LUCRETIUS ON WHAT ATOMS ARE NOT

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In memoriam Hugh Sykes Davies

I

FROM ANTIQUITY to the present day atomic theory has demanded that people confront a startling idea: that the world, on scales both very small and very large, is not faithfully represented by the experiences of human subjects. All familiar things enjoy their set seasons and then pass away: the microscopic elements are eternal. All bodies within our ken give way before sufficient pressure: theory dictates that certain imperceptible particles are atomic and absolutely unyielding. Many objects filling our environment are colored, they exude odors, have tastes, and give off sounds when struck. Theory reveals to the mind's eye a stark, pure vista of colorless, odorless, tasteless, soundless atoms traveling through the never-ending void. It opens a gap between basic reality and at least the most familiar or basic appearances, threatening to make strangers of us in our own world. We inhabit a home at once so dim and so vast that our sight cannot penetrate its recesses.

How might we make sense of our reaction to atomism? A possible rejoinder to the claim that atomism typically exerts an alienating effect is to counter that, even if as a matter of sociological fact people often succumb to it, they ought not to do so, that the disturbance engendered by atomism issues from philosophical error. Although we cannot perceive atoms, we do see the fire and hear its crackling. Granted that a cow is not immortal, it nonetheless truly exists throughout its lifetime. The human domain may be small, our senses, frail, but these limitations should not lead us to suppose that what we seem to know is not real, or that we do not really know it. Accordingly, anyone who draws such frightening conclusions from atomistic premises is mistaken. He has fallen prey to the bugbear of reductionism: the delusion that atomism somehow entails that fires, cows, and people only seem to be.

As it stands this bald response to the felt threat of atomism stimulates rather than settles worries because of its reliance on the vexed notion of reductionism. In current philosophical debate "reductionism" means too many things to too many people. The word can indicate the view that

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certain ostensible, complex phenomena do not exist in their own right but are merely appearances generated by things and happenings of a seemingly different, and usually simpler, type. Some brands of physicalism in the philosophy of mind exemplify "reductionism" so understood. Then again, "reductionism" can serve as a label for the thesis that events falling within a given, more or less strictly defined class are to be explained exclusively in terms drawn from a distinct and more fundamental class. For example, a proponent of "reductionism" understood in this second sense might propose that biological explanations are reducible to physical explanations.[1]

The topic is exceedingly difficult. How are ontological and aetiological reductionism related? Can we have one without the other? Most pressingly, if we embrace reductionism with regard to certain appearances, is the world an emptier place than we had supposed? Even the precise meaning of this last question is far from clear; various alternative elucidations of it, and the available stock of competing answers, generate the range of philosophical positions on offer. The simplest way to gain a sense of the workings of the reductionism debate is to consider a sampling of candidate arguments.

Our hypothetical individual who feels threatened by the pretensions of atomism might argue as follows: "The fire before me seems to be hot and red. But atomism declares that it is made up of myriad imperceptible particles that are neither hot nor red. Elemental shapes, sizes, and trajectories produce macroscopic appearances of temperature and color. If, however, there just are no such qualities at the microscopic level, and if atomic features suffice to explain our everyday sensations of fire, then surely there is not really anything hot and red, any fire, in the world. Arguing on similar grounds, can I remain confident that anything that I (apparently) grasp with the senses is real?" His hypothetical opponent could respond: "Just because a story cast in atomic terms accounts for the properties of fire does not mean that atomism explains fire away. To render an appearance explicable is hardly to destroy it. You seem to presume that since my theory dictates that fire consists of nothing but fundamental particles, it as it were dissolves into them without remainder—but that does not follow. Furthermore, although human beings, like everything else that we perceive, are made out of atoms, I do not claim that atomic features and behavior can on their own provide the whole story about us."

1. The philosophical literature directly or indirectly concerned with reductionism in one sense or another is encyclopedic. The reader largely unfamiliar with this issue might begin by consulting E. Nagel, *The Structure of Science: Problems in the Logic of Scientific Explanation* (London, 1982). His pioneering statement of necessary and sufficient formal conditions for the reduction of one science to another has elicited a great volume of rich critical responses, often from practicing biologists and philosophers of biology. F. J. Ayala and T. Dobzhansky, eds., *Studies in the Philosophy of Biology: Reduction and Related Problems* (Berkeley, 1974), is a useful collection of contrasting arguments on the viability and desirability of reductionism. P. Kitcher's "1953 and All That: A Tale of Two Sciences," *Philosophical Review* 93 (1984): 335–73, deserves singling out as an exceptionally accessible and vigorous contribution to the debate from the anti-reductionist side.

It is of course impossible for us even to begin to evaluate these competing philosophical lines, since we did not provide ourselves with a substantive version of atomic theory. There are and have been many theories that deserve to be called "atomic" because their conception of matter is particulate and they attribute relative or absolute atomicity to their elements. But since the theories differ widely in the scope claimed for their explanations and the attitudes adopted towards complex phenomena, there can be no single, ultimate resolution of the reductionism issue. In principle, each type of atomism can call a distinct "reductionism" debate into being.

