Jeremy Anderson, Ph.D.
jeremy@jeremyanderson.net

PROBLEMS IN EPICURUS' THEORY OF VISION

Epicurus emphatically asserts the veracity of perception, including visual perception, yet most of the literature on Epicurus' atomistic theory of vision pays scant attention to what Epicurus believed transpires outside the body that leads to it. The treatments by DeWitt, Everson, Hicks, and Rist are all very brief; Glidden focuses primarily on the processes occurring inside the perceiver; and while the discussions by Asmis and Bailey are more detailed, they hardly more than note in passing that the process is problematic.[1] In this paper I will critically examine Epicurus' theory of vision, in particular his theory of the events occurring between perceived objects and the eye. I will argue that while certain common objections to Epicurus' theory may be answerable, it nevertheless suffers from serious problems. These problems, in turn, occur on two levels. On the mechanical level, it demands that dissimilar atomic complexes behave in strikingly similar ways. And on the theoretical level, there is tension created by the need for the intermediary between objects and the observer to be both like objects and unlike them.

After an overview of Epicurus' general atomic theory and his theory of sensation I will examine, in separate sections, the main stages of the process which Epicurus claims leads to visual stimuli: the emanation, transit, and reception of eidola. Part of this work is speculative, of necessity. Most of Epicurus' original texts are lost, and those remaining are sometimes obscure or are fragmented in key places. The most detailed source of information on Epicurus' theory is a treatise by his follower Lucretius,[2] but even the latter's writings are fragmented, and at times obscure or inconsistent. So we will face exegetic issues, which I will attempt to resolve as much as appears justified by the texts. The available texts on hearing smell, touch, and taste are very sketchy; hence I will not examine them in any detail here.

---

[1] Cf. DeWitt (1954) pp. 204-6, Everson (1990) pp. 176-7, Hicks (1962), pp. 229-238, Rist (1972) pp. 19-24, 83-6, Glidden (1971), Asmis (1984), pp. 104-117, and Bailey (1964), pp. 407-14.

[2] *De Rerum Natura*; Lucretius (1975).

II. HOW EPICURUS EXPLAINS PHENOMENA

The Epicurean universe consists of but two elements, atoms and void (E 39b-41a; L 1.418-48[3]), and all events and objects are to be explained in terms of them.

Atoms have but three attributes: mass, shape, and size (E 54). They are everlasting and unbreakable. They are neither created nor destroyed, nor are they composed of "subatomic" parts, being absolutely solid. They have, of themselves, no capacity for sensation or thought, and no color, heat, sound, or smell (L 2.730-990), and are far too small to be perceived (E 56a; L 4.110-28). They are simply tiny bits of solid, dead matter, which move unceasingly through the void.

The void is that through which the atoms move; it is empty space (E 40a, 67). Without it, all matter would be in one solid mass, the various portions of which would be incapable of movement. Void, then, is what makes each atom a separate entity, and it allows the atoms to move about (E 40a; L 1.329-97).

The atoms, moving about like the motes seen in a sunbeam (L 2.112-25), collide with each other; and, due to their various shapes, may either rebound away or hook together and form complexes, which in turn form "macro-objects": rocks, trees, water, people, and the rest of the perceivable world. Once trapped in complexes, however, atoms do not stop moving (E 43-44, 47a, 61; L 2.225-50). Rather, they vibrate within their confines and will, if freed, speed away, traversing any conceivable distance "in an inconceivably brief time," until colliding with other atoms or getting caught in other complexes. For Epicurus, then, the perceivable macro-world consists, ultimately, entirely of atoms moving through void, and all changes in it are explainable in terms of the movements of unchanging atoms in the unperceivable "micro-world" (L 2.125-41).

Since their constituent atoms are constantly moving, macro-objects are constantly shedding them, and it is by the intermediary of these shed atoms that remote objects make themselves known to the senses (E 49, 52b-53b; L 6.921-35). Our sense organs are structured to

---

[3] In parenthetical references, E refers to Epicurus' "Letter to Herodotus" in Epicurus (1964) unless otherwise noted, and L to Lucretius' *De Rerum Natura*, Lucretius (1975). See also Epicurus (1926).

receive different sorts of outflow from remote objects (L 6.979-97). Certain types of emissions are the source of odors (L 4.687-705), and others create auditory sensations (E 52b-53a; L 4.524-71). And "thin, hollow films" of atoms—eidola[4]—which retain the shape of the object shedding them, continuously form around macro-objects, travel swiftly through the air, and enter the eye, stimulating visual sensations (E 46a-50a; L 4.26-44). (Still finer films, which glide through the body and affect the mind directly, generate dreams and hallucinations (L 4.724-56), but do not act on our eyes.) In the process, information is given to us about objects' shape, texture, color, distance, and so on. It is because we receive these material emanations directly from objects that our visual perceptions are veridical (E 49-50b).

III. EMANATION

The texts give us little information on how eidola are formed. We are told (E 46a; cf. L 4.54-89) that "there are images of the same shape as the solid bodies from which they come but in thinness far surpassing anything that the senses can perceive" and (E 48) "Moreover, there is nothing to prevent our believing that the creation of idols [eidola] is as swift as thought. They flow from the surfaces of the body in a constant stream...."

Following Glidden and others, we may infer that since each eidolon is too fine to be perceived individually the eye must receive a steady stream of them from an object if the object is to be seen, even if it is stationary.[5] And to account for the steadiness of our normal visual perceptions, eidola must be emanated at a high rate; otherwise objects would appear to flicker and our perception of moving objects would be choppy. This in turn would explain why their formation must be "as swift as thought"; to maintain a high rate of emanation, each eidolon must

---

[4] Following the practice of Glidden (1971), Asmis (1984), and others, I will use the term "eidola" (singular "eidolon") to denote the material emanations which give rise to our visual perception of remote objects. I do this to avoid words like "image", which are easily confused with the mental picture we form of a perceived object.

[5] Glidden (1971), p. 97; also cf. Bailey (1964), p. 410 and Rist (1972), p. 84. At least, the eidola which stimulate sensation are individually imperceptible. Of the "finer" type of eidola—those that create the images of dreams and hallucinations—it is said that a single eidolon can create a mental image (L 724-38) because of its ability to penetrate the body and stimulate the mind directly. Since these eidola do not have a role in Epicurus' theory of visual stimuli, we will overlook them for the most part from here on.

be formed very rapidly.

These facts have led to one of the most commonly raised objections to the theory: that if it were correct, we ought to see objects shrinking before our eyes. Lucretius (L 4.72-78) claims, "Assuredly we see many things cast off particles with lavish bounty, not only from the depths and from within...but from the surface...." Objects lose untold numbers of atoms by casting off eidola as well as the effluxes which stimulate our sensations of heat, cold, smell, sound, and so on. As fine as atoms may be, these losses have led writers such as Hicks and Rist to wonder why it is that objects do not melt away before our eyes.[6] Epicurus' statement that eidola "flow from the surfaces of a body in a constant stream, but this is not made evident by any decrease in the size of the body since other atoms are flooding in" (E48) seems unsatisfying, at least at first glance. Where do the atoms come from? Living beings replenish lost atoms by eating (L 2.700-717), but this merely compensates them for the extra atoms they lose due to their activity (L 4.858-876); and in any case this would not help explain why nonliving beings do not waste away as we watch them.

