

**Richard Sorabji**

**Perception,  
Conscience and Will  
in Ancient Philosophy**

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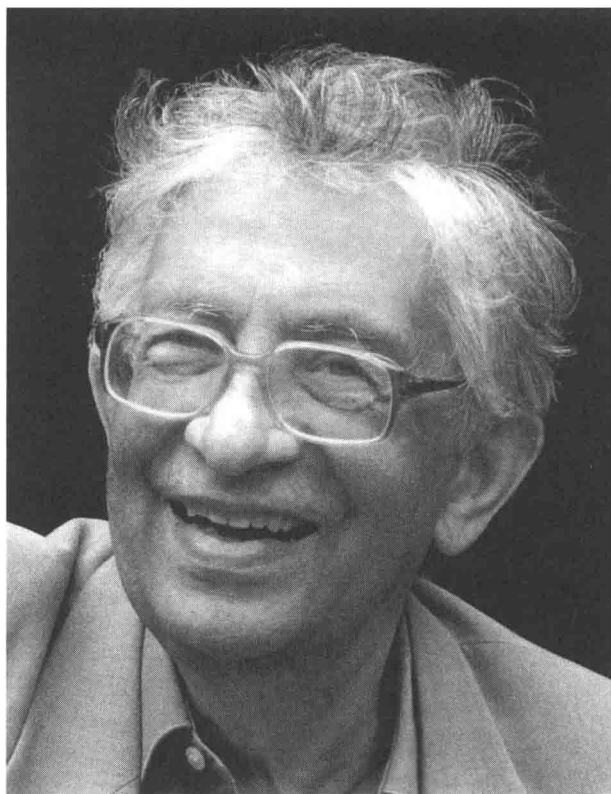
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# INTRODUCTION

This book is about the human mind with a focus on sense perception, but it finishes with chapters on moral conscience and will. Sense perception raises the further questions of the mind-body relation, of self-awareness, of infinite divisibility and the continuum, of the capacities of animals and children and of the relation between perception and reason. On all topics the introduction interconnects the papers and presents fresh material to fill out the picture. For the topic that has proved most popular, the physiological process in sense perception, a bibliography is provided as well as latest thoughts. On the final two topics, a view of moral conscience and the will is argued that provides an alternative to other interpretations. The picture of the main topics shows that each continued to develop into a richer and richer account throughout the 1200 year course of Ancient Greek Philosophy up to 600 CE, and, in such subjects as self-awareness or the approach to intentional objects, into an increasingly sophisticated one.

## **The Mind-Body Relation, Chapters I-II**

The first two chapters are about the mind-body relation, the first in Aristotle, the second in Plato and in late Greek Aristotelians and Platonists. In Chapter XIII below, I shall sometimes have to distinguish soul from mind in ancient discussions, but for the present I am using the term 'mind' as the term most familiar in current usage. Concerning Aristotle I argued that his account of the mind-body relation is interestingly different from modern accounts. About the late Greeks my theme is that in a variety of ingenious ways they revolted from materialistic accounts, such as that found in Galen. In between the original publication of Chapters I and II, there appeared a pioneering article about the period intervening between Aristotle and Galen by Victor Caston, from whom first as a pupil and then as a colleague I have often learnt.<sup>1</sup> To defend a very small difference between us on the post-Galen part of the story, I owe a clarification.

Aristotle's greatest defender and interpreter to a later age was Alexander of Aphrodisias, who lived five hundred years after Aristotle and held

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<sup>1</sup> Victor Caston, 'Epiphenomenalisms, ancient and modern', *The Philosophical Review* 106, 1997, pp. 309–63.