There nevertheless remains one anxiety besetting anyone contemplating any sort of atomism whatsoever; this worry is "primitive" inasmuch as it arises before atomic theories come to differ over the constellation of issues to do with reductionism, and survives any particular handling of those issues. In fact, one might contend that my initial description of the alienation produced by atomism depicts this primitive, general disturbance rather than any more particular apprehension linked to specific theories, and that modern philosophical discussions err in their concentration on reductionism to the neglect of this effect. The primitive worry is this: atomism insists that basic reality is unavailable to us. Not only is the ultimate nature of things lifeless, but our access to it is at best indirect. Although the mere adoption of atomist principles need not entail reductive conclusions, they do reveal that the world is fundamentally an odd and very bare place. Yet that is not how the world appears to us.

There is an easy way to dismiss my expression of the alienation effect. The critique would run as follows: the worry is the product of surreptitious play on the connotations of words like "basic." The concealed and illicit presumption is that because the elemental is fundamentally simple, it is therefore fundamentally important; and given the imperceptibility of atoms, we live at a permanent remove from essential reality. None of this reasoning survives inspection: how can one suppose that atomism suggests that reality is "unavailable" to us? On the contrary, atomism promises us triumphant comprehension, so long as we trust in our minds rather than in our senses. Verbal trickery and stubborn adherence to untutored perception combine to create an anxiety that is truly "primitive" in the pejorative sense of the word.

This quick rejection is thoroughly unfair, since it is blind to the genuine difficulty manifested in the alienation effect. Whether or not we persevere with reason long after the senses give out and repose all our confidence in theory, we remain open willy-nilly to appearances which no degree of theoretical conviction has the power to alter. To put the point crudely but conveniently, the world does not in the first instance look atomic, and no amount of schooling makes it look any different thereafter. This is not the feeble protest that the savant fails to develop supernatural eyes, functioning like powerful microscopes. Rather, the idea is that our first and our final impressions are of a macroscopic

world whose characteristics do not in crucial respects match microscopic features. Τὰ φαινόμενα happen to us, we are passive in our basic experiences. Since ratiocination cannot modify τὰ φαινόμενα, at least not to the degree required before an atomist could trust the simple appearances, he can never move smoothly from what seems to be to what is. Thus we might reformulate the alienation effect by saying that for the atomist, phenomenology is pathology. Since it is indeed reasonable to feel philosophical dissatisfaction when confronted with this type of permanent gap between appearance and reality, the worry must be assuaged, not merely shrugged off.

Ancient atomists could claim either that what we perceive is only an illusion or that our vision is partial yet trustworthy. To recapitulate: a commitment to atomic microstructure separates the seen and the unseen, but does not of itself compel the theorist to adopt any particular ontology of macroscopic objects and consequently any particular epistemological evaluation of perception. It is, I think, correct to portray Democritus as a thinker who denies that anything exists apart from atoms taken singly and Epicurus as an opponent of the reduction of the human mind to its constituent atoms, although the validity of such interpretations is not at issue here.[2] The important point is that these interpretations are certainly coherent, even if false, and so bear out the contention that atomism on its own does not have any particular implications for the reality or unreality of familiar phenomena.

Yet there is no modern parallel for another, non-atomic, ancient theory of material constitution which states that although our vision certainly gives out, things which are just as they appear to the unaided senses are present in nature indefinitely far below the threshold of perception. "Hence the greatest of the physicists, Anaxagoras, in disparaging the senses on the grounds of their weakness, says, 'Owing to their infirmity we are unable to distinguish what is true.' And as an assurance of their lack of sureness he alleges the gradual change of colors: for if we were to take two colors, black and white, and pour some of the one into the other drop by drop, our sense of sight will be unable to distinguish the gradual alterations, although they exist in nature" (Sext. Emp. *Math.* 7. 90). Mental vision is the strict continuation of perception. That Anaxagoras makes a surprisingly familiar place of the world is most likely the reaction of a modern, probably of a philosopher, and certainly of someone unacquainted with any alternative to atomic theory. Of course, the protection of the familiar paradoxically entails Anaxagoras' rather esoteric doctrine of mixture, which is in large measure responsible for his philosophical appeal. Nevertheless we must not play down the striking opposition between his continuous world and the atomists' discontinuous world.

2. These readings of Democritus and Epicurus are to be found in, respectively, my "Eleatic Pluralism," *Archiv für Geschichte der Philosophie* (forthcoming), and D. Sedley's "Epicurean Anti-Reductionism," in *The Bounds of Being*, eds. J. Barnes and M. Mignucci (forthcoming).

Because ancient atomism was alive to the seeming tension between appearance and reality, it was not only in obvious conflict with Anaxagorean physics, but also deeply challenged by it. Anaxagoras, after all, was φυσικώτατος, as Sextus says; yet "the greatest of the physicists" had developed a theory that could not have been more at odds with the atomists' own. The challenge could not go unanswered: whatever the historical basis for the anecdote, let us take it that if Democritus really did commend Anaxagoras for his dictum ὄψις τῶν ἀδήλων τὰ φαινόμενα (Sext. Emp. *Math.* 7. 140), his praise could only have been heavily ironic, since the ὄψις that τὰ φαινόμενα provide does not in fact faithfully represent the truth that lies in the depths.[3]

How does Lucretius confront the problem of relating seen and unseen? Inevitably it is a problem for him because of the strangeness of the vistas revealed by Epicurus. Strangeness naturally induces discomfort, perhaps fear and pain (the novel idea that the world ends creates difficulty: 5. 97–103). The purpose of Epicurean philosophy is to release us from disturbance: what if it rids us of divine terror and the fear of death only by showing us a world that is comfortlessly alien, inhumanly featureless? Lucretius does not take a stand on reductionism; but in his attempt to convince us that a few microscopic properties give birth to the fecundity of familiar appearances he tries to face and overcome the effect of alienation.

