

Locke, Berkeley

And

Philosophy of Science.

**Jonathan Craig Walmsley.**

**MPhil Philosophy.**

**LSE.**

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## Abstract.

In part one of this thesis I illustrate how it is that many modern commentators come to believe that Locke and Berkeley belong to the respective categories of realist and instrumentalist as regards the contemporary philosophy of science debate. Locke is seen as a realist because of his adoption of the corpuscular hypothesis, and Berkeley as an instrumentalist because of his objections to the Newtonian theory.

Part two illustrates that lots of what both Locke and Berkeley actually said regarding the science of their day is inconsistent with the modern interpretation, and shows how their views are either contradictory, or are not as the commentators of the first section take them to be. This is the case because Locke seems explicitly to rule out the possibility of ever using hypotheses about the corpuscular substructure to acquire practical knowledge, and Berkeley seems to accept a version of the corpuscular hypothesis

Part three of the thesis gives a close reading of these philosophers works to see what their views are, in their historical context. This illustrates how they arrived at their respective conclusions and what these conclusions were. That is to say, it is demonstrated that Locke's choice of the corpuscular hypothesis is based purely on philosophical considerations, and Berkeley's philosophical prescriptions can easily accommodate a version of the corpuscular hypothesis, even though it postulates "insensible particles".

In conclusion I show how it is that these positions fit together in their respective philosophical systems, and how, far from being inconsistent, Locke and Berkeley's positions are well thought out and perfectly coherent with the rest of their work. A final note is added as to why we get into this interpretative mess in the first place, and how it can be avoided in the future.

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## Introduction.

The contemporary debate in the philosophy of science, between the realists and the anti-realists, has been raging over the whole of the twentieth century. As the issues have become sharper, and the debates more heated, lines have been drawn between those who believe that the success of scientific theories argues for their literal truth, and those who maintain that it does not. As these battles are waged, with no one side apparently strong enough to win the war, both sides have looked to find the cause of this division, and allies to help them in the fight. In doing the former, they often think that they have discovered the latter.

It is not implausible to suggest that the seeds of the current dispute were sown in the late seventeenth and early eighteenth centuries, when empiricism was finding its first serious modern expressions. John Locke first delineated, in a modern context, the idea that all knowledge comes from experience. But, he was also a philosophical realist, believing that there was more to the world than his sense data. Berkeley, on the other hand, is seen to correct Locke on this point; we can't advance beyond what we can experience and we become idealists. These positions do, indeed, seem to mirror the contemporary debate: on the one hand the scientific realists argue that our successful scientific theories describe parts of the world that are beyond our sensory perception, where the anti-realists typically restrict what we can properly believe in science to that which is purely observable.

But not only have we found the cause of the division in the historical context, we have also found allies in the battle. At least, this is the view expressed by many modern commentators. Both Locke and Berkeley were actively engaged in the scientific disputes of their day, and with careful interpretation we can see that Locke, with his corpuscular theory, and Berkeley with his treatment of theories as mere calculating tools, fit neatly into the respective camps of scientific realist and instrumentalist. Indeed, these views are taken to be little more than their general philosophical positions written in more detail and aimed specifically at the area of science.

It is my view that, plausible though this last interpretation is, it is false that Locke and Berkeley belong to the different warring factions. Indeed, I will argue that if you accept they do, then a great deal of what they subsequently say regarding natural philosophy is complete nonsense - if Locke was a scientific realist then he contradicts

himself time and again. The same, I maintain, applies to Berkeley. It is my aim in this thesis to outline clearly what these two philosophers views actually were regarding the science of their day, and to show that much modern comment in this area is wrong. To this end I will pursue an unusual method that should allow me to attain these aims. This thesis is divided into three main parts, each comprised of two Sections. In the first part I will put forward as forcefully as I can the considerations that have lead modern thinkers to believe that Locke and Berkeley fit into these neat categories of the modern dispute. In the second part I will then show how, if we believe that our subjects do fit into these categories, a lot of what they say is completely inconsistent. In the final part I will illustrate the views that they held are in fact perfectly consistent, but that the substance of the views, or the reasons that they were held were radically different from those attributed to them by modern philosophers. In this way I hope to illustrate what the views were, why they were held and how they cohere in the respective philosophical systems.

In conclusion, then, I hope to show two things. Firstly that Locke and Berkeley had very interesting and fully consistent views regarding the scientific thinking of their day, which is different from that which is usually attributed them. But, second, I want to show that the modern comment simply misses a lot of what Locke and Berkeley actually said. I will end the thesis by stating why I think this is so, and how, perhaps, this problem can be remedied.

In one respect the thesis itself will exemplify one of the conclusions that I reach, in that I believe it important to have a full grasp of the texts of any philosopher's work, so as to fully understand what points they are making. A lot of this thesis, therefore, is comprised of a careful working through of the principal works in context. I hope that I will be forgiven, then, the generous use of quotations to which I have helped myself.

It would also be wise at this point to describe the referencing system that I have used in this thesis. All of the references are included in the text, bracketed immediately after the relevant quote. Quotes from Locke's Essay will simply have the form of the number of the Book, Chapter and Section, for example (II.viii.24). Quotes from Berkeley's Principles, De Motu and Siris will simply have the initial from the respective titles and the paragraph number referred to, for example (P 25), or (DM 43). Quotes from the introduction to the Principles will have a capital letter "I" to illustrate their origin, for example (PI 2). Quotes from the "Three Dialogues" will retain the page ordering from the

1948-51 edition of Berkeley's works. All the other references will contain a capitalised abbreviation of the title of the book in question, with the page number of where the quote is to be found. This number will come from the edition of the book listed in the bibliography. So a quote from page 43 of the "Selected Philosophical Papers of Robert Boyle" will have the reference (SPPRB Pg43). The edition will then be found in the bibliography. I hope this is clear.



"There is not an error to be named, which has not had its Professors."

Locke, Essay, IV.xx.17.

## One.

Arguably it is Locke's examination of the origin of our ideas that has had the most impact on philosophy, with his repudiation of innate ideas being pursued in the whole of the first book of the Essay. The second book opens with what he proposes to replace this conception with; "From *Experience* ... all our Knowledge is founded; and from that it ultimately derives it self." (II.i.2.) Indeed, the rest of book two is spent in an attempted exposition of how it is that all our many and varied ideas all derive solely from experience. But it is in an enlarging of this exposition of the content and origin of our ideas that Locke, in his chapter "Some further Considerations concerning our simple Ideas", first draws a distinction between "*Ideas* ... as they are *Ideas* or perceptions in our minds; and as they are modifications of matter in the Bodies that cause such Perceptions in us." (II.viii.7) And it is soon after this that he introduces the distinction between the primary and secondary qualities of bodies, a distinction that has caused much philosophical dispute, regarding its tenability, its basis in the philosophy of science, or indeed, what the distinction is at all. It is in this chapter also that one first finds a substantial reference to the Corpuscularian Hypothesis that was prevalent in the science of the day. It is here that one finds the nascent arguments of those who want to show that Locke was a realist regarding scientific hypotheses and, prima facie, it seems that there is a strong case to make.

J.L. Mackie, in his book "Problems from Locke" starts the defence of the distinction spiritedly saying that he "shall try to show that Locke's own primary and secondary quality distinction is fairly clear and interesting in its own right, that Locke had good reasons for drawing it, and that something close to it is correct." (PFL Pg8) He does however feel that the way that Locke draws the distinction is a little misleading and that in order to get to the nub of the problem, and to outline the distinction in a way more easily understandable to a modern audience it will "therefore be better to state the substance of the view in somewhat different terms, and only afterwards show how [Locke's] words fit into this picture." (PFL Pgs8-9) The description that Mackie gives goes approximately as follows: There are material things existing in three dimensional space and lasting through time, that are made up of lots of tiny particles, all of which are in motion. Apart from the shape, size, motion and arrangement of these particles the bodies that the particles make up also have other properties - colour, temperature, etc. But,

these properties are only differences in the arrangements of the particles in the respective bodies. Each individual particle is also solid or impenetrable, though arrangements of particles need not be.

Material things also causally interact with other bodies, for example our sense organs, and they can produce in us ideas with experiential content. This content is of two types: the content of properties that have already been noted as belonging to material things, i.e. the shape, size, etc. But it is also made up of colours smells etc, and one ascribes this experiential content, of the second type to the material thing itself, as belonging to this thing in the same way as the first type does.

But, according to Mackie's reading of Locke, all of this is a systematic mistake, all that is really out there is the primary qualities of the bodies: namely the shape, size, position, and arrangement of particles, and the arrangements of these tiny bodies is what causes the sensations that are our ideas of colours, smells, etc, whose qualitative experiential content we wrongly ascribe to the material things that cause these sensations. Mackie then gets down to the nitty gritty of what it was that Locke actually wrote and he seems to have fairly well captured the distinction as drawn in Locke's Essay.

Recalling the heading of sections 7 and 8 of this chapter of Book II; "Ideas in the mind, Qualities in Bodies", Locke goes on to distinguish primary and secondary qualities. Primary qualities are "such as are utterly inseparable from the Body in what estate soever it be ... such as Sense constantly finds in every particle of Matter, which has bulk enough to be perceived ... v.g. Take a grain of wheat, divide it in two parts, each part still has *Solidity, Extension, Figure* and *Mobility*." These qualities of body Locke thinks "we may observe to produce simple *Ideas* in us, *viz* Solidity, Extension, Figure, Motion, or Rest, and Number." (II.viii.9)

Objects also have such qualities "which in truth are nothing in the objects themselves, but Powers to produce various sensations in us by their *primary Qualities* i.e. by the Bulk, Figure, texture and Motion of their insensible parts ... these I call *secondary Qualities*." (II.viii.10) It should be noted here, as Mackie does, that "nothing ... but" in the description of secondary qualities must mean "nothing ... except". Some commentators have taken it to mean "nothing ... and", and from here concluded that there are no secondary qualities in bodies, and they exist therefore only in the mind. Berkeley was the first who seems to have read things in this way, though whether it was for dialectical

impact, or was a misreading is open to question. That it is a faulty reading cannot be open to doubt, as to attribute Locke this meaning makes him talk nonsense: Secondary qualities cannot be first nothing and then have some property, for nothing has no properties, and this reading would also seriously distort the distinction drawn three sections earlier between qualities being in bodies and ideas in the mind. For both these reasons we will side with Mackie on this issue, and against Berkeley.

There is also a third set of qualities which are "Powers to produce changes in other bodies, for example the power of the sun to melt wax." (II.viii.10) And these powers of objects depend upon "the same primary Qualities viz The Bulk, Texture, and Motion of its insensible parts." This is one of the first mentions of "insensible parts" of bodies and the phrase re-occurs several times when Locke is explaining how primary and secondary qualities produce their ideas in us. For example "since the Extension, Figure, Number and Motion of bodies of an observable bigness, may be perceived at a distance *by* the sight, 'tis evident some singly imperceptible Bodies must come from them to the Eyes, and thereby convey to the Brain some *Motion*, which produces these *Ideas*, which we have of them in us." Regarding secondary qualities he continues: "After the same manner ... we may conceive, that the *Ideas of secondary Qualities* are also *produced*, viz. *by the operation of insensible particles on our Senses*." (II.viii.12+13) It may seem implausible that our ideas of colour should come from motions, as they are things with which they have no resemblance but, "It being no more impossible, to conceive, that God should annex such *Ideas* to such motions, with which they have no similitude; than he should annex the *Idea* of Pain to the motion of a piece of Steel dividing our Flesh, with which that *Idea* hath no resemblance."

Locke then, so far, has introduced us to a distinction between the qualities that are "utterly inseparable from the Body, in what estate soever it may be" and all the other qualities of bodies, which he says are dependant on these primary ones. "From whence," he thinks, "it is easie to draw this Observation" that the ideas we have of these primary qualities are resemblances of them but, "the *Ideas, produced in us by these Secondary Qualities, have no resemblance* of them at all. There is nothing like our *Ideas* existing in the bodies themselves." (II.viii.15) From this Locke then goes on to say that primary qualities are the real and original ones "because they are in the things themselves, whether perceived or no", but all others are "Powers barely ... yet they are generally otherwise

thought of." (II.viii.23+24) The reason why secondary qualities are taken to be real is because their mode of production, matter in motion, bears no resemblance to the ideas themselves. "Hence it is, that we are so forward to imagine, that those *Ideas* are resemblances of something really existing in the Objects themselves." This, though, for Locke is a mistake, and we can see that Mackie's reading of Locke as a corpuscularian, is not at all an erroneous one.

So, Mackie can be seen to fairly represent Locke's distinction as a correction of the contents of our experience. The substantive question that now poses itself is, what philosophical justification, if any, did Locke have for drawing this distinction? He must admit, after all, that the distinction is not one that is founded in sensory experience as "The Powers to produce several *Ideas* in us by our Senses, *are looked upon as real Qualities, in the things* thus affecting us." (II.viii.24) That is, we think of objects as coloured in the way that we experience the colour. Our experience presents all the qualities of objects, primary and secondary, as being in the object, yet for Locke, to subscribe to this view is wrong. But how can we know this? After all, Locke was the founding father of modern empiricism whose main premise is that all knowledge derives from experience of the world around us. We haven't had any experience at all of these "insensible parts" of bodies, and from our experiential content we don't see any need to draw this distinction, so why draw it?

Mackie notes that "it is clear that Locke adopted the distinction as part of the "corpuscularian philosophy" of Boyle and other scientists of the time whose work Locke knew and admired" (PFL Pg17) and cites as his support for this the "Epistle to the Reader" of the Essay where Locke describes Boyle as a "Master Builder ... whose mighty Designs, in advancing the Sciences, will leave lasting Monuments to the Admiration of Posterity." This is, as yet, scant evidence for a Boylean connection, and it would be very useful to turn to Boyle's work to see if Locke's writings bear any resemblance to the former's thought.

There are indeed great similarities in the two men's works, the most telling of which is to be found in Boyle's work of 1666; "The Origins of Forms and Qualities according to the Corpuscular Philosophy." The Passage where Boyle first introduces the place of secondary qualities in his philosophy goes as follows:

"And if we should conceive all the rest of the universe to be annihilated, save one body - suppose a metal or a stone - it were hard to show that there is anything physically more in it than matter and the accidents ... (motion, bulk and shape) ... But now we are to consider that there are de facto in the world certain sensible and rational beings that we call men, and the body of a man having several of its external parts, as the eye, the ear, &c., each a distinct and particular texture, whereby it is capable to receive impressions from bodies about it ... we must consider, I say, that these sensoria may be wrought upon by the figure, shape, motion, and texture of bodies without them ... And to these operations of the objects on the sensoria, the mind of man, which perceives them, giveth distinct names, calling one *light*, or *colour*, the other *sound*, the other *odour*, &c." (SPPRB Pg30+31)

Boyle calls these qualities in bodies, "secondary Qualities". So, again Mackie has pointed in the right direction; Locke does seem to have borrowed the distinction from a natural philosopher and employed it as the distinction between primary and secondary qualities. It had, Mackie notes, "long been known that sound was a vibration in the air" and scientists of the time were postulating corpuscular theories of light. And, says Mackie, "though science has changed the details of its accounts since the seventeenth century, the broad outlines of its message ... have remained the same." But why should this make a philosophical difference? Just because physicists find no need to postulate colour as we see it in the object, that doesn't mean that there isn't any such thing. "This," says Mackie, "is to miss the point ... the physical considerations ... show that there is no good reason for postulating features of a certain sort, namely thoroughly objective features which resemble our ideas of secondary qualities." Mackie then admits that physics itself does not require that we limit our postulated entities to those it describes, this denial of the ideas of secondary qualities of bodies "is a further, philosophical, step, but it is one which is at least prima facie reasonable in the light of the successes of physical theory." (PFL Pgs17-19) Mackie's argument for Locke's acceptance of the corpuscularian hypothesis, is a straight forward one: Locke adopts the theory as it is a successful physical theory, and then he infers from its scientific success to its truth. This success justifies the distinction between primary and secondary qualities in both the scientific and philosophical sphere. Locke, then, on this reading was a scientific realist; he argued from the empirical success of a theory, to its truth.

Whilst this is by no means an implausible argument, Mackie notes that it is not immediately apparent that it is the one Locke subscribes to. Mackie says that Locke didn't take over the distinction straightforwardly from Boyle, but argued for the distinction, and these arguments are a "rather mixed bag". Mackie is pleased to note that Locke did refer to the "physical considerations which provide the best support for the distinction - the

causal processes involved in perception". But Mackie is less impressed with the rest of the considerations designed to support the corpuscularian hypothesis in Sections 16 to 21 in Chapter viii, of Book II. Referring to the example of the pounding of an almond in Section 20, Mackie calls this "picturesque", and says that all Locke can possibly get from it is that the experimental result is consistent with his view. Turning his attention to the example of the manna in Section 16, Mackie concedes that since we do say that there is nothing like the pain in the manna we may well infer that there may be other ideas that don't exist as we experience them in the objects. But, says Mackie, this argument gives no reason for supposing that colours, sounds and so on conform to this paradigm case, whereas shape, size etc, don't. (PFL Pg22) Indeed Mackie finds no other support from any of the arguments in the above mentioned sections, saying that "the arguments that Locke explicitly offers add up to something of a case for that primary and secondary quality distinction, but not a very strong one." The main support comes, on what must therefore be an implicit basis, from physics, where, "in Locke's time it had some success ... and it had a fair degree of initial plausibility." (PFL Pg23)

Here Mackie seems to be subscribing to the commonly held view that the arguments given in Sections 16-21 are intended to outline the grounds of the distinction, and as such are simply feeble. But this seems unlikely given that by the time that the arguments are put the distinction has already been made. Rather these Sections are intended to give only indirect support to the corpuscular hypothesis as a whole and this is to be done by showing how lots of puzzling phenomena can be explained simply and economically in terms of matter and motion. Peter Alexander in his book, "Ideas, Qualities and Corpuscles", gives much support to this reading.

Considering the first example in Section 16, we see that Locke is looking at the differing effects of fire on a person at differing distances. We often take it that the warmth we feel is actually in the fire when we place our hand near it, but as it gets closer, we feel pain, which no-one takes to be in the flame itself. Locke does not then go on to say that my sensory input shows this naive view to be mistaken, but rather that we have no reason for accepting it. Why should we say that the heat is in fire, and the pain not, or indeed either of them in it, or in me? The reason for putting both sensations in me, as it were, is that both can be relatively easily explained by the corpuscular hypothesis, and Locke puts this point rhetorically at the end of the passage: "Why is Whiteness and Coldness in

Snow and Pain not, when it produces the one and the other *Ideas* in us; and can do neither but by the Bulk, Figure, Number and Motion of its solid Parts?" Locke here is already taking it for granted that explanations of sensation can only be done in terms of the primary qualities, and so the argument is surely not to make this distinction, but is rather to illustrate its explanatory economy. Section 17 is a further insistence that the ideas of secondary qualities are "*no more really in [bodies], than sickness or Pain is in Manna.*" Section 18 pushes further the parallel cases of pain, or sickness, and the other secondary qualities: "*That the Ideas of Sickness and Pain are not in the Manna, but Effects of its Operations on us, and are no-where when we feel them not: This also everyone readily agrees to. And yet Men are hardly to be brought to think, that Sweetness or Whiteness are not really in the Manna; which are but the effects of the operation of the Manna, by the motion, size and figure of its Particles.*" Section 19 asks how we can say that the ideas of red and whiteness are in the Porphyre when "*'tis plain it has no colour in the dark?*" It only has a "texture", that is to say an arrangement of particles, which at all times is apt to produce in us particular ideas, when the particles of light rebound off it: "But, whiteness or redness are not in it at any time, but such a texture, that hath the power to produce such a sensation in us." In Section 20 Locke notes that in the pounding of an almond the colour and taste change, and what else can be producing this change, but an alteration of the texture of its insensible parts? And finally in Section 21 Locke purports to explain how something may feel both hot and cold to us at the same time; "Whereas it is impossible, that the same Water, if these *Ideas* were really in it, should be at the same time both Hot and Cold." This explanation depends upon a corpuscularian world view where we see temperature as simply the motion of particles effecting our nerve endings, to produce the sensation. If I have one hand whose particles are moving at a great speed, and another, whose particles are very much slower, and if I press both into water whose motions of particles is between these two speeds; then to the first hand the water seems cold, and to the second it feels hot: the motion is reduced in the first hand, and increased in the second, thus producing the differing sensations.