the Aristotelian chair in Athens around 205 CE. There is only limited agreement now with the verdict of an earlier leading scholar of Alexander, who emphatically described him as a materialist both in philosophy of mind and more generally.<sup>2</sup> I side with the current majority against a materialistic interpretation. As Chapter 2 explains, Alexander disagreed with his older contemporary, the great doctor-philosopher Galen (c. 129–199 CE), who held that that the soul, apart from Plato's immortal soul if there was such a thing (36,12–16), was simply the chemical blend of the body (a view rejected in Plato's *Phaedo* along with its equivalent that the soul was simply the attunement of the body), and that capacities of the mind simply *followed* the blend of the body. Galen congratulated the early Aristotelian Andronicus for saying that the soul either was the blend of the body or followed the blend of the body, but himself insisted on its actually *being* the blend.<sup>3</sup> Alexander repeatedly denied that the soul was the blend or attunement of the body, and insisted instead that it was, as Aristotle thought, a capacity that *supervened* (*epiginesthai*, sometimes just *epi*) on the blend of the body. The clarification I must introduce is that 'supervene', though a literal translation of the Greek, does not carry the same meaning that it has been given in modern analytic philosophy. In Alexander, to say that the soul supervenes on the blend tells us no more as yet than that the blend is a necessary prerequisite for there being a soul. In modern analytic philosophy by contrast supervenience implies covariation. Same bodily state – same psychological state. That would be closer to materialism than Alexander's view.

Alexander's use of the term 'supervene' may be illuminated by the sixth century Christian scholar of Neoplatonism, Philoponus, who repeated Alexander's term later, with the difference that he transferred it from the soul to the soul's capacities, and said that they *supervene* on the blend. Philoponus contrasted with supervening both Galen's '*following*' the blend as a necessary accompaniment and being its *result* (*apotelesma*). The blend is merely a necessary prerequisite and the soul's capacities neither follow necessarily from it, nor result from it.<sup>4</sup> Nonetheless, colours are treated differently from capacities of the soul. Although a colour merely *supervenes* on the suitability

<sup>2</sup> Paul Moraux, *Alexandre d'Aphrodise, Exégète de la Noétique d'Aristote*, Les Belles Lettres, Paris 1942, pp. xviii; 10–11; 32–3; 49; 167–9. Marwan Rashed cites 6 more recent opponents, himself included, in his *Essentialisme, Alexandre d'Aphrodise entre logique, physique et cosmologie*, de Gruyter, Berlin 2007, p. 30, nn. 92; 94: Donini, Thillet, Accattino, Sharples and Gottschalk. On the other hand, William Charlton, has an unpublished paper, 'Physicalism in Alexander's *De Anima*', which argues for a certain materialism and also for a mechanistic tendency.

<sup>3</sup> Galen, *Quod animi mores* 44, 12–20.

<sup>4</sup> Philoponus, *Commentary on Aristotle On the Soul* 51,13–52,1;



of the blend, and is not a *result* of it,<sup>5</sup> it is allowed to *follow* (169,17; 170,28) the suitability of a blend. Philoponus often followed Alexander closely, and indeed, the same differentiation between capacities of the soul and colours is found earlier in Alexander. In two texts, talking of white, Alexander allows that it both supervenes on *and* follows from the blend of the body.<sup>6</sup> But with the soul Alexander repeatedly confines himself in his treatise *On the Soul* to saying that it is a capacity that ‘*supervenes*’ on the blend.<sup>7</sup> That ‘supervene’ does not automatically imply ‘follow’ becomes clear at 66,6–8, where, talking of the soul in a different context, he says that its more perfect capacities supervene on (*epi*) the lower ones, reason on perception. Here he could not add ‘follow’, which implies necessarily accompanying, because lower animals, in his view, have perception without reason.

The situation in Alexander, then, seems to be that supervening does not automatically imply following. It is allowed to be compatible with following a blend in the case of properties like white, but he does not countenance the idea that the soul follows the blend of the body. The only exception is found in the supplement to his *On the Soul*, a work called *Mantissa*, which starts with a summary of his views and includes some stretches that are clearly incompatible with his other work. *Mantissa* 104,28–34, has not been particularly suspected of inauthenticity, but it has no parallel in *On the Soul* when it says that different types of soul in different animals *follow* from different types of blend. I don’t know whether this represents a change of view, or rather a change of subject from speaking of when we find any soul at all, to discussing when we find different *types* of soul. Certainly the first (the presence of any soul at all) has not been allowed to *follow* from the blend. That would again have brought us somewhat closer to materialism, so it is important to see that Alexander avoids it.