I shall argue that in order to reassure us, to make the novel view more familiar, he attacks Anaxagoras and exploits what, for lack of a better name, I shall call the "optical model": that is, a means of conveying the strangeness of atomic theory in terms of certain familiar visual experiences. In the course of introducing concepts that figure in discussions of the match or mismatch between appearance and reality, I have availed myself of various turns of phrase that express the issues of alienation and reductionism in visual terms (e.g., my talk of various "perspectives" on the world). It is tolerably clear that were we to concentrate on modern theories, such language would prove at best merely analogical, while at worst it could positively mislead. On the other hand, evaluating the arguments of ancient philosophers in which the "optical model" is used is far from straightforward. For them this model is by no means entirely metaphorical, nor does it function as part of a neutrally descriptive language, untouched by their theoretical commitments. This hermeneutic uncertainty brings us up against the perennial difficulty of deciding how properly to react to *De rerum natura:* metaphor or argument? poetry or philosophy? I shall attempt to make good the claim that a certain special use of visual imagery neither simply embellishes this ancient discussion nor disgracefully conceals argumentative lapses, but in fact provides the very terms in which the issue was conceived—hence

3. In his unpublished paper "'All the World's a Stage Painting': Scenery, Optics and Greek Epistemology," Myles Burnyeat presents a subtle and convincing account of Anaxagoras vs. Democritus on the φαινόμενα.

a concentration on Lucretius is not merely acceptable, but highly appropriate. Richard Rorty has recently insisted vigorously that philosophy loses its old fight with literature:[4] despite the philosophers' pretensions to objectivity and authority, in the last analysis they too only flog metaphors. Let us examine how imagery actually works in an especially interesting case.

II

I have suggested that Lucretius does not address the issue of reductionism directly but that he does attempt to get us over the intellectual and emotional disturbance produced by the sheer unfamiliarity of the world at the relatively featureless level of atoms and void. Before turning to the passages devoted to this task, we should devote some attention to the section of the poem that introduces the distinction between *coniuncta* and *eventa* (1. 449–82). These lines might be thought both to contradict my assertion that Lucretius' attention to the relation between microcosm and macrocosm does not take in reductionism, and to undermine his claim that he seeks to convince us through argument.[5] Careful examination of the passage will, however, reveal that the ostensible contradiction disappears, and will show how Lucretius works on the reader's sensibility in order to effect his eventual conversion to Epicureanism.

In the course of developing his case for an anti-reductionist Epicurean metaphysics, David Sedley suggests that *De rerum natura* is at least compatible with his view: "Since the two kinds of property [viz., *coniuncta* and *eventa*] exist by belonging to *per se* entities (Lucretius 1. 445–50), their range can give us a clue as to the range of *per se* entities. . . . [Lucretius' examples] implicitly make men prominent, as the *per se* existents of which slavery, poverty, war and their opposites exist as accidents (1. 445–46; see also 467, where the point becomes explicit). Stones, fire and water also feature (1. 453) as bearers of certain inseparable properties over and above those pertaining to body as such."[6] Sedley properly recognizes that his inference from type of property to range of *per se* entity is not explicitly made by Lucretius and limits himself to the claim that the wide range he assigns to Epicurean *per se* entities is implicit in what Lucretius says.

A difficulty arises because the curious later section of this passage (1. 464–82), not considered by Sedley, has been read as asserting an obscure version of reductionism. Lucretius imagines an opponent who objects that at any rate historical events must possess some sort of metaphysical independence, since all the protagonists to whom they

4. See esp. "The Contingency of Selfhood," *London Review of Books*, 8 May 1986, pp. 11–15.

5. For the classic portrayal of Lucretius as a rhetorical cheat, see C. J. Classen, "Poetry and Rhetoric in Lucretius," *TAPA* 99 (1968): 77–118. The best antidote is D. West, "Lucretius' Methods of Argument (3. 417–614)," *CQ* 25 (1975): 94–116.

6. "Epicurean Anti-Reductionism."

might have been ascribed are no longer around to bear them as complex dependent properties. Lucretius' response is twofold: first, these events can properly be considered accidents of the places wherein they occurred. Second, they could not have happened without body and space. Why should anyone suppose that this answer is reductionist? Diskin Clay comments: "Lucretius looks to the great and shifting patterns of human history—slavery, poverty, riches, liberty, war, and harmony; events whose coming and going leave the nature of things unchanged (1. 455–58). These *eventa* (the 'outcome' of the temporary unions of bodies combining in space), time, and history itself (as represented by Paris' passion for Helen and the Trojan War) are no more than the events of bodies and the space in which they move (*corporis atque loci res in quo quaeque gerantur,* 1. 482)—a striking formula that reduces the Roman concept of *res gestae* and the events that led to the *Iliad* and the destruction of Troy to the status of accidents combining for a brief span of time on the ground of the Troad."[7]

Clay's interpretation is a mixture of illogicality and shrewdness. On the one hand, he is surely correct to suggest that in this passage Lucretius, as a good Epicurean, is attacking the ethic of personal and corporate ambition vividly evoked by the words *res gestae*—the choice of example is far from casual (cf. 5. 1444–45 *carminibus cum res gestas coepere poetae / tradere*). Furthermore, we might suppose that Lucretius is at the same time pursuing his personal, literary polemic, denigrating the entire epic tradition that records and glorifies mere *eventa* rather than explaining the nature of what is *per se,* as he himself does. On the other hand, Clay is clearly wrong when he asserts that according to Lucretius, the historical actors themselves are nothing more than *eventa* of the places where they were born and moved.[8] The text actually says (469–70) that whatever is done may properly be considered an accident of the place where it occurred, not that whoever performs the action can be reduced away. Clay seems to think that Lucretius' use of the ethnics *Troiiugenas* (465) and *Graiiugenarum* (477) reveals the reduction, but this is not so.