None of these illustrations can be seen as a way to draw or establish the distinction, as it has already been made, and clearly can't be established purely in terms of our sensations, as this is a theory that attempts to correct our sensory input. Rather these arguments are intended to show how the distinction works, to give applications of



it in real life, and from these explain its efficiency, on Alexander's view. The view that this part of the Chapter is an exposition of the benefits of the corpuscularian theory is supported, says Alexander, by the fact that in each of these Sections Locke explicitly mentions the corpuscularian explanation in terms of the bulk, figure, motion and texture of parts. This interpretation is further supported by the admission later on where Locke says that he had been "engaged in Physical Enquiries a little farther than, perhaps, I intended ... I hope, I shall be pardoned this Excursion into Natural Philosophy." This seems clearly to illustrate that the distinction and the foregoing commendations of it were from the natural philosophical realm and that Locke was not intending "to give a philosophical justification, based on experience, for the primary and secondary quality distinction" (IQC Pg129), according to Alexander. "Locke", says the commentator, "was reporting scientific findings to the layman ... thus, if they were arguments at all, they were simply parts of the grand argument of the whole of the Essay for the corpuscular hypothesis and mechanical explanation." (IQC Pg124)

This reading is given further credence for Alexander, by the fact that in these Sections Locke's language and examples often resemble those of Robert Boyle on these points. Alexander, thinks that rather than attempting independent philosophical work, "Locke was not attempting to *make* the primary and secondary quality distinction but was accepting it, ready made, from Boyle" and he "was reporting scientific findings to the layman" (LHU Pg70). So Alexander is correcting Mackie in the interpretation of the arguments of Sections 16-21, but was even more strongly endorsing the view that Locke's considerations were based on the explanatory success of the atomic hypothesis.

So looking at the great similarity of approach and examples we can see that Locke was greatly influenced by the science of the day, and that the distinction between primary and secondary qualities depends entirely on the support given by the corpuscularian programme. This, therefore, would only seem to strengthen the reliance placed on scientific realist considerations for the acceptance of the distinction within Locke's philosophy. It is no surprise therefore to find philosophers who think that scientific realism is at the very heart of Locke's views. One such philosopher is Maurice Mandelbaum who, in his book "Philosophy, Science and Sense Perception" gives a vigorous espousal of his view of Locke as scientific realist. Indeed, the first chapter, entitled "Locke's Realism", purports to solve a lot of the philosophical problems in the

Essay purely in terms of a corpuscularian approach:

"The aim of this essay is to untangle a badly snarled set of problems in Locke's philosophy by picking up a loose end that has not usually been thought to lead to the heart of the tangle. This loose end is to be found in the fact that Locke, like Boyle and Newton, was an atomist. As we shall later see, neither Boyle nor Newton regarded atomism as a speculative or metaphysical system, but as an inductively confirmable theory basic to their new experimental philosophy. Therefore, when one recalls Locke's faith in the achievements of the new science, and his high opinion of Boyle and Newton, ... it is surely not surprising to find him taking the truth of atomism for granted." (PSSP Pg1)

Mandlebaum then goes onto discuss how this world view can help sort out some of what Locke meant when he wrote the Essay. But he does note, as I hope you have by now, that there seems, prima facie, to be something missing from the discussion in Locke. It may well be that Locke's considerations regarding atomism were realist ones, and that they are sound considerations. But Locke doesn't seem to provide any explicit statement that this is the case. Mandlebaum says: "What seems missing is the absence of any attempt to justify the acceptance of that atomism which runs through his discussion of human knowledge." (PSSP Pg60) But Mandlebaum thinks that "Locke did not feel obliged to justify this theory because he not unnaturally viewed it as an empirically based conclusion drawn from the experimental enquiries of the day." (Ibid) In short Locke took it as true on the basis of its experimental success in accounting for the phenomena.

The case then seems firmly to be won; Locke was a corpuscularian, and made this view central to his philosophy. He was justified in doing this because of the inductive confirmation of the hypothesis, and he inferred from the confirmation of the theory, to its truth. Regarding science, therefore, he was a realist.

## Two

Almost the entire thrust of the Berkelerian system can be simply captured by examining what he would do to the famous Lockean tenet "Ideas in the Mind, Qualities in Bodies". Berkeley's treatment would simply have to read: "Ideas in the Mind." That this is the case is clear from the first line of the Principles of Human Knowledge; "It is evident to anyone who takes a survey of the objects of human knowledge, that they are either ideas actually imprinted on the senses, or else such as are perceived by attending to the passions and operations of the mind, or lastly ideas formed by the help of memory or imagination, either compounding, dividing, or barely representing those originally perceived in the aforesaid ways." From this empiricist foundation Berkeley drew some fascinating conclusions, most of which were in direct opposition to the Lockean position.

Aside from ideas themselves there is "something which knows and perceives them ... This perceiving, active being is what I call *mind, spirit* or *myself*." (P 2) But these words "mind", "spirit" etc, do not denote an idea, but denote simply where these ideas exist, or in what they are perceived. Ideas do not exist otherwise than in their being perceived: "There was an odour, that is, it was smelled; there was a sound, that is to say, it was heard." This having been said, to say that some unthinking thing exists is a contradiction. If existence amounts to no more than being perceived, or perceiving, then something that does neither of these things cannot exist: "To be convinced of this, the reader need only reflect and try to separate in his own thoughts the being of a sensible thing from its being perceived." (P 6) This places the entire world into the mental realm; there is no *matter* out there causing our ideas, nor could there be, and even if there were such a thing it would be entirely superfluous, for how could a non-mental thing cause or even resemble anything in the mental realm?

The next phase of Berkeley's program is to delineate the roles and properties of the world as he sees it; i.e. what is the relation between ideas and spirits? In Section 25 Berkeley comes to consider what ideas do. "All our ideas," he says, "are visibly inactive, there is nothing of power or agency included in them." And we know this by a "bare observation of our ideas." For since all and every part of them exist only in the mind, it follows that there is nothing in them that is not perceived. And in attending to our own ideas we see there is no activity in them at all: "A little attention will discover to us that the very being of an idea implies passiveness and inertness in it, in so much that it is

impossible for an idea to do anything, or, strictly speaking, be the cause of anything." Two important points are made here. Firstly that our ideas are transparent, in that there is nothing in them that we do not perceive. Secondly our ideas are completely inert and can be the cause of nothing. But, if ideas truly are inert, where does the continual succession of them that we perceive, come from? Clearly it can't be an idea that causes them, due to their causal inactivity, nor can it be some material substance, "it remains therefore that the cause of ideas is an incorporeal active substance or spirit."

That a spirit should be ascribed the power of agency is not a problem at all: "For I find that I can excite ideas in my mind at pleasure ... it is no more than willing and straight away this or that idea arrives in my fancy." (P 28) So spirit or immaterial substance can be seen to be a causal agent.

But this, of course, only covers the ideas I can excite in my imagination and most of my sensation comes not from memory, but from something independent of me. Berkeley notes that "When in broad daylight I open my eyes, it is not in my power to choose whether I shall see or no ... the ideas printed on [the senses] are not the creation of my will. There is therefore some other will or spirit that produces them." (P 29) The sensations that make up our everyday experiences are stronger and livelier than the ideas of our imagination and they form a steady train according to "set rules" and "established methods" that are "Laws of Nature"; "these we learn by experience, which teaches us that such and such ideas are attended with such and such other ideas, in the ordinary course of things." (P 30) These ideas "imprinted on the senses by the Author of Nature are called *real things*." And indeed the Author of Nature, being so benevolent to us, as to give us this useful "foresight, which enables us to regulate our actions for the benefit of life," (P 31) and "*in whom we live, move and have our being*" (P 66) is simply God.

This lightening tour, then, gives us a rough appraisal of the Berkelerian system and the important elements in it. All knowledge having come from experience we can think of nothing outside of this sensory realm, so that a posited material substance behind these sensations must be inconceivable, and therefore non-existent. It is only mind or spirit, and the sensations which inhere in them, that can be said to exist. Only minds are active, and the active spirit that creates the ideas we sense from outside of us is God.

Straightforwardly we can see how Berkeley will have taken great exception to the corpuscular philosophy put forward by Locke and will have presented many contrary

points of view. It should be noted at this point though, that I will try to steer clear of the "relativity" considerations Berkeley is supposed to have ascribed to Locke in the latter's formulating of the primary and secondary quality distinction. It does indeed seem that Principles 14 and 15 rails against the arguments Locke used in II.viii.21, and similar arguments are to be found in the Three Dialogues, especially on pages 187 to 189. But whilst they do seem to be an attack on Locke they could be construed as a way for someone sceptical to the idealist position to have more respect for it. If they were to concede that sounds, tastes, etc were only mental, they would be forced to agree that motions, extensions, etc are also ideas and thus exist only in the mental realm. While the interpretation of these arguments is a matter of much contention, it is clear that Berkeley was aware of the claim that the corpuscularian philosophy gained support from being an explanation of the origins of our ideas and set about removing the purported explanatory success. It is to this endeavour of Berkeley's that we now turn.

At the beginning of the Second Dialogue Hylas agrees that he has not been able to reject the previous days conclusions, as long as he keeps in mind the reasons for them. "But," he says, "when these are out of my thoughts, there seems on the other hand something so satisfactory, so natural and intelligible in the modern way of explaining things, that I know not how to reject it." (3D Pg208) This modern way of explaining things, "the way of accounting for our sensations and ideas" is a corpuscularian one: Hylas elaborates "it is supposed that the soul makes her residence in some part of the brain, from which the nerves take their rise, and are thence extended to all parts of the body: and that outward objects by the different impressions they make on the organs of sense, communicate certain vibrative motions to the nerves; and these being filled with spirits, propagate them to the brain or seat of the soul, which according to the various impressions or traces thereby made on the brain, is variously affected with ideas." (3D Pgs208-9) Philonous response to this "modern way of explaining things" is more than a little contemptuous: "And you call this an explication of the manner whereby we are affected with ideas?" He objects firstly that the brain here used by Hylas in the explanation is a sensible thing, and sensible things, being but collections of ideas, exist only in the mind. This entails the ridiculous notion that one idea existing in the mind causes all the others. But even if Hylas were able to get this causal account of how one idea could cause the others, up and running, he should still have made no explanatory

headway at all. Philonous notes that "after all, this modern way of explaining things, as you called it, could never satisfy any reasonable man. What connexion is there between a motion in the nerves, and the sensation s of sound or colour in the mind? Or how is it possible this should be the effect of that?" (3D Pg210) In looking at the corpuscularian explanation of the production of our ideas, and even allowing a corpuscular matter with its primary qualities, the hypothesis explains nothing at all.

So, Berkeley, far from missing the central explanatory argument for the adoption of the corpuscular hypothesis, having put all his eggs in the perceptual relativity basket, has put a large amount of pressure at its most vulnerable point: "[H]ow matter should operate upon spirit, or produce any idea in it, is what no philosopher will pretend to explain." (P 50) Thus Berkeley felt that he had every right to reject this sort of explanation, even on the home ground of the corpuscularians. Moreover, he felt that he could retain most of the results of the philosophy in his own system without recourse to this unthinking substratum. In Section 50 of the Principles he hypothesises that if you take away matter and motion "you destroy the whole corpuscular philosophy, and undermine these mechanical principles which have been applied with so much success to account for the phenomena." To which he replies that "there is not any one *phenomenon* explained on ... [the corpuscular] ... supposition, which may not as well be explained without it, as might easily be made to appear by an induction of particulars." "Besides," he continues, "those who attempt to account for things, do it not by corporeal substance, but by the figure and motion and other qualities, which are in truth no more than mere ideas." But recalling from Section 25 that ideas are "visibly inactive", to say that our sensations "are the effects of powers resulting from the configuration, number, motion and size of corpuscles, must certainly be false." We can thus see Berkeley as hostile to the corpuscular philosophy as an account of the cause of ideas in us.

This much, then, can be gleaned from a relatively straight forward reading of Berkeley's philosophical writings. This is not to delineate the whole of his philosophy of science, however; the fact that he rejects one theoretical account of the properties of bodies tells us little of his views of science in general. And it is a fact that few commentators have regarded as especially significant his rejection of mechanistic explanation in terms of his approach to the aim and structure of scientific theory. Scholars have, for the most part, concentrated on the very interesting critique of Newtonian theory

that Berkeley gave and most of these criticisms were laid out in his work of 1721, "De Motu". It is usually from this source that most noted philosophers have attempted to decipher Berkeley's views, and it is to these attempts that we now turn.

Karl Popper was struck, when reading Berkeley's Newtonian critique, how very modern his approach was, and wrote a short commentary on this, seeing Berkeley as a pre-cursor to Mach and Einstein. In this article Popper lists twenty one theses of Berkeley's "in the field of the philosophy of physics which have a striking new look." These, says Popper, "are mainly ideas which were dismissed and re-introduced into the discussion of modern physics by Ernst Mach and Heinrich Hertz." This is no small praise, as it was the development of Mach's philosophy that led to the Einsteinian revolution.

The first thing that Popper wants us to note is Berkeley's views on meaning: "The meaning of a word is the idea or sense-quality with which it is associated." Thus, for a Popperian Berkeley, words that do not stand for a sensation or reflection can have no meaning. Berkeley felt that some of the concepts on Newtonian dynamics fell into this category, not least the posits of absolute space and time. For example in De Motu 53 he considers what it would be like for this absolute space to remain alone in the universe: "that space is infinite, immovable, indivisible, insensible, without reaction and without distinction ... it seems therefore to be a mere nothing. The only slight difficulty arising is that it is extended, and extension is a positive quality ... But what sort of extension, I ask, is that which cannot be divided, or measured, no part of which can be perceived by sense or pictured by the imagination? From absolute space then let us take away the name, and nothing will remain in sense, imagination, or intellect." So, since the word stands for no sensible quality at all, the word stands for nothing. Similarly for time: there can be no meaning to absolute time, separate from a succession of ideas in our mind; "Whenever I attempt to frame a simple *idea* of time, abstracted from the succession of ideas in my mind, which flows uniformly, and is participated in by all beings, I am lost and embrangled in inextricable difficulties. I have no notion of it at all." (P 98) Again the words "absolute time" have no meaning as you simply can't separate our perception of time from a particular succession of ideas in our minds. So, rather than positing absolute space and time, we use the relative measures; ones that are sensible to us. So in the case of "the philosophers of mechanics who take a wider view of the system of things, it would be enough to bring in, instead of absolute space, relative space, as confined to the heavens

of the fixed stars, considered as at rest." (DM 64) Time is similarly treated "[it] being nothing, abstracted from the succession of ideas in our minds, it follows that the duration of any finite spirit must be estimated by the number of ideas or actions succeeding each other in the same spirit or mind." (P 98) These are relativistic meanings, but, for Berkeley the only conceivable ones, as they alone can be attached to sense experience.

Thus motion, the central feature of the tract cannot be said to be absolute, and must be gauged to take place in relation to other bodies. This view is neatly summed up in De Motu 63:

"No motion can be recognised or measured, unless through sensible things. Since then absolute space in no way affects the senses, it must necessarily be quite useless for the distinguishing of motions. Besides, determination or direction is essential to motion; but that consists in relation. Therefore it is impossible that absolute motion be conceived."

This deals largely with the absolute metrics used in Newtonian dynamics, and from his metaphysical principles Berkeley re-interprets all of these to their relative, and therefore perceivable counterparts. What though, of the substance of the Newtonian system; the three laws of motion and the law of universal gravitation? How are the concepts of "force" and "gravity" to be used? Dealing with gravity first, Berkeley notes our sensations of supporting heavy bodies, and our perceptions of other bodies falling in an accelerated motion toward the earth; about gravity or force "this is all the senses tell us." (DM 4) He continues "By reason, however, we infer that there is some cause or principle of the phenomena, and that it is properly called *gravity*." But since we cannot perceive what the cause of the fall of a heavy body is, gravity cannot truly be called its cause - "gravity in that usage cannot be properly styled a sensible quality." (Ibid) It is thus an "occult quality", and these can explain nothing intelligibly. According to Berkeley we similarly attribute to bodies "*force*", separate from all their sensible qualities, but again, without any sensory referent this term is empty, and therefore occult. So when natural philosophers set down gravity or force separate from the concrete motions we can see and feel they breed "errors and confusion", as "it is idle to lay down gravity or force as the principle of motion; for how could that principle be known more clearly by being styled on an occult quality?" (DM 6) Again we should eschew these "absolute" notions: "those terms *dead force* and *gravitation* by the aid of metaphysical abstraction are supposed to mean something different from moving, moved, motion and rest, but, in point of fact, the



supposed difference in meaning amounts to nothing at all." (DM 11) Once more we are to replace the absolute, which "gives rise to various exceedingly difficult opinions (not to say absurd)" and concentrate "on the particular and the concrete, that is on the things themselves." (DM 4)

At this point Popper says that Berkeley rules out Newtonian theory as truly causal, or discovering any essential qualities of bodies; "The view that gravity causally explains the motions of bodies, or that Newton discovered that gravity or attraction is an "essential quality" whose inherence in the essence or nature of bodies explains the laws of their motions must be discarded." (C+R Pg168) But we do not want to throw out the fantastically unifying and predictive baby with the metaphysically unsound bath water. We want to retain the empirical success of the theory, but get rid of the causal connotation so, "*Force, gravity, attraction*, and terms of this sort are useful for reasonings and reckonings about motion and bodies in motion, but not for understanding the single nature of motion itself or for indicating so many distinct qualities. As for attraction, it was certainly introduced by Newton, not as a true, physical quality, but only as a mathematical hypothesis." (DM 17) If we do "distinguish mathematical hypotheses from the nature of things ... all the famous theorems of the mechanical philosophy by which the secrets of nature are unlocked, and by which the system of the world is educed to human calculation, will remain untouched." (DM 66) The reason that Popper attributes to this move on Berkeley's part is that "in physics there is no causal explanation i.e. no explanation based upon the discovery of the hidden nature or essence of things ... [because] ... physical things have no secret or hidden, true or real nature, no real essence, no internal qualities." He quotes in support of this view Principles 25 and 101. He then concludes that, for Berkeley, "there is nothing physical *behind* the physical bodies, no occult physical entity. *Everything is surface*, as it were, physical bodies are nothing but their qualities. Their appearance is their reality." (C+R Pg168)

Popper reads Berkeley as saying that the aim of science is the construction of Laws of Nature "that is to say, of the regularities and uniformities of natural phenomena. "These are learnt by experience and teach us that some phenomena are regularly followed by others. Once such a law is found, Berkeley says that the job of the natural philosopher is to "show of each phenomena that it is in conformity with those laws, that is necessarily follows from these principles." (DM 37) But here there is no causation - although we may

use the word, as long as we remember that it is only being used in a secondary, vulgar sense: Berkeley says "The physicist studies the series or successions of sensible things ... what precedes as cause and what follows as effect. And on this method we say that the body in motion is the cause of motion in the other .. In this sense second corporeal causes are to be understood, no account being taken of the actual seat of the forces or of the active powers or of the real causes in which they are." (DM 71)

From these Laws of Nature we are to distinguish "mathematical hypotheses". Such a thing, in Popper's words, "is a mere formalisation, or mathematical tool or instrument ... [which] .. is judged merely by its efficacy." (C+R Pg169) These are neither true nor false, merely useful. For Berkeley "[Mathematical hypotheses] serve the purpose of mechanical science and reckoning; but to be of service to reckoning and mathematical demonstration is one thing, to set forth the nature of things is another." (DM 18) So, regarding Newtonian theory, we can keep the laws of nature as far as they are true or false, but the conceptual side must be parsed down. The absolute measures must go, to be replaced with relative counterparts, but the laws of motion can remain, and that of gravitation can remain as a useful calculating tool, but neither of these latter posits describe a causal structure. According to Popper they erect "a fictitious mathematical structure behind that of appearance, but without the claim that this world exists." (C+R Pg169) Such theories that do claim that this world exists, though, must necessarily be meaningless, as the words used can stand for no ideas and are therefore vacuous.