To turn to Philoponus’ own innovations, and to different aspects of the mind-body relation, I mention one of them only briefly in Chapter II: mutual interaction between mind and body. By philosophising one can change one’s emotional disposition. Attending philosophy lectures can reduce irascibility. But the causal interaction between mind and body works in two directions. Attending philosophy lectures can make one leaner and drier, and it is this in turn that reduces irascibility. The passage adds another influence of mind on body: the student’s understanding of the lecture is shown by physiological changes reflected in the face, and this guides the lecturer. This is the only

<sup>5</sup> Philoponus, *On Aristotle On coming to be and passing away* 169,24–7; 170,12–35.

<sup>6</sup> Alexander, *On the Soul* 24,10; *Commentary on Aristotle’s Topics* 50,19–23 and 51,3.

<sup>7</sup> Alexander, *On the Soul* 24,18–23; 25,3–9; 26,20–22.

contribution I mentioned to knowledge of other minds. But there are others in other authors and I have discussed some of them elsewhere.<sup>8</sup>

Plato thought of the soul as making *spatial* movements which accounted for some mind-body interactions. Later Platonists preferred to relate soul to body non-spatially. This view is found especially in Porphyry, although I should have warned that there is controversy about the identification of one of the texts ascribed to him.<sup>9</sup>

Another big aspect of mind-body relations that I have discussed only elsewhere is the Platonist theory of reincarnation whether in human or in animal form. This raised questions as to whether Plato believed literally in reincarnation in animal form, and if so, whether the animal is animated only by remote control or by some non-spatial relationship, of which some are discussed in Chapter II. It also raises questions about incarnation as a human. What role is played in forming the body by the parents, including the mother, what by the soul that is waiting to be incarnated and what by Plato's World Soul? If the parents play a large role, what directs the waiting soul to a suitable body? Is it the World Soul, or does the waiting soul create its own body? Since I wrote about this,<sup>10</sup> an important treatise by Porphyry has been translated, *Porphyry to Gaurus On how embryos are ensouled*,<sup>11</sup> and the translator is now writing about the development of the subject after Porphyry.

So far I have spoken chiefly about Chapter II. As regards Chapter I, I did not intend, as two good colleagues suggested, to imply that Aristotle endorsed another modern theory, functionalism.<sup>12</sup> My intention was rather to show that his view about the mind-body relation differed from *all* current views. My denial that Aristotle's theory contains Brentano's idea of an intentional object of perception is more fully discussed in Chapter IV, where I trace the intervening reinterpretations which I think were required before Brentano

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<sup>8</sup> *The Philosophy of the Commentators 200–600 AD, a Sourcebook*, vol. 1, Psychology, Duckworth, London, and Cornell University Press 2005, Bloomsbury, London, 2011, Ch. 9, 'Knowledge of other minds', pp. 242–4.

<sup>9</sup> John Rist doubts if the whole of the passage cited from Nemesius is a quotation from Porphyry, and from his *Summikka Zetemata*, 'Pseudo-Ammonius and the soul/body problem in some Platonic texts of late antiquity' *American Journal of Philology* 109, 1988, pp. 402–15.

<sup>10</sup> Richard Sorabji, *Animal Minds and Human Morals*, Duckworth and Cornell 1993, Bloomsbury 2011, Ch. 13; *The Philosophy of the Commentators 200–600 AD, a Sourcebook*, vol. 1, Psychology, Duckworth, London, and Cornell University Press 2005, Bloomsbury, London, 2011, Ch. 6(d), pp. 213–16. The subject is taken much further by James Wilberding, *Porphyry to Gaurus*.

<sup>11</sup> *Porphyry to Gaurus On how embryos are ensouled*, translated by James Wilberding, Bloomsbury, London 2011.

<sup>12</sup> Kathy Wilkes, *Physicalism*, Routledge, London 1978; Myles Burnyeat also took me this way in our earlier discussions.

could read his idea into Aristotle. As regards the passage where Aristotle says that what rules out *seeing* that one sees is not lack of coloration in the eye, my early interpretation is corrected in Ch. III, p. 213, and Ch. XI, pp. 132–3, below. These explain that this is a dialectical move and does not imply that one is self-aware of seeing by *perceiving* as well as *receiving* coloration in the eye jelly. The dialectical move should be clearer still from the fuller treatment in my book *Self*, Oxford and Chicago University Presses 2006, pp. 206–9.

