant whiteness is the power of the sun to act on what is actually transparent. Although, in the case of the sun, given the strength of its illumination, the sun is also the cause of daylight. The sun does not merely have the power to alter what is actually transparent, but it also has the power to make what is potentially transparent actually transparent. The whiteness of the sun is the sun's power to affect light in a certain way, to both produce it and endow it with a certain character. In possessing the power to affect light in this way, the sun also possesses the power to mediate affect organs of sensation sensitive to such alterations in illuminated media. The whiteness of the late morning sun, in all its brilliance, is the cause of its presentation in your visual experience. What explains your taking in the sun's color is the sun's brilliant whiteness being open to your view. Just as the signet ring must have the shape it has prior to imposing its form upon the wax, a particular must have the color that it has prior to its chromatic form being assimilated in visual perception. And just as it is the shape of the signet ring, and not its matter, that primarily explains the form that it imposes upon the wax, it is the color of the particular and not its matter that primarily explains the chromatic form assimilated, the color's presentation in visual consciousness. (For contemporary defense of the claim that colors are explanatorily indispensable in the production of color experience see Campbell 1997; Broackes 1997; Yablo 1995; for related discussion in Aristotle scholarship see Broadie 1993; Broackes 1999)

Previously, we distinguished causal and constitutive senses of shaping. Something may causally shape a thing by causing it to have a certain shape. But, importantly, something may constitutively shape a thing, by being a part, or contour, of that thing's shape. I suggested that we might understand the doctrine of the assimilation of sensible form in terms of the primary objects constitutively shaping sensory consciousness. In experiencing the sun's brilliant whiteness, the sun's chromatic form constitutively shapes your visual experience by being present in the awareness that it affords. How does this square with Aristotle's insistence that the assimilation of sensible form is the product of the sensible form assimilated?

In claiming that the sun's brilliant whiteness constitutively shapes your visual experience, the contrast is with the sun's whiteness merely causally shaping that experience. The sun's brilliant whiteness consist in its power to affect light in a certain way, to both produce it and endow it with a certain character. The sun possesses this power prior to being perceived. Indeed it must possess this power prior to perception since it is the cause of that perception, and so must be actually like the perceiver's experience potentially is. The sun's brilliant whiteness is presented in the awareness that your visual experience affords you of the sun. The sun's whiteness shapes the contours of your visual experience by being present in the awareness that it affords. Consistent with its constitutively shaping visual consciousness, the sun's brilliant whiteness brings about its presentation in your consciousness, by altering your eye's interior illumination and so triggering your reactive capacity for sight. The first actuality of color is the cause, in appropriate circumstances, of the second actuality of color, its presentation in visual consciousness. So the primary object of sight, color, causes a suitably placed, awake, and attentive perceiver to stand in a certain relation to it, that of visual awareness. And in standing in that relation, in being presented in visual awareness, the color constitutively shapes the perceiver's visual experience. The object of perception is a cause that brings it about that a perceiver is perceptually related to it, like a wind causing a fire to burn in its direction.

Colors may be causes, but that does not make the shaping of visual experience by color merely causal. The sun's whiteness may elicit a perception of it in suitably placed, awake, and attentive viewers, but what that perceptual experience is like depends upon and derives from what the sun is actually like prior to perception, namely, brilliant white. If color shaped visual experience in a merely casual sense this latter conjunct would not be true. Consider Descartes' (1637) striking and paradoxical comparison, in the *Optics*, of color vision with a blind person's use of a stick in navigation (see figure 9.2). Part of the point of the comparison is that there need be nothing in the objects which resembles the ideas or sensations that we have of them (Descartes 1637, *Optics*, First Discourse, 85). Descartes is here supposing that colors are the ways that bodies receive light and reflect it against our eyes (Descartes 1637, *Optics*, First Discourse, 85). Nevertheless, he maintains that our sensations of color do not resemble the colors that elicits them. Colors, according to Descartes, shape sensory consciousness merely causally since there is nothing in the colored particular that resembles our visual impression of it. Descartes' claim, here, is representative of a dominant theme in early modern thinking about sensory experience that coincides with an emerging consensus that colors are, in some suitable sense, secondary qualities.