How, then, should we understand Lucretius' response? Someone has raised a semantic problem about referring to things that no longer exist, so as to predicate certain properties of them. The counter is to offer him not just any present existent as a stand-in subject, but the very regions wherein the events in question occurred. These are the best possible substitutes now available because there is a genuine causal and perhaps even material link between disintegrated Trojan and Greek bodies and their respective countries, as the deliberate use of the ethnics suggests. But Lucretius' concession goes no further; he allows that it is acceptable to call historical events geographical accidents but does not commit himself to the strong thesis that they really are regional *eventa* (469–70).

7. *Lucretius and Epicurus* (Ithaca and London, 1983), p. 125.
8. Ibid., p. 316, n. 20.

The second stage of his answer, that nothing could have happened had body and void not then been present, also does not seem to lean towards reductionism. Anyone who is not a dualist (and some dualists, for that matter) will of course suppose that matter and space are at least necessary conditions for the occurrence of events, and in any case there is no need to limit *materies rerum* (471) to microscopic *primordia*. The point is simply that though it might be acceptable to pull in a suitable replacement subject in order to satisfy certain semantic qualms, whatever happens, when it does actually happen, is only an accident of body or void.

But this is not yet fair to Clay. If the nonreductive reading of the passage is correct, then how does Lucretius manage to denigrate destructive Roman political ambition and pernicious Greek literature? Clay's sensitivity to this effect is admirable and accounts for his assumption that a reductionist thesis must be in play. If it is instead correct to suppose (as I suggest) that reductionism simply does not follow from the claims made in the text, we seem to be confronted by a pair of nasty alternatives: either Lucretius is an illogical poet, or he is consciously indulging in some cheap rhetorical sophistry. It would be insane to suppose that an event is not an important event because it is a happening, not a thing: neither swatting a fly nor sacking a city is *per se,* but they differ in gravity for all that. Yet it is all too easy for the unwary and inexperienced student of philosophy to draw just that wrong conclusion from the unremarkable assertion that what happens is "only" an accident. If Lucretius' conclusion (478–82) is designed precisely to encourage that mistaken but convenient impression, he not only goes beyond what his argument really permits but also employs the meretricious resources of rhetoric and poetry to delude us—which is why philosophers should avoid such texts.

I believe that it is possible to clear Lucretius of these charges. We need to explain how the poet deflates injurious political ambition and specious literature by his choice of example and his strictly metaphysical conclusion, while relying not at all on the spurious inferences that might be drawn from that neutral metaphysical conclusion. Lucretius can do all this by revealing to us the philosopher's perspective on the world, contrasting that vision with the radically different appearance the world wears from the Roman or epic point of view, and helping us to see the world in this new way.

He is not hinting that the sack of Troy is trivial because it is an event rather than a body. He is suggesting that if you look at the world as the philosopher does, you will be less and less affected by the damaging historical and ideological associations clustered about the central events of the epic past. I have argued that atomism in any form poses an intellectual and emotional challenge which people easily perceive as a threat, since atomic theory must deny that our basic appearances furnish even an Anaxagorean glimpse of fundamental reality. But not all appearances are basic. The Roman eye, as it were, is not the healthy

human eye: those features of the world which strike the good Roman as salient should not do so. What, though, is the force of this "should"? Even if a vision is false, the purely passive seeming which underlies it cannot by that token be rejected as false; since, as I have already remarked, appearances just happen to us, we cannot be held directly accountable for τὰ φαινόμενα. In the case of politics and literature we might express this contention by observing that ideology is successful just insofar as its efficacy in shaping behavior remains independent of people's perceptions of ideology's intellectual credentials. Accordingly, the Epicurean poet does not so much strive to refute whatever rationalizations could lend support to Roman pretensions as to shift the reader's perspective by undoing the pernicious effects of acculturation and propaganda.

Lucretius elegantly describes these *eventa* in just the way that prevents one from claiming *per se* existence for them: he describes them imagistically, in a fashion which deliberately hinders any inclination to accept his account as veridical. His imagistic descriptions simply cannot be literally true. Though in other contexts this obvious feature of literary discourse might not disconcert the sophisticated reader, in the present passage it makes a significant contribution to Lucretius' polemic. That is, Paris' amorous ignition is not even a real occurrence, but only a metaphorical one (although according to Epicurean physics there is real fire in the soul); the *partus Graiiugenarum* is not even a real birth. Lucretius exposes his own metaphor for the mere fiction it is by designating the men as *Graiiugenarum* in the midst of the false talk of their birth from a horse.[9] To the metaphysician the sack of Troy is just a complex happening, not a *per se* existent. If we ourselves increasingly adopt his perspective, then Homeric stories gradually lose their hold on us; these events no longer look important to us and so no longer are important for us.