### **Chapters III–V, physiological process and intentional object in perception**

Chapter III (defended in Chapter V) discusses both the physiology of perception and its cognitive aspect. It thus both links with the preceding topic of mind-body relations and paves the way for Chapter IV, which concerns the centuries of reinterpretations leading up to Franz Brentano's. He found in Aristotle his idea, seminal for modern philosophy of mind, of perception and all mental activities as being directed to non-physical 'intentional objects', as they are called.

Chapter III examines first the *formal* cause of perception in Aristotle. He thought it a kind of discrimination. But since he differs from his teacher Plato in denying *reason* to animals other than humans, he has to explain how other animals cope in the world by expanding dramatically in comparison with Plato what *perception* can do. The sense of smell, for example, enables them to perceive not just an odour, as in Plato, but an odour as lying in a certain direction and as belonging to a deer. They can thus combine the idea of an odour with various predicates, or predicate certain things of it. But perception requires also a *material* cause, a physiological process. I argue that in seeing, for example, the physiological process is the eye jelly's borrowing colour patches from the scene perceived.

This physiological interpretation is presented (pp. 211, 220, 224–5 of the original) as a preliminary to the discussion of Franz Brentano in Chapter IV. Brentano lay at the far end of a long tradition of commentary on Aristotle, when in 1874 he cited Aristotle's 'reception of form without matter' in perception and thought as already referring to his own distinctive idea, that perception and thought are directed to 'intentional', rather than real objects. The object of my visual experiences or of my hopes and fears does not have to exist in reality in order to be their object. It need only have what Brentano calls 'intentional inexistence', and this he considered a characterising feature of mental as opposed to physical activity.

Victor Caston has argued, and will document more fully in a book in preparation, that ideas of intentional objects and attitudes are to be found also

in the Stoics and in Augustine,<sup>13</sup> although the route of commentary on Aristotle was, I think, the one that influenced Brentano. In my view, in order to see how Brentano could understand Aristotle to be talking about something so non-physical as an intentional object, we need to trace the series of reinterpretations through late antiquity and the Islamic and Latin-speaking Middle Ages. It was in order to free Aristotle from various difficulties in the *physical* side of his theory of perception that the late Greek commentators increasingly understood his ideas in a *non-physical* way. Their aim was not to give the most straightforward reading of Aristotle's text, but to give Aristotle the most defensible view. This might be called simply a distortion of his actual view, but I see it as a heuristically fruitful transformation of his view that finishes up by giving us the concept of an intentional object. If my interpretation of Aristotle's original view is right, we shall miss the transformation and the way the history of philosophy works, if we do not see what the original view was. But my interpretation is still a matter of controversy.

The controversy about physiology between myself and my one-time sparring partner, Myles Burnyeat, first published in 1992, has proved very popular. For most of 1970 to 1978, Burnyeat and I lectured together to London philosophy students, one delivering the lecture and the other making objections. An appendix will provide a list, kindly assembled by others,<sup>14</sup> of 37 publications on the subject between 1992 and 2012. But I also cite in Chapter III many agreements and disagreements with my interpretation from before 1992. On my view, Aristotle thought that seeing, for example, involved the physiological process of the eye jelly borrowing colours from the scene observed. On his, Aristotle postulated no physiological process at all. Caston's masterly attempt to adjudicate<sup>15</sup> has not convinced the protagonists entirely, but it has changed the terminology of the debate as being one between followers of the *spirit* and of the *letter* in interpreting Aristotle's idea that the organ becomes like the sense object.

In 1992, Burnyeat very interestingly showed that Philoponus understood Aristotle's idea that in seeing we receive matter without form in his way and differently from me.<sup>16</sup> In text 9 of my Chapter III,<sup>17</sup> Philoponus says that the

<sup>13</sup> Victor Caston, 'Something and Nothing: The Stoics on Concepts and Universals' *Oxford Studies in Ancient Philosophy*, vol. 17, 1999, 145–213.

<sup>14</sup> 31 items were assembled by Joachim Aufderheide, and I drew others from Peter Lautner, Roberto Grasso, Kunio Qatanabe and from my own awareness.