This is not without ancient precedent. Consider Democritus, at least as presented by Sextus Empiricus (*Against the Logicians, adv. math.* VII). Linguistic con-



Figure 9.2: Descartes 1637

ventions may license, in certain circumstances, our predicating “white” of the sun given the character of the sensory experience that it elicits, but there is nothing corresponding to this predication over and above our sensory reaction to atomic stimuli. What is novel in early modern thinking about sensory experience is not the idea that the causes of color perception do not resemble the colors that perception purports to present. That idea is present in the ancient atomists and arguably has Parmenidean roots. What is novel about the early modern period is the enthusiasm with which this doctrine was met, and the widespread consensus that emerged, a consensus that remarkably persisted for four centuries. It is only against the background of such a consensus that Hume (1748) can claim that it takes but the slightest bit of philosophy to show that there are no colors that inhere in bodies that resemble our impressions of them. While there may be ancient precedent for this doctrine, there is nothing like the modern consensus in the ancient world. There is no ancient correlate of the modern paradigm that would render intelligible Hume’s dismissiveness. Aristotle himself is an important and notable dissenter. As the great defender of the manifest image in the classical world, Aristotle defends a pre-Parmenidean perceptual realism by post-Parmenidean means. (For a recent different account of these matters see Lee 2011.)

Colors that constitutively shape visual experience may be causes of such experiences, but the character of our visual experience depends upon and derives from the character of the color presented to our point of view. In this sense does the perceptual experience come to resemble its object in assimilating its sensible form. Should color experience not resemble, in the relevant sense, the colors that are their objects, then colors would shape our visual experience merely causally, as Democritus and Descartes maintained. According to Aristotle’s perceptual re-

alism, colors are causes of color perceptions that resemble them, by perceptions being the presentation of the colors, a presentation that constitutively shapes our visual consciousness.

We have been discussing Aristotle's two remarks about the material aspect of the wax analogy: (1) that the wax takes on the impression of the signet ring without the bronze or the gold, and (2) that the bronze or gold signet ring produces the impression but not qua bronze or gold. The first remark is the summation of Aristotle's case against the Empedoclean principle. Color perception may be the assimilation of chromatic form, but nothing material is assimilated. The second remark is the expression of a color realism that was rejected by early modern thinkers—not only by Descartes, but by a diverse group of thinkers that includes Galileo, Locke, Boyle, and others as well. According to this premodern realism, it is the color of the particular and not its matter that primarily explains the perception of its color. Colors are causes of color perceptions that resemble them, in the sense in which they can, by color perception being the presentation of color to the perceiver's point of view. Color's presence in visual awareness shapes the experience that affords that awareness in that its character depends upon and derives from the character of the presented color. Nevertheless, consistent with this, color is the cause of its presentation in perception. Color, being the power to affect light, has the derived power to mediately affect the organ of sight by affecting the intervening medium. In altering the character of the illumination in the eye's interior, color triggers the reactive capacity for sight whose exercise is the presentation in visual awareness of that color. Like a wind causing a fire to burn in its direction, color causes a perceiver to stand in a perceptual relation to it, that of visual awareness. And in being so presented in visual awareness color constitutively shapes color experience.

9.2.3 Sensory Presentation as a Mean

After offering the definition of perception, Aristotle writes:

A primary sense-organ is that in which such a power is seated. The sense and its organ are the same in fact, but their essence is not the same. What perceives is, of course, a spatial magnitude, but we must not admit that either the having the power to perceive or the sense itself is a magnitude; what they are is a certain form or power in a magnitude. (Aristotle, *De Anima* II 12 424^a24–28; Smith in Barnes 1984b, 43)

A sensory capacity and its sense organ are the same. It is at least the case that no animal has that sensory capacity unless they also have the relevant sense organ. Nevertheless sensory capacities and their sense organs are essentially different. Sense organs have magnitudes whereas sensory capacities do not. Recall it was

by reflecting on virtues and capacities that the Eleatic Visitor elicits a refinement of the Giants' metaphysics. The palpable remains real, but not only the palpable is real. The Giants are thus led to recognize the being of capacity. Sense organs must have magnitudes if they are to be mediately acted upon by distal sense objects. A medium in contact with the sense organ is what acts upon it, and the sense organ must have spatial magnitude for this to be the case. But a sensory capacity, being a power or potentiality, lacks spatial magnitude. Sensory capacities and sense organs may be united in the animal that possesses them, but they are essentially distinct. Sensory capacities are a certain form or power in magnitude. Sensory capacities are no warrior senses within the insensate Wooden Horse. It is the animal that sees and not their eyes. Nevertheless, the capacity to see is united with the organ of sight. It is only in that particular spatial magnitude, the eyes that naturally and harmoniously occur as a parts of the whole and healthy animal, that the animal's capacity to see resides.