Lucretius has not indulged in any cheap trickery. He is not implying without good reason that events in themselves are unimportant from any point of view; rather, he is introducing a perspective from which we can see the true significance of things because they no longer wear the distracting features imposed by mistaken belief and misguided action. Because of its position early in the poem, this passage takes its force from the unexpected contrasts in value that it introduces. Lucretius first catches our attention by making the world look strange; he will have succeeded in his effort to make Epicureans of us if as we progress through the poem, his descriptions gradually lose their novel and poten-

9. *Durateus* (476) occurs only here in Latin poetry; δουράτεος, which is itself quite rare, occurs only twice in Homer, both times with reference to the wooden horse (*Od.* 8. 493, 512). One can therefore suggest that Lucretius' phrase *durateus . . . equus* plays directly on Homer as part of the literary polemic that the poem launches against the epic tradition. This multilingual, functional cleverness would be very much of a piece with the thesis concerning Anaxagorean language that I develop in section IV, below. The astute comments of Stephen Hinds and John Henderson on this passage have helped me no end.

tially distressing aspect and begin to appear fitting, even inevitable. It has been worthwhile to dwell at length over these lines, not simply to lay to rest the specter of dishonest reductionism, but also because we have uncovered certain significant characteristics of Lucretius' persuasive technique. Argument is not abused, but evocative and resonant allusions are cleverly exploited.[10]

III

Lucretius must take advantage of imagery and analogy in order almost to bring before our senses the imperceptible atomic character of things. Of course, any Epicurean must use analogy with recognizable phenomena as the primary means to identify and describe elemental features and is justified in doing so as long as the analogy is not misleading. As a poet, Lucretius is in a position at once potentially stronger and more precarious, since the imagistic devices at his disposal are more powerful and complex—and so, far less easy to control. He seeks a fruitful tension between the familiar and the alien, a delicate balance between reassurance and enlightenment.

The motion of motes in a sunbeam illustrates the continuous random motion of the atoms as they constantly collide and change direction (2. 112–41). How Lucretius deploys this *simulacrum et imago* deserves careful attention, since it provides an especially vivid instance of his versatile techniques for inducing "perspectival shift." Unlike the microscopic turmoil, this image is always before our very eyes (113). Letting in the sunlight makes the motes visible and enables our mental vision to glimpse the invisible (114–15); the transition across the threshold of perception is smooth, as the suggestive use of *inane* (116) and *corpora* (117) indicates.[11]

"Dumtaxat rerum magnarum parva potest res / exemplare dare et vestigia notitiai" (123–24): this summing-up, superficially nothing more than a lifeless tag, is in fact full of interest and illustrates superbly Lucretius' skill in cleverly, provokingly balking the reader's standard expectations. For an atomist, of course, theoretical magnitude and sheer physical size are inversely related to each other, and these lines produce a startling change of perspective. At our level bits of airborne dust are

10. The reader might object that I have concentrated on this passage to the neglect of another that also seems to bear on the question of reductionism. When Lucretius is expounding the theory that innate character varies according to the balance of psychic ingredients, he avoids a lengthy account with this excuse (3. 316–18): "quorum ego nunc nequeo caecas exponere causas, / nec reperire figurarum tot nomina quot sunt / principiis, unde haec oritur variantia rerum." Does this not perhaps suggest that elemental differences are responsible for differences in human character? Maybe, but *unde oritur* can cover a variety of relations, and it might be significant that Lucretius immediately assures us that Epicurean teaching is strong enough to overcome all the major effects of natural endowment (319–22): this is hardly the message of a reductionist.

11. The editor of the revised Loeb edition comments: "*inane* (116) refers to the air (*cf.* Virgil, *Aen.* 12. 906) through which the motes move, not to void in the strict scientific sense. But, like *corpora* in 117, the word is carefully chosen in order to emphasize the parallel with the behaviour of the atoms" (M. F. Smith, ed., *Lucretius: "De Rerum Natura"* [Cambridge, Mass., and London, 1975], p. 104).

both very small and utterly unimportant, and at first glance we presume that that is how they function within the analogy. But then we realize that the perceptible motes are huge in comparison with the truly minuscule bodies: the scale alters, suddenly the world looks very different. So a small thing can supply as us with *vestigia notitiai;* what cannot itself be grasped may yet leave tracks for a sharp mind to follow. *Vestigia* alone should remind us of the hunting metaphor Lucretius had employed in the previous book to depict the keen philosophical mind as a hound on the trail of the hidden truth (1. 406–9):

> cum semel institerunt vestigia certa viai,
> sic alid ex alio per te tute ipse videre
> talibus in rebus poteris caecasque latebras
> insinuare omnis et verum protrahere inde.

And as Lucretius himself follows in the footsteps of Epicurus towards the truth (3. 3–4 "inque tuis nunc / ficta pedum pono pressis vestigia signis"), so can we follow the *vestigia* of analogy towards knowledge of the microscopic.

The analogy of the motes is significant in another respect. The discontinuity between the atomic and the phenomenal world poses a conceptual, imaginative, and emotional challenge. But the dust motes are so very small on the macroscopic scale that it is possible to trace a gradual transmission of motion right from its origin in the *primordia* through the threshold of perception to the disturbance that we can finally see (2. 138–41):

> sic a principiis ascendit motus et exit
> paulatim nostros ad sensus, ut moveantur
> illa quoque in solis quae lumine cernere quimus,
> nec quibus id faciant plagis apparet aperte.