But as Bailey and Rist note,[7] Epicurus does not believe that objects do not diminish; in fact he exploits the visible diminution of objects over time—for example, stone stairways worn by long use—as evidence that they are composed of particles which escape (cf. L 1.311-321, 2.67-79). Instead, the theory claims that the process of diminution is too gradual to be seen as it happens (L 1.318-321). So the burden on Epicurus is not to show how objects do not diminish at all; rather it is to show that the process is very slow.

And it seems to me that the theory has the wherewithal to show that the process is indeed slow. First of all there is the fineness of the atoms, which is such that an object would have to lose a great deal of them to be noticeably diminished. Secondly, while according to the theory all objects lose atoms, the lost atoms do not disappear; they flow towards all surrounding objects.

---

[6] Hicks (1962), p. 231; Rist (1972), p. 85.

[7] Bailey (1964) p. 352; Rist (1972), p. 86.

This page, according to the theory, is losing atoms rapidly, but so are the adjacent pages, the walls in the room, the reader's body, the furniture, the buildings outside the window, and so on, and many of those atoms fly towards this page, and hook into its structure. There is no shortage of atoms available to replace those that escape, and no mystery to where they come from. Simply put, macro-objects constantly exchange them.[8] Perhaps many of the incoming atoms will bounce away—indeed they should, if objects are to gradually diminish—but some will be of the right shape to hook into the object's structure, thus slowing the process of diminution.

However, the primary reason an object does not diminish perceptibly from one moment to the next probably must be that the atoms it loses represent only a very small portion of the object. For the inrush of atoms from all around may account for how the sum total of atoms in an object may stay fairly steady, but there is no reason to suppose that the incoming atoms happen to fall into just the places where atoms have been shed, instead of piling on unevenly. Furthermore, if the main reason why things do not waste away was that they received atoms from their surroundings, an object should tend to take on the material characteristics of surrounding objects. We might expect that if we stood next to a brick wall long enough we would turn red, stony, and flat. Since such phenomena do not occur, it appears we should suppose that the total mass of effluxes is slight compared to the total mass of objects, and consequently that an object diminishes only very slowly due to its own efflux, and the atoms received due to other objects' emanations are insufficient to perceptibly alter a given object's characteristics.

It seems to me that the problem with Epicurus' doctrine of emanation is not how objects retain their size despite giving off eidola, but rather how it is that all visible objects give them off in the first place. The theory of vision does not merely require that visible objects shed atoms, but that they all shed them in a very particular way: in the form of thin semblances (L 4.42) of themselves, in all directions, unceasingly, and very rapidly. Epicurus' account of the differing

---

[8] Everson's translation of E 48 echoes this idea: "...there is a continuous flow from the surface of bodies—not revealed by diminution in their size, thanks to reciprocal replenishment...." Everson's translation is the only one I encountered which explicitly mentions reciprocity. Everson (1990), p. 176.

qualities of material objects makes it appear unlikely that all the objects we see could indeed perform the task.

Epicurus accounts for the differing qualities of different macro-objects—a rock's hardness, water's softness, etc.—by means of the diverse shapes and sizes of their constituent atoms:

> ...the indivisible, solid particles of matter, from which composite bodies are formed and into which such bodies are dissolved, exist in so many different shapes that the mind cannot grasp their number; for it would not be possible for visible objects to exhibit such great variation in form and quality if they were made by repeated use of atoms of conceivable variety. (E 42b; cf. L 2.440-443)

> Again, whatever seems to us hardened and close set must consist of elements more closely hooked and held knit deeply together by branch-like shapes. Amongst the first in this class, diamond stones, for example, stand in the front rank, accustomed to despise blows; and stout stone and the strength of hard iron.... Those others, the fluids which consist of liquid body, must be of elements smoother and rounder. (L 2.444-53)

There is a general rule presented here: if one object has different characteristics than another, it is because they have different atomic structure and/or composition; and if two objects have similar characteristics, their structure and/or composition is similar. But Epicurus' doctrine of emanation demands that markedly dissimilar atomic complexes behave in a markedly similar way. For example, picture a carved stone bowl filled with milk. The text claims that the stone has a structure consisting of tightly intertwined branch-like atoms, while the milk has a much looser structure consisting of smoother ones. Yet, side by side, we see them equally well. According to the theory, then, the outermost atoms of the milk are disengaging from the rest and emanating as eidola, but so are the tightly-intertwined atoms on the outside of the bowl. How can these two objects be so dissimilar in their makeup, yet similarly able to give off effluxes of eidola?

We might try to solve the problem by exploiting the insight that the eye must receive a steady stream of eidola from an object for that object to be visible. This requirement implies that there is a threshold below which we would not be receiving a rapid enough succession of eidola to see clearly. We need only suppose, then, that each object seen, regardless of its structure, forms eidola rapidly and frequently *enough* to generate in us a continuous visual sensation. We

need not suppose that all objects emanate eidola at the same rate, or even nearly the same rate; all that is required is that the rate be above the necessary threshold. Beyond that, we may suppose that some objects form eidola at a much higher rate than others, depending on their structure.

This consideration somewhat eases the burden of explaining how it can be that objects with differing structures can all be seen well, but it still leaves the theory of vision saddled with a strong demand on diverse atomic structures to behave similarly. It does not tell us why we should suppose that every visible object—in addition to whatever other sorts of atomic effluxes it may have—gives off eidola at a rate above the threshold, each of which is similar enough to the others to create a clear visual image; or why very hard objects, composed as they are of closely intertwined atoms, give off any at all.[9] Epicurus' theory seeks to explain the diversity of phenomena—the hardness of rocks, the penetrability of liquids and air, etc.—by claiming that objects have diverse atomic shapes and structures, yet it must also explain the similar *observability* of these objects by means of these same atoms and their behavior. We will see that this demand for similar behavior from diverse structures is endemic in the theory.

IV. TRANSIT

In order to stimulate visual perceptions, eidola must make the journey from the objects emanating them to the eye of the perceiver. In this section we will find that the available texts provide grounds for conflicting accounts of the structure of eidola, each of which is relevant to the issue of their travel. Each account, it turns out, meets serious difficulties.

Epicurus' claims made about the behavior of eidola suggest one picture, which I will call the shotgun model. He says (E 47b) that

> Nothing in nature as we see it prevents our believing that the idols [eidola] are of a texture unsurpassed in fineness. For this reason, their velocity is also unsurpassed, since they always find a proper passage, and since moreover their course is retarded by few if

[9] In one place (L 6.1012f) Lucretius appears to claim that, if the air on one side of a piece of iron were evacuated, the force of the iron atoms' unsuccessful attempts to break free would drag the whole piece into the evacuated area. If this were so, it is hardly plausible that the iron would be giving off any eidola. However, the text is fragmented and it is difficult to tell whether this is what was intended.

> any collisions, while a body made up of an inconceivably large number of atoms [such as an ordinary solid object] suffers many collisions as soon as it begins to move.