That the animal's capacity to perceive is a certain form or power in a spatial magnitude echoes an important earlier claim. Aristotle explains what the soul of an animal is by means of an analogy with artifacts and parts of animals. If the eye were an animal, then the capacity to see would be both essential to it and its soul. Moreover this claim is understood in terms of Aristotle's hylomorphic theory: "sight is the substance of the eye which corresponds to the account, the eye being merely the matter of seeing" (*De Anima* 11; Smith in Barnes 1984b). Sight is the form and substance of the eye, the material parts of the eye—the membrane, the internal water—the matter. On the hylomorphic theory, matter is a kind of potentiality and form a kind of actuality. The matter of the eye is potentially an eye since it is capable of taking on the form of an eye, by sustaining a transparent passage to the perceptive part of the soul so that it may be mediately acted upon by color and so ground the reactive capacity for sight. When interior water is bound by the membrane and the other parts of the eye are suitably arranged, the matter in taking on the form that it does, in so acquiring the capacity for sight, actualizes this potentiality. The animal's capacity to perceive is in a spatial magnitude, the sense organ with which it is united, in a specific technical sense. The capacity to perceive is the form of the sense organ. It is only by the material parts of the sense organ taking on that form does it endow the animal with the relevant perceptual capacity. A perceptual capacity is united to its sense organ as form is to matter.

Given this interpretation, we can see how this passage is relevant to the definition of perception that precedes it. Perception so defined was a power or potentiality, the perceiver's power or potential to become like the perceived object is actually. In assimilating the sensible form of the object, the sense, being a form or power lacks magnitude. Thus the relevant assimilation could not be the enmattering of the sensible form in the perceptive part of the soul of the perceiver. The

sense being a form or power has no matter to in-form. Consider, again, the smith's production of the sword. In producing the sword, the iron takes on the form of the sword contained in the soul of the smith possessing the art of sword-making. The form of the sword exists in the soul of the person possessing the art but not as enmattered. There is no sword in the smith's soul. And there is no color in the perceiver's soul. Yet each are *relata* of correlative qualitative assimilations. The senses may assimilate sensible form but not by enmattering it.

According to Aristotle, that the capacity to perceive is a certain form or power in a spatial magnitude, understood as the organ of sensation, has two explanatory consequences:

This enables us to explain why excesses in objects of sense destroy the organs of sense; if the movement set up by an object is too strong for the organ, the form which is its sensory power is disturbed; it is precisely as concord and tone are destroyed by too violently twanging the strings of a lyre. This explains also why plants cannot perceive, in spite of their having a portion of soul in them and being affected by tangible objects themselves; for their temperature can be lowered or raised. The explanation is that they have no mean, and so no principle in them capable of taking on the forms of sensible objects but are affected together with their matter. (Aristotle, *De Anima* II 12 424^a28–424^b3; Smith in Barnes 1984b, 43)

The claim that a sensory capacity is a form or power in a spatial magnitude, understood as the organ of sensation naturally occurring as a part of the healthy animal, is a key part of two explanations. First, that claim is meant to explain why if the movement set up by an object is too strong for the organ, its sensory power is disturbed. And second, that claim is meant to explain why plants cannot perceive. Let us consider these in turn.

“If the movement set up by an object is too strong for the organ, the form which is its sensory power is disturbed.” Why should this be so? Begin with the movement. The movement is set up by an object, presumably, the object of perception. It is not the object's movement, but a movement set up by the object, that is said to too strongly affect the sense organ. A movement set up by an object is the object of perception mediately acting upon the sense organ of a suitably placed, awake, attentive perceiver by acting upon an intervening medium. In the case of seeing in light, color is the primary object of sight. What is too strong for the eye would be, not the color's movement, the manner in which it moves and acts upon the external transparent medium, by altering the character of its illumination, but the movement set up by the color, a movement conveyed by the external medium to the transparent medium within the eye's interior, the external light extended within. In the case of vision, the movement that is too strong for the eye is the

color of a remote external particular mediately acted upon the transparent water within the eye's interior. Not only does light enables us to see the scene before us, but if it is particularly intense, it can blind us to the scene as well. Sorenson provides a nice example:

The *Krak Des Chevaliers* (Castle of Knights) in Syria has a covered passageway. When visitors travel through the long stretch of darkness, they emerge suddenly in daylight. The passageway was designed to dazzle invaders. (Sorensen, 2008, 6)