This can be seen from the fact that the same appearance *may* be successfully calculated from more than one mathematical hypothesis, when the mathematical hypotheses which yield the same results concerning the calculated appearances may not only differ, but even contradict each other. Berkeley explains: "It is clear, moreover, that force is not a thing certain and determinate, for the fact that great men advance very different opinions, even contrary opinions, about it, and yet their results attain the truth ... Newton and Torricello seem to be disagreeing with one another ... [but] the thing is sufficiently well explained by both. For all forces attributed to bodies are mathematical hypotheses ... But mathematical entities have no stable essence in the nature of things; and they depend on the notion of the definer. Whence the same thing can be explained in different ways." (DM 67)

Popper sees this rejection of metaphysical causal explanations, the adoptions of

instrumental hypotheses, and the reduction of laws of nature, to be a very modern view, that he christens "Berkeleyian or Machian positivism or instrumentalism" (C+R Pg173). In doing so he explicitly identifies Berkeley's views with the positivistic construal of scientific theories popular from the beginning of the century to the sixties. Indeed, in a footnote to this article Popper says that "Moritz Schlick, under the influence of Wittgenstein, suggested an instrumentalist interpretation of universal laws which was practically equivalent to Berkeley's "mathematical hypotheses"." (C+R Pg166)

Popper then, views Berkeley as firmly in the instrumentalist camp with regard to the philosophy of science and immediately after his summary of what he takes the four main Berkeleyian theses to be (C+R Pg170), he expands these conclusions to the other scientific areas of interest: "These results," says Popper, "clearly apply to cases other than Newtonian theory, for example to atomism (corpuscular theory). In so far as this theory attempts to explain the world of appearances by constructing an invisible world of "inward essences" behind the world of appearances, it must be rejected." (C+R Pg170) And again: "Berkeley and Mach are both convinced that there is no physical world (of primary qualities, or of atoms) behind the world of appearances." (C+R Pg173) To support this view Popper quotes Principles 102: "the current opinion [is] that everything includes within itself the cause of its properties, or that there is in each object an inward essence, which is the source whence its discernible qualities flow, and whereon they depend. Some have pretended to account for appearances by occult qualities, but of late they are mostly resolved into mechanical causes, to wit, the figure, motion, weight and such like qualities of insensible particles: whereas in truth, there is no other agent or efficient cause than *spirit* ... Hence to endeavour to explain the production of colours or sounds, by figure, motion, magnitude and the like, must needs be labour in vain." In addition to this Popper quote Principle 50, which we have already looked at, and *Siris*, Sections 232 and 235. These latter passages I will omit for the moment for the sake of brevity.

This view of Berkeley as an instrumentalist is far from a unique one; in his commentary on Berkeley, G.J. Warnock takes a very similar standpoint to that of Popper. Again Warnock notes Berkeley's pre-occupation with Laws of Nature as the aim of the scientist, but again runs up to problems with "insensible corpuscles". "How could Berkeley accept such talk as this?" (B Pg202) Warnock states that "occasionally ... [Berkeley] seems inclined to dismiss it as mere verbiage, implying that scientists' "rules"

can be adequately described in terms only of ordinary objects ... these he could accept as "collections of ideas". But, according to Warnock, Berkeley later came to the view that these theories involving "insensible corpuscles" could not easily be parsed away into observable objects, so, for example, in the "Theory of Vision Vindicated and Explained", "Berkeley recognised that the nature and motion of light and the theory of optics were commonly discussed in terms of the motions of "insensible particles", and he recognised the value of the proceeding." (Ibid) Warnock said that "he could ... have maintained that these so-called "insensible particles" were in fact perceived by God and were thus no exception to his principles: but he was not satisfied with this arbitrary-looking solution." So, according to Warnock, Berkeley does not say there are any such particles or corpuscles, rather, "he relied on a distinction between the *observed facts* of science, and the *theories* constructed to comprehend them." (Ibid)

Taking De Motu as his source, Warnock sets out a Berkelerian argument like this one: In the formulation of Laws of Nature we may be "enormously assisted if we *suppose* light (for instance) to consist in the emission of insensible particles." With the help of this supposition we can, from a few general rules and principles mathematically derive a wide range of empirical results. "Thus are derived," continues Warnock, "a number of special concepts - "particle", "atom" and the like - which are used, not in order to describe any observed *facts*, but in stating the general theory by which it is sought to account for such facts" (B. Pg203). So, Warnock adds, "The scientist has not really discovered that *there are* "insensible particles"; it is rather that it suits his purposes as a theorist to *say so*." (Ibid)

This view of Berkeley is shared and further expounded by W.H. Newton-Smith, who attributes to Berkeley a philosophy of science called "semantic instrumentalism" where "theoretical sentences are held not to have been provided with the kind of meaning that gives them truth values ... Their role is not to express facts about the world but to facilitate the business of making correct empirical predictions." (EOB Pg150) This sort of philosophy of science was ranged against the realist inferences that "led to the presumption that it was possible to determine whether these theoretical sentences were on fact true or not." (EOB Pg151) In other words the realist would infer the existence of the actual theoretical entity which, in Berkeley's time, "had come to include such entities as corpuscles, magnitudes such as mass and gravitational attraction and *sui generis* items like

absolute space." (Ibid) So Berkeley's instrumentalism was to reject the truth or falsity of these sentences involving such entities; they are only fictitious and used for calculations.

"That Berkeley held this view," according to Newton-Smith, "in at least embryonic form is illustrated in the following passages:" Here he first refers to De Motu 17 which we have already discussed, and to De Motu 35, where Berkeley says, "It is not, however, in fact the business of physics and mechanics to establish efficient causes, but only the rules of impulsions and attractions, and, in a word, the laws of motions, and from established laws to assign the solution, not the efficient cause of a particular phenomena."

So, again we are to reject the corpuscular account of the properties of bodies as meaningless, but accept such suppositions as allow us to make the correct empirical predictions, and in this view we seem to have it that Berkeley does indeed fit into the instrumentalist camp in the philosophy of science. Theories are not to attribute unknown or unseen causes at all, but can contain mathematical hypotheses as long as they save the phenomena. These hypotheses are neither true nor false, but are merely instruments. In this way we can see Berkeley strongly rejecting the realist line Locke seems to have defended; Berkeley refuses to infer to the best explanation.

"What obscurity this has unavoidably brought upon the Writings of Men, who have lived in remote Ages, and in different Countries, it will be needless to take notice."

Locke, Essay, III.ix.10.

### Three

Things, then, seem quite simple: Locke relied on the scientists of the day to provide him with an account of matter, and this they did in the form of the corpuscularian hypothesis. This theory postulated the unobservable causes of observable phenomena, and the reason that it was accepted by Locke and his contemporaries was that it best saved the phenomena. It was, we are told, a classic case of inference to the best explanation. Berkeley, on the other hand, outright rejects this form of reasoning. Just because it's successful doesn't mean it's true. Indeed, the theory is strictly meaningless on a Berkelerian view, we are told. But that doesn't mean that it isn't useful for empirical prediction making; "insensible particle" talk is just a convenient fiction to help save the phenomena. So, when we accept a corpuscularian theory of the propagation of light, for example, we don't accept that light really *is* made up of tiny particles, its just that if we pretend it is we can do better predictions.

Whilst this view of these two philosophers is certainly tempting, I shall argue that it is strictly false. With this in mind I turn to Locke's attitude to the acquisition of empirical knowledge from the postulation of unobservable corpuscular mechanisms, those that are sub-microscopic in the Lockean milieu. It is first requisite to define what "empirical knowledge" and "sub-microscopic" will mean in the following discussion. The latter is most easily dealt with, and can be usefully expanded to the phrase "so small as to be imperceptible to a human using the best available instruments". "Empirical knowledge" does not here correspond to Locke's own use of the term "Knowledge", which was one of theoretical certainty: "*Knowledge* then seems to me nothing but *the perception of the connexion or agreement, or disagreement or repugnancy of any of our Ideas*. In this alone it consists." (IV.i.2) Anything less than this certainty, for Locke, doesn't count as something we know: "Where this Perception is, there is Knowledge, and where it is not, there, though we may fancy, guess, or believe, yet we always come short of Knowledge." (Ibid) This is not the sort of knowing that we are presently concerned with; by empirical knowledge we will mean practical propositions that describe the well founded behaviour of observable things in various circumstances. So that we could say that "antibiotics will cure measles", or "distillation will separate water from alcohol" and it is with this sort of practical method for achieving various outcomes that we shall concern ourselves.

The corpuscular hypothesis presents itself as a candidate for use in this context,

for it purports to account for the behaviour of observable properties solely in terms of unobservable sub-microscopic mechanisms. This candidacy has four main requirements for the belief that such a hypothesis will be useful for the acquisition of such empirical knowledge. First any hypothesis that will give us empirical knowledge from the postulation of unobservable mechanisms, must assume that most, if not all, of the observable properties of bodies are dependent on unobservable phenomena. Secondly, such a candidate must state that if we could discover the nature of such unobservable events we could discover the powers of an object, a lot faster than by just observing it, by looking for the correlations between observable events. Next we need to presume that the fact that such processes are sub-microscopic will not prevent us from manipulating them, and so, through them, observable events. Finally we need to have grounds for believing that the nature of these sub-microscopic events will be discoverable to us. We need to be sure in these four points in order to have any belief at all in the usefulness of a hypothesis postulating unobservables as a means to empirical knowledge.

There are notes scattered throughout the Essay, and his other writings, that, when carefully considered, should shed some light on Locke's views on theories that postulate sub-microscopic entities. That Locke believed there to be sub-microscopic events that are causally responsible for the observable events in everyday experience, is beyond doubt, as whatever the reasons are for his holding the corpuscularian theory, there is no question that he actually held it. He says: "I have here instanced in the corpuscularian Hypothesis" (IV.iii.16). He also used the corpuscularian theory to draw a distinction between things as they appear to us, and as they are *in rerum natura*. For example he draws a distinction between the ideas we have of substances - which he calls the "nominal essence" of the substance - and the real essences of substances: "The *real essence*," then, "is that constitution of the parts of matter on which these qualities and their union depend." (III.vi.6) and "insensible corpuscles are the active parts of Matter, and the great Instruments of Nature, on which depend not only all secondary qualities, but also most of [the] natural operations." (IV.iii.25)

Locke also held that a deductive science of bodies was perfectly possible; if you had the "blueprints" of things and the laws of nature, then you could know without trial the powers of things:



"Had we such *Ideas* of substances, as to know what real Constitutions produce those sensible qualities we find in them, and how those qualities flowed from thence, we could, by the specific *Ideas* of their real essences in our Minds, more certainly find out their Properties, and discover what Qualities they had, or had not, than we can now with our senses: and to know the properties of *Gold*, it would be no more necessary that *Gold* should exist, and that we should make experiments upon it, than it is necessary for knowing the properties of a Triangle, that a triangle should exist in any Matter, the *Idea* in our minds would serve the one, as well as the other." (IV.vi.11)

So, that there are sub-microscopic mechanisms, and that a full knowledge of these would allow us to deduce the properties of bodies *a priori*, Locke did not doubt. But there are no examples of Locke conceding that he thought we had any practical hope of using this deductive science of bodies. For Locke, to tell how bodies behave when placed in various changed circumstances is to know to what species the objects belongs to, and this is determined by observable appearances. That this is the case is outlined forcibly and repeatedly in Book III of the Essay (See, for example, III.iii.12+13). And that this is the sort of empirical knowledge we will acquire in enquiring into the powers of bodies is illustrated by the following passage:

"For our *Ideas* of the Species of Substances, being, as I have shewed, nothing but certain collections of simple *Ideas* united in one common subject and so co-existing together: v.g. our *Idea* of *Flame* is a Body, hot luminous and yellow ... When we would know anything further concerning [this] or any other substance, what do we enquire but what other Qualities, or Powers, the Substances have, and have not? Which is nothing else but to know, what other simple *Ideas* do, or do not co-exist with those that make up our complex *Idea* ." (IV.iii.9)

But that this knowledge is based purely upon previous observation of co-existing qualities, i.e. the nominal essence of a thing (how we fit it into a species category), and is not knowledge of the real essence of that thing is illustrated by our mistaken supposition of this nominal for real essence:

"That the *Species of Things to us, are nothing but the ranking them under the distinct names according to the complex Ideas in us; and not according to the precise, distinct real Essences* in them, is plain from hence; That we may find many of the individuals that are ranked into one sort, called by one common name, and so received as being of one sort of Species, have yet Qualities depending on their real constitutions, as far different from one another, as from others, from which they are accounted to differ *specifically*." (III.vi.8)

So Locke warns against taking our complex ideas of substances as the real constitutions of things, as this can often lead us to make mistakes in the assumptions as to what qualities bodies can have. Yet he specifically recommends the use of these species names as the foundation of our knowledge of bodies. Why? He does this for the same

reason that he generally refuses to consider the possibility of interfering in the sub-microscopic mechanisms in order to produce the desired observable event. That is, he denies the possibility of ever producing any account of the sub-microscopic mechanisms to the sort of specificity that would make the outcome of a desired observable event even probable, let alone certain.

The evidence that Locke thought sub-microscopic hypotheses mostly useless in the acquisition of empirical knowledge, comes in two basic forms: Firstly, he repeatedly and emphatically states that we are utterly ignorant of any sub-microscopic phenomena, and will remain in the dark in this respect. And the second strand of evidence concerns the method that Locke recommended to enable you to arrive at any sort of the empirical knowledge we have been talking about. It is to a consideration of these two points that I now turn.

Most of the examples of Locke's refusal to countenance these hypotheses appeared in R.M. Yost's 1951 article, so I will here summarise the main points that he sees Locke as making. That Locke was aware of the advances being made in microscopy it is impossible to doubt and he often mentions these advances, even speculating as to how things will appear when we have powerful enough instruments to see the corpuscles. Indeed, he uses these contentions to illustrate the distinction between primary and secondary qualities:

"Had we Senses acute enough to discern the minutest parts of Bodies, and their real Constitution on which their sensible qualities depend. I doubt not but they would produce quite different *Ideas* in us; and that which is now the yellow Colour of Gold, would then disappear, and instead of it we should see an admirable Texture of parts of a certain Size and Figure. This Microscopes plainly discover to us ... Thus Sand, or pounded Glass, which is opaque, and white to the naked eye, is pellucid in a Microscope ... Blood to the naked Eye appears all red; but by a good Microscope, wherein its lesser parts appear, shews only some few Globules of Red, swimming in a pellucid Liquor." (II.xxiii.11)

Despite this, though, Locke had grave doubts that we have got any ideas of the constitutions of things:

"Nor indeed *can we rank, and sort Things ... by their real Essences*, because we know them not. Our Faculties carry us no farther towards the knowledge and distinction of Substances, than a collection of those simple *Ideas*, which we observe in them ... There is not so contemptible a Plant or Animal that does not confound the most enlarged Understanding ... When we come to examine the Stones we tread on; or the Iron, we daily handle, we presently find, we know not their Make, and can give no Reasons, of the different Qualities we find in them. 'Tis evident the internal Constitution, whereupon the Properties depend, is unknown to us." (III.vi.9)

That even the best scientists of the day were "ignorant" of the internal constitution of matter, Locke was also sure:

"The clearest, and most enlarged Understandings of thinking Men find themselves puzzled, and at a loss, in every Particle of Matter." (IV.iii.22)

The reason why we are in this predicament of ignorance regarding the qualities of bodies, is because of the nature of what is being asked: What is requisite for our knowledge of substances

"is in truth, no less than to know all the Effects of Matter, under its divers modifications of Bulk, Figure, Cohesion of Parts, Motion and Rest. Which, I think everyone will allow, is utterly impossible to be known by us, without revelation." (IV.vi.14)

This last remark regarding revelation hints at why it was that Locke thought, despite our improving microscope technology, we were forever likely to be destitute of the faculties needed for a penetration in to the constitutions of things. Continuing his discussion directly after his talk about the use of microscopes, Locke elaborates on why our faculties are set at the level they are, and not at some different, and perhaps more enlightening level:

"The infinite wise Contriver of us, and all things about us, hath fitted our Senses, Faculties and Organs, to the conveniences of Life, and the Business we have to do here ... But it appears not, that God intended, we should have a perfect, clear and adequate Knowledge of [the constitution of things]: that perhaps is not in the Comprehension of finite Being. We are furnished with Faculties (dull and weak as they are) to discover enough in the Creatures, to lead us to the Knowledge of the Creator, and the knowledge of our Duty; and we are fitted well enough Abilities, to provide for the conveniences of living: These are our Business in this World." (II.xxiii.12)

Locke goes on to elaborate that had we senses acute to the minutest things, the world would be so different to us that we could not practically get on in life: If we could see what a mite sees, then we could detect the texture of bodies, but could not converse in the market place; if we had fantastically acute hearing we could hear lots that passes ordinary people by, but could never sleep because of the eternal noise. God, in Locke's opinion, has fitted our faculties to our daily business of life, and for our practical convenience, but just has not set them to penetrate into the internal fabric of bodies, as this would detract from our ability to do what we have to on earth.