The smaller and smoother an individual atom is, the more likely it is that it will be able to avoid striking another atom as it speeds through the void. Consider Lucretius' explanation of the speed of a lightning bolt (L 6.323-334; cf. L 2.381-7):

> [the bolt]...consists of small and smooth elements [atoms], and it is not easy for anything to bar the way of such a substance, since it speeds in between and penetrates through narrow passages; therefore not many obstacles can delay it or check it, and so it flies smoothly with a swift rush.

Schwab argues that since the atoms in eidola also are said to travel swiftly through air without collision, they too are small and smooth, and Everson concurs.[10] Schwab also believes that the fact we sense no impact on our eyes from eidola is a further indication of the smallness of their atoms, as does DeWitt.[11]

Also, consider that although atoms never stop moving, if they are hooked together (i.e., if they are formed into a complex) some of their velocity is spent merely vibrating back and forth between other atoms.[12] Hence a complex apparently would not move as fast as an individual atom—or a group of disconnected atoms traveling in parallel—even if nothing were in its way.

We may then infer that if eidola indeed traverse great distances at unsurpassed speed, they (a) are not formed into complexes, and (b) they consist of the smallest, smoothest atoms possible. On this view, an eidolon would be like pellets fired from a shotgun: a group of similarly small, smooth particles flying in parallel. Instead of constituting an object by virtue of interlocking, on this conception the atoms would make up an eidolon simply by virtue of traveling together. Such a "structure" and makeup would have considerable advantages.

The most obvious would be maximal speed, as noted above. Not only is some of its speed

---

[10] Martin Schwab, class lecture, April 23 and 26, 1991, and subsequent personal discussions; Everson (1990), p. 176f. Everson provides no explicit argument for this conclusion, but evidently draws it from Epicurus' description of the behavior of eidola.

[11] DeWitt (1954), p. 205.

[12] This point is discussed in some detail by Hicks (1962), p. 233, and by Asmis (1984), p. 110.

wasted by internal collision, but a complex of atoms seemingly would be slowed as a whole by collisions as it travels, because its atoms are hooked together; if one atom is slowed, the others are slowed, too. If a "shotgun" eidolon encountered other atoms, only those atoms in it which suffered direct collision would be slowed or deflected, while the rest moved on, unaffected, at atomic speed.

This ability to leave some atoms behind while the rest stay on their trajectory is important. Imagine a sheet of tissue paper carried along by a breeze. If the tissue were to encounter, say, an antenna, the tissue's internal structure is strong enough that instead of ripping, the tissue would wrap around the antenna. Similarly, if eidola had an internal structure of intertwined atoms, the structure's cohesiveness might tend to make them wrap around the solid objects they encountered. Even if in the end they "ripped", the remaining parts might change their orientation and perhaps their direction, and we would expect to see distorted images, for instance when the eidola of a house had to travel past a lamppost to reach the eye. The shotgun pseudo-structure avoids this problem entirely. (This is not a problem Epicurus explicitly considered, but it is one it seems to me the theory must deal with at some point, since many observed objects are partially obstructed.)

Also, as Bailey and Rist point out, not only must eidola travel past obstacles and through the air, but they must also pass through each other.[13] As I look at you, the eidola coming to me from you must be passing through the eidola going to you from me. On top of that, both your eidola and mine must pass through the eidola emanated by the floor we both stand on, the walls and ceiling of the room we are in, and any other visible objects present, without altering their form. In Epicurus' system, atomic complexes are not held together by some gravitational or other force capable of holding atoms in proximity to each other without touching; such notions are absent from Epicurean theory. Rather, complexes are held together by the entanglement of atoms with each other (E 44; L 2.440-477). It is difficult to conceive how complexes of intertwined

[13] Bailey (1964), p. 411; Rist (1972), p. 84. This also is an issue neither Epicurus nor Lucretius raises in the available texts.

atoms, no matter how fine or porous, could pass through each other successfully, let alone as frequently as the theory demands; complexes ought to collide and become entangled with each other, or break each other apart. The shotgun model, by supposing no connections between an eidolon's constituent atoms, makes their interpenetration more plausible. It makes their passage through glass (cf. L 4.147, 4.602, 6.992), and water, not to mention the membrane of the eye (L 4.337-353[14]), more plausible as well: the small smooth atoms of the eidola could make their way through "pores" in such materials.

Despite its advantages, however, the shotgun model does not appear to be what Epicurus had in mind. Rather, the available texts bearing specifically on the subject of the structure of eidola indicate that they are to be conceived of as complexes, and that they may be made up of variously-shaped atoms, not just the smallest, roundest ones. He claims that

> ...there are images of the same shape as the solid bodies from which they come but in thinness far surpassing anything that the senses can perceive. It is not impossible that...there are opportunities for the creation of these *thin, hollow films*, and that the particles composing them retain as they flow from the solid object the same position and relative order that they had while on its surface. (E 46a, emphasis added)

And Lucretius says

> ...there exist what we term images of things, which are to be called as it were their *films* or *bark*, because the image bears a look and shape like the object, whatever it is, from whose body it is shed....
>
> [S]ince amongst visible things many throw off bodies, ...as when calves at birth throw off the caul from their outermost surface, and also when the slippery serpent casts off his vesture...: since these things happen, a *thin image* must also be thrown off from things, from the outermost surface of things. Why *thin films* should not fall and be thrown off from things as much as those others, no one could whisper a reason, especially since there are numerous minute bodies [atoms] on the outermost side of things, which can be cast off in the same arrangement they were in before, preserving the shape of the object, and far more quickly.... (L 4.50-70, emphasis added)

These texts indicate that eidola, like films and bark, are composed of atoms (i.e., an eidolon is not a type of atom), and that eidola are released or ejected from the surface of objects as wholes

---

[14] The need for eidola to penetrate the eye's pores is apparently taken by Asmis as evidence for their being particles and not complexes of them. Cf. Asmis (1984), pp. 115-6.

which retain certain characteristics (e.g., shape and color) of the objects they come from, because their constituent particles remain in "the same position and relative order that they had while on its surface." This much is perhaps not inconsistent with the shotgun conception. But the references to eidola as films, the comparison of them to cauls and shed snakeskin suggest that, in contrast to the shotgun model, their constituent atoms are hooked together at least in some minimal fashion.

Moreover, Lucretius states (4.724-7) that "many images of things are moving about in many ways and in all directions, very thin, which easily unite in the air when they meet, being like spider's web or leaf of gold." Lucretius makes this comparison in connection with eidola which are evidently of the non-visual type. However, it seems reasonable to infer that if even the eidola that are too fine to "assail the vision" have structure, as the metaphors imply, the less fine eidola which cause vision do, too.

This suggestion of hooked-together structure is confirmed by another Lucretian text (L 4.90-97), where he states that

> ...all smell, smoke, heat and other such things stream away from objects all diffused abroad...because they arise from the depths, and as they come forth they are torn up in their tortuous course, there being no direct openings to the paths to let them push out together when they have gathered together. But contrariwise when a thin film of surface colour is thrown off, there is nothing to tear it up, since it lies in front and on the very outside.

The elements of smoke and heat are, in contrast to eidola, "torn up" after they "gather together," because they emanate through a "tortuous course." The implication is that if eidola emanated from the depths they would be torn, too, i.e., they have the sort of structure that *can* be "torn."