It is the strength of the movement conveyed to the eye's interior that disturbs the sensory power which is its form. The strength of the movement affects the sense organ not the soul. One of the lessons from Book I was that the soul does not move. If the soul does not move, it cannot be acted upon. The organ of sensation, being a bodily magnitude, may, however, be acted upon. Moreover, in order for the sense organ to function, to endow the perceiver with the relevant sensory capacity it must naturally occur harmoniously as a part of the healthy animal. We have an echo here of Empedocles' cosmology. Recall at a certain stage of the cosmic cycle animal parts appear, though in a disordered state. These combine giving rise to fantastical animals that could not reproduce and tended not to survive. However, due to an increase in Aphrodite's love, when the parts of the animals are harmoniously combined, this fits them to life in their natural environment and they gain the ability to reproduce. It is Aphrodite's Love, the principle of harmony, obtaining among the parts of animals that enables them to properly function thus fitting the animal to life in its environment. Despite rejecting the harmony conception of the soul in Book I, Aristotle retains this aspect of Empedocles' cosmology. In part it is the organ's relation to the perceiver that allows it to endow the perceiver with the relevant sensory capacity. The strength of the movement conveyed to the eye's interior acts upon the eye so as to change this relation. Overly intense illumination taken within the eye's interior loosens the form of the eye, the capacity to see by means of it, thus blinding the perceiver. Throughout this process, the perceptive part of the soul remains unaffected, remaining ready to assimilate sensible form as soon as the eye returns to a functioning state.

It is extreme sensible objects, too loud a noise, too bright a light, whose mediate action upon the internal medium disturbs the functioning of the relevant sense organ, in fortunate circumstances, only temporarily. Notice also it is the positive extreme of the range of qualities that disorders the sense organ's functioning. It is too loud a sound and not too still a silence that deafens. It is too bright a light and not too dark a night that blinds. It is the extreme positive determinants of sensible qualities and not their privation that loosens the form and power of the sense organ. This is why Aristotle emphasizes the strength of the movement set up by the object. Aristotle explains this by means of analogy: "it is precisely as concord and

tone are destroyed by too violently twanging the strings of a lyre.” Just as it is the organ that is violently acted upon, it is the instrument that is violently acted upon. Moreover, just as the strength of the movement disrupts the functioning of the sense organ, the strength of the movement disrupts the functioning of the instrument, concord and tone are destroyed by too violently playing the lyre. Aristotle is describing a loss of attunement. Thus Hamlyn argues:

I do not think that, when Aristotle speaks of the consonance of the strings of an instrument being destroyed by too violent a blow, the reference to consonance implies anything to do with the harmony of different strings. It is the consonance and pitch of a single string which is destroyed when it is struck too violently; the string does not then sound properly at the right pitch and with the proper timbre. (Hamlyn, 2002, 114)

The lyre in being played too violently loses its attunement. Its string is loosened, and the lyre no longer functions as it should, the consonance and pitch of the string destroyed. Due to the operation of Strife, the parts of the instrument are no longer harmoniously arranged making it no longer fit to be played. Similarly, the eye in being illuminated too violently loses its attunement. Its form is loosened, and the eye no longer functions as it should, its capacity to take in the environment destroyed. Due to the operation of Strife, the eye is no longer harmoniously related to the animal in which it naturally occurs as a part making it no longer fit assimilate external color.

Aristotle moves from the effects of extreme sensible objects on certain bodies, sense organs, the spatial magnitudes in which sensory capacities reside, to the effects of sensible objects on bodies that are not themselves sense organs. That sense is a certain form or power in a spatial magnitude can explain why bodies that are not sense organs, that lack that form and power, do not perceive. Plants, unlike animate natural bodies with sense organs naturally and harmoniously occurring as parts, do not perceive. Heat is a sensible object. And plants, while they may be heated, do not perceive heat. “The explanation is that they have no mean, and so no principle in them capable of taking on the forms of sensible objects but are affected together with their matter” (*De Anima* II 12 424^b1-3; Smith in Barnes 1984b, 43).

Talk of “mean”, here, is a back-reference to the previous chapter, where the power to discriminate among tangible objects was explained as the power to detect differences by a sort of mean:

That is why we do not perceive what is equally hot and cold or hard and soft, but only excesses, the sense itself being a sort of mean between the opposites that characterize the objects of perception. It is to this that

it owes its power of discerning the objects in that field. What is in the middle is fitted to discern; relatively to either extreme it can put itself in the place of the other. As what is to perceive white and black must, to begin with, be actually neither but potentially either (and so with all the other sense-organs), so the organ of touch must be neither hot nor cold. (Aristotle, *De Anima* II II 424^a1–10; Smith in Barnes 1984b, 42)

An animal feels the warmth of a body that it touches, in part, because the animal's flesh is cooler than that body. The animal feels the warmth by noticing the difference in temperature between it and the body that it feels. An argument from blindspots is offered on behalf of this: If the body that the perceiver's flesh is in contact with is the same temperature, then the perceiver will not feel its temperature. Plants are natural beings. They have nutritive and reproductive capacities and thus are also animate, but they are insensate lacking the perceptive part of the soul. The air that surrounds them, or the earth in which they are implanted, may heat or cool them. But despite being animate natural beings acted upon by sensible objects, plants do not perceive differences in temperature and so do not feel hot or cold. What they lack, according to Aristotle, is a sort of mean. Animals may change in temperature, but they have the ability to regulate their temperature. This more or less fixed regular temperature serves as the mean by which departures from it may be felt. But plants lack such a fixed regular temperature and so lack a mean by which differences in temperature may be perceived.