This constitutes the case that Locke, throughout his work, as his comments are far from limited to those given above, rejected the idea that we could know or be acquainted

with the internal constitution of things, so as to be able to discover their qualities. That this is so is further strengthened by his discussion regarding the methods that one should employ for the acquisition of such empirical knowledge. Because we cannot get ideas of the real essences of bodies we have to content ourselves with the recording of the observable qualities that bodies exhibit. Rather than chase after ideas of these mechanisms ("it is lost labour to seek after it" (IV.iii.29)), he wanted people to classify things and perform trials on the basis of the "characteristical notes and marks" (II.xxiii.8), i.e. the ideas we have of the secondary qualities, that we use to distinguish different substances. His method was "historical":

"In the Knowledge of Bodies, we must be content to glean, what we can, from particular Experiments: since we cannot from a Discovery of their real Essences, grasp at a time whole Sheaves; and in bundles, comprehend the Nature and Properties of whole Species together. Where our Enquiry is concerning Co-existence or Repugnancy to co-exist, which by Contemplation of our *Ideas*, we cannot discover; there Experience, Observation and natural History, must give us by our Senses, and by retail, an insight into corporeal Substances." (IV.xii.12)

As Yost puts it, "This was the method of trial, experiment, observation and inference to observable, but unobserved, by means of "wary analogy"." Referring to the causes and observable effects that take place in the observable events of everyday, Locke says that "in there we can go no farther than particular experience informs matter of fact, and by Analogy to guess what Effects the like Bodies are, upon other tryals, like to produce." (IV.iii.29) But while this produces no theoretically certain knowledge, it does have its use and can lead to discovery:

"Possibly inquisitive and observing men may, by strength of *Judgement*, penetrate farther, and on Probabilities taken from wary Observation, and Hints well laid together, often guess right at what experience has not yet discovered to them. But this is guessing still." (IV.vi.13)

We should take careful note of the scope that this sort of analogy and guessing is restricted to; it is not referring to the sub-microscopic realm, but is concerned solely with regularities between observables. Although Locke didn't spell out clearly what he meant by "Analogy" in an experimental context in the Essay, he did delineate its meaning in "Of the Conduct of the Human Understanding". This was a short treatise that Locke wrote as addition to the Essay, and it would have been one of its longest chapters, if Locke had revised it before he died. Whereas most of the Essay sought to outline what the human understanding *can* do, the "Conduct" was an attempt at saying how it *ought* to be

employed. In the *Conduct*, Locke spelt out exactly what the term "Analogy" was supposed to mean with respect to natural philosophy:

"Analogy is of great use to the mind in many cases, especially in natural philosophy, and the great part of it which chiefly consists in happy and successful experiments. But here we must take care that we keep ourselves within that wherein the analogy consists. For example, the acid oil of vitriol is found to be good in such a case, therefore the spirit of nitre or vinegar may be used in like case. If the good effect of it be owing wholly to the acidity of it, the trial may be justified; but if there be something else besides the acidity of the oil of vitriol, which produces the good we desire, we mistake that for analogy, which is not, and suffer not the understanding to be misguided by a wrong supposition of analogy where there is none." (C 40)

This sort of analogy that Locke was referring to in these passages, then, was one based on observable qualities alone. It was not one of inference from observed effect to unobservable causes, but was rather the comparison of two observable substances having like properties: the analogy stands and falls in the observable realm.

So, the job of the natural philosopher for Locke seems to be that of an experimenter and recorder of the co-existence, or repugnancy of qualities in substances, who, through examining the observable qualities of several bodies may be able, through this use of analogy, to guess at what qualities a body may have, prior to an experimental trial. None of this seems to require the postulation of unobservable mechanisms, but depends on a historical, inductive, approach to natural philosophy.

Locke, though, was clearly not unaware that there were inferences being made about these mechanisms, and attempted to outline what sort of epistemic status these propositions would have, separate from the sort of science he has been illustrating. The discussion of the mechanisms, "which sense cannot discover" occurs towards the end of Book IV, after his discussion of the methods of natural science, discussed above. The relevant passage, IV.xvi.12, begins by prefacing that all that had gone before had concerned only observable mechanisms: "The Probabilities we have hitherto mentioned, are only such as concern matters of fact, and such Things as are capable of Observation and Testimony." There is therefore, another sort of probability concerning things "that *falling not under the reach of our Senses, they are not capable of Testimony.*" This type of probability falls, for Locke, into two main categories: First, those things that are spiritual, and we can have no sensory experience of, or those things that are so small or far away from us as to preclude our having any ideas of them. And, second "Concerning the manner of Operation in most parts of the Works of Nature: wherein though we see

the sensible effects, yet their causes are unknown, and we perceive not the ways and the manner how they are produced." So for example we can see that a magnet attracts iron filings but we have no conception of the manner in which this happens. We can only guess why it happens, and the gauge by which we judge the guesses is as follows: "For these [guesses] not coming within the scrutiny of the humane Senses, cannot be examined by them, or be attested by anybody, and therefore can appear more or less probable, only as they more or less agree to Truths that are established in our Minds, and as they hold proportion to other parts of our Knowledge and Observation." The criterion of success in this area, then, is that a proposition on these matters concurs with our everyday experience. Locke then sums up his criterion as follows: "*Analogy* in these matters is the only help we have, and 'tis from this alone that we draw all our grounds of Probability." Here, Locke sums up the requirement in terms of "*Analogy*", but this is clearly not the same sort of analogy that was spelt out with regard to observable phenomena. This new usage is introduced as a technical term referring to those cases when we have no sensory testimony, and that it is a technical usage is attested to by the fact that Locke uses italics to highlight it. This contrasts with all the other uses of the word "Analogy" in the Essay, where it is used without italicisation, and in a non-specific way. This is indeed often the case in the Essay; that when Locke wants to introduce a new term that is different from common usage, he will italicise it, so as to separate it from what it is usually taken to mean.

Locke then illustrates how this new sense of "*Analogy*" might work: "Thus observing the bare rubbing of two Bodies violently upon one another, produces heat, and very often fire it self, we have reason to think, that what we call Heat and Fire, consists in a violent agitation of the imperceptible minute parts of burning matter." So, since on the observable level we see motion and heat as correlates, we can conjecture that motion and heat are correlates at the unobservable level too. Locke also cites two other examples. He first talks of the properties of pellucid bodies and how they produce several colours, and since in watered silks, a similar phenomenon occurs, we can conjecture that the colours of bodies are nothing but the arrangement of insensible parts. Finally Locke notes that there seems to be below us a gradual move upward in "degrees of perfection", from earth, to vegetable, to animal, to man, so "the rule of Analogy may make it probable, that it is also in things above us [this great chain of being] ... and that there are several ranks

of intelligent beings above us ... ascending toward the infinite Perfection of the Creator."

Each of these examples uses this rule of analogy to give us a very general notion of what might be the case in the realm beyond the senses, but what I think all would concede is that none of the examples given can hope to furnish us with the empirical knowledge that we hoped the corpuscularian theory would bring. In regard to the inferences of heat, motion and colour, Locke is inferring from what we see on the observable level, to unobservable phenomena, but doesn't infer anything at all from the propositions about the sub-microscopic phenomena. Indeed, he couldn't really hope to, given the general nature of the claims he has made. None of these inferences will give us any testable predictions, or allow for any sort of theoretical confirmation. Locke is deliberately putting such speculations on a par with the metaphysical notions of the great chain of being. They are equally yielding in empirical knowledge, that is to say, not at all.

This, however, seems overly pessimistic regarding the pursuit of natural philosophy, that Locke had previously praised, but so as not to give this impression, Locke corrects it at the end of the passage:

"This sort of Probability, which is the best conduct of rational Experiments, and the rise of Hypothesis, has also its Use and Influence; and a wary reasoning from Analogy leads us often into the discovering of Truths, and useful Productions which would otherwise be concealed."

This passage is carefully worded, so we should take note of what it says. He is saying that this type of speculation, i.e. claims that only amount to probabilities, not certainties, "has also its Use and Influence" which means to say that in addition to these idle speculations, on both the material and immaterial level, we can get some empirical knowledge from claims that are only probable, i.e. in the conduct of "Rational Experiments." And here he reverts back to his old use of "Analogy", where a wary reasoning can produce new truths, echoing his remarks in IV.iii.29, IV.vi.13 and IV.viii.9. Locke, then, clearly had two uses of the word "Analogy" in mind; in the usual sense it is the type of comparison of observable qualities which has a "Use and Influence" and can lead us to "often guess right at what experience has not yet discovered to [us]". And in the second, technical sense, it gives us a general idea of what may be going on at the sub-microscopic level, without our being able to garner any empirical knowledge from this. The use varies with context.

To summarise then, Natural Philosophy for Locke is the conduct of trials and

experiments to determine the qualities of bodies where, through inference to unobserved, though, in principle, observable cases, by this "wary analogy" we may "guess right" at the qualities of the bodies. This method is not speculative, or hypothetical, in the sense of predicting events from inferred unobservable mechanisms, but was one based purely on and in experience.

This spirited defence of Locke as a Natural Historian, rather than Locke as scientific realist has not gone unnoticed in those who support the thesis of Section One, but I hope to show that defences of Locke as a realist employing hypothetico-deductivist reasoning, are at best flawed, and are in some cases patently false. One of the best expositions of these points of view comes from Laurens Laudan in his 1967 article, reprinted in I.C. Tipton (ed) "Locke on Human Understanding" Here his case is that since corpuscularianism is at the heart of Locke's conception of the material world, then he simply must have been pro-hypotheses as a means of acquiring empirical knowledge. Whilst prima facie this seems a not unreasonable argument we have seen that the conclusion need not follow from the premises, as Locke himself thought that you could be a corpuscularian without having any knowledge of any of the mechanisms involved. Laudan's basic textual case involves the passage just discussed involving mechanisms that fall beyond the testimony of the senses, but Laudan fails to notice the two uses of "Analogy", and seeing the word used once, assumes it applies to the same thing in both places.

Seeing that heat and motion are identified in the first part of IV.xvi.12, and later noting the use of the "useful discoveries" and "new Truths", Laudan comments that "Locke explicitly states that the use of corpuscular hypotheses could lead us "into the discovery of truths"." But as we have seen, this is not, and could not be the case. From the supposition that heat is motion at the micro level we are not able to infer anything back up to the macro level, as we have no means of so doing - we have no description of the atomic structure, or the way in which it works, and no description of the ways in which we could use this information, if we had it, to influence observable events. We would need hypotheses about all these different things to even hope to get empirical knowledge from such a supposition. But we have none of these things so the amount of empirical knowledge we can get from the supposition that heat is motion is precisely zero.

Laudan also tries to make capital from the fact that Locke distinguishes



"Knowledge" and "Judgement", saying that of course we can't "know" the internal constitutions of things, but we can conjecture about them:

"The faculty which God has given man to supply the want of clear and certain knowledge, in cases here that cannot be had, is *Judgement*, whereby that Mind takes its *Ideas* to agree, or disagree; or which is the same, any Proposition to be true, or false, without perceiving a demonstrative Evidence in Proofs." (IV.xiv.3)

Laudan states that such statements in regard to the corpuscular hypothesis are both "informative and highly probable" for Locke, even though "the highest Probability amounts not to Certainty, without which there can be no true Knowledge." (IV.iii.14) Having dealt with the contention that Locke thought these judgements to be informative, which he did not, let us now consider their probability.

In all the uses of "Analogy" Locke mentions, i.e. IV.iii.29, IV.viii.9 and IV.xvi.12, "Observation and Analogy may assist our Judgments in guessing" or help us "probably conjecture" (my emphasis) Locke is careful to associate these reasoning from observed to unobserved cases with "guessing" and "conjecture", and doesn't fail to use these words. This is significant because Locke was also careful to outline what assent such judgements would enjoy. In the Chapter "Degrees of Assent" Locke lists a descending scale of probability we should attach to statements that do not amount to demonstrative knowledge. He starts at the "highest degree of Probability ... when the general consent of all Men, in all Ages, as far as it can be known, concurs with a Man's constant and never-failing Experience in like cases ... [this is] *Assurance*." (IV.xvi.8) Next is "*Confidence*" and the next is indifferent assent to a proposition: "Thus far the matter goes easie enough." Problems arise though "when Testimonies contradict common Experience, and the reports of History and Witnesses clash with the ordinary course of Nature." (IV.xvi.9) In these cases, "this only may be said in general, That as the arguments and Proofs, *pro* and *con*, upon due Examination, nicely weighing every particular Circumstance, should to anyone appear, upon the whole matter, in a greater or less degree, to preponderate on either side, so they are fitted to produce in the Mind such different Entertainment as we call *Belief, Conjecture, Guess, Doubt, Wavering, Distrust, Disbelief* etc." (Ibid)

Here we can clearly see that Locke was careful to rank guessing and conjecturing as one of the lower forms of probability, below even straight-forward belief on his scale, with guessing just one notch up from doubt. So, for Laudan to say that Locke thought

conjectures highly informative and probable, is for him to be sorely mistaken. High probability is conferred on Confidence and Assurance, not on Guessing and Conjecture. Lauden's case of Locke having had a method of the postulation of hypotheses for the acquisition of empirical knowledge is deeply flawed.

Mandlebaum's attempt to portray Locke as a believer in the hypothetical methodology is, frankly, bad. In responding to challenges such as Yost's he deals first with some of the quotes from more minor works that Yost included. "But what," Mandlebaum asks, "shall be said concerning Yost's contention that even though Locke did in fact accept atomism he ... did not believe the employment of hypotheses about sub-microscopic events would accelerate the acquisition of empirical knowledge?" Mandlebaum notes that a full answer to this question would require a point by point examination of all the textual evidence there is for this claim, and as we have seen it is weighty. "Needless to say, I shall not engage in a detailed examination of this sort." (PSSP Pg10), is the first reply. Instead he will ignore all the evidence contrary to his own opinion and "bring forward one consideration which seems .... to constitute fairly strong prima facie evidence against Yost." (PSSP Pg11) This evidence is that "in his "Epistle to the Reader", Locke spoke of Boyle, "the great Hygenius", and "the incomparable Mr. Newton" as the master builders of his age - yet all were staunch advocates of the corpuscular hypothesis." I think the basic point that is being put across here is that if Locke held in high esteem these people who held the corpuscular hypothesis, he thought that the employment of sub-microscopical hypotheses would speed the acquisition of empirical knowledge. This plainly doesn't follow, but I take it that Mandlebaum means to suggest that Locke just took for granted the work of these "master builders" without criticism, just as Mandlebaum is taking for granted the claim that Boyle, Newton et al, did use these hypotheses in the way that would bolster his case, because he has so far provided no evidence to that effect.

Mandlebaum also says that for the modern reader the lack of "Knowledge" Locke states exists in our ideas of substances, may strike a sceptical note that was not intended. But when Locke says things like "Though the familiar use of things about us, takes off our Wonder, Yet it cures not our Ignorance" (III.vi.9), you can't help but feel that a sceptical note is being struck, whatever time it is. Mandlebaum also tries to say that since there is, in the Essay, a distinction between things as we perceive them and as they are

in themselves, "Locke is really concerning himself with everyday experience, not with scientific inference [so], these passages take on a quite different meaning: not being concerned with the problem of how we know the internal constitutions of things, the account in the passages falls on the disparity between common knowledge and the fruits of scientific enquiry." (PSSP Pg13) The only textual reference Mandlebaum uses to support this interpretation is of II.xxxi.6, where the context of the passage Mandlebaum states to be "the common *Idea* men have of" substances. In this passage Locke then goes onto say that such ideas are usually collections of powers, and that when he [Locke] enquires after the real essence of a substance he cannot discover any idea of it. That this is Mandlebaum's sole evidence is bad enough, but the fact is, as we have seen, that the Essay does repeatedly deal with the fruits of scientific enquiry, and the methods used to acquire them, and that method is the method of natural histories.

What Mandlebaum does find lacking though is the basis of the justification for the inference to "insensible corpuscles" in scientific terms, but he again states that Locke defers to Boyle and his contemporaries; for this reason Locke "may be perhaps excused for not having challenged their [the scientists] assumptions" (PSSP Pg14). This seems to assume that Locke was such a philosophical duffer as to have never even thought about scientific inference, or the basis of his contemporaries achievements. We know the first to be false, and the second is open to serious doubt, as I hope to illustrate in Section Five. What we can say with certainty at the moment, though, is that when talking of Natural Philosophy, Locke thinks that "Experience is that, which we in this part must depend on. And it were to be wished, that it were more improved. We find the advantages some Men's generous pains have this way brought to the stock of Natural Knowledge." (IV.iii.16) and in talking of the previous generation of schoolmen, Locke thinks "we have Reason to thank those, who in this latter Age have taken another Course, and have trod out to us, though not an easier way to learned Ignorance, yet a surer way to more profitable Knowledge." (IV.xii.12) In short Locke has as large a praise for those "master-builders", Boyle, Newton et al, as he has for those who do not feign hypotheses and who provide advantage and profitable knowledge through experience and experiment. It is not too fantastic a supposition to assume that these two sets of people, are, in fact, only one set, addressed by different names.

Mandlebaum's position becomes all the more absurd near the end of his discussion

when he does confront the fact that Locke specifically ruled out the possibility of penetrating into the inner constitutions of things. Mandlebaum says, "whatever may have been [Locke's] scepticism regarding our ability to penetrate into the secret material constitutions of *individual* things, this scepticism did not cast doubt on the acceptability of the atomic hypothesis as a general explanation of all of the powers which we observe that particular types of bodies are capable of displaying." (PSSP Pg55) When Mandlebaum can explain to me how we can get confirmation in a realist way for a general theory without being able to get any confirmation from any particular instance of that theory, I will happily re-consider his claims. But, in the meantime two conclusions stand. Firstly Locke was a corpuscularian. Secondly, he did not believe that the postulating of hypotheses about the corpuscular constitutions of things would in any way help to produce empirical knowledge. Indeed, the corpuscular theory could not have been predictively successful at all on this view, as Locke didn't think it possible to make any corpuscular predictions at all. These two facts cannot reasonably be doubted.

## **Four**

Berkeley was not at all unaware of these two conclusions of Locke's, and found them deplorable. Indeed it is this postulation of the unknown essences and the scepticism he thought they engendered that was the main motivator in his writings of the Principles. The Introduction begins with an examination of what philosophy had, in his day, of late achieved. He notes that we would expect philosophers, great lovers of truth that they are, to have a "greater calm and serenity, a greater clearness of evidence and knowledge." (PI 1) But this description seems only to apply to "the illiterate bulk of mankind that walk the high-road of plain, common sense." Whereas, in beginning to philosophise, "a thousand scruples spring up in our minds, concerning those things which before we seemed to fully understand." Trying to rectify the problems we think we find in our sensory knowledge we get tied up in "uncouth paradoxes, difficulties and inconsistencies" to the point when we either get back to where we were, or, "which is worse, sit down in forlorn scepticism."

Obviously this is a less than satisfactory state of affairs and Berkeley naturally wants to know what reason there is for this odd situation, where the lovers of knowledge end up with none, and those who pay little heed to the vicissitudes of modern thought are never troubled with these sceptical affectations. Berkeley cuts to the heart of the matter in the next section:

"The cause of this is thought to be the obscurity of things, or the natural weakness and imperfection of our understandings. It is said the faculties we have are few, and those designed by nature for the support and comfort of life, and not to penetrate into the inward essence and constitution of things." (PI 2)

So here is the cause of our sceptical worries, but from what arguments, or from what school of thought do these doubts arise? Berkeley identifies them with the natural philosophers who say:

"that we are under an invincible blindness as to the *true* and *real* nature of things ... We are miserably bantered, they say, by our senses, and amused only by the outside shew of things. The real essence, the internal qualities, and constitution of even the meanest object, is hid from our view; something there is in every drop of water, every grain of sand, which is beyond the power of human understanding to fathom or comprehend." (P 101)

There can be very little doubt as to who the principal target of these attacks was, having acquainted ourselves with Locke's thought on this point. The first quote seems

directed against Book II, Chapter xxiii, Section 12, and the latter against Section 32 of the same chapter. And Berkeley's remarks on "every drop of water [and] every grain of sand" seem to recall exactly Locke's contention that "The clearest and most enlarged Understandings of thinking Men find themselves puzzled and at a loss, in every Particle of Matter." (IV.iii.22)

Berkeley's aim, then, in writing the Principles was to try to find the root cause of these doubts that had led to "absurdities and contradictions [in] several sects of philosophy; insomuch as the wisest men have thought our ignorance incurable." This is all the more important because Berkeley suspects that these worries "do not spring from any darkness and intricacy in the objects, or natural defect in the understanding, so much as from false principles which have been insisted upon, and might have been avoided." (PI 4)

But what are these false suppositions? The problem is broached in the last of the Dialogues between Hylas and Philonous. Previously the notion of matter had been given a thorough going over, and Hylas is convinced that all such philosophical disputations are without point: "What we approve today, we condemn tomorrow. We keep a stir about knowledge, and spend our lives in pursuit of it when, alas! we know nothing all the while." (3D Pg227) That this is always the case is because, according to Hylas "There is not a single thing in the world where of we can know the real nature, or what it is in itself." Philonous objects that we all seem to know what fire, or water is, and the same goes for all the other everyday objects. Hylas says that we may know that fire appears to me to be hot, in that when it is applied to your sense organs the appropriate sensations are produced, but that is trivially true; "Their internal constitution, their true and real nature, you are utterly in the dark as to *that*." The vulgar may get by through the bustle of life not considering their mistakes on these points, but "the very meat I eat, and the cloth I wear, have nothing on them like what I see and feel." To know nothing of them is, on Hylas' view "the very top and perfection of human knowledge."