Further evidence that eidola are to be thought of as cohesive complexes is given by Lucretius' explanation of their impetus. He does not say that eidola move about simply due to the native tendency of atoms to move. Rather, he compares their movement to that of sunlight (L 4.183-98):

> ...the sun's light and his heat, because they are made of minute elements, which are as it were beaten with knocks, and do not hesitate to pass through the intervening air when struck by the blow of that which follows; for instantly light comes up behind light, and

> flash is pricked on by flash, as in a long team. Therefore the images [eidola] in like manner must be able to run through space inexpressible by words in a moment of time, first because there is a very small impulse far behind which carries them on and pushes them on, also because the move with so swift a lightness, next because they are emitted with such a rarefied texture that they can easily penetrate anything, and as it were ooze through the intervening air.

I interpret this conception as similar to when a moving car runs into a parked car. One car strikes the other, which is propelled forward. Such pushing from behind could not occur if the elements were traveling as free atoms, as in the shotgun model, since free atoms all move at the same speed (E 61; L 2.238-9) and thus would be unable to catch up with one another. So it appears we must reject conclusion (a) above, and suppose that an eidolon is more like a membrane, or perhaps a fishnet, than a group of shotgun pellets.

A final (and I think compelling) reason for rejecting (a) is that if we do not suppose that the atoms in an eidolon are joined in some way, we seemingly must suppose that each eidolon's atoms all happen to leave the object's surface at once, and travel precisely in parallel for long distances,[15] through the merest chance. And for objects to be visible, this must occur very often. If the atoms are loose, it is more plausible to suppose that they would fly off in different directions from adjacent ones; and they would not wait for one another. Epicurus' theory of vision is committed to the notion that vision is stimulated by discrete emanations from objects. The shotgun conception offers no assurance that eidola would be discrete (or to put it another way, it offers no assurance that eidola as such are formed at all), while the fishnet hypothesis suggests that the atoms, since they are interconnected, all leave together and travel as a group in the same direction.

Lastly, regarding the type of atoms which compose eidola, there is evidence that eidola do not contain just small, smooth atoms. Lucretius indicates in his account of our perception of pleasant and unpleasant things that our reaction is due to the sorts of particles conveyed by eidola

---

[15] Cf. the claim that "the particles composing them retain as they flow from the solid object the same position and relative order they had on [the object's] surface"; and cf. E 48, where it is claimed that they retain their position and order "for a long time."

(L 2.418-25):

> ...never suppose that agreeable colours fit to feed our sight consist of seed [atoms] like those which make the eye tingle and force it to weep, or such as by their ugly aspect seem terrible and vile. For nothing whatsoever that soothes the senses is made without some smoothness in the first-beginnings [atoms]; but contrariwise whatever is offensive and harsh has been found to be not without some roughness in its material.

Eidola from pleasant-looking objects contain smooth atoms, and eidola from ugly ones contain rougher ones. We cannot suppose, then, that all eidola are made up of just one sort of atom, small and smooth. This is also apparent from Lucretius' discussion of why some sights affect different animals differently (L 4.706-721)—why, for instance, lions fear roosters while we do not. It is because certain particles from roosters injure lions' eyes, yet do not harm us. If the eidola from roosters were composed of the same sorts of atoms as eidola from other objects, as (b) implies, this account would be nonsensical.[16] So it appears we must reject (b) above. Note also that the texts (cf. E 46a, and 47b, quoted above, as well as L 4.196 and elsewhere) say it is the texture of *eidola* that is thin and fine, not that their constituent atoms are fine, as (b) implies.[17]

Together, these texts indicate, at a minimum, that eidola are extremely thin, light atomic complexes resembling the shape of objects which emit them and consisting of various types of atoms.[18] (Consider again what an extreme demand this places on the theory of emanation: to be seen, all visible objects must incessantly emit these.) And if we look at Lucretius' metaphors of

---

[16] Here I am assuming that these lion-repelling particles are borne on eidola. Lucretius does not explicitly say this; but the account comes in the middle of a discussion of visual phenomena, so this assumption seems to be the only reasonable one to make. He mentions no other kind of emanation which affects the eyes.

[17] Lucretius also says (L 2.582-84) that "there is none of those things which are in plain view before us which consists only of one kind of element, nothing which does not consist of various seeds commingled...." This statement applies to plainly visible objects, which eidola are not; but the statement may have general application.

[18] William Harms raised the question whether Epicurus' claim (47b) that the eidola are "unsurpassed in fineness" is consistent with Lucretius' claim (L 3.244) that the fourth, "nameless" ingredient of the soul consists of the smallest, smoothest elements. The apparent inconsistency could be resolved if we interpreted the "fineness" of eidola to be fineness of *structure*, as I do here, and interpreted the "fineness" of the fourth ingredient of the soul to be fineness of *atoms*. The former interpretation seems clear from the text, but the latter is not so clear; the text suggests that the nameless ingredient is both finest in texture and contains the finest atoms.

Martin Schwab has raised the related question of whether eidola may themselves give off eidola. Since there is no text at all on this point, any conclusions about this would be purely speculative. But if eidola are complexes more than one atom thick, and if we accept that complex structures emanate eidola despite their structural differences, this would seem possible. But if they did, they would disintegrate.

cauls and snakeskins more closely, the drift of the texts appears to be that eidola are to be thought of as thin layers which peel off an object's outer surface, which not only have *some* structure, but retain the *same* atomic structure as the solid, and the solid's constituent atoms as well. Thus they truly would be semblances of the object.

This account of eidola is in the spirit of Epicurus' rejection of other theories of vision (E 49):

> We could not as readily perceive the color and shape of external objects by means of impressions made on the air that lies between us and them, or by means of rays or beams of some sort sent from us to them, as we can when outlines of some kind, like the objects in color and shape and of the proper size to affect either our eyes or our minds,[19] come to us from the objects.

Epicurus wants to contrast his theory with others, which claim that vision is due to the reception of impressions via a medium (air, or rays) which is *unlike* the objects we see.[20] The contrast is strongest if we suppose that the intermediary which gives us our representation of an object is as much like the object as possible, given that the object is at a distance. To Epicurus, our perceptions are like the object because it is likenesses of the object which create our perceptions; and what could be more like the object than layers from its outer surface? Most commentators on Epicurus' theory of sensation say that for Epicurus, all sensations reduce to the sensation of touch. On the view I am suggesting, it is as if they eye "touches" (rather, is touched by) the object via the intermediary of the object's eidola.

This likeness of eidola to the objects which emit them is a crucial factor in Epicurus' argument for the truth of sense perceptions. Epicurus justifies his claim that "When by the purposeful use of our mind or of our organs of sense we receive a mental picture of the shape of an object or of its concomitant qualities, this picture is true" (E 50b) by citing the fact that "it is created by the continuous impact of the idols [eidola]...." He continues (E 51):

---

[19] The eidola which affect our minds (as opposed to our eyes) would seem to be of the kind which causes dreams and hallucinations.

[20] See DeWitt (1954), p. 204, Bailey (1964), p. 406, and Epicurus (1964) p. 15. The "air" theory is apparently that of Democritus, and the "ray" theory that of Plato and perhaps Empedocles.