<sup>15</sup> Victor Caston, 'The spirit and the letter: Aristotle on perception', in R. Salles, ed., *Metaphysics, Soul and Ethics. Themes from the Work of Richard Sorabji*, Oxford University Press, pp. 245–320.

<sup>16</sup> Myles Burnyeat, 'Is an Aristotelian Philosophy of mind still credible?', 1992. see appendix.

<sup>17</sup> Philoponus, *On Aristotle On the Soul*, pp. 432, 32 – 433, 11; 438, 6–15.

sense organ does not become coloured or odorous. The organ of sight, for example, does not contain a liquid, but the gas *pneuma*, and this is the basic organ for all five senses. It would not be a suitable material for taking on colours. Philoponus' interpretation is that receiving form without matter does not involve, as I thought, receiving coloration without particles. Rather, form is received only cognitively (*gnōstikōs*). The only exception is the sensing by touch of hot, cold, fluid or dry, which inevitably involves, in addition to the cognitive effect, the sense organ being affected materially (*hulikōs*) by these four qualities.

On the other hand, there have been two recent new pieces of evidence thanks to a finding by Peter Lautner, whose relevance we both noticed. An 11th century codex of Philoponus' commentary *On Aristotle On the Soul* includes a passage that is printed by Hayduck at the foot of p. 293 of his edition.<sup>18</sup> The author appears to be Philoponus and in the first 13 lines, he repeatedly says that perception is nothing but the discrimination of the effect (*pathos*) produced in the sense organ by the object of sense. So there is a physiological process as well as the cognitive activity. This claim is compatible with Philoponus' denial that the sense organ becomes coloured or odorous, as emerges from more recent work by Lautner. The physiological change received by the organs of sight, hearing and other sensitive powers, as he explains in a new paper in preparation,<sup>19</sup> is rather compression or expansion in the *pneuma* which they contain. I leave it to Lautner to provide the evidence.

Chapter V seeks to present some other chapters of Aristotle's *On the Soul* as offering no counter-evidence about physiological processes, and finishes by finding Brentano's idea of an intentional object absent from Aristotle's theory of thinking.

## Chapter VI, demarcating the five senses

Book 2, chapters 3, 4 and 6 of Aristotle's *On the Soul* make clear that the five senses and other perceptual powers should be defined by reference to the properties that they perceive. Each is the perception of such objects, and this, with one exception, is the programme of definitions carried out in the ensuing chapters. The description in 2.6 of these properties as intrinsic (*kath' hauta*) objects of the senses may actually mean that they define the senses, as I

<sup>18</sup> *Commentaria in Aristotelem Graeca* vol. 15. Peter Lautner, 'Methods in examining sense-perception: John Philoponus and ps-Simplicius', *Laval Théologique et philosophique*, vol. 64, 2008, pp. 651–61, at p. 654.

<sup>19</sup> Peter Lautner, 'Gnōstikōs and/or hulikōs: Philoponus' account of the material aspects of sense perception'.

suggested. But I also warned that Aristotle recognises more than one meaning of the expression and that the case does not rest on this. Colour, sound and flavour are named as intrinsic objects of their respective senses, but shape and size are also intrinsic objects, evidently to what is sometimes elsewhere called the common sense, because they are later said to be merely accidental objects of the five senses, 3.1, 425a15.

2.6 makes a second distinction, or perhaps double distinction: colour, unlike shape, is a peculiar or proper (*idion*) object of sight, because it is perceived *only* by sight, and he adds about proper objects that *hearing*, for example, cannot be deceived that there is *sound*. This second claim would be justified if he intended the further point that *whenever* we hear, we hear sound. This is not to deny that *sight* might be deceived that there was sound, which could be why he weakens the ‘cannot’, when he later switches from hearing to *perception*, and says that *perception* is *minimally* deceived about a proper object, 3.3, 428b19.