Berkeley can be clearly seen to place a Lockean point of view in the mouth of Hylas, and draws out the absurd consequences of such notions, but this is not to spell out why these suppositions are held. Philonous puts his finger on it: "is it not evident that you are led into all these extravagancies by the belief in *material substance*? This makes you dream, of unknown natures in everything. It is this that occasions your distinguishing

between the reality and sensible appearances of things. It is to this you are indebted for being ignorant of what everybody else knows perfectly well." Berkeley feels that it is this notion of an unperceiving matter that is responsible for all these sceptical doubts, here singling out Locke's distinction between real and nominal essences, and the insistence of the ignorance of the former, as consequences of this postulate. But in doing so Locke is open to the attack that this unperceiving matter is either a non-existent something, or else a directly contradictory notion. "And so," Philonous points out, "you are plunged into the most deplorable *scepticism* that ever man was."

So we can see that Berkeley correctly identified this notion of a matter outside our perceptions as a crack in the Lockean system that collapses under sceptical pressure, so as to preclude any possibility of knowledge. Berkeley was also perceptive in noting that these sceptical problems stemmed from the metaphysical prescriptions of the natural philosophers, that Locke kindly spelt out in the Essay. And that while Locke spelt out the epistemological and metaphysical consequences of the materialistic corpuscular world view, the theory was not of his own derivation, but was adopted from the natural philosophers.

We can see therefore, that aside from the purely epistemic nature of the problem posed by "insensible particles" on an empiricist view point, Berkeley had another reason to reject corpuscles, and to construe them in the same way as he construed the laws of motion.

The problem with this eminently plausible view is that Berkeley simply never said about corpuscles what he said about forces. Not only did he not re-write talk of corpuscles as instrumental fictions, but he embraced them as real things on a par with tables and chairs. In the remainder of this Section I hope to show that even in the very earliest works, taken as his most idealistic, there is a Berkelerian corpuscularianism implicit in the text and that it becomes explicit where space is allowed for a fuller exposition of the Berkelerian system.

The first mention of corpuscular subject matter comes in "An Essay Towards a New Theory of Vision", a very interesting work that had a profound influence on the idealistic world view later developed in the Principles and Dialogues. It did not however share his immaterialistic metaphysics by allowing objects of touch to be independent things in external space. But since it was published only a year before the Principles, and

was re-printed later in original form, we can assume that it did not contain anything Berkeley seriously disagreed with later on. It is interesting therefore, that in discussing optical phenomena, Berkeley invokes a corpuscularian explanation. The problem was that the moon appears bigger at the horizon, than at its zenith. Section 68 explains that "the particles which compose our atmosphere intercept the rays of light proceeding from any object to the eye"; where there is more atmosphere there is more interception and consequent feintness of image, which is an experiential cue for distance, and there is more atmosphere at the horizon.

That Berkeley invoked a mechanistic explanation, in this rather more scientific than metaphysical text need not distress those who see Berkeley rejecting corpuscularianism; such a supposition may have been another "vulgar error" that was "beside [his] purpose to examine and refute ... in a discourse concerning vision." (P 44) Never the less, Berkeley must have thought the explanation a worthwhile one in some sense in order for him to have retained it in later editions of the book. Had he wanted to re-construe it in instrumentalist fashion, as was suggested by the authors quoted in Section Two, then surely he would have done so when the book was re-published in 1732, 11 years after *De Motu*, his most instrumentalist text.

But whilst these worries may be dismissed by those who see Berkeley in the instrumentalist camp, yet there are much more troubling passages in the *Principles* themselves. In Principles 60-66, Berkeley raises the eleventh anticipated objection to his immaterialist metaphysics: if God is the immediate cause of all our ideas what is the point of all the mechanism and complex inner structure that we can detect in the world? Couldn't all those visible effects happen without these "internal parts so elegantly contrived and put together, which being ideas have nothing powerful or operative in them, nor have any necessary connexion with the effects ascribed to them"? Berkeley then considers the case of a watchmaker, who designs the tiny cogs and wheels and puts them altogether, so as to permit the accurate reading of time from the watches hands: "yet he must think all this is done to no purpose, and that it is an intelligence which directs the index, and points to the hour of the day." Why couldn't the intelligence that directs the world simply do without these mechanisms, and why is it that when the watch stops working, a correspondent fault is always to be found in the internal parts? "The like may be said of all the clock work of Nature, great part whereof is so wonderfully fine and



subtle, as scarce to be discerned by the best microscope." So if there is a great intelligence causing all these events "how upon [these] principles can any tolerable account be given, or any final cause be assigned of an innumerable multitude of bodies and machines framed with the most exquisite art, which in common philosophy have very apposite uses assigned to them, and serve to explain abundance of phenomena." (P 60)

It should be noted that if, in the previous discussion Berkeley was portraying a Lockean view with respect to our faculties and their ability to attain knowledge of real essences, then he is certainly using corpuscularian language here again. Indeed, never does Berkeley express any doubt that there are these internal mechanisms in bodies; he takes his problem to be how to explain their use in immaterialistic terms. In setting up this problem Berkeley explicitly uses corpuscularian terms, even to the point of using the metaphor of nature as a clock; this was a favoured metaphorical image of both Boyle and Locke. In fact Boyle's primary work that set forward the corpuscular hypothesis most forcefully was riddled with the idea that nature was just one giant mechanical clockwork:

"And thus is this great *automaton*, the world (as in a watch or a clock), the materials it consists of being left to themselves could never at the first convene into so curious an engine: and yet, when the skilful artist has once made it and set it a-going, the phenomena it exhibits are to be accounted for by the *number, bigness proportion, shape, motion (or endeavour), rest, co-aptation*, and other mechanical affectations, of these springs, wheels, pillars and other parts it is made up of." (SPPRB Pg71 cf. 19,27,37,41,45,46,72)

Locke also drew the analogy between the world and a clockwork, and used Boyle's favourite example. In Book III, Chapter vi; "Names of Substances", Locke wants to illustrate early on that the nominal essence of a thing is very different from its real essence, and does so in the following way: if we had an idea of the real essence of a man, we would have as different an idea from what we have now, "as is his, who knows all the Springs and Wheels, and other contrivances within, of the famous clock at *Strasbourg*, from that which a gazing Country-Man has of it, who barely sees the motion of the Hand, and hears the clock strike, and observes only some of the outward appearances." (III.vi.3) It is surely not insignificant then that Berkeley chose to use this metaphor that stood close to the corpuscular theory, and the inference to the existence of these insensible particles, as well as using words like "mechanism" and "parts". But this is not the end of Berkeley's corpuscular phraseology. In Principles 62 he attempts to outline a rough solution to this problem by saying that whilst these mechanisms are not absolutely necessary to the

production of any visible ideas we have, themselves being inefficacious perceptions, yet they are "necessary to the producing of things in a constant, regular way, according to the Laws of Nature." He then continues, "And it is no less visible that a particular size, figure, motion and disposition of parts are necessary, though not absolutely to the producing of any effect, yet to the producing of it according to the standing mechanical Laws of Nature." This language is clearly corpuscularian. Compare it with Locke's description of secondary qualities, which are "nothing in the objects themselves, but Powers to produce various sensations in us, and *depend upon those primary Qualities viz. Bulk, Figure, Texture and Motion of parts.*" (II.viii.14)(My emphasis) Locke used this kind of language when talking of the distinction between primary and secondary qualities, and it can be no oversight on the part of Berkeley that in talking of the inward mechanisms of bodies, as the producers of visible effects, he uses this sort of terminology. Indeed, it is notable that Berkeley fails to include any secondary qualities of bodies as things that are "necessary, though not absolutely so to the producing of any effect." This could easily be construed as an implicit recognition of the explanatory efficacy of the primary and secondary quality distinction, that had previously been ridiculed. But here, rather than import all the metaphysical baggage of resemblance with an unperceiving matter, Berkeley simply means that the "particular size, motion and disposition of parts" of the internal mechanisms of things are those that are used in the production of the effects at the observable level, some of which are secondary qualities.

The same distinction is made in a passage in *De Motu*, where Berkeley is discussing what it could be that causes motion. In Section 22 he outlines "all that which we know to which we have given the name *body*" and spells this out as "impenetrability, extension and figure." Again this is another distinction by omission, but it is surely noteworthy that Berkeley should have written two such passages related to the scientific conception of body wherein the secondary qualities he so stalwartly defended on the observable level are notable by their absence.

If this isn't enough to convince that Berkeley had in mind unobserved corpuscular mechanisms in these passages, the way that he states the objection again in *Principles* 64 should be. Here he notes that ideas are not produced in any chaotic way, "there are also several combinations of them, made in a very regular and artificial manner, which seem like so many instruments in the hand of Nature, that being hid as it were, behind the

scenes, have a secret operation in producing those appearances which are seen on the theatre of the world, being themselves discernable only to the curious eye of the philosopher." This passage is very reminiscent of Locke's ideas that corpuscles are "the great Instruments of Nature." (IV.iii.25)

It seems then that Berkeley was not averse to the notion of hidden mechanisms producing effects in the world by means of their primary qualities, and he conferred the same reality on these inner constitutions as he did everyday objects. But am I not missing the point of his objections to the theory, namely that you cannot have unobservable ideal entities? To make Berkeley corpuscularian is to make him contradict himself, on the fundamental point of idealism. It is true that Berkeley was very careful to couch all of his language in terms of sensible properties; the clockwork of nature was "scarce to be discerned by the best microscopes." But it was surely sensibly discerned. In short all of the things that Berkeley is referring to are made up of ideas, and corpuscles, being too small to see, cannot be sensible in this way.

This move, though, is too hasty, and seems to side too much with the Lockean point of view. Locke seemed to think that corpuscles would never be perceivable on the grounds that God had only suited our faculties to get by in the business of everyday life. We would therefore suffer an "incurable Ignorance" as to the internal constitutions of things (II.ii.12). Berkeley on the other hand was not at all ready to make a move of this sort:

"We should believe that God has dealt more bountifully with the sons of men, than to give them a strong desire for that knowledge, which He had placed quite out of their reach. This were not agreeable to the wonted, indulgent methods of Providence, which, whatever appetites it may have implanted in the creatures, doth usually furnish them with such means as, if rightly made use of, will not fail to satisfy them." (PI 3)

Berkeley was clearly not as pessimistic as Locke in the aim of discovering the corpuscular sub-structure of bodies, and he was in the good scientific company of Hooke, or Newton, who was also optimistic: "For if those instruments are or can be so far improved ... I should hope that we might be able to discover some of the greatest of those Corpuscles." It would have been naive of Berkeley to rule out the possibility of ideas of corpuscles. Indeed, he did not cast doubt on the reality of the mechanisms simply because in the past, when there were no microscopes, they hadn't been observed. The fact that

these mechanisms hadn't yet been observed by humans didn't mean that they weren't real or didn't exist. So too with all the other things that haven't yet been discovered because the means to observe them didn't yet exist; there may be still other "instruments in the Hand of Nature, that being hid .. behind the scenes, have a secret operation in producing appearances." These will simply be corpuscles, and they will be made up of ideas like everything else; just because we haven't seen them yet doesn't mean that they aren't extant. This seems the most natural way to take Berkeley's views on the optical advances made in observing the heavens: "if you take a telescope, it brings into your sight a host of new stars that escape the naked eye." (3D Pg211) Berkeley does not want to say that these stars didn't exist prior to our observation of them via these optical aids. There may be yet further things undiscovered, and among these may be corpuscles.

Whilst some might argue that this construal of Berkeley in the Principles does not necessarily lead to the possibility of a corpuscularian science in the Berkelerian system, a position that Popper, Newton-Smith and Warnock will all have to maintain, I think that it can be seen that Berkeley explicitly adopts the above outlined stance in a passage from the Dialogues. Near the beginning of the Second Dialogue, Philonous is setting up his picture of the world as being in the mind of God. This argumentation he takes to be a refutation of the atheists of the day. Having their "causes and effects ...[and] a fortuitous concourse of atoms" these people attempt to create a world without God. Berkeley's strategy is to

"[l]et any one of those abettors of impiety but look into his own thoughts, and there try to conceive how so much as a rock, a desert, a chaos, or a confused jumble of atoms; how anything at all, either sensible or imaginable, can exist independent of a mind, and he need go no farther to be convinced of his folly." (3D Pg213)

Here Berkeley allows whatever the atheist wants for his world view, yet arrives at no-where but the mind of God. Atoms are either "sensible or imaginable", that is to say, either real or candidates for reality. In short, even in the earliest, and most radical of Berkeley's works corpuscles were as much a part of the world as was "the boundless extent [of the universe] with all its glittering furniture ... [which] ... though labouring mind exert and strain each power to its utmost reach, there still stands out ungrasped a surplusage immeasurable." (3D Pg211) And if this is the case in the early work it is even more so in the later writings.

"Siris" is a much latter work, from 1744, and as such contains a more mature thought. It has been neglected though, because of its esoteric subject matter; the curative powers of Tar-Water. Berkeley speculates as to the reason for its healing excellence, and these speculations lead to considerations as to the role of science and what it can hope to achieve, until finally the book collapses into straight-forward philosophy. It has often been dismissed because its science is so anachronistic, the work of a philosopher with too much spare time, but once the science is jettisoned we can see that the philosophy of science it contains is based firmly in a re-iteration of the idealist world view. What should surprise anyone who sees Berkeley as an instrumentalist, committed to parsing away talk of unobservables into observation language, is the fact that corpuscles play a huge role in this book, not as fictions or fancies of the scientific imagination, but as real things.

Approximately one seventh of the entire book deals explicitly with "particles" or "corpuscles" and many more passages deal with corpuscularian subject matter. It is a vivifying spirit in the air that is responsible for Tar Water's powers because "Air .. is a general agent, not only exerting its own, but calling forth the qualities or powers of all other Bodies, by a division, communication and agitation of their particles." (S 139) Berkeley then identifies the active force in nature with this property of air, which is, in turn, the motion and impact of tiny particles. But what gives air this active force? "Air ... is a mass of various particles .... cohering with particles of aether." (S 151) But what is this aether? "Aether or pure invisible light or fire ... [is] ... the most subtle and elastic of all bodies ... [and] ... is the first natural mover or spring from whence the air derives its power ... being always restless and in motion." (S 152) The aether is then a set of tiny active bodies or particles.

Berkeley does not restrict his scientific thoughts to Tar Water, speculating that pain is "Small imperceptible irritations of the minutest fibres or filaments." (S 86) He seems to have no problems as an idealist that the origin of pain is in something imperceptible. Berkeley also discusses the composition of light as we see it saying it is made up of "solid particles of light ... [which] ... we may suppose to be indefinitely small, that is, as small as we please, and their aggregate to bear as small a proportion to the void as possible, there being nothing in this that contradicts the phenomena." (S 209) All of this corpuscularian talk in a book where Berkeley the idealist re-affirms that "all the phenomena are, to speak truly, appearances in the soul or mind." It seems clear then that

Berkeley was prepared to talk of corpuscles as real sensible things, even though, in his day this "spirit ... [was] ... somewhat too fine and subtle to be caught alone and rendered visible to the naked eye." (S 42) This was for the reason stated above; just because corpuscles hadn't yet been seen didn't mean they wouldn't be and, moreover, even if they were never seen, it still didn't mean that they weren't real, and didn't exist in some mind. Berkeley takes it that the search for the bottom level of such entities had no foreseeable end: "the more nicely you pry into natural productions, the more do you discover of the fine mechanisms of nature, which is endless or inexhaustible; new and other parts, more subtle and delicate than the precedent, still continuing to offer themselves to view." (S.253) But this is no bar to their existence. Not only does Berkeley fully accept a corpuscularian theory in this book, which would be heretical to the instrumentalist Berkeley of the Section Two, but he also seems to endorse a version of the primary and secondary quality distinction. In Section 162 he notes that:

"The pure aether ... contains parts of different kinds, that are impressed with different forms, or subjects to different laws of motions, attraction, repulsion and expansion, and endued with divers distinctive habitudes towards other bodies. These seem to constitute the many various qualities, virtues, flavours, odours, and colours which distinguish natural productions."

That is to say that the motions of the parts of bodies are responsible for the qualities by which we distinguish different types of bodies, i.e. the colours, tastes etc. The primary qualities are responsible for the secondary qualities. And were that not good enough textual evidence, this surely is:

"The Pythagoreans and the Platonists had a notion of the true system of the world. They allowed of mechanical principles, but actuated by a soul or mind: they distinguished the primary qualities in bodies from the secondary, making the former to be physical causes, and they understood physical causes in a right sense." (S 266)

Two things are clear. Berkeley was in some sense an instrumentalist, regarding some scientific theories to be mathematical fictions. But to one of the prime candidates for this theoretical reduction, the corpuscular hypothesis of insensible particles, this reduction did not extend.

"CORPUSCULARIAN  
Philosophy most intelligible"

Locke, Essay, Index.

## Five

We seemed to have reached an impasse. Locke was a corpuscularian without confirmation and Berkeley was an instrumentalist with insensible particles. It is very clear that something has gone wrong and in the next two sections I hope to show how it is that these philosophers get into positions that are, *prima facie*, contradictory. After having resolved these difficulties in the respective systems I hope to illustrate why we find ourselves in this mess in the first place. But, for now, let's get down to a little fine grained historical work.

It is significant for our purposes to look at the intellectual trends of the late seventeenth century to see why it was that Locke chose the corpuscularian theory. Basically, at the time of the writing of the *Essay* Locke had two main philosophical accounts of the properties of bodies available to him. On the one hand was the scholastic theory that had developed from the thought of Aristotle, and on the other was the account of corpuscles. Having looked at the corpuscularian account it is worth our while looking very briefly at the main thrust of the scholastic effort. Suffice it to say that the distinction in Aristotle between substance and accident was used to create a causal account of how it was that bodies came to have the qualities they did, and how they affected us. So, in looking at a piece of gold we can say that it is the quality of yellowness in it that makes the gold appear yellow to us. Not exactly substantive, but no less so than the corpuscularian, where the quality of yellowness is due to the internal constitution, which has such a texture as is apt to produce the idea of yellowness in us. What caused problems in this account was the reification of the qualities of bodies, where a white wall is informed with the real quality of whiteness. This real quality is able to exist independent of the wall, and can be transmitted to us, for us to perceive the whiteness of the wall.

The other option was corpuscularianism. This was the one that Locke chose, so looking at the debate around the issue and the reasons given for the acceptance of the one over the other will help us see whether Locke was a scientific realist, as his twentieth century commentators would have it, or not. The most important piece of work on the conflict between the two theories was done by Boyle, and since it is Locke's deference to Boyle that has been so often cited as the reason for his adoption of the theory, it is important to look at what Boyle's thought amounted to. In doing this we can more fully



see why the scholastic account was deemed to be wrong, and what the arguments for the corpuscularian account added up to in this scientist's work. So we will be finally able to see what arguments Locke did or did not adopt on the basis of his contemporary science and whether or not they were realist ones.