> The mental pictures that we receive in the images that either come to our minds in sleep[21] or are formed by the purposeful use of the mind or of the other instruments of judgment would not have such similarity to those things that exist and that we call true if there were not some such material effluence actually coming to us from the objects....

However, this leaves Epicurus with the problem of explaining how these atomic complexes can meet the demands noted above. Perhaps eidola are porous, so that air atoms slip (or "ooze") through them as they go. And perhaps the thinness and lightness of eidola suffice to explain both the fact that we feel no impact from them and their apparent ability to cleanly break when passing solid objects (cf. the tissue paper problem). But it does not explain how their velocity could be "unsurpassed" (E 47b), for they could not travel as fast as loose atoms do. And more importantly, it is not at all evident how fishnet-type eidola could penetrate hard materials like glass, or interpenetrate each other. (It should be pointed out that even if hypothesis (b) were true and eidola were all made entirely of small, smooth atoms, the interpenetration problem would still arise, since it is a consequence of complex structure.) Epicurus admits that sometimes eidola "become confused, and sometimes they combine in the air" (E 48; cf. L 4.724-7), but the theory requires that vast numbers of them make the trip from object to observer successfully.

In addition, here we confront the same problem we encountered in considering the emanation of eidola. There, the problem was that objects must behave similarly (by emitting eidola) despite strongly disparate atomic makeup. Here the problem is how we can expect eidola made of different shapes and sizes of atoms to all behave so as to meet the stringent (and perhaps impossible) requirements described above. For the theory to work, we must somehow suppose that eidola made of rough atoms from an ugly object and eidola made of smooth atoms from a pretty object are similarly able to consistently (and rapidly, and frequently) travel faster than light (L 4.199-208) and penetrate the air, each other, glass, etc., and cohere enough to retain structural integrity yet not enough to waste much of the atoms' motion or prevent a clean break when passing a solid object.

---

[21] Again, what he seems to mean by "the images that ...come to our mind in sleep" are those caused by non-visual eidola.

As we have seen, Epicurus provides grounds for conflicting accounts of the structure of eidola: that they have complex structure and that they do not, and that they are made up of one type of atom or of atoms of varying shapes. It is evident that every alternative presents us with difficulty:

If we suppose that eidola (whether complexes or not) are all composed of the same type of atom, it would ease the burden of explaining the strikingly similar behavior of eidola; but it would be a step towards a more Democritean theory of vision in which the intermediary through which we receive perceptions is unlike the object of perception; the more that eidola differ from the objects they inform us of, the harder it is to account for how our perceptions of objects are similar to them (cf. E 51, quoted above).

If we suppose eidola are composed of disconnected atoms flying in parallel, we could better account for their transit; but this, too, tends to undermine the truthfulness of perceptions and is mechanically implausible as well.

And finally, I have argued that eidola are meant to be thought of as complexes composed of variously-shaped atoms, on the grounds that the textual weight is in favor of this conception, that the theory of their discrete emanation is implausible otherwise, and that this conception of them is in line with Epicurus' belief that his theory best accounts for how we see objects as they are. But, as shown above, this conception leads to the greatest mechanical problems of any of the alternatives.

The theory, then, appears caught in a dilemma. The more that eidola are like the objects which emanate them—i.e., the more they are like heterogeneous atomic complexes—the less plausible it is that they could reach the observer unscathed. Yet attempts to overcome this difficulty by supposing that eidola are less like the objects which emanate them end up undermining the perceptual truthfulness the theory is intended to provide. To put it another way, the theory needs for eidola to be like the objects emanating them for perception to be veridical; at the same time, it needs them to be unlike objects in order to make the trip from object to eye.

V. RECEPTION

After emanation and transit, eidola reach the eye, stimulating visual perception.[22] In connection with this, Bailey, among others, notes a pressing practical problem:

> The 'idol' [eidolon], as it left the concrete object, would be of course of the same size as the object itself: how then, if the object were a large one, could it enter the tiny pupil of the eye, or if it could not, how did it produce the image of the whole thing and not merely of such a small part as would come into contact with the pupil?[23]

In other words, how can eidola from objects like houses, mountains, or even just this page register on the eye if the pupil is only about a quarter of an inch wide? It would seem that, if eidola remain the same size, we would only see a pupil-sized portion of a large object, corresponding to the portion of its eidola that actually struck the eye. So what accounts for our ability to see the whole thing?

In the available texts by Epicurus and Lucretius there is no clear indication that this problem was considered, let alone how it was solved. But Bailey and Rist note that ancient commentators attributed to the Epicureans the view that eidola must become smaller as they travel.[24] Bailey's statement of the hypothesis and the grounds for it is concise, so I will quote rather than paraphrase it:

> ...the image in transit from the object to the eye is actually reduced in size, so that it can enter the eye as a whole: this is not merely perfectly consistent with Epicurean theory generally, but in fact supported by such information as is extant. The 'idols' in passing through the air, slight as they are, would yet be beaten upon all sides by a large number of atoms and loose compound bodies. The constant succession of blows the solid compound [i.e., the object which emanated the eidola] can resist because of its internal structure: but the effect upon the 'hollow' [cf. E 46] 'idol' would surely be to cause it to collapse, or be squashed inwards and so gradually diminish in size. The longer the transit, the further would the process of diminution be carried: hence it results that we do actually 'see' a distant tower the same size as a small stone close at hand: the rate of diminution would be

---

[22] Note that this discussion of reception is modulo a solution to the problems discussed in the previous sections.

[23] Bailey (1964), p. 411; cf. Rist (1972), p. 24.

[24] Bailey (1964), pp. 411; DeWitt (1954), pp. 205f; Rist (1972), pp. 21-4. Cf. Sextus Empiricus, *Adv. Math.*, 7.209, Plut., *Adv. Col.*, 1121.

uniform, and the amount proportionate to the distance.[25]

There is some controversy whether Epicurus held this view himself; Rist thinks he probably did, Bailey that he did not. I find nothing in Epicurus' or Lucretius' writings which directly either confirms or disconfirms it. Epicurus does say (E 49, quoted above) that eidola are "like the objects in color and shape and of the proper size to affect either our eyes or our minds...." But it is unclear what "size" refers to; it could be a reference to the size of eidola when they reach the eye, but it might also refer to some property which differentiates visual from non-visual eidola, given the context. Bailey's own translation of E 49 suggests the latter interpretation;[26] and Asmis believes the passage concerns the size of the eidolon's constituent particles, not the size of the eidolon itself.[27] Besides, the text says nothing about whether eidola were supposed to change their size in order to be of the right size when they arrived.

Nevertheless, this is the only hypothesis for which there is any indication that Epicurus may have held it. It is also supported by Bailey and DeWitt,[28] so let us consider it.

One consideration in its favor is that it might be seen as a logical extension of an Epicurean postulate mentioned above. The theory holds that discrete emanations from objects stimulate vision. The contraction hypothesis extends this to postulate that reception of discrete and *complete* likenesses of objects by the eyes stimulates vision. If the hypothesis worked, it would solve the problem we began with. And it might explain how an object appears smaller when farther away: if the eidola coming from it contract with distance, they would make a smaller impression on the eye the farther away the object was.

But the contraction hypothesis doesn't appear to be workable. It suffers from severe mechanical difficulties, and it creates peculiar problems of its own.