All the stress falls on *paulatim.*

In order more fully to appreciate the imagistic resources that Lucretius calls on in his attempt to describe the imperceptible, we ought next to consider a case that provides a complementary contrast to the motes in the sunbeam, a case that illustrates how the familiar testimony of the seen can fail and how Lucretius employs the "optical model." Although the *primordia* are in constant motion, the sum of things appears to be at rest (2. 308–32). How can this be? The movements of what is invisible are also invisible (313–14). But in order to convince us of this discontinuity between seen and unseen, Lucretius develops an analogy within the visible world: appearances deceive on account of either the smallness of what we look at or the vantage point from which we observe things far removed (315–16). Again, the effect achieved is optical, but now the crucial shift is one of distance rather than of scale, in order to reproduce within the phenomenal world the appearances that mislead as one moves in thought between the microscopic and macroscopic levels.

Both of Lucretius' examples of distant scenes work in quite a subtle way. All the living and lively detail of the flock grazing and playing on the hillside (317–22) fades into a simple, static effect of color as the viewer moves back. Within the analogy there lies a concealed contrast. Viewed up close both the atoms and the animals reveal restless movement; but the hillside also teems with life, whereas the atomic scene lacks even the color that is visible from afar in the familiar world. Next (323–32) Lucretius first places us in the midst of a terrific cavalry maneuver on the plains and then pulls us back to a point in the mountains, so that sound and the sense of motion fade together, as if we viewed a thunderstorm from such a distance that we could see the flash of the lightning but no longer hear the thunder's rumble.

The first, pastoral example contains an echo of the invocation of Venus (1. 14–20); the following military description returns us to the proem of Book 2. The tranquil vision of a distant battle ought to remind us of Memmius' viewing his legions and of Lucretius' warning that such a sight cannot drive off superstition and the fear of death (40–46), although it is pleasant to watch such a display when one has no part in it (1–6). The battles are fake, they are mere *simulacra* (41, 324): when we have read Book 4 we shall realize that this description both contains a hint of Epicurean perceptual theory and suggests the inauthenticity of martial ideals, be they epic or Roman. What does give us true security is the prospect from the stronghold of philosophy, from which we can look down on everything and everyone beneath us (2. 7–9). Lucretius' depiction of ordinary, vainly ambitious people from the philosopher's point of view daringly compares them to atoms, as they wander (10 *errare, palantis;* cf. 132) and fight (11 *certare, contendere;* cf. 118–20). From that supreme vantage-point non-Epicureans appear to be caught up in utterly senseless, random turmoil, as purposeless as atomic collisions. *O pectora caeca!* (14)—*o corpora caeca!* They live in the shadows and fail to see what is manifest to healthy eyes (15–19).

IV

We are now at last in a position to assess Lucretius' view of what atoms are not, bearing in mind the prominence of the "optical model" in his argument and poetry and the facility with which he exploits the tension created by the analogies he skillfully draws between the seen and the unseen, the familiar and the alien, the phenomenal and the microscopic. Lucretius denies macroscopic properties to atoms in a series of arguments that falls into two parts: first, atoms lack all secondary qualities, a thesis sustained at length for color (2. 730–864); second, atoms are not alive (2. 865–990).

Lucretius warns us not to suppose that what appears white or black before our eyes consists of elements that are themselves similarly colored. Things do not wear the look they do because their visible characters continue all the way down to the level of ultimate constitution; the

atoms lack all color whatsoever (2. 731–38). Lucretius must persuade us to accept an anti-Anaxagorean world, and recognizes that one might doubt the mind's capacity to leap the gap separating the unseen from the seen (2. 739–40). Children tremble in the dark, and ignorant men similarly fear what is not really fearful (cf. 2. 55–61): the very idea of blindness is terrifying, and Lucretius usually portrays Epicurus and his philosophy as the great source of illumination. If we are to accept that there is no color in the microscopic world, then must we not imagine a sight so thin that those with good eyes might as well be blind? Now Lucretius reminds us that people who are congenitally blind can nevertheless make out *corpora nullo coniuncta colore* by means of touch; this is a manageable deprivation on the side of the percipient, but is matched by a deprivation on the side of the object for which the mind's conceptual resources can compensate (741–45). I suspect that the use of *caecigeni* (741) to indicate those who cannot see and of *caecis* (746) to designate the shadows that prevent us from seeing supports my speculation concerning complementary deprivations. Even the blind need not submit to ignorance and terror.

In the next section Lucretius argues that color imports mutability and so cannot qualify the first beginnings that (as he has already proved) must not change in any respect (2. 748–56). He then attempts to convince us of the following: the hypothesis that the *primordia* possess shape and position and transmit motion but lack color not only does not clash with perceptible phenomena, it actually explains them as no other theory could. The appearances on which Lucretius focuses are rapid shift in color (2. 757–71) and uniformity of hue or sheen (2. 772–87).