In "The Origins of Forms and Qualities according to the Corpuscular Philosophy" Boyle took in upon himself to thoroughly examine the teachings of the scholastic philosophers to see how their accounts of natural phenomena were defective, and then to illustrate how these "forms and qualities" could be accommodated to the corpuscular world view. Boyle thought the scholastic theory too much tied up in "logical and metaphysical notions and niceties" as to be "so obscure" and "so perplexed", "that it is very difficult for any reader of but an ordinary capacity to understand what they mean." (SPPRB Pg3) That this was the case was mostly because the modes of explanation the scholastics used were involved much less with the actual physical processes, than with the Aristotelian metaphysical distinctions between substance and form, matter and qualities, and the essences that determined what species a thing was part of. This was the case because the scholastic theory was developed prior to the use of microscopes, so things to the scholastics were nothing more than they appeared. So, to stop the explanatory process at the observable level, by positing real qualities as the causes of observable qualities, was not so unreasonable; it was the only mechanism they needed to posit.

With the advent of these optical advances the theory was criticised in the very way it went about these explanatory appeals. Boyle picks on this feature of scholastic explanation, and uses it to show that the theory is empty and tells you nothing you didn't already know, and in doing this precludes any scientific research:

"I consider that the Schools have ... much amused the world with a way of referring all natural effects to certain entities that they call *real qualities*, and accordingly attribute to them a nature distinct from the modification of matter they belong to ... by which means they have ... made it needless or hopeless for men to employ their industry in searching in to the nature of particular qualities and their effects ... accordingly if you farther ask them how white bodies in general do produce this effect of dazzling the eyes ... you should perchance be told that it is their respective natures to so act: by which way of dispatching difficulties they make it very *easy* to solve all the phenomena of nature in general, but make men think it *impossible* to explicate any of them in particular." (SPPRB Pgs.15+16)

But this is not the only problem with the theory; we need to ask what status these "real qualities", the causal components of the explanation, actually have. Boyle notes that "if you ask what whiteness is, they will tell you ... that it is a *real entity*, which

denominates the parcel of matter to which it is joined *white*" But this is not to answer the question - what is a real entity? "they speak of it much after the same rate that they do of their substantial forms ... or at least they will not explicate it more intelligibly." (Ibid) This brings us to two closely connected faults that Boyle finds with the scholastic theory. Firstly if these qualities of whiteness, hotness etc can exist separately from matter, are they not substances on an Aristotelian view, in that they can subsist by themselves, rather than the accidents they are supposed to be? So, "it will not be hard to discover the falsity of the ... scholastic opinion touching real qualities and accidents, their doctrine about which does ... appear to me to be either unintelligible or manifestly contradictory." Because "if they will not allow these accidents to be modes of matter, but entities really distinct from it ... they make them indeed accidents in name, but represent them under such a notion as belongs to substances." (SPPRB Pg22)

Boyle then moves to his second attack on real qualities, enquiring after their ontological status:

"Nor could I ever find it intelligibly made out what these real qualities may be, that they deny to be matter, or modes of matter, or immaterial substances." (SPPRB Pg22)

For Boyle, this is clearly a mess, with no thought even being given to what how these real qualities affect the sense organs, let alone what they are. In short Boyle's criticisms on these points can be summarised to a charge of unintelligibility against the scholastics: They may have a theory, but what it says or how it works is completely opaque. We don't even know what "real quality" means, let alone what role it plays, or how it plays it.

A final criticism that Boyle levels against the scholastics is that the real qualities that the scholastics say inhere in bodies "may have as almost infinite number". (SPPRB Pg24) This is because of the relations a thing can have with others. It is thought to be a property of gold that it dissolves in aqua regia, and another that it not dissolve in aqua fortis. But if we find a new liquid that gold reacts with in a certain way then it seems that gold has a new real quality on the scholastic view, "yet the nature of Gold is not a whit other now than it was before this last menstruum was first made." (Ibid) And it is possible that we can create through chemistry an indefinite number of these new compounds that will each give a familiar substance a new real quality but "a considering man will hardly imagine that so numerous a crowd of real physical entities can accrue to a body, whilst

in the judgement of our senses it remains unchanged." (SPPRB Pg25) Apart from a notion of substance we have no idea how these separate qualities come to attach to each other. So much for the scholastic theory.

That the scholastic theory was a mess does nothing to provide positive support for the corpuscularian view. What, then, were Boyle's arguments in favour of his hypothesis? He recognised that corpuscularianism was a hypothesis, and as such was in need of confirmation "since by lovers of real learning it is very much wished that the doctrine of the new philosophy (as it is called) were backed up by particular experiments, the want of which [Boyle has] endeavoured to supply." (SPPRB Pg11) And ultimately the hypothesis is "to be either confirmed or disproved by the historical truths that will be delivered concerning particular qualities." (SPPRB Pg18)

The question then arises regarding where we are to find this confirmation, recalling that Boyle saw the mechanical philosophy as "so general and pregnant that among things corporeal there is nothing *real* that may not be derived from, or be brought into subordination to, such comprehensive principles." (SPPRB Pg151) On the very same page Boyle says that

"the sagacity and industry of modern naturalists and mathematicians having happily applied [mechanical principles] to several of those difficult phenomena (in *hydrostatics*, the practical part of *optics*, *gunnery* &c.) that before were or might be referred to occult qualities - it is probable that, when this philosophy is deeper searched into and further improved, it will be found applicable to the solution of more and more phenomena of nature." (Ibid)

Might we not reasonably ask what successes there have been in these areas? Boyle comments on those natural philosophers who have put forward theories in hydrostatics and in this area he notes that some things are more dense than others, and denser ones will sink if placed in less dense liquids, and this may be generalised into an empirically confirmable law. So, such a natural philosopher "may be allowed to have rendered a reason of a thing proposed ... though he does not deduce the phenomena from the atoms, nor give us the cause of the gravity; as indeed scarce any philosopher has given us yet a satisfactory account of it." (Works, Vol 1, Pg198) It is not clear then how hydrostatics is supposed to be a confirmation for the reductionist mechanical programme, as it presupposes weight; something that is supposed to be explained in purely mechanical terms.

Boyle in fact explicitly acknowledged that in all the cases presently available to

him there were few, if any, areas that could claim to have a purely mechanical explanation, and he was content to glean what he could from intermediate causal laws. Even his works in pneumatics and chemistry were not founded on the purely mechanical reductions he aimed for, and Hobbes, an arch mechanist, was scathing in his criticism of Boyle, when the latter had talked of the elasticity of air without giving it a mechanical explanation. To take a clearer example, Boyle's lasting monument, his law relating the pressure, volume and temperature of gasses, contains no reference to corpuscles, it is just an inductively confirmable generalisation about macroscopic observable qualities. So much then for the empirical confirmation of the corpuscular hypothesis.

But if we don't have confirmatory evidence for these mechanisms, don't we at least have the corroborating evidence of analogy from the macro to the micro world? Boyle says that the mechanical principles are to be found holding as true in the large scale, as in the small: Do not grains of sand have a figure, size and motion? Do not pebbles obey the laws of free fall, as do boulders? Do not shotgun pellets travel the same way as cannon balls? "And therefore to say that, though in natural bodies whose bulk is manifest and their structure visible, the Mechanical principles may usefully be admitted, they are not to be extended to such particles of matter whose parts and texture are invisible, may perhaps look to some as if a man should allow the laws of mechanism may take place in a town clock, but cannot in a pocket watch." (SPPRB Pg143)

This argument may work in one respect; since all observable portions of matter have primary qualities, and since microscopic particles have these too, we can use analogy to say that sub microscopic bodies can have these qualities too. But the rest of Boyle's arguments simply don't work the way that he wants them to. Perhaps it is the case that the law of free fall is scale invariant, but this being the case would only mean that particles have weight too. However, since the corpuscular philosophy is attempting to explain the observable phenomena in terms of the primary qualities of bodies and motions alone, perhaps this interpretation of Boyle is the wrong one, as it implies that the corpuscles have weight, and the explication of weight is an aim of the corpuscular philosophy. So maybe we should say that the scale invariance of the law applies to the corpuscular constitutions of bodies, not individual corpuscles, as this is more consistent with the reductionist programme. But to say this is not to give support to the analogy right down to the basic level of corpuscles, and the analogy will not give support to the

corpuscular hypothesis as a whole. The problem here is that there is a fundamental qualitative difference between the observable and corpuscular worlds, on this reductionist picture, where observable effects and secondary qualities drop out altogether at the micro level. All that is left is matter and motion. It is not merely a quantitative change in scale.

Boyle himself though seems not to have been too sharp on these points, his analogy with a pocket watch is a case in point. Here Boyle has a rough sense of mechanism on the observable level, where the contrivance of cogs, springs and wheels work to bring about an effect. He then attempts to push this sense of mechanism down to the corpuscular level. But here he is committed to a technical sense of the term "mechanical", where all talk of elasticity and rigidity at the observable level has to drop out to be replaced with corpuscular mechanism. It is this substitution of these two senses of "mechanical" that made the analogy seem plausible, when it is not. Indeed, that Boyle didn't clearly distinguish between the properties that could be extrapolated to the unobservable level, and those that could not, is illustrated in his final words on the analogy argument: To admit mechanism on the observable, but to deny it on the unobservable level is as if to say there can be magnetism on the scale of the earth, but to deny it in a lodestone. Straightforwardly we would therefore be inclined to say that the corpuscles also have magnetic properties, but this was far from Boyle's intention. He wants to explain magnetic phenomena in terms of matter and motion alone. So much then for the argument from analogy, and so much for the solution to Mandelbaum's "problem of transduction". (PSSP Pg107)

There is another argument that Boyle brought forward to recommend to corpuscular hypothesis and it is simply this: with it he was able to account for the phenomena in a way that was clear and intelligible, whereas his opponents could not. Talking of the Peripatetics he notes that even if you grant them their principles,

"it is very hard to understand or admit their applications of them to particular phenomena ... But come now to the *Corpuscular* philosophy, men do so easily understand one another's meaning, when they talk of *local motion, rest, bigness, shape, order, situation and contexture* of material substances, and these principles do afford such clear accounts of those things ... that even these Peripatetics ... acquiesce in explications made by these, when they can be had and seek not any farther." (SPPRB Pg140)

In addition to the intelligibility of the terms used, and the principles on which the qualities are to be explained, namely matter and motion, these two basic principles afford

an innumerable variation. For example, the shape of the corpuscles could vary hugely, and corpuscles of the same shape could have different sizes, etc. So we have a situation where, with a few fundamental terms we can attempt to explain all the observable properties of bodies (SPPRB Pgs139-142). We thus have a system that uses only notions we have had experience of, and attempts to account for a multiplicity of phenomena in a clear, intelligible and efficient way. In so far as his opponents failed, Boyle had a pretty good point.

But this doesn't seem like a telling point to a twentieth century eye. Surely a hypothesis of this nature needs empirical confirmation to derive any support? Here, I admit to having presented Boyle's arguments in a misleading way. I first talked of confirmation, then analogy and only last intelligibility, and this is the way that in our age we would look at things, but in "About the Excellency and Grounds of the Mechanical Hypothesis", Boyle presents his arguments in exactly the reverse order. When he proceeds "to the particulars that should most properly recommend [the corpuscular philosophy] ... The first thing [he] shall mention ... is the intelligibleness or clearness of Mechanical principles and explications." (SPPRB Pg139) It is only later that he mentions empirical support. Why did he do this? The answer is straightforward: We have seen in both Locke and Boyle the clear understanding that the internal mechanisms of bodies were simply beyond the realms of the physical enquiries that were available to them. The speculations that they were engaged on were on a level that was not physically accessible to them; they were on a level above the physical, or, if you like, they were metaphysical disputes. A very great deal of the work that was put into this dispute was to show that the scholastic system was untenable on philosophical grounds, for example, it was inconsistent in taking real qualities as types of substances. Intelligibility therefore is a perfectly legitimate criterion for judging such systems as the corpuscular or the scholastic ones, it too being a philosophical notion; the corpuscularians making the straightforward metaphysical claim that the world is comprehensible to us, or at least the epistemic claim that our own theories of the world ought to be understandable by us. With this principle comes the possibility of scientific research. Whereas the scholastics had always had to eschew searching for causal accounts, the corpuscularians had at least the notion that they could get to explanations at a level beyond the strictly observable, even if they couldn't yet get down to the most basic level. Corpuscularianism, then, had advantages that the

scholastic theory clearly did not in terms of seventeenth century natural philosophy. What, though, was Locke's thinking on this point?

If you look through the index that was added to the second edition of the Essay, you should find your answer. Under "C" it says:

"CORPUSCULARIAN Philosophy most intelligible"

Or, if you prefer you might look at the Section in "Some Thoughts Concerning Education" where Locke notes that in doing natural philosophy a young gentleman is more likely "to understand the Terms and Ways of Talking of the several Sects, than with hopes to gain thereby a comprehensive, scientific and satisfactory Knowledge of the Works of Nature." But he went on: "Only this may be said, that the modern *Corpuscularians* talk, in most Things, more intelligibly than the *Peripatetics*, who possessed the schools immediately before them." (STCE Pg305) And finally this recommendation of the corpuscular philosophy can be found in the Essay itself, in the indexed passage:

"I have here instanced in the corpuscularian Hypothesis, as that which is thought to go farthest in an intelligible Explication of the Qualities of Bodies." (IV.iii.16)

Locke was well aware that the dispute over the philosophical conception of body at this stage in the seventeenth century was essentially a choice between the corpuscular theory as an attempt to understand the world, and scholasticism with its unknown, and unknowable forms and qualities:

"Concerning the real Essences of corporeal substances ... there are, if I mistake not, two Opinions. The one is of those, who using the word Essence, for they know not what, suppose a certain number of those Essences, according to which all natural things are made ... the other, more rational Opinion, is of those, who look on all material things to have a real, but unknown Constitution of their insensible parts, from which flow those sensible Qualities." (III.iii.17)

This scholasticism Locke was quick to dismiss; He continues:

"The former of these Opinions, which supposes these *Essences*, as a certain number of Forms or Molds, wherein all natural things, that exist, are cast, and do equally partake, has, I imagine, very much perplexed the Knowledge of natural things." (Ibid)

So Locke rejected the scholastic account as having made impossible the study of nature in his recent past, and he is clear why this is so; scholastic theories are simple unintelligible:

"Those ... who have taught, that several *Species* of substances had their distinct internal *substantial Forms*; and that it was those *Forms*, which had made the distinction of Substances into their true *Species* and *Genera*, were led yet farther out of the way, by having their Minds set upon fruitless Enquiries after *substantial Forms*, wholly unintelligible, and whereof we have scarce so much as any obscure, or confused Conception in general." (III.vi.10)

The criterion of acceptability then, seems to be that we simply can't conceive what the terms of the scholastic theory refer to, or indeed whether they have any meaning at all. This can be clearly seen when we consider what it is for a word or theory to be intelligible for Locke, and while he did not provide an explicit definition of this term, its meaning is not hard to extract from the text. Recalling that, for Locke, "*Words in their primary or immediate Signification, stand for nothing, but the Ideas in the Mind of him that uses them*" (III.ii.2), a word will be unintelligible when it stands for no idea at all. This is borne out by Locke's discussion of the "Imperfection of Words" in Chapter IX of Book III. In Section 5, Locke discusses those things that often get in the way of an "intelligible Discourse with others". We can have problems with understanding the discourse when we don't fully attend to the ideas for which a word stands. For example, when a word stands for a very complex idea some aspect of which we are apt to omit, or forget. Here our discourse with the word will be made more difficult. In this example, though, and the others he lists in Section 5, the words do stand for ideas, even if the ideas are confused. So, "these are difficulties that attend the signification of several Words that are intelligible." (III.ix.5) Where words stand for ideas, though there may be difficulties in the arbitrary connection between the two, yet there is intelligibility. However, where there are words that do not stand for any ideas at all, we have words that are unintelligible:

"Those which are not intelligible at all, such as Names standing for any simple *Ideas*, which another has not Organs or Faculties to attain ... [are, for example] ... the Names of Colours to a blind Man, or Sounds to a deaf Man." (Ibid)

So a word is unintelligible when it doesn't stand for any idea at all. Locke's criticism of scholasticism, then, is that it is simply meaningless; the terms it uses don't stand for any ideas.

A comparison between the two accounts of body is now possible, having got clear the notion of intelligibility:

"If any one will say that the real Essence, the internal Constitution, on which these



Properties depend, is not the Figure, Size and Arrangement or Connexion of its solid Parts, but something else, call'd its particular *form*; I am farther from having any *Idea* of its real Essence than I was before. For I have an *Idea* of Figure, Size and Situation of solid Parts in general, though I have none of the particular Figure, Size, or putting together of Parts, whereby the above mentioned qualities are produced ... But when I am told, that something besides the Figure, Size and Posture of the solid Parts of that Body, is its Essence, something called *substantial form*, of that, I confess, I have no *Idea* at all, but only of the sound *Form*; which is far enough from an *Idea* of its real Essence or Constitution." (II.xxxi.6)

Locke is here seen to reject the scholastic theory because the words the scholastics use, like "Form", simply don't stand for any ideas, and the theories that use these terms, like the words themselves, are completely unintelligible. On the other hand, of course, the corpuscularian theory uses words like "Figure, Size, and Situation of solid Parts" which stand for the relevant ideas we have of each; the words this theory uses stand for ideas, so the theory that uses them is perfectly intelligible, in so far as its ideas are clear and determined. Locke, then is perfectly entitled to claim that the corpuscularian theory "goes farthest in an intelligible Explication of the Qualities of Bodies" (IV.iii.16) It is more intelligible than the scholastic theory because, whereas the terms employed in the latter theory do not stand for clear and determinate ideas, the ones the corpuscularian hypothesis uses, do; it is a "philosophy most intelligible".

So we can see that it is the ability to have particular ideas that governs the choice between the scholastic and corpuscular theories. Indeed, the fact that it was a comparative choice that was made informs many of the central corpuscularian passages in the Essay, some of which have just been noted. But I believe that this comparison of views is central to the most famous corpuscularian passage in the Essay, that which expounds the distinction between primary and secondary qualities, in Chapter VIII of Book II. Moreover I would suggest that this passage's structure is designed purely to illustrate not the corpuscular theories advantages *simpliciter*, but its merits compared to the scholastic theory. This will be most clearly illustrated by a careful working through of the text.

It is often thought puzzling that Locke should have chosen to start this chapter with an exposition of the notion that positive ideas in us could come from privative causes in the things themselves. In fact the very first section suggests that if we have any simple idea "when it comes to be taken notice of, by our discerning Faculty, it is by the Mind looked on and considered there, to be a real *positive Idea* in the Understanding ... though, perhaps the cause of it be but a privation in the subject." (II.viii.1) Section 4 suggests how this might be the case, in that all sensation could be produced by motion, so that a

stopping of motion produces a new idea in us. Sections 5 and 6 then go on to illustrate how this notion may come easily from common sense - surely a shadow is just an absence of light, and yet it causes a positive idea in us. This, according to Locke, is straightforwardly the case, "according to the common Opinion." (II.viii.6) The question is, why is Locke concerned here to state this, seemingly obvious, truth? The answer is simple if we consider what the scholastic theory would say regarding this phenomenon. Considering the case of a shadow let us suppose that it is on a white wall. Before, there was a real quality of whiteness inhering in the wall, which is being transmitted to the eye. But, once a shadow is cast, that part of the wall fails to be white any more, so that the real quality cannot be in the shaded part of the wall any more. But this doesn't mean that there is no colour quality there, or that the piece of wall is no longer coloured, rather, the real quality of whiteness will have to have been replaced with one of greyness. This is simply because for each perceptual quality we have on the scholastic view, a separate real quality needs to be assigned to the object we are having a perception of. In these early passages of Chapter VIII, Locke is softening up this notion; we need not attach a separate quality in the things themselves according to each idea we have of it. By using common sense examples, like the shadow, Locke is showing that we just don't need as many qualities in the objects as the scholastic theory attributes. Some parsing down is perfectly acceptable, and, common sensically, is desirable.