---

[25] Bailey (1964), pp. 412-13.

[26] Bailey (1926), p. 29: eidola "similar in colour and shape, leave the objects and enter according to their respective size either into our sight or into our mind....".

[27] Asmis (1984), p. 115-6.

[28] Bailey (1964), pp. 412-13. DeWitt (1954), p. 205, simply says that "reduction in size must be assumed."

Rist notes the mechanical difficulties with the contraction hypothesis which stem from its claim that eidola contract because of their buffeting by "atoms and loose compound bodies," presumably the air and bits which have dislodged from macro-objects.[29] He notes, first, that Lucretius' text does not support the idea of uniform diminution: Lucretius (L 4.353-62) explains that

> when afar off we see the foursquare towers of a city, they often appear to be round...because, while the images are rushing through a great space of air, the air with frequent buffetings forces it [sic] to become blunt.

This suggests that buffeting distorts eidola rather than uniformly shrinking them. Second, Rist points out that

> ...a theory that images are battered into collapsing during their journey through the air between the object and the eye does not easily harmonize with the undoubtedly Epicurean doctrine that because of the fineness of the images they travel at nearly atomic speed and are only very slightly hindered by external objects.

Bailey might reply to Rist by noting that distorting effects such as the rounding of the tower's corners are only said to take place when the eidolon travels over long distances. However, it is still very odd to suppose that an eidolon's "collapse" should be uniform, given the variability of conditions between object and observer. (It is even odder to suppose that each eidolon, from every object, must collapse uniformly; yet Bailey's model requires this.) Under this hypothesis, we should expect movements of air to have an effect on our vision. We should expect objects suddenly to appear smaller when we exhale; and gusty winds such as the Santa Anas typical of Southern California would be disastrous: eidola would be tossed about and distorted by the wind and the dust it carries. There are simply too many variables in the region between the object and the eye for Bailey's model to work even over short distances.

If, unlike Bailey, we speculate that eidola contract due to some internal cause and not due to external collisions, additional strain is placed on the theories of emanation and structure to

---

[29] Rist (1972), p. 85. Rist seems to believe that eidola must contract, but that if contraction is caused by buffeting it cannot work; yet he suggests no alternative. Rist (1972), p. 24.

show how it is that every eidolon from every object has this property of consistent, uniform contraction.

Schwab has pointed out some peculiar implications of the contraction hypothesis.[30] It demands that eidola contract very quickly: this page is eleven inches high, yet per the hypothesis its eidola uniformly contract sufficiently to fit the reader's pupils at a distance of (I assume) about 18 inches. That is very rapid contraction over a short space. But on the other hand, if the page's eidola uniformly contracted at that rate, the reader should be unable to see the page from a distance of two feet because the eidola would have shrunk to practically nothing; or if the reader moves the page to within a foot, its eidola would not have contracted enough to fit in the eyes, and so the entire page should not be visible. The contraction hypothesis, then, doesn't seem able to account for our ability to see the same object at different distances (or how we could see small objects like grains of sand at all, if their eidola shrink at such a rate).[31]

It seems to me that there is a way to solve the problem of how we see large objects without supposing any change in eidola, but to show this will require some groundwork.

First we need to establish some basic facts about the emanation of eidola. Lucretius claimed (L 4.160) that

> ...just as the sun must send up many lights in a brief space, that all places may be full of them without a break, so in like manner from things also it must be that in a moment of time many images pass off in many ways and in all directions everywhere....

Eidola must pass off an object in all directions, and do so continually; if they did not, there would be (at least sometimes) locations in an object's surroundings where an observer would receive no eidola and hence could not see the object.[32] The object would then "disappear" even when the

---

[30] Martin Schwab, personal communication, 21 September 1992.

[31] DeWitt (1954), p. 206, believes that what reaches the eye is not compressed eidola but the "residue" of the original. In my view, this idea has all the difficulties of Bailey's model, plus it seems to weaken the truthfulness of perceptions by claiming that what we receive is not a likeness of the object but the residue of a likeness.

[32] One complication: eidola from one side of an object presumably cannot emanate towards points on the object's other side, because the object itself obstructs them—unless the object is transparent, in which case, since eidola penetrate transparent materials, it seems they would go through the object and into the space on the other side.

observer's view was unobstructed.

And if eidola emanate in every direction, then *a fortiori* so do the portions of eidola which come from each part of the object's surface. Again, if they did not, portions of the object would be invisible from some vantage points. In other words, particles from portion *x* of an object's outer surface are continually borne in every direction by eidola (which are traveling in all directions), thus enabling visual perception of portion *x* from any point in the surrounding space.

There are two interesting consequences of this, one promising and the other problematic. First the promising one: if eidola from *every* portion of an object's surface are emanating in *all* directions, then eidola from *all* portions of an object are emanating towards *every* point in the surrounding space. So from any given vantage point, eidola carrying particles from every portion of the object converge upon the observer's eye. But if this is so, there is no need to account for our ability to see large objects by supposing that their eidola shrink to fit into the eye. Eidola from each part of the surface of the object (say, this page, or a house, or a mountain) will converge upon the observer's eye, enabling visual perception of the whole thing.[33]

The problematic consequence is that, since eidola from each portion of the page reach every point in the surrounding space, they also reach every point on the eye. If the eidola coming in from each portion of an object's surface are, as it were, sprayed across the eye's surface, how could any particular image be discerned? (For instance, eidola from the bottom of the page must reach the top of the reader's eye and eidola from the top of the page must reach the bottom of the eye, so why isn't the image inverted?) This seemingly should result in what Bailey calls "a hopelessly confused vision, from which the eye could not obtain an orderly image of the whole." This is why Bailey favors the contraction hypothesis, which he claims is simpler.[34]

What Bailey failed to notice is that the contraction hypothesis has the same difficulty.

---

[33] The convergence model I am suggesting appears similar to a proposal attributed by Bailey to Giussani: "[Giussani] has invented the subtle theory that, as the eye confronts a large object, 'idols' flow towards it from all parts of the opposite surface preserving their original size: a fragment of each of these will strike the eye and the eye piecing together these fragments will grasp an image of the whole, yet of the right size." Bailey (1964), p. 412.

[34] Bailey (1964), p. 412.

Suppose, per the contraction hypothesis, that an observer is receiving in her eye[35] a steady stream of complete, shrunk-to-fit eidola from this page. If she moves her head to the left just a couple of millimeters, only part of that stream of eidola will enter her eye. If this were the only stream of eidola emanating towards her eye from the page, she would now be unable to see the rightmost part of the page, since no particles from it would reach her eye. Thus, for her to still see a complete image (which of course she does), another stream of eidola must be reaching her eye to bring her the image of the rightmost part of the page. Suppose she moves her head left again; the fact that she still sees the whole page shows that yet another stream of eidola must be emanating at a slightly different angle. And so on, to the left, right, above, and below. For the whole page to be visible from every angle (that is, every angle from which it is still facing the observer), eidola carrying particles from the rightmost part of the page must be emanating in all directions. The same goes for every other portion of the page. Eidola from every portion of an object's outer surface must therefore be emanating in all directions. But then, as before, eidola from each portion of the surface reach every point in the surrounding space, and thus they reach every point on the observer's eye.