Is the notion of a mean at work in Aristotle's explanation of our ability to discriminate temperature also meant to characterize sensory presentation more generally? Is it that plants lack a mean and thus a principle to assimilate temperature? Or is it that every principle for the assimilation of sensible form without matter essentially involves a mean? This issue is raised by the proximity of the back-reference to Aristotle's general definition of perception. The argument from blindspots is only offered in the case of touch. Moreover, it works best with the tangible quality of temperature. Is it really true that it requires a hard hand to appreciate delicate softness? Moreover, the analogy with vision presented in the passage does not ascribe a mean at work in vision, rather something weaker is attributed—if the eye is to see white and black it must be neither. This is true. But the transparent water in the eye's interior is neither some intermediate shade determined by an equitable ratio of light and dark. It does not have within itself the source of its own color but is rather transparent. Lacking a mean may make you insensible to differences in ambient temperature, but this does not entail that all sensory capacities operate by discriminating from a mean. The plant being heated without being warmed is meant to have a different lesson.

The plant in being heated is acted upon and altered. An animal in feeling warmth is acted upon, but it undergoes only an alteration of a sort. Aristotle is

thus emphasizing the central denial of *De Anima* II 5, that the exercise of our perceptual capacities is not a qualitative alteration. In so doing he is also emphasizing a feature of the qualitative assimilation at work in perception. The ambient air acts upon the plant and heats it, say. In being heated, the plant is altered. One quality of the plant has been destroyed and replaced by a contrary from the same range. In being altered in this way, the sensible form of heat is enmattered in the plant. Some commentators suggest that the plant is heated by taking in hot material, other suggest that heating requires no material assimilation. On either model, the sensible form of heat is enmattered in the plant. But the assimilation of sensible form in sense perception does not involve that form becoming enmattered in the perceptive part of the soul, anymore than an enmattered sword resides in the soul of a person possessing the art of making swords. Insensate plants are emphasizing that the constitutive shaping of sensory consciousness by its object does not require the sensible form be enmattered in the perceiver. So in perception, the perceiver, or perhaps their perceptual experience, assimilates the form without the matter of the remote external particular. The assimilation of sensible form occurs without matter in two ways. Perception involves a nonmaterial mode of assimilation in that nothing material is taken in. To be palpable is to be imperceptible. Assimilation may not involve taking in anything material but could still involve the assimilated sensible form in-forming the perceiver's matter. However, assimilation is nonmaterial in this sense as well. Perception involves a nonmaterial mode of assimilation in that the assimilated sensible form is not enmattered in the perceiver.

9.3 The Resolution of Empedoclean Puzzlement

Empedoclean puzzlement about the sensory presentation of the colors of distal particulars was due, in part, to Empedocles' adherence to a general conception of sensory awareness for which ingestion provides the model. Central to that model was the Empedoclean principle, to be perceptible is to be palpable to sense. Empedoclean puzzlement about the sensory presentation of color consists in the apparent tension between two claims:

- (1) The objects of color perception are qualities of external particulars located at a distance from the perceiver.
- (2) *The Empedoclean principle*: To be perceptible is to be palpable to sense—in order for something to be the object of perception it must be in contact with the relevant sense organ.

Effluences in Empedocles' theory of vision are meant to resolve this puzzle by explaining how the colors of remote external particulars may be palpable to the organ of sight. Distant objects may be sensed by sensing the material effluences they

emit. If the color of an object is the material effluence that it emits, then the color of a remote object can be assimilated and so be palpable to sight. Not only does Aristotle reject the theory of effluences, and with it Empedocles' own resolution of the puzzle, but he also rejects the principle that generated the puzzle that effluences were meant to resolve. Specifically, he rejects the Empedoclean principle, to be perceptible is to be palpable to sense. Far from being a material precondition for the sensing of color, contact precludes sensation. A colored particular's contact with the eye, the organ of sight, blinds the perceiver to that particular and its color. To be palpable is to be imperceptible. Aristotle's rejection of the Empedoclean principle is a resolution of Empedoclean puzzlement, at least in its original form, precisely by that puzzlement being generated by the tension between the that principle and the claim that the objects of color perception are qualities of external particulars located at a distance from the perceiver.