Locke then gets on with illustrating this separation between the things themselves and our ideas of them; to discourse of our ideas "intelligibly, it will be convenient to distinguish them, as they are *Ideas* or Perceptions in our Minds; and as they are modifications of the matter in the Bodies that cause such Perceptions in us." (II.viii.7) This is done "so that we *may not* think (as is perhaps usually done) that they are exactly Images or Resemblances of something inherent in the subject." (Ibid) So Locke is railing against the idea that there is something inhering in each object that corresponds to the ideas we have of those objects. Again, it is not difficult to identify the position that Locke wishes to distance himself from as the received scholastic view.

In Sections 9 and 10 Locke then goes on to outline the primary and secondary quality distinction and limits his claims about the micro world to those things that the analogy from the macro world will bear, his claim being a great improvement on Boyle's:

"Qualities thus considered in bodies are, First such as are utterly inseparable from the Body in what estate soever it be; such as in all alterations and changes it suffers, all the force can be used upon it, it constantly keeps, and such as sense constantly finds in every particle of matter, which has bulk enough to be perceived, and the Mind finds inseparable from every particle of Matter." (II.viii.9)

Note here that it is the mind that finds the primary qualities inseparable from matter; the justification of their claim to be primary is not just that fact that they are always seen to be in body, but rather that we cannot conceive of a piece of matter without these primary qualities. Locke's next claim is that these primary qualities are in all bodies, whether or not we have the senses fine enough to perceive them; we cannot seriously suppose that division does away with these primary qualities, "for division ... only makes two, or more separate masses of Matter, of that was but one before." (Ibid) Secondary qualities are simply all those other qualities of bodies.

This argument is of a lesser extent than Boyle's argument from analogy and gets us only to the primary qualities of insensible particles, and not to the unhappy supposition of non-mechanistic properties at the micro level. This argument is also more convincing in its limited scope, and any analogical considerations are placed hundreds of pages away in IV.xvi.12, as he recognised them to be much less convincing and speculative. But with these simple qualities of bodies and the consideration that bodies produce ideas in us "manifestly by *impulse*, the only way we can conceive bodies to operate in," (II.viii.12) he can get a general mode of explaining the powers of bodies:

"That the size, figure, and motion of one Body, should cause a change in the size, figure and motion of another Body, is not beyond our Conception, the separation of the Parts of one body, upon intrusion of another, and the change from rest to motion, by impulse; these, and the like, seem to have some *connexion* one with another." (IV.iii.13)

This is couched in terms of what it is possible for him to conceive, i.e. what is thinkable, and this is another aspect of the dispute's philosophical nature. In looking at the two different accounts, corpuscular and scholastic, Locke "cannot (and [he] would be glad that anyone would make intelligible that he did) conceive how Bodies without us, can anyways affect our senses, but by the immediate contact of the sensible bodies themselves, as in Touching or Feeling, or the impulse of some insensible particles coming from them, as in Seeing, Hearing and Smelling; by the different impulse of such Parts, caused by their different Size, Figure and Motion, the variety of Sensations produced in us." (IV.ii.11) It is certainly conceivable for him to think of matter and motion causing

these changes in bodies, but how he can even begin to think about what happens in the scholastic system, it is impossible to know, as the words used do not correspond to any ideas at all.

Locke also recognised that his view was extremely economical, positing only matter and motion, and so was able to give an account of how bodies affect each other, and produce ideas in us, that is both informative and intelligible, despite the fact that detailed accounts were unavailable: I can talk about the real corpuscular constitution of a body, "For I have an *Idea* of the Figure, Size and Situation of Solid Parts in general, though I have none of the particular Figure, Size and putting together of Parts, whereby the ... qualities are produced." (II.xxxi.6)

Sections 12 to 14 are an exposition of how bodies can produce ideas in us, and it is clear from the foregoing that it will be in terms of the impact of corpuscles on our sense organs. In the cases of secondary qualities we just have to accept "that God should annex such *Ideas* to such Motions." Indeed the argument at this stage compels this result; to infer any other mechanisms by which we come to have ideas is to use words that are less intelligible than those of the primary qualities, as we simply can't conceive how bodies can affect us but by motion. Also the resemblance thesis of Section 15 is not so implausible given the basis on which the distinction is drawn. Since we can conceive the causal efficacy of the world to be only in terms of matter and motion, and since we say that all ideas must be occasioned by this means alone, to say that our ideas of secondary qualities exist in the objects themselves is to attribute a causal mechanism between us and the objects that we cannot conceive. We can however attribute our ideas of primary qualities to resemble something in the object itself, as this will not be attributing a quality to the object that is inconceivable.

Locke here though seems to have gone too fast. We might agree contra scholasticism that we need not attribute a real quality for each idea we have, but surely we shouldn't jump straight away in to parsing the world down into just the primary qualities, surely this is too severe? To some extent the arguments of Sections 16 to 21 are an attempt to address this anticipated objection, by showing how the primary qualities can do the job of being the source of all our ideas. But they are also designed to show how the scholastic theory is terribly implausible given the explanatory efficacy and intelligibility of the corpuscularian hypothesis.

Concerning the first point, Locke considers the example of a hand approaching a fire:

"[H]e that will consider, that *the same Fire*, that at one distance *produces* in us the Sensation of *Warmth*, does at a nearer approach, produce in us the far different Sensation of *Pain*, ought to bethink himself, what Reason he has to say, That his *Idea of Warmth*, which was produced in him by the Fire, is actually *in the Fire*; and his *Idea of Pain*, which the same Fire produced in the same way, is *not* in the Fire." (II.viii.16)

Locke here is appealing to our believing that pain is not in the fire and saying, in effect, that for the very same reason the warmth isn't either. Pain is taken by us not to be in the fire, and according to Locke its method of production can only intelligibly be by motion. Warmth, therefore, if we are not to attribute some unintelligible mechanism to its production, is brought about in the same way, and is equally not in the object itself. Anyone who maintains otherwise needs a reason to hold the view that the warmth really is in the fire, and the pain isn't. A similar point is made in Section 18, where Locke compares the sweetness and whiteness of manna, with the sickness it produces. The sickness is thought to be nothing but the operation of the manna in the guts, that doesn't exist as a real quality in it, when it is not felt. Why the sweetness or whiteness "should be thought to exist in the *Manna*, when they are not seen or tasted, would need some Reason to explain." (II.viii.18) Locke is keen to point out that since we can only conceive of matter in motion as the possible causes of the production of ideas in us, we need some additional reasoning to suppose that there are any other sorts of mechanism responsible for the ideas we have. Any attempted explication of the causes of our ideas is going to have to be very much more intelligible than the scholastic theory in order for us to even consider it as a rival to the corpuscular view. Locke's thought is that there is really very little chance that we will come up with anything that is more intelligible than matter in motion.

Locke then goes on to place more emphasis on his account contra the scholastic one. He considers porphyre in the dark, where its colour vanishes, and then in the return of light, when it is red and white again. He asks "Can anyone think of any real alterations made in the *Porphyre*, by the presence or absence of light; and that those *Ideas* of whiteness and redness are really in the *Porphyre* in the light, when 'tis plain *it has no colour in the dark?*" (II.viii.19) All there is on Locke's view is a configuration of particles in the porphyre, there both night and day, that is apt to produce certain ideas in us when

proper interaction takes place with particles of light. There are no real alterations, and whiteness and redness are not really in the porphyre, as there are no real qualities, as the scholastic theory would have it, at all. There is no need to attribute these changes in real qualities all the time, there is only a single unchanging corpuscular constitution. And again:

"Pound an Almond, and the clear white *Colour* will be altered into a dirty one, and the sweet *Taste* into an oily one. What real Alteration can the beating of the Pestle make in any Body, but an Alteration of the *Texture* of it?" (II.viii.20)

Here Locke is asking how to conceive of any change in the real qualities of a thing on the scholastic view, when we have a ready explanation purely in terms of the primary qualities of things. What need can there be, and what use can we get from, these mysterious real qualities?

Perhaps, though, I am reading too much into these passages, can I be sure that it was the scholastic theory that was the target here? The answer is yes. In his summing up of the Chapter, Locke outlines how his view differs from the received opinion, and why the received view makes the mistakes it does. Noting that anything other than primary qualities are but powers in the things themselves dependent on the arrangement of the primary ones,

"yet they are generally otherwise thought of. For the *second sort, viz, The Powers to produce several Ideas in us by our Senses, are looked upon as real Qualities, in the things thus affecting us ... v.g. the Idea of Heat, or Light, which we receive by our Eyes or Touch, from the Sun, are commonly thought real Qualities, existing in the Sun, and something more than mere Powers in it.*" (II.viii.24)

Locke also notices that we distinguish these powers into two sorts, the powers to produce ideas in us, secondary qualities, and powers to affect other objects. He asks,

"*Why the one are ordinarily taken for real Qualities, and the other only for bare Powers?*" (II.viii.25)

He is obviously placing his own view against those where we take ideas of secondary qualities to be the result of "real Qualities" in the things themselves, that are exactly like our ideas of them. This is the scholastic view; Locke even uses their own terminology of "real Qualities", and given his knowledge of Boyle's work contra scholastic theory at this historical point, it would be a massively naive slip on Locke's part to have

included these terms without having the scholastic theory firmly in mind. It would be hugely implausible to suppose that these final passages, and indeed, the whole chapter leading up to them, were not intended to refer to the problems of the scholastic theory. The solutions all come in the corpuscular hypothesis. Here, as everywhere else in the Essay, the corpuscular theory is recommended as comparatively better than its rivals, because it is more intelligible.

The corpuscular hypothesis even manages to solve the problems that the scholastic theory had regarding the interactions with new substances. Boyle notes that on the scholastic view when a body interacts with another body, previously unknown, a new real quality is added to the first body in some unknown way. But on the corpuscular view there is no new quality added, this new power is just the deductive product of the two bodies corpuscular constitutions.

So we can see that Locke had a great advantage in adopting the corpuscularian hypothesis and had good conceptual reasons for doing so, in that corpuscularian theories are conceivable, because we can conceive of a body's constituent parts, and scholastic ones are not. Intelligibility is the key for Locke, and it had a good philosophical side effect:

"It being necessary, to make the Nature of Sensation a little understood, and to make the *difference between the Qualities in Bodies, and the Ideas produced by them in the Mind*, to be distinctly conceived, without which it were impossible to discourse intelligibly of them." (II.viii.22)

Intelligibility and a meaningful philosophical concept of body enabled people to talk about how things are "in themselves" separate from our perceptions of them, which distinction the schoolmen failed to make. They imagined that for every idea there was a separate real quality out there in the world that corresponded to it, and it was this that led to serious problems in the view, that were highlighted in the cases of perceptual relativity. According to Locke you must distinguish between these ideas in the mind and qualities in bodies, to even be able to talk intelligibly about the world, and since the corpuscularian theory enabled him to do this, it is no surprise that he chose it.

His adoption of the theory also gave him a great deal of philosophical capital to work with, giving conclusions regarding the extent of our knowledge of the external world, and the best methods we can use for acquiring more. He noted that our ideas of substances did not, contrary to scholastic teachings, depend on or depict the real essences

of bodies, but only the nominal ones, which formed our ideas of substances, and as we have seen they helped with a lot of problems in his own thought. But he did not adopt it primarily for these reasons; he adopted it because it "is thought to go farthest in an intelligible explication of the Qualities of Bodies." It is intelligibility, not confirmation, that is the key to his acceptance of the corpuscular hypothesis.



## Six

Locke chose corpuscularianism because "it goes farthest in an intelligible Explication of the Qualities of Bodies." But this is not to say that it didn't have its problems which Locke had to admit. There was trouble with both matter and motion, and even more troublesome was how these two could produce any ideas at all.

Locke considers his differing ideas of substances and what grasp we can be said to have of both the material and immaterial. Responding to the charge from the materialists, that they "cannot comprehend a thinking thing", Locke replies that the notion of extended matter is equally problematic. How solid parts can cohere to form extended matter Locke cannot explain, so:

"since body is no farther, nor otherwise extended, than by the union and cohesion of its solid parts, we shall very ill comprehend the *extension* of Body, without understanding wherein consists the union and cohesion of its parts; which seems to me as incomprehensible, as the manner of thinking, and how it is performed." (II.xxiii.24)

Motion, too, is dealt with in short shrift, not long afterwards:

"For in the communication of motion by impulse, wherein as much Motion is lost by one Body, as is got to the other, which is the ordinarist case, we have no other conception, but of the passing of Motion out of one Body into another; which, I think, is as obscure and inconceivable, as how our Minds move or stop our Bodies by Thought." (II.xxiii.28)

Indeed Locke later goes on to add that "the active power of Moving" is clearer in spirits than bodies, as spirits everyday can be seen to move bodies, i.e. I can raise my hand at will, whereas bodies "placed by one another at rest, will never afford us the Idea of a power in the one to move the other, but by a borrowed motion." (Ibid)

But, even given these "incomprehensible", "obscure" and "inconceivable" notions we still have explanatory problems because "it is impossible to conceive that Matter, either with or without Motion, could have originally and from itself generate Sense, Perception or Knowledge." (IV.x.10) So if you were to posit matter and motion, "you may as rationally expect to produce Sense, Thought and Knowledge, by putting together in a certain Figure and Motion, gross Particles of matter, as by those that are the very minutest, that do any where exist. They knock, impell and resist one another just as the greater do, and that is all they can do." (Ibid) This issue highlights the dualism that infects the corpuscularian account of sense perception; from the body via the nerves to the brain we can provide an account, but to translate a motion in the nerves, into an idea in the

mind, of this we can give no explanation, short of a super-natural one:

"Body as far as we can being only able to strike and effect Body; and Motion, according to the utmost reach of our *Ideas*, being able to produce nothing but Motion, so that when we allow it to produce pleasure or pain, or the *Idea* of a Colour, or a Sound, we are fain to quit our Reason, go beyond our *Ideas*, and attribute it wholly to the good Pleasure of our Maker." (IV.iii.16)

Whilst this might seem to count against the Lockean claim for the intelligibility of the hypothesis, we should recall the terms in which the recommendation was made: Locke said that it "goes farthest" in explicating the qualities of bodies, not that it was fully lucid in its explanation. In so far as it dealt with the powers and qualities of bodies it was surely a vast improvement over the scholastic theory, which attributed crowds of real qualities to an unknown substance, to which they were attached in an unknown way. Locke's theory, on the other hand, explains how these qualities were attached and how they affected us and other bodies in an intelligible way. Perhaps we can't get down to the basic level in discovering how matter coheres, or how motion is communicated, but we can clearly see from sense experience that it *does* cohere, and that motion *is* communicated by impulse. The worst problem is how matter causes these ideas in us, but since dualism was, and perhaps still is, felt to be a radically intractable problem, it is surely no criticism of Locke in particular that he failed to find a satisfactory solution to it.

As we have seen Berkeley was not at all unaware of the purported explanatory success of corpuscularianism, so it is not at all surprising that he responded to Locke's claim of intelligibility for the theory. Of course, he rejected it. But since he seems to have also accepted at least a version of corpuscularianism, even in his early writings, it is in order to examine fully which aspects of the hypothesis he objected to, on what grounds, and what was left remaining for him to accept.

Berkeley zeroed in on the suspect aspects of the system and undermined the whole foundation for its acceptance by branding them, simply, "unintelligible". Even in the very earliest exposition of his idealism he rejects the Lockean tenet of "Matter". Identifying the existence of something sensible, with that things being perceived, Berkeley expresses what existence is to mean in the idealist world view:

"The table I write on, I say, exists, that is, I see it and feel it ... For as to what is said of the absolute existence of unthinking things without any relation to their being perceived, that seems perfectly unintelligible." (P 3)

Further, in Principles 6 he notes that:

"all those bodies that compose the mighty frame of the world, have not any subsistence without a mind ... it being perfectly unintelligible and involving all the absurdity of abstraction, to attribute any single part of them an existence independent of a spirit."

In addition to this Berkeley puts forward the corpuscular account of the production of our ideas in the Three Dialogues, in the words of Hylas as "natural and intelligible". Philonous response to this account of motions in the brain causing ideas in the mind was to say that since the brain is a sensible thing, it too can only be a congerie of ideas. So, Philonous asks, "When therefore you say, all ideas are occasioned by the brain, do you conceive this brain or no? If you do, then you talk of ideas imprinted in an idea causing the same idea, which is absurd. If you do not conceive it, you talk unintelligibly, instead of forming a reasonable hypothesis." Philonous' thinking therefore is that if you take the brain to be an idea, then you have one idea causing others, but if you don't conceive the brain as a sensible thing, and take it to be a material thing, independent of our perception of it, then, again, your talk is unintelligible. Berkeley is pressing hard on this notion of material substance: Since the very notion of it is unintelligible, any explanation using it must be so too. Berkeley is strongly attacking Locke's claim of intelligibility of corpuscularianism, by attacking the main supposition of an unthinking material substance.

This last remark of Philonous', also points the way to another criticism of the theory. Philonous said that to have one idea causing others is absurd, a point that Berkeley had emphasised in Principles 32. Here it is noted that the consistent uniform working of the laws of nature is a testament to the goodness and wisdom of God. But this action on God's part "is far from leading our thoughts to Him, that it rather sends [us] a wandering after second causes. For when we perceive certain ideas of sense constantly followed by other ideas, and we know this is not of our doing, we forthwith attribute power and agency to the ideas themselves, and make one the cause of another, than which nothing can be more absurd and unintelligible." So, when we note correlations in our ideas we think that the one is causing the other, moreover, when we see one thing move another, we are inclined to think it is the things that are doing this moving. But since these things are nothing but congeries of ideas, it must be the ideas causing the movement, which Berkeley takes to be absurd; only God can cause this to happen. Berkeley gives his own example: "perceiving the motion and collision of bodies to be attended with sound, we

are inclined to think the latter an effect of the former." But, as we have seen Berkeley thinks this unintelligible. So a corpuscularian explanation of sound as a motion of particles in the air is absurd. The causes and nature of motion, that were seen as problematic by Locke, were again picked upon by Berkeley, so the explanatory project as a whole cannot claim any sort of intelligibility. But, it is not motion *per se* that Berkeley is objecting to, it is the general attribution of causal powers to ideas that he rejects. It is on this second basis that he rejects the atomistic account.

The crucial passage in this respect is Principles 25. Here Berkeley notes that our ideas are "visibly inactive, there is nothing of power or agency included in them." Consequent from this "one idea or object of thought cannot produce or make any alteration in another." So, "a little attention will discover to us that the very being of an idea implies passiveness and inertness in it, insomuch that it is impossible for an idea to do anything, or, strictly speaking, to be the cause of anything." (My Emphasis) This has a straightforward consequence for the atomistic hypothesis, namely "that extension, figure and motion cannot be the cause of our sensations." And this is simply because they are ideas and ideas cannot cause anything. "To say therefore, that these are the effects of powers resulting from the configuration, number, motion and size of corpuscles, must certainly be false." So the account is false in so far as it takes one idea to be the cause or effect of another.

It is this sort of thinking that precipitates the rejection of corpuscular accounts in Principles 50. Here, Berkeley first observes that matter is of no explanatory use in natural philosophy as we have no idea how it can operate on spirit, or produce ideas in it. But even on the corpuscular home ground matter is of no real use because "they who attempt to account for things, do it not by corporeal substance, but by figure, motion, and other qualities, which in truth are no more than mere ideas, and therefore cannot be the cause of anything."

On this point Berkeley seems to have taken very seriously the point Locke made in II.xxiii.28, where we have at least had experience of the active power of spirit, whereas bodies left to themselves have no active power in them. Generalising this to all the properties of sensible things, Berkeley concludes that all ideas are inactive, and it is on this ground that he rejects the corpuscular system.