On either conception, then, it seems we must give up the idea of the eye receiving only whole eidola, at least from any object larger than the eye itself. Rather, it receives a collage of them. And however one may choose to construe Epicurus' statement that all perceptions are true, this is a significant finding. It implies that vision is not a passive process wherein the visual image we experience is merely the result of our being struck by eidola. Rather it is an active process, wherein our visual apparatus must perform the complex task of weeding out extraneous fragments. (The difficulty of this task, and the speed with which it must be done to account for the clarity and steadiness of our vision, seem formidable.) Vision, then, requires a good deal of participation by the perceiver in the process of forming the perceived image.

---

[35] For simplicity I assume she has one eye closed. The reader may note that I, like Epicurus, do not consider what difference it may make that most of us normally use two eyes. However the issues we are considering are such that the number of eyes should make little difference.

There is one respect, however, in which the contraction model is superior to the convergence model. On the convergence view, the eidola the eye receives are unaltered and hence in a way more like the objects which emanated them. But on this view, the eye seldom receives eidola which depict an entire object; only objects the size of the pupil (or smaller) could emanate such eidola. According to the convergence model, then, most visual experience is the result of the observer's assimilation of the mostly partial eidola received, and thus the truthfulness of a perception depends mostly on the observer's ability to put the pieces together correctly. On the other hand, the contraction model implies that, although the observer still must assimilate partial and overlapping eidola, many of the eidola it receives may be of whole objects, and this would seem to be more in keeping with Epicurus' claims about the truthfulness of sensation. While in both models the observer bears a burden of assimilating eidola, in the contraction model the burden is one of picking out the correct whole image. On the convergence model, the observer usually must somehow piece together a whole image out of the pupil-sized portions of life-size whole eidola reaching the eye.

And this (to return to our main theme) once more shows the tension in Epicurus' theory. In the previous section we found that the conception of the eidolon which best supported Epicurus' claims about the truthfulness of perception—that they are heterogeneous atomic complexes—ran into the worst mechanical difficulties, and the mechanically more plausible one—the homogeneous shotgun conception[36]—tended to undermine such claims. Here we find that the conception of how we receive eidola which better supports Epicurus' truthfulness claims—the contraction model—is mechanically absurd, while the more mechanically plausible alternative —the convergence model—does more to undermine the claim that perceptions are truthful. Epicurus rests his claim that the senses are trustworthy on the claim that what we receive

[36] I say that the shotgun model is more plausible, even though above I found compelling reason to reject it. But I am only claiming that it is *more* plausible than the heterogeneous complex model. I say this because while it is very unlikely that disconnected atoms would emanate in discrete groups flying in parallel (as the shotgun model requires), it seems to me impossible for complex eidola to interpenetrate each other without change (as the heterogeneous complex model requires).

from remote objects is images of them; the convergence model denies that, in most cases, the observer's eye receives a complete likeness of anything.

The other sort of problems we have encountered along the way, that of demanding dissimilar atomic complexes to behave similarly, arises here as well. We noted in the previous section the problem of accounting for how eidola with dissimilar atomic compositions could all behave similarly enough to meet the demands of transit. Here we find that they must also, at least on the contraction model, meet the demand of uniformly shrinking so as to enter the eye.

And both the contraction and convergence model encounter this problem once more, when the eidola finally contact the eye. According to Epicurus, the emanations which stimulate the different senses are of different kinds. Those which give rise to smell are different from those which give rise to hearing, and the emanations which cause visual perception—eidola—are still different (E 46a, 52b-53b; L 4.478-99, 4.595-614, 4.687-705).[37] Each behaves differently due to differing structure, mode of emanation, and movement. Similarly, each organ of sense differs in what emanations it can take in (L 6.979-997). Each has different pores, which allow the appropriate emanations to enter and filters out the rest. (That is why we do not hear or smell eidola, nor do we "see" the bodies which give rise to hearing or smell.) The theory of vision demands, then, that eidola, despite their differences in composition, are yet similar enough to (a) affect only the eyes, and not other sense organs, and (b) enter the membrane of the eye. Or, we must suppose that the pores of the eye are somehow able to let in a tremendous array of different sorts of atoms and their complexes in the form of eidola, yet can screen out the bodies of hearing and smell.

VI. SUMMARY AND CONCLUSION

There are many other issues one might explore in Epicurus' theory of vision: the interpretation of the many obscure texts, what difference he thought it made for us to have two eyes instead of one, why we can't see in the dark, and so on. In this paper I have chosen what I

[37] Everson (1990), p. 176, and Asmis (1984), pp. 115-6, also discuss this.

take to be the main issues of the theory—how eidola are emanated, how they get from object to observer, and how the observer receives them—and attempted to show, within the boundaries of what the original texts tell us, (a) that the process is highly problematic, and (b) that (what I take to be) the main problems the theory encounters are on two levels.

At the mechanical level, there is the demand that dissimilar atomic complexes behave similarly: dissimilarly structured objects must similarly emit eidola; eidola, despite having dissimilar atomic makeup, must behave similarly to each other in their transit and penetration of the eye. This runs counter to the Epicurean tenet that if two objects have similar characteristics, their structure and/or composition is similar.

At the theoretical level, we find tension in the form of the need for eidola to be both like and unlike the objects emitting them. The account of their behavior is made most plausible (if not actually plausible) if we suppose eidola to be different from the objects emitting them: disconnected aggregates instead of interlocked complexes, homogeneous instead of heterogeneous, converging instead of contracting. Meanwhile, the theory's requirement for our perceptions to be like their objects leads to the most mechanically implausible suppositions about eidola: heterogeneous composition, complex structure, and contraction in transit.[38]

And for a metaphysical theory like Epicurus', which purports to explain the universe in straightforwardly mechanical terms, this is a surprising discovery. It may be that neither Epicurus nor Lucretius foresaw the difficulties the theory confronts; nevertheless it is ironic that the theory should in effect consistently opt for the most mechanically farfetched account of phenomena.

---

[38] Rist (1984), p. 23, claims that "Epicurus' sensations give evidence not about the truth of judgments, but about the existence of objects sensed." Thus he might say there really is no tension here; all that is required is a theory of how we become informed of the existence of remote objects. However he seems to be alone among modern commentators in holding this weak position; and even if he is correct, the mechanical problems with the theory of eidola are such as to cast some doubt on how even this can reliably occur.

BIBLIOGRAPHY

Asmis, Elizabeth (1984). *Epicurus' Scientific Method*, Ithaca, NY: Cornell University Press.

Bailey, Cyril (1964). *The Greek Atomists and Epicurus*, New York: Russell & Russell. (Originally issued in 1928.)

DeWitt, Norman W. (1954). *Epicurus and His Philosophy*, Minneapolis: University of Minnesota Press.

Epicurus (1926). *Epistula ad Herodotum*, in *Epicurus: the Extant Remains*, Cyril Bailey, trans., Oxford: Clarendon Press.

Epicurus (1964). *Letter to Herodotus*, in *Epicurus: Letters, Principal Doctrines, and Vatican Sayings*, Russel M. Geer, trans., New York: Macmillan.

Everson, Stephen (1990). "Epicurus on the Truth of the Senses," in Stephen Everson, ed., *Epistemology*, Cambridge University Press.