The exception is the sense of touch, which Aristotle defines differently, partly, no doubt, because it perceives so many different kinds of property. He defines it not by the numerous objects it perceives, but by the fact that it operates by direct contact. Contact, however, is equally a feature of the sense of taste, which was not by ordinary Greeks thought of as a form of touch any more than it is by us. Plato had a solution. He had defined touch in his *Timaeus* as the sense which does not depend on a localised organ, because many parts of the body can exercise it. This makes it unlike taste. This is the second case in which Aristotle’s contact criterion causes him difficulty. Another, highlighted by the work of John Ellis, was discussed in Chapter IV. If touch and taste are the only senses that operate by direct contact, will not the fragrance of an apple have to detach itself from any apple particles, rather than the particles directly contacting the organ of smell? But Aristotle’s logic denies that a particular apple’s fragrance can detach itself from the apple’s particles. If Aristotle counters that what detaches itself and is received by the organ is not the fragrance, but some effect of the fragrance, will that fit with his idea that in perception sensible forms are received?

### *Chapters VII–IX, the physics of senses and sense-objects*

#### **Chapter VII, intermediate colours**

Chapters VII–IX move to the physics of perception and perceptibles, the subject of Aristotle’s *On Sense Perception*. Chapter VII treats Aristotle’s view in *On Sense Perception*, Chapters 3, 4 and 7 that other shades of colour are mixtures of the darkest, the black of pure earth, with the brightest, the white of pure fire. The most pleasant of the other colours are produced by ratios of black to white

which are numerically simple, and similarly for flavours and odours. This would transfer to other sensibles the Pythagorean discovery that the pleasing consonant pairs of notes are produced by mathematically simple differences of string length in the ratios 1:4, 1:3, 1:2, 2:3, and 3:4. Goethe backed Aristotle against Newton as understanding the painter's colours. They both noticed that the sun is variously coloured by a cloudy or sooty atmosphere and Goethe thought that this was how varnishes changed the colour of paintings. Aristotle knew of theories about the combination of black and white ingredients, but he substituted in place of the idea that they are juxtaposed or superimposed, his own idea that they are blended into a chemical mixture.

It is interesting that Aristotle, despite important oversights in his theory, is more mathematical in intent here than Plato, contrary to a very common stereotype. For Plato had said in *Timaeus* 68B and D that no one could know the ratios of his own theory of colour and no human could test them. A very limited testability is suggested for Aristotle's Pythagoreanising theory.

### Chapter VIII, borrowed colour and light, minimum perceptibles

The next subjects are discussed in Aristotle *On Sense Perception*, Chapters 3, 6 and 7. Every body, Aristotle thinks, contains the transparent elements air and water, and therefore has some degree of transparency, however low, throughout. The seat of colour in a body is its transparency, and, more precisely, the outer surface of its transparency, which coincides with the outer surface of the body. But as to which colour appears at the surface, the mixture of dark and bright colour at the surface, discussed in Aristotle's Chapter 3, does not apply to *borrowed* colour. The borrowed colour of the sea depends on the viewer's distance and angle of viewing. But Aristotle does not ascribe this borrowed colour to reflection, even though he knows that what is reflected also depends on the viewer's angle of vision. Implausibly, he speaks as if the variation of colour depends only on the sea's movements. As to how borrowed colour differs from illumination or light, the latter (light) makes the sea seeable-*through*, the former makes it seeable. Moreover, light penetrates beyond the surface.

Light is defined as the property of being *actually* seeable-through because of the presence in the transparent medium of fire or fire-like substance. Because light is the product of mere *presence*, it does not have to travel, part way before whole, and in this it is like some qualities, such as a pond's being frozen. Freezing can also 'leap', without travelling part way before whole. But the acceptance of mere *presence* prevents Aristotle from explaining the directionality of light, why it does not easily go round corners, but allows shadows and night. He is nonetheless very aware of its directionality, and he uses the common talk of rays. But he prefers to speak of the directionality not

of light, but of the influence of colour. Moreover, this is talk of the direction of causal *influence*, not of travel, part way before whole. Philoponus was later to extend the directionality of causal influence to the case of light. Aristotle is aware, unlike Democritus, that mirroring is due to the reflection, or bending, of something, *On Sense Perception* 2, 438a8. At *On the Soul* 3.12, 435a5–10, he thinks of it as due to the bending of the influence of colour.