Aristotle, nevertheless, retains a conception of perception as a mode of assimilation even as he rejects the ingestion model. The naturalness of thinking of seeing as taking in the external scene before one persists even after rejecting the Empedoclean principle. This natural thought gives rise to a residual puzzlement. How can one take in what remains external? And if one can, what could taking in mean, here, such that one could? Empedoclean puzzlement, in its most general form, consists in the persistence of this latter question.

How can one take in what remains external? If the generalized form of the Empedoclean puzzlement consists in the persistence of this question, then Aristotle's definition of perception can be understood to address this puzzlement precisely by offering an answer. A perceiver takes in what remains external by assimilating the chromatic form of the remote external particular while leaving its matter in place. Aristotle's definition of perception as the assimilation of sensible form without matter is meant to address the generalized form of Empedoclean puzzlement. It is meant to be the sense in which the perceiver takes in the scene before one. More specifically, it is meant to be the sense in which the perceiver takes in what remains external.

In seeing, we take in the scene before us by assimilating the chromatic form of the particulars arrayed in that scene, by our experience being constitutively shaped by their color. In chapter 8.4, the epistemological significance of this doctrine was stressed. If the perceiver becomes like the way the perceived object actually is, in the sense that their perceptual experience is constitutively shaped by that object, then it is impossible for their experience to be as it is and that object be some way other than it actually is at least in sensible respects. The assimilation of sensible form thus underwrites the objectivity of perceptual content. Moreover, this objectivity is achieved quite independently of any spatial contact with the object of perception. In Aristotle's definition, the qualification, without matter, empha-

sizes just this point. Only matter is spatially located, and thus only matter may be in contact with the organ of sensation.

The perceiver assimilates the chromatic form of the perceived particular and so becomes like that particular actually is prior to perception. The perceiver, or perhaps their perceptual experience, becomes like the colored particular in that their visual experience is constitutively shaped by the presentation of that color to their point of view. In being constitutively shaped by the color of the perceived particular, the visual experience of the perceiver may become like the particular actually is in chromatic respects, but this does not mean that they or their perceptual experience is exactly like the perceived object. So being constitutively shaped by the presented color does not require that in seeing the sun the perceiver becomes actually white.

The likeness involved in the visual assimilation of color concerns the qualitative character of visual experience and the way that it depends upon and derives from the qualitative character of the object of that experience, the color presented to the perceiver's point of view. Qualities, like the brilliant white of the sun, like states, lack locations. Colors may only inhere in located things with extensive magnitudes, but the colors are at best indirectly located where they inhere. Colors, being qualities, lack location and so are not at a distance from the perceiver, at least not directly. There is neither the need for, nor the possibility of, the color of a remote particular traveling the spatial gap between that particulars and the perceiver. Qualitative assimilation lacks the spatial presuppositions that makes the material assimilation of remote objects seem problematic.

Understanding assimilation, not as it figures in the ingestion model, as a mode of material assimilation, but on the model of qualitative alteration, thus bears on Empedoclean puzzlement in two ways. First, it bears on the original form of the puzzlement in that qualitative assimilation lacks the spatial presuppositions that makes the material assimilation of remote objects problematic. That is merely a negative claim about sensory presentation, that it lacks a feature that made the sensory presentation of remote objects seem problematic. But importantly, Aristotle, in his definition, is also making a positive claim. In seeing the brilliant white of the sun, the perceiver may take in the color of the sun consistent with its being distant. The sun remains in the heavens even as it shapes the perceiver's experience of it. Talk of taking in may be a phenomenologically apt description of the perceiver's experience of the color of the sun, but what does taking in mean, here, if it is not a material mode of assimilation? Aristotle positive claim provides an answer, and one that is consistent with the object of visual experience remaining remote.