Glidden, David K. (1971). "The Epicurean Theory of Knowledge," Ph.D. dissertation, Princeton University.

Hicks, Robert D. (1962). *Stoic and Epicurean*, New York: Russell & Russell.

Lucretius (1975). *De Rerum Natura*, W. H. D. Rouse, trans., Martin Ferguson Smith, ed., Cambridge: Harvard University Press.

Rist, John M. (1972). *Epicurus: An Introduction*, Cambridge University Press.

APPENDIX:

PERCEPTION OF DISTANCE AND DARKNESS

Lucretius tells us that an impression of the distance to an object is communicated to us by the amount of air eidola push ahead of them (L 4.244-55). There are a number of problems with this account of distance perception, but before attending to them I would like to note an interesting side effect of it. Lucretius declares that the eidolon

> ...takes care that we distinguish how far each thing is distant from us; for when it is sent off, at once it pushes and drives all the air that is between itself and our eyes, and thus this air all streams through our eyes and, as it were, brushes the pupils and thus passes through. This is how we come to see how far off each thing is; and the more air is driven before it, the longer the breeze that brushes our eyes, the more distant and far removed the thing is seen to be.

Recall that since individual eidola are unperceivable, we must receive them at a rate above some minimum threshold in order to sustain a visual sensation. We must receive at least a certain number of eidola within a given amount of time, i.e., with a certain frequency, to see. This implies that

P1: *There is a minimum possible rate of eidolon formation, below which no visual sensation is caused.*

And while we do not know just how fast eidola travel, we know that they cannot travel faster than free atoms, whose speed is finite albeit great. Thus,

P2: *There is a maximum possible speed at which an eidolon can travel.*

P1 and P2 together allow us to conclude that

C1: *There is a maximum possible distance between the eidola which cause visual sensation*, viz., their maximum speed divided by their minimum rate of emanation.

If visual sensation is to occur, there is a limit to how far apart eidola can be. For any given speed of travel, if they are too far apart, they will not arrive at the eye frequently enough to stimulate visual sensation.

Now, since each atom takes up a definite (if tiny) amount of space (E 56b-57a), there is a finite number of air atoms that can occupy any given space. From this we can infer

C2: There is a maximum possible amount of air in between eidola.

C2, combined with

P3: The amount of air pushed by eidola determines what distance we perceive to be between us and an object (L 4.244-55, quoted above).

allows us to conclude that

C3: There is a maximum possible perceived distance.

Since there is a finite amount of air that can fit between the eidola traveling towards the eye, there is a maximum amount of air that each can be pushing before it. And since it is this volume of air that causes us to perceive how far away an object is, there is a limit to how far away we can perceive an object to be. Given a very high eidolic speed, this distance may be great, but it is nevertheless finite.

The payoff of this rather peculiar finding is that it helps explain some of the odd visual phenomena mentioned by Lucretius. He writes (L 4.397-99, 4.404-413):

> ...mountains that stand up afar off from the midst of the ocean, between which is a great channel wide enough for a fleet to pass freely through, these nevertheless seem to be joined into a single island.
>
> Again, when nature begins to uplift on high the sun's beam red with flickering fires, and to raise it above the mountains, those mountains which the sun then seems to be above, quite close and touching them with his hot fire, are scarcely distant from us a couple of thousand bowshots ...but between them and the sun lie vast stretches of sea below the wide regions of the sky, between them are thrown many thousands of lands....

The notion of maximum perceivable distance may account for these phenomena. If the maximum distance between eidola were roughly that between the observer and the nearest of distant mountains, then the observer would be unable to discern any distance between the nearest mountains and those behind them, or between the mountains and the rising sun; eidola from all of them would be pushing the same amount of air before them.

Objections to the theory. The Epicurean theory of how we perceive distance, however, is subject to objections which seem to me to be fatal. It is not just that the air-pushing theory is inconsistent with the argument that eidola move fast because they slip through the air without

suffering collisions with it, although this is certainly something to ponder. It does not seem possible that eidola could avoid collisions and yet push air particles before them at the same time.[39]

But also recall that as eidola travel from me to you, they also travel from you to me. In order for the air-pushing theory to work, so that each of us could tell how far away the other was, these eidola traveling in opposite directions would have to push the same air in opposite directions simultaneously. And at the same time, that same air between us is being swept in all directions by the eidola emanating upward from the floor, sideways from the walls, downwards from the ceiling, and so on. It is plainly impossible that "all" the air between any given object and the observer could be pushed into the observer's eye; it hardly seems possible that more than a small fraction of it could. And after this cross-sweeping process eidola give each other, it seems that no eidolon would be pushing significantly more air than any other, regardless of the distance traveled between object and observer.

Furthermore, if eidola are solid enough to push air before them, how do they still interpenetrate each other? The demand this capacity would place on the theory of eidolic structure would be incredible. And even if eidola could succeed at this, how is it that the air stays in front of the eidolon? Wouldn't the air atoms instead simply tumble off to the side of it, like water does when pushed by a hand, leaving only a small pile of air atoms at the front of each eidolon? Again, no eidolon reaching the observer would seem able to push more air than others—at least, not as a function of its distance traveled.

There seems to be no way for the theory to work.

Ramifications. This failure may seem to be of little importance, since it could be argued that we don't directly *perceive* distance anyway; we *estimate* it based on parallax, the apparent

---

[39] Asmis (1984), p. 110, does not seem to regard this as a serious problem. She simply notes, "Even though Lucretius points out that the eidola slip through the network of air particles, he also claims that the distance of an object is known by the amount of air that the successively arriving eidola push ahead of themselves. Thus, it seems that although eidola collide less with air particles than does any other type of atomic complex, it would be rare for an eidolon to enter the eye without having suffered any external collisions at all."

size of the object versus its known actual size, and its proximity to other, familiar objects. But another part of the Epicurean theory of vision depends on eidola pushing air.

According to Epicurus, we do not see objects due to light reflecting off of them; rather, we see them simply because the objects themselves are emitting eidola, which they do without rest (L 4.225-29). But if objects emit eidola at all times, why can't we see them equally well at night, or when they are in deep shadow?

Lucretius explains that we perceive shadow due to eidola from objects pushing "dark" air particles before them (L 4.337-54); "dark" air is simply air without light (L 4.369). So, when we look inside a cave, the eidola from objects inside the cave push air before them, and the dark air from inside the cave comes last and clogs the passages of the eyes.[40] If we are inside the cave, eidola coming in push the dark cave air into our eyes, but this is washed away by the "bright" air pushed immediately ahead of the incoming eidola.

But this account of darkness relies on contact between eidola and air, and must suffer from the same objections as the theory of distance perception. (Even if the eidola from inside the cave push some dark air atoms before them, why aren't these washed away by the bright air atoms pushed by eidola from the observer, or surrounding objects?) And that appears to leave the theory without means of explaining some of the most common of visual phenomena: our inability to see objects in deep shadow, or why we cannot see just as well at night as in the day.[41]

---

[40] Thus we could say that Epicurus' theory of vision is to some extent light-dependent: light must be mixed with air for us not to have our eyes' pores obstructed.

[41] There is no explanation in the text of why we do not see well at night; perhaps he would say that at night, all the air atoms are "dark".