Aristotle also discusses how many colour patches in an area, or how many variations of shade or pitch in a range, are ‘separately’ perceptible, as opposed to being perceptible in some weaker sense, such as contributing to the perceptibility of a larger whole. He decides the number will be finite, so that there are minimal ‘separately’ perceptible patches and variations. This introduces an element of discontinuity into his system. But he introduces refinements: a singer’s discontinuous change of separately perceptible pitch may be due to a *continuous* change of vocal tension, and similarly with the *continuous* motion of a stopper along a musical string. This permits us to identify the target of certain objections raised by Aristotle’s friend and successor, Theophrastus.

Unexpectedly, however, Aristotle goes on a little later to say that, although a perceptible magnitude can *appear* the smallest possible, it cannot in fact be indivisible. I now think that he means to allow what he previously allowed, that it is still the smallest ‘separately’ perceptible and is only denying that it is indivisible as an area in its own right. He uses an argument that will be the subject of the next chapter concerning the instant of change. But he uses the argument unsatisfactorily in a way that would prove too much by ruling out larger perceptible patches. If there were an indivisible perceptible patch, he says, imagine it approaching an observer until it becomes perceptible. What would be the last distance of imperceptibility and what the first distance of perceptibility? Every answer appears paradoxical. In the next chapter, we shall see Aristotle offering clever answers for some contexts.

Whatever his view of minimal perceptible patches, Aristotle does not welcome a minimal limit for perceptible *times*, with shorter times being imperceptible, an idea which seem to have been required by certain theories that he addresses. Certainly, modern psychology has established that our perception depends on a number of illusions about the relative timing of things perceived, because of the imperceptibility of small time differences. One of the pointilliste theories that Aristotle rejects, of intermediate colours being produced by juxtaposed black and white dots, probably postulated that the effects of the black and white reach the observer at different speeds, and imperceptibly different times. This would protect the observer from having to perceive opposite qualities at the very same time. Another type of theory, including probably Plato’s in his *Timaeus*, explains the two notes in a consonant pair as travelling towards us at different speeds, the higher one



arriving imperceptibly sooner, and a theory in the pseudo-Aristotelian *On Audibles* postulates undetectably small differences of string vibration. The last description may have been written after Aristotle, but either it or some predecessor may have added further objectionable features, since that would explain why Aristotle adds several extra objections that would not apply to the other theories. Once again, Aristotle's successor Theophrastus is said to have replied that there can be a first instant of having changed, in cases where change takes no time, and he was thought to have been referring to Aristotle's 'leap' of light or freezing.

## Chapter IX, the instant of change

The problem of the instant of change is a general problem of physics. But it is applied to the change of becoming perceptible, as we have just seen, and to a change of coming to be wholly of a new colour. If the train leaves at the sizeless instant of noon, what is the first instant of motion and the last of rest? If the first instant of motion coincides with, or precedes, the last instant of rest, we seem to have both motion and rest at the same time, which sounds like a contradiction. If the first instant of motion follows the last instant of rest, we will have neither state during the intervening period, and how can this be? Finally, to say that there is a last instant of rest but not a first instant of motion, or vice versa, appears arbitrary.

I have suggested that different solutions should be found for different contexts. But if, like Aristotle and modern physics, we treat motion as continuous, not jerky like motion on a cinema screen, in that context there would be a way of avoiding arbitrariness. Since in continuous motion, there is no first distance or instant away from the starting point, and no first instant of exceeding zero velocity, it would not be arbitrary (although it would not be mandatory) to prefer a last instant of rest to a first instant of motion, since there are *independent* reasons for denying a first instant of motion.

Are other changes continuous in this way? If shades of colour do not form a continuous series, according to Aristotle *On Sense Perception* Chapter 6, it might seem that a leaf could change discontinuously to a new colour at an instant. But Aristotle points out that the new colour may spread continuously over its surface. Even if the whole leaf changed colour instantly, this might be due to a continuous underlying change, in which case it might be thought of as changing to the new colour continuously, but imperceptibly, according to one suggestion in Aristotle's discussion. In all the cases so far, it would be non-arbitrary to say that there was no first instant of changing, though, as Aristotle is aware, there would be a first instant of having wholly acquired and of having the new colour.