Taking in the scene before one is not a mode of material assimilation, it is a mode of qualitative assimilation akin to, but distinct from, the qualitative assimilation involved in qualitative alteration (chapter 8). Perception is like qualitative

alteration in that the perceiver must be acted upon to exercise their perceptual capacities and that this exercise involves a mode of qualitative assimilation, but crucial differences remain. The exercise of our perceptual capacities may involve qualitative assimilation, but it is not the destruction of something by its contrary, the replacement of one quality by a contrary from a common genus, but a preservative change. This is a kind of perfection—in exercising their perceptual capacities, the perceiver realizes their nature as a perceiver. And whereas the motion of qualitative alteration is incomplete, the relevant potentiality exhausted in its realization, perceptual activity is complete at every instance, its potentiality preserved. In seeing the brilliant white of the sun, the perceiver both sees and has seen. Moreover, qualitative assimilation in the case of vision does not require the perceiver to become exactly like the way the perceived object is prior to perception. The visual experience of the perceiver may be constitutively shaped by the color of the sun and so like it, in some relevant sense, but not by the perceiver becoming white within. Moreover, qualitative assimilation in the case of vision, if not in the case of alteration, is relative to a point of view. The perceiver takes in the white of the sun by the perceiver, or perhaps their perceptual experience, becoming like the way the sun is actually like, brilliant white—by the sun’s brilliant whiteness constitutively shaping their visual consciousness in being presented to their point of view.

It is this further positive claim that constitutes Aristotle’s resolution of the generalized form of Empedoclean puzzlement. Even if we grant that we can take in what remains external, we can still be puzzled about what talk of taking in, here, means such that we could. Aristotle’s definition of perception is a resolution of this residual puzzlement precisely by offering an answer: In seeing we take in the color of the remote external particular by our experience becoming like the color presented to our point of view, by that color, presented in that way, constitutively shaping our visual consciousness.

Not only does Aristotle’s positive claim provide an answer to what taking in amounts to when we take in the external scene by seeing it, but it also provides the basis of explaining the enduring appeal of talk of taking in or assimilation. In seeing the brilliant white of the sun, we take in the color of that heavenly body by our experience becoming like the sun actually is, by its color constitutively shaping our visual consciousness in being presented to our point of view. In perceiving we become like the perceived object actually is. The objectivity of perception consists in its being a mode of assimilation. If there is nothing that visual experience becomes like, if there is nothing it assimilates to, then it would not be a mode of assimilation and, hence, not a mode of perception. The perceiver’s perceptual experience could not be as it is if a Cartesian demon eliminated the perceived object. If perception is a mode of assimilation, then the visual experience that the perceiver undergoes in seeing a particular could not be as it is if that particular differed in visible respects

relative to the perceiver's point of view.

What was compelling, all along, about the rhetoric of assimilation was its pretension to objectivity. The Giants were rightly impressed by the reality of what can be handled and offers resistance to touch (Plato, *Sophist* 246^a; see chapters 1.4 and 2.1.2). In understanding taking in as a mode of qualitative assimilation akin to, but distinct from, the qualitative assimilation involved in qualitative alteration, Aristotle provides proof of the pretended objectivity. If the perceiver becomes like the way the perceived object actually is, in the sense that their perceptual experience is constitutively shaped by that object as presented to their point of view, then it is impossible for their experience to be as it is and that object be some way other than it actually is at least in sensible respects.

Consider grasping a solid body. In handling that body it offers resistance to touch. Being solid, it retains its shape, a shape that the grasping hand conforms to. The Giants' grasping of rocks and trees is a powerful rhetorical gesture. Grasping something which offers resistance to touch is a phenomenologically vivid and primitive compelling experience of what is external to us. If Boswell is to be believed, Dr Johnson's performance outside of a church in Harwich belongs to the rhetorical tradition inaugurated by the Giants:

After we came out of the church, we stood talking for some time together of Bishop Berkeley's ingenious sophistry to prove the non-existence of matter, and that every thing in the universe is merely ideal. I observed, that though we are satisfied his doctrine is not true, it is impossible to refute it. I never shall forget the alacrity with which Johnson answered, striking his foot with mighty force against a large stone, till he rebounded from it, "I refute it *thus*." This was a stout exemplification of the *first truths* of *Pere Buffier*, or the *original principles* of Reid and Beattie; without admitting which, we can no more argue in metaphysics, than we can argue in mathematics without axioms. To me it is inconceivable how Berkeley can be answered by pure reasoning ... (Boswell, 1935, I 471)

The reality of external matter was demonstrated in the resistance it offered to Dr Johnson's foot, which rebounded despite its mighty force. It was a demonstration not in the sense of proof, since it is inconceivable how Berkeley can be answered in pure reasoning. Moreover, what was stoutly exemplified was metaphysically axiomatic, a first truth, but proof proceeds from axioms, it does not establish them. Rather Dr Johnson's performance was a demonstration of first truths by showing or exhibiting them (on the character of Johnson's refutation of Berkeley see Patey 1986). The incident reported by Boswell thus dramatizes an important part of the Giant's doctrine—that the palpable is real—even if it fails to dramatize the whole of that doctrine—that only the palpable is real.