The change from black to white, illustrated by the look of the sea churned up by the wind (2. 764–71), is sudden, not gradual (765 *repente,* 771 *continuo*). Remember: Anaxagoras claims our vision gives out, since it cannot discern the innumerable shades between black and white that surely are there in the nature of things, as reason assures us. Lucretius now defends the capacity of the senses precisely by restricting the scope of their deliverances to what lies within the limits of perceptibility. The shift in color does not just appear discontinuous, it really is so, since shape, rearrangement, addition, and subtraction at the microscopic level produce abrupt change at the macroscopic level (2. 769–70). Thus Lucretius is able to argue that acceptance of the atomist's vision of a discontinuous world permits us to trust the accessible appearances—as far as they go.

Lucretius pursues the idea that shape explains color with the argument that only the atomist can account for uniformity of hue. Since what appears to be of a single color often changes into another shade, it is no good to suppose that seawater, for example, is blue through and through (2. 772–75). But if the apparently uniform surface actually consists of variously colored elements, then we ought to be able to discern the mixture, just as we can make out the irregularly shaped bits that together constitute a square (2. 776–87).

Is this not just to beg the question, blatantly to ignore the Anaxagorean's contention that "nothing else is like anything else, but each single body is and was most plainly those things of which it contains most" (B12 D.-K.)? Why should we concede to one party in the dispute that nature might be built up out of imperceptible shapes but deny to the other the thesis that there might be imperceptible qualities? Insofar as Lucretius claims that his theory possesses superior explanatory strength, he is in the wrong. But the issue is not as simple as all that. The atomist and the Anaxagorean offer us incompatible, competing ways of looking at the world. Given the indeterminacy of any comparison between them in terms of aetiological satisfaction, we cannot make a straightforward decision. The exponents of such positions attempt to habituate us to their preferred vision. It may very well be the case that no decisive reason is forthcoming to compel us to choose one perspective over the other. Yet the absence of compelling reasons does not mean that the choice is unreasoned, or irrational, or the product of dishonest means of persuasion—that is why there is a place for philosophical poetry.

This point becomes clear if we examine 2. 810–16. Here Lucretius argues that since visual sensations come about when extrinsic particles hit the pupil of the eye, a tactile process causes sight; but since color is simply irrelevant to tactile properties, elemental pigmentation would contribute nothing to our capacity to perceive color in phenomenal objects. Never mind that this argument expects us to accept not only the basics of atomism but also Lucretius' analysis of perceptual mechanisms, which is yet to come; of course it cannot convince someone hovering above the atomic theory and its rivals. What it can do, instead, is fill in more of the Epicurean picture for someone who has already learned to observe the world in the favored way.

Before attacking the idea that the world is alive all the way down, Lucretius very briefly applies his negative conclusions about color to other sorts of secondary quality (2. 842–64). It is part of my brief that he does not single out a visual quality for extended treatment casually; I deny that sound or smell would have done as well, and not simply because the notion of colorless bodies is more of a challenge (2. 834–35). Lucretius discusses color because what I have called the "optical model" works as an epistemological paradigm in the ancient debate between atomists and their rivals. We cannot translate that discourse into a vocabulary free of optical terms, as if the imagery were merely decorative. By the same token, we cannot ignore the irreplaceable thematic function that the imagery performs in the articulation of the debate, which prohibits us from simply ascribing their ordinary, literal connotations to the words of Lucretius' discourse about color. The neat distinction between the "literal" and the "metaphorical" cannot do justice to the problematic semantics of the "optical model."

The reader will have noticed that my selective exposition of Lucretius' denial of secondary qualities to his elements takes it for granted that we

can contrast his vision with a competing prospect I label Anaxagorean. One could question whether this tactic is legitimate, let alone helpful. I hope that the discussion to come will allay some of these doubts, since Lucretius' sections on color and on life are intimately related. True, even in what follows Lucretius does not explicitly name Anaxagoras; but it is incontestable that he lurks not far below the surface. He is not named, I believe, because if my hypothesis is accurate, his hidden presence would be obvious to any sensitive reader of the poem.

Is there any explicit evidence that Anaxagoras is for Lucretius the great enemy? Certainly there is at least a fascinating hint to be discovered in the section of the first book devoted to criticism of the pre-Socratic.[12] *Nunc et Anaxagorae scrutemur homoeomerian* (1. 830): this daring hexameter, with its indigestible Greek words and remarkable scansion, serves as an emblem of the complete opposition between continuist and discontinuist. Commentators have too easily accepted at face value Lucretius' excuse of the *patrii sermonis egestas:* in fact, the explanation of this extraordinary line is to be found in the preceding section, where he draws his famous comparison between natural and linguistic *elementa* (803–29). Atomic reshuffling corresponds to rearrangement of letters, and the truth of Epicurean theory perhaps validates certain semantic transformations:[13] we should not forget that in a number of senses Lucretius is translating from the Greek. Accordingly, the suggestion of 1. 830 is that Anaxagorean philosophy is in a number of senses untranslatable. Were the world as the continuist claims, there would be no ultimate, constant *elementa* to be reached. This state of affairs finds metaphorical expression in the supposed impossibility of breaking down Anaxagoras' technical Greek into letters that can be recombined in the language of the poem. Instead, the actual sonic constituents of *homoeomerian* directly yield some bits of Latin: 830 *homoeomerian* > 833 *ipsam rem* > 834 *rerum . . . homoeomerian.*

What some people find repulsive in the atomists' vision is its lifelessness, if they assume that atomism entails reductionism and that reductionism entails loss; and even if the specter of reductionism is exorcized, the notion of life emerging at higher levels of composition is harder to accept than the idea that certain secondary qualities the atoms lack appear on the way up through levels of compositional complexity. Lucretius does not promote a reductionist conception according to which *animalia,* despite appearances, are somehow lifeless. Rather, he insists that everything sensate arises from insensible principles. Of

12. Robert Brown discusses Lucretius' explicit critique (1. 830–920) in "Lucretian Ridicule of Anaxagoras," *CQ* 33 (1983): 146–60.