Grasping is an important trope in the rhetoric of objectivity. But notice that even the Giants' grasping of rocks and trees involved a mode of assimilation. Consider the way their hands assimilated to the shape of the rocks and trees they grasped. It is precisely our perceptual experience assimilating to its object that is the source of its objectivity. Grasping may be a paradigm case of sensory presentation, but not because it involves an object being in contact with a sense organ. Rather, it is a paradigm case because the grasping hand assimilates to the object grasped, and thus the objects grasped are presented to us as being independent of our grasping them. But suitably understood, this is a feature of all perceptual experience:

For sensation is surely not the sensation of itself, but there is something beyond the sensation, which must be prior to the sensation (*Metaphysica* Γ 6 1011^a1; Ross in Barnes 1984a, 56).

For a sensory experience to be perceptual is for it to assimilate the sensible form actually instantiated by its object. This is what underwrites the objectivity of perceptual content. Tactile descriptions of non-tactile modes of sensory awareness are thus emphasizing the objective presentation of their objects.

Aristotle's explanation of the objectivity of perception, and his premodern perceptual realism more generally, is lost by the early modern period. Insofar as the early moderns deny that our sensory ideas resemble the objects that elicit them, they deny, as well, that sensory experience is a mode of qualitative assimilation. Insofar as sensory experience is no longer understood as the assimilation of the sensible form actually instantiated by an external particular, the moderns no longer have available to them the Aristotelian explanation of perceptual objectivity. As the modern paradigm reaches the stage of normal science, perceptual presentation is replaced by the *simulacrum* of "sheer receptivity" (Sellars, 1967, 16). The reliable differential responsiveness of sensation usurps the role previously played by sensory presentation. (For contemporary discussion of these matters see McDowell 1998 and Kalderon 2011c; for its history see Hamlyn 1961.)

According to a form of skepticism found within the phenomenological tradition, modern philosophy is ultimately unsustainable because of its adherence to the metaphysics of presence. If the metaphysics of presence cannot be coherently sustained within modern philosophy, at least with respect to sensory presentation, this is not because of any contradiction or incoherence within the metaphysics of presence, but because modern philosophy abandoned sensory presentation from the beginning. If perception does not resemble its object, then perceived object does not constitutively shape the perceiver's experience, and so that experience could not consist in that object's sensory presentation. Moreover, the idea that colors are, in some suitable sense, secondary qualities depends upon the perceiver's

visual experience not resembling its external cause. The modern conception of colors as secondary qualities only arises in a philosophical context where Aristotle's premodern realism has been abandoned and, with it, sensory presentation itself. Colors only seem secondary when color experience is conceived as a mode of sheer receptivity rather than a mode of sensory presentation.

Consider the revulsion Melville expresses for Locke's (1706) metaphysics. In an extended meditation on the whiteness of the Whale as the source of mortal terror, Melville considers Locke's view that colors are secondary qualities having just discussed Newton's theory of color:

And when we consider that other theory of the natural philosophers, that all other earthly hues—every stately or lovely emblazoning—the sweet tinges of sunset skies and woods; yea, and the gilded velvets of butterflies, and the butterfly cheeks of young girls; all these are but subtile deceits, not actually inherent in substances, but only laid on from without; so that all deified Nature absolutely paints like the harlot, whose allurements cover nothing but the charnel-house within ...
(Melville, 1851, ch. 42)

Experience presents itself as the presentation of particulars whose natures and powers are independent of their being perceived. But if it does, then it is misleading in this regard. The apparent colors of things are but subtile deceits laid on from without for nothing in our phenomenologically vivid color experience resembles its external cause. It is the absence of colors inherent in substances that Melville expresses revulsion for. And he represents this color nihilism as a fall from innocence. We move from the butterfly cheeks of young girls to the painted harlot whose allurements cover nothing but the charnel-house within. I suspect that the "charnel-house" is less an expression of misogyny or New England prudery, but Melville further echoing the Lapsarian myth. Death comes East of Eden. The Fall changes our relationship with mortality, and with it, our relationship with ourselves. This absence, and the morbidity of its description, is emotional resonant in the context of the chapter, echoing, the way it does, God's absence. It is because the whiteness of the Whale signifies the absence of God that it inspires mortal terror in those who behold it. Experiencing God's absence is also a kind of fall, and one that changes our relationship with mortality. And it is precisely this that was the source of terror. But if color is absent in the external world, the way the whiteness of the Whale intimates that God may be, then our visual experience could not be as it presents itself as being, as the presentation of the colors that inhere in remote external particulars. (For a different interpretation of the Lapsarian myth as applied to these matters, one given from within the modern paradigm, see Chalmers 2006.)

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