13. See P. Friedländer's seminal study of Lucretian wordplay, "Pattern of Sound and Atomistic Theory in Lucretius," *AJP* 62 (1941): 16–34, followed up by J. M. Snyder, *Puns and Poetry in Lucretius' "De Rerum Natura"* (Amsterdam, 1980). J. Tatum ("The Presocratics in Book One of Lucretius' *De Rerum Natura,*" *TAPA* 114 [1984]: 177–89) believes that "Lucretius' refusal to translate Anaxagoras' terminology and his lengthy definition are an implied criticism" but suggests that the criticism is limited to Anaxagoras' use of philosophical jargon (p. 184). Conversation with Denis Feeney on this topic has been of great help to me.

course there is not much of a story to be told about how inanimate stuffs are gradually transformed into living beings. It is like combustion (2. 879–82):

> ergo omnes natura cibos in corpora viva
> vertit et hinc sensus animantum procreat omnes
> non alia longe ratione atque arida ligna
> explicat in flammas et in ignis omnia versat.[14]

This metaphor of course directs us back to Lucretius' critique of Anaxagoras in Book 1, where it is objected on behalf of the continuist that *ignis* can be got out of *lignis* (1. 897–914). Quite so, responds Lucretius; but that is because the *elementa* can be shuffled so as to create new arrangements constituting very different things (1. 907–14; cf. 2. 883–85). Trees are not full of concealed fire, and dung really is lifeless: so far from denying life, atomism alone allows its true emergence.

Just what is it that compels the recalcitrant student to reject this vision of a world that is not alive all the way down to the atomic level? Lucretius slyly portrays his struggle in the very terms that he cannot accept (2. 886–88). The cause of the trouble is something that strikes the *animus* in such a fashion as to move it and force it to express discordant opinions (887 "quod movet et varios sensus expromere cogit"). Implicit in this description is the atomic conception of mind: the *animus* can be influenced by the right sort of blow from without because it is a collection of particles, individually insensate, held together so as to make up a mind. Arrangement is everything, as Lucretius goes on to emphasize (2. 889–901).

Lucretius confronts the advocate of animate elements with a dilemma: such elements must possess sensation either as bodily parts do or as entire animals do (2. 907–23). Neither alternative is acceptable. If the elements are supposed to be like individual organs, then they would lose sensation on removal from the whole to which they contribute. But if they are instead autonomous centers of feeling, then their independence would be too great to permit them to combine into a single, integrated living thing (2. 920–23):

> quod tamen ut possint, at coetu concilioque
> nil facient praeter volgum turbamque animantum,
> scilicet ut nequeant homines armenta feraeque
> inter sese ullam rem gignere conveniundo.

Here Lucretius hints that the introduction of life on the microscopic level would kill his live metaphors by making them literal. That is, when Lucretius uses words like *coetus* and *concilium* (as he often does) to describe the coming together of atoms as if they were people meeting in assembly, his poetry is strongly and strikingly metaphorical, because the *primordia* are inanimate and purposeless.[15] Were the principles really

14. Cf. 2. 943 *accensi sensus*, 959 *accendere sensus*.

15. H. Sykes Davies, "Notes on Lucretius," *The Criterion* 11 (1931–32): 25–42, is still the very best indicator of this dimension of Lucretius' poetry.

alive, then this imagery would simply be realistic description. Lucretius stresses again and again (2. 937–43, 963–72) that since combination brings life, the incomposite is lifeless. As we learned in Book 1, nothing could exist were there not a simple, atomic, and thus indestructible foundation laid down for all the great variety of complicated things that come to be. Only inanimate beginnings can generate life.

Lucretius concludes with some familiar sarcasm (2. 973–90; cf. 1. 915–20), finally allowing his concealed adversary to break cover: doubtless the continuist himself consists of tiny Anaxagorean philosophers, carrying on discussions *de rerum mixtura,* themselves made up of yet further elemental thinkers, and so on *ad infinitum*. This is satire, but not in lieu of argument—we have had plenty of that, conveyed by means of a semantic device, the "optical model," that should intrigue and challenge both the literary critic and the student of ancient philosophy. In Lucretius, poetry and philosophy do not fight. There are works like *De rerum natura* because philosophers can construct theories of the world that rely on argument but still demand poetry to communicate the look of the world so understood. This is persuasion of a sort rarely encountered because of the supreme difficulties that obstruct the successful transmission of a novel vision—but that is no reason for us to neglect Lucretius' signal achievement.[16]

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16. The articles by David Sedley and Myles Burnyeat mentioned above inspired this paper, and I should like to record my thanks for their stimulus. I have also enjoyed and profited from discussions with Catherine Atherton, Richard Davies, Denis Feeney, John Henderson, Stephen Hinds, and Geoffrey Lloyd. Positive criticism from *CP*'s anonymous readers helped me considerably in revision; my thanks also go to the Editor for his suggestions.