To summarise, then, Berkeley rejected the notion of matter and the notion that

ideas can cause other ideas as unintelligible. So any system that retain these two aspects must be rejected, and Locke' claim that his chosen theory was at least a little better than its rival, is dispensed with on the grounds that any system built on unintelligible notions must be vitiated with this unintelligibility.

But, when we have a system that has jettisoned these two metaphysically dubious notions, there is no reason why Berkeley cannot accept it. We have already seen that in Principles 50 Berkeley says that the corpuscularians themselves don't really use the notion of matter to explain things, but only the primary qualities of bodies. So, an idealist can simply forget the "matter" and concentrate on these particular qualities of bodies. In so far as one set of ideas or qualities is supposed to cause another, the account must be rejected, as spirit alone is the active power in nature. But this need not prevent there being another relation that pertains between the differing ideas that go into making up real things. Berkeley exploits this possibility in the answer he gives to the eleventh objection to idealism, that we have already noted in Section Four.

In Principles 64 Berkeley re-states the objection, observing that "what has been objected in *Sctn. 60* amounts in reality to no more than this: ideas are not anyhow and at random produced, there being a certain order and connexion between them, like that of cause and effect ... But since one idea cannot be the cause of another to what purpose is this connexion?" It is clear in this passage that the problem with corpuscles was seen to be, not the minuteness of the particles, or the fact that they had not yet been perceived, but rather that the account relied on the notion of one set of ideas causing another. The problem was felt to be what purpose this artifice has if its relations are not really causal. His response is to exactly this worry:

"To all which my answer is, first, that the connexion of ideas does not imply the relation of *cause* and *effect*, but only of a mark or *sign* with the thing *signified*. The fire which I see is not the cause of the pain I suffer upon approaching it, but the mark that forewarns me of it." (P 65)

His move is to re-construct the notion of a corporeal cause, and replace it with a notion of the conveyance of information. So, for example, the object I see as a folder over there is a sign of the tactual sensation I will receive if I move my hand to it. It is not that the visible object causes the tangible object, the one merely indicates the potential presence of the other. This theory of indication can also be spread to corpuscular accounts; Berkeley continues,

"In like manner, the noise that I hear is not the effect of this or that motion or collision of ambient bodies, but the sign thereof." (Ibid)

So, the corpuscular account of sound as a motion in the air, which was rejected as absurd in its causal form in Principles 32, where "perceiving that motion and collision of bodies to be attended with sound, we are inclined to think the latter an effect of the former", can be accepted later on, when the former is a *sign* for the latter. It is only the causal aspect of the account that makes it unintelligible; once this aspect is removed Berkeley has no problem with it.

He then gets on with explaining why it is that there are mechanisms on this theory of indication, and in doing so interestingly steals a corpuscular analogy that Boyle was fond of making:

"the reason why ideas are formed into machines ... is the same for that of combining letters into words. That a few original ideas may be made to signify a great number of effects and actions, it is necessary that they be variously combined together ... By this means abundance of information is conveyed to us, concerning what we are to expect from such and such actions." (P 65)

This recommendatory device was stolen straight from Boyle, (who had borrowed it from Lucretius):

"that all the innumerable multitude of words ... are made up of the various combinations of some of the 24 letters of the alphabet, it will not be hard to conceive that there may be an incomprehensible variety of associations and textures of the minutest parts of bodies, and consequently a vast multitude of portions of matter endowed with store enough of differing qualities to deserve distinct appellations." (SPPRB Pg49)

Stealing Boyle's clothes, Berkeley has got the explanatory efficacy of the atomist account on his own idealist premises and is therefore in a position to put forward his reconstrual of the corpuscular hypothesis. In Principles 65 he ends his remarks:

"which in effect is all that I conceive to be distinctly meant when it is said that by discerning the figure, texture, and mechanism of the inward parts of bodies, whether natural or artificial, we may attain to know the several uses and properties depending there on, or the nature of the thing."

So, a corpuscular blueprint, or the real essence of the body, has a use in the Berkelerian system, not as a cause of the macroscopic qualities we see, but as signs for them. It should be clearly noted that Berkeley is not attempting to parse away this talk

of the inward mechanism of body as a fiction, or linguistic shorthand for an instrumentalist view of science, but is rather assigning new meaning to the words "cause" and "effect" in the realm of ideas. The mechanisms are real, they do exist, but they aren't causal. This point is made explicit by Berkeley in his next section:

"Hence it is evident, that those things which under the notion of a cause co-operating or concurring to the production of effects, are altogether inexplicable, and run us into great absurdities, may be very naturally explained, and have a proper use assigned to them, when they are considered as marks or signs for our information." (P 66)

So, to those who say that Berkeley rejected a corpuscular account as it involved "insensible particles", and re-constructed it instrumentally, I say they are wrong. Berkeley's beef was with causation, not perception, and once the causal problem was solved the account was perfectly acceptable.

Berkeley makes similar points throughout his writings, making it clear the issue with which he disagrees with Locke. Indeed his objections to the Lockean hypothesis are forcefully put in Principles 102. Here a resolution of the qualities of bodies into "mechanical causes" is dismissed as a "labour in vain" because "there is no other agent or efficient cause other than *spirit*, it being evident that motion, as well as all other *ideas*, is perfectly inert." The point is most forcefully put in his earlier writings, where he spells out precisely those areas that have caused natural philosophy to be unintelligible:

"laying aside matter and corporeal causes, and admitting only the efficiency of an all perfect mind, are not all the effects of Nature easy and intelligible?" (3D Pg257)

So, in the earliest and most radical of his works Berkeley recognised Locke's recommendatory claim and rejected it on the two counts spelt out above: Matter and Causation.

We have seen that in his latter writings this nascent scientific outlook was further built upon; so too with his views regarding science's limits and purpose. In *Siris* Berkeley tackled head on the claim of the mechanists to be able to "solve the phenomena", and in doing this outlined what it was the natural philosopher was to do. Berkeley thinks that, rightly considered, mechanism doesn't solve any phenomena at all:

"for all the phenomena are, to speak truly, appearances in the soul or mind, and it hath never been explained, nor can it be explained, how external bodies, figures, and motions, should produce an appearance in the mind. Those principles, therefore, do not solve, if by solving is meant the real, either efficient or final, cause of appearances, but only reduce them to general rules." (S

As spirit is the only cause of ideas all the scientist has to do is fit the phenomena into laws of association; she "inquires properly into the rules and modes of operation alone, and not concerning the cause; forasmuch as nothing mechanical is or really can be a cause", (S 249) for the usual reasons.

What, then, are we to make of the claims in this book that "Air ... is a general agent ... calling forth the qualities or powers of all other bodies, by a division, comminution, and agitation of their particles, causing them to fly off and become volatile and active" ? (S 139) And if this is the case, what are we to make of the seeming cause of air's efficiency?

"If the air be the immediate agent or instrument in natural things, it is the pure invisible fire [or aether] that is the first natural mover or spring from whence air derives its power. This mighty agent is everywhere at hand." (S 152)

If we are to parse away causal talk, as was previously suggested, what is Berkeley doing attributing causal powers to the particles of aether? Berkeley is quick to spell out exactly what he means by such claims. By looking carefully at the world we see that mind alone is active and that "the inferior instrumental cause is pure aether" (S 154). So that "when we therefore speak of corporeal agents or corporeal causes, this is to be understood in a different, subordinate and improper sense" (Ibid). "Causation" in the corporeal realm is not a real type of agency, but merely a "gross and popular sense, which sticks in appearances, and doth not analyse things to their first principles" (S 155). Berkeley is not recanting his previous views, he is just using the word "in compliance with established language and the use of the world." (Ibid) When it comes to the truth of the matter, though, he will distinguish the two meanings. It is this meaning restriction that allows him to accept the primary and secondary quality distinction that we noted in Section Four; the Ancients had a "right sense" of the qualities, as spirit is the only cause in their system and primary qualities were signs for, not causes of, secondary qualities. To distinguish the qualities is not to draw metaphysical conclusions, but merely to note that primary qualities are particularly useful signs.

So, his approach to mechanism here is exactly the same as it was in the early writings, the only difference being that where Berkeley was reluctant to use words like "corpuscle" or "particle" before, and only alluded to the terms, in *Siris* he is much more



upfront. This reluctance on his part is perfectly understandable. It is part of the aim of the earlier works to refute the scepticism that matter and God-independent causation in corpuscularianism would allow, as it would permit atheism. This main point was very much to be desired by Berkeley, so to re-introduce corpuscles at this point would only have served to confuse the readership and detract from his aims. It is only later, when the idealist principles have been firmly established that he can finally clarify what is good and useful in the corpuscular system.

All of this may well be the case, Berkeley may have supported a version of the mechanical hypothesis, but in doing so was he not committed to a massive contradiction in his own system? How can someone whose central tenet is that to be is to be perceived admit the existence of "insensible particles" ? I hope that I have already dealt with the "in principle" problem in this regard in Section Four, but still "in practice" problems remain. How can these things be said to exist if we have no ideas of them?

It should be recalled that Berkeley was prepared to sanction the existence of a whole realm of entities which couldn't possibly be ideas, namely spirits. And his indication of how they can be "perceived" without our having ideas of them will give us a clue as to how we can "perceive" things that although presently unavailable to us, are, in principle, sensible things:

"Such is the nature of *spirit*, or that which acts, that it cannot of itself be perceived, but only by the effects it produceth." (P 27)

One might not be able to directly perceive it, but that doesn't mean that it doesn't exist. And if this is possible for things that are in principle unperceivable, then it is surely a reasonable option for things that are presently beyond the realm of the senses. The point is made in *Siris*:

"No eye could hitherto discern, and no sense perceive, the animal spirit in a human body otherwise than from its effects. The same may be said of pure fire, or the spirit of the universe, which is perceived only by means of some other bodies, on which it operates, or with which it is joined." (S 159)

Berkeley doesn't want to rule out the existence of the aether just because it hasn't been seen yet. Rather, his position will float to the level of microscopic entities for which we have good evidence to believe. In an indirect sense we can see that the aether is there because it "causes" some perceivable "effects". Berkeley will then allow it, and anything

else we have good evidence for, even if we haven't seen it yet. Berkeley's view doesn't yet rule anything in or out as far as the possible extent of the microscopic world goes.

You might well feel, though, that, at best, this is a promissory note for the existence of corpuscles: All we have ideas of are observable scenes and whilst it is certainly possible that improved optics may lead to yet further and more minute scenes, there is a level to which we may not attain perceptual access; at some level won't we be frustrated? Consider those smallest particles by which we perceive other things, the Newtonian particles of light. By use of these we may indeed be able, with the advent of enhanced microscopy, to use these smallest particles to outline the shape and colour of grosser corpuscles. To be able to do this the light particles would have to be considerably smaller than those they outline in any mechanical account. So we can get ideas of the larger particles; they are sensible things. But what of the particles of light, themselves (or whichever particle it is that turns out to be the smallest). What mechanical means are we to use to get ideas of these? We may indeed be able to rig up larger particles to be able to detect smaller ones, but this again is the use of a promissory note: we see "effects" and attribute a "cause" that seems in principle unobservable. But if I can't have ideas of these smallest particles surely they are not sensible things, and therefore can't exist. Indeed, if they are the means by which light and colour are transmitted to us there seems to be no way to detect their colour at all. Since sensible qualities tend to be of an "all for one, one for all" nature, where we lack one sensible quality, we lack them all.

So if Berkeley does embrace this idealist mechanism then he will be in serious trouble regarding these smallest atoms. To see how the problem can be solved it is necessary to take a step back to the everyday realm to see what the existence of something amounts to, in the first place. In Principles Three, Berkeley outlines what it is to say that the table exists when I am not in the room to perceive it: "if I were out of my study I should say it existed, meaning thereby that if I were in my study I might perceive it." Here the existence of a thing is conditional on a certain state of affairs, so, an unperceived thing exists if, had a set of conditions been met, that thing would have been perceived. The question is "What are these conditions?" Straightforwardly we see that they are the standing laws of nature. A presently unperceived thing exists if, given a certain set of actions and a state of initial conditions, the laws of nature entail that the thing in question is perceived. So we can say that corpuscles up until now unperceived exist if a

law of nature entails that in the correct situation, for example, the use of a new microscope, the corpuscle would be perceived. But in the situation outlined above we have a case where the mechanistic laws of nature seem to entail that the smallest particle cannot be perceived in any situation. Must we then say that it doesn't exist, or are we to violate the idealist principles?

We need not do either. The reason being that Berkeley is not at all committed to a universal mechanism, in the same way as Locke is. Indeed Berkeley is explicit in noting that things often taken by scientists to be universal are not so. The point is put in the form of a question:

"Why may we not suppose certain idiosyncrasies, sympathies, oppositions, in the solids, or fluids, or animal spirits of a human body, with regard to the fine insensible parts of minerals ... not depending on the different size, figure, number, solidity, or weight of these particles, nor on the general laws of motion, nor on the density or elasticity of a medium, but merely and altogether on the good pleasure of the Creator, in the original formation of things?" (S 239)

The whole world, and all the laws of nature depend solely upon the divine mind, and He can set up whatever regularities He likes in it - He is far from confined to the mechanistic approach. Indeed, in the Principles, Berkeley notes that properties and laws taken to be universal are far from being so. Gravitation is his example:

"so far is that gravitation, from being *essential* to bodies, that, in some instances, a quite contrary principle seems to shew itself: as in the perpendicular growth of plants, and the elasticity of the air. There is nothing necessary or essential in the case, but it depends entirely on the will of the *governing spirit*, who causes certain bodies to cleave together, or tend toward each other, according to various laws, whilst keeps others at a fixed distance; and to some he gives a quite contrary tendency to fly asunder, just as he sees convenient." (P 106)

So, God on Berkeley's view can make laws for corpuscles that are not confined to the usual laws of mechanism: "For although the general laws of motion are deemed mechanical, yet peculiar motions of the insensible parts, and peculiar properties depending thereon, are occult and specific." (S 239) Thus Berkeley is not committed to universal mechanism and so is not faced with the problem of the perceivability of the smallest particles. All that need be the case for the smallest particles to exist is that there be a standing law of nature, of whatever type, which entails that if you were in such and such circumstances, you would perceive such and such ideas of the smallest particles. A mechanist might not be able to explain how it is that we acquire these ideas, but Berkeley is not so restricted in his explanatory resources - he will take laws of nature where he can

find them. As long as the relevant laws have been in place "in the original formation of things", then the corpuscles exist, whether we know it or not.

To conclude then, Berkeley was quick to recognise the claim of intelligibility for the corpuscular hypothesis and rejected it. But, once the metaphysically dubious aspects of the theory were excised he was free to accept it, and did so. He does this because, while the primary qualities are not of a radically different metaphysical nature, they are of great predictive use in the natural sciences, being a highly informative set of signs of the properties of bodies. Berkeley was, in his own way, a corpuscularian too.

## Conclusion.

Let us look at what this final part of the thesis has taught us, first in regard to Locke's views. It is clear that Locke did choose the corpuscular hypothesis as his favoured philosophical conception of body and it is also true that his doing this was heavily influenced by the considerations put forward by Boyle. Locke, however, did not just accept all that Boyle wrote, but modified it in an interesting and perceptive way. Locke did not rest his case on empirical confirmation, of which there was none, nor did he place his faith in an argument from analogy. Rather he rested on, and improved upon, the philosophical arguments that are to be found in Boyle. Locke's criteria of intelligibility, which he developed from Boyle, is central to his argument.

So, in a sense, what the commentators of the first Section said was right. Locke did use the materials supplied by Boyle to build his own arguments, they are wrong however in thinking that these were the empirical considerations. Just because Boyle was interested in what we would now classify as "science" as opposed to what we would call modern "philosophy", doesn't mean that the considerations he used were purely empirical. Recall that in the seventeenth century there wasn't the sharp distinction between the two areas that there is today; the study of nature was called "natural philosophy" back then. Boyle himself objects to the scholastic theory on what we would today call philosophical grounds: Scholastic words are meaningless, the term "real quality" is a category mistake, applying substantial attributes to an accident, etc. As we have seen Locke took over similar arguments and further refined them so that the argument he gave for the acceptance of the corpuscular theory, though based on the work of a "scientist", was one that was firmly based in the non-empirical realm.

This fact allows Locke to create a perfectly consistent point of view regarding the natural world. If Locke chose the theory on the grounds of its intelligibility, and had given what he took to be good reasons why we can never have ideas of the real essences of substances, then it follows that the best possible method for the acquisition of empirical knowledge, as defined in Section Three, is one based purely on the observational level. If we can never get to the corpuscular level we have to confine our natural philosophical enquiries to the phenomena alone in order to spot interesting patterns and similarities. So, a reading where intelligibility is the motivator for the acceptance of a theory is one where

the only real way of getting empirical knowledge is via the method of natural histories. Here, the methodology he adopted follows as a natural consequence of the reasons he had for the adoption of the theory in the first place.

This, of course, contrasts sharply with the comments in Section One. Here they posit Locke as a realist in science, looking for the empirical success of his sub-microscopic hypotheses to confirm the truth of the corpuscular hypothesis. When Locke says that we can never have ideas of the internal constitutions of things, and should pursue only natural histories, their case is in tatters: Locke is apparently waiting for a type of confirmation that he has *a priori* ruled out. This fact alone makes their reading hugely implausible, but, as we have seen, there is a simple alternative explanation.

A similar situation is to be found in the case of Berkeley; despite what philosophers have said, Berkeley never did extend his instrumentalist reduction to hypotheses positing unobservable bodies. The reason, again, is simple: Berkeley intended this reduction to apply only to those theories that posit non-sensible active forces or powers as the causes of the motions of sensible things. The law of gravity, for example, posits an active quality of gravity in every body around us which we cannot perceive except by its actuating power on the sensible level, i.e. by moving things around. This law is scale invariant, it doesn't posit a mechanical cause to explain it, it is just a fact about the motions of all bodies. It is to properties like this that Berkeley intends his reduction to extend - these "occult qualities" don't posit anything in the objects themselves for Berkeley, rather they are simply codification schemes for motions that allow a lot of diverse phenomena to be reduced to a simple mathematical formalisation. This reduction is perfectly acceptable for Berkeley as it doesn't get rid of any real thing in the Berkeleyian world. These rules just set forth the manner in which these collections of sensible qualities are regulated in terms of sign and thing signified, all of this for our information. This must be contrasted very sharply with theories positing corpuscles. These theories refer to real things, that is to say actual or potential ideas of sense. Whereas gravity is an occult quality that allows us to predict the movement of bodies, without saying that there is any such real property of gravity, corpuscles are the things themselves that are moved.

So for Berkeley to admit that there are such corpuscles is not for him to contradict himself at all; he never intended to rule them out, indeed, he goes out of his way, in

Principles 65, to outline what meaning attaches to the corpuscular claims made by Locke and others. These statements are far from meaningless, but rather than have the causal connotations Locke insists upon, they have a signficatory function. It is just false to say that Berkeley rules out these theoretical entities on the basis of his instrumentalism. All the things in the universe, from atoms to galaxies, exist only in the mind of God, and it is God that lays down the principles by which the actions of these things are governed. We can formulate these principles in laws of motion and mathematical hypotheses. These rules are just that; they don't have any causal force in the things themselves, they just tell us how God makes things work for our benefit. The modern commentators of Section Two simply make a mistake in thinking that just because some theories are to be treated as calculating tools, they all are.

The question that poses itself most forcefully now is, why did we get these interpretations so wrong to start with? Rather than list all the individual errors that have been made, I want to take a broader look at the reasons why the whole of the approach of the commentators of the first part to this thesis is flawed. To do this I will look at a few examples from Berkeley scholarship.

Let us first, then, look at some of Poppers claims where he takes Berkeley to rule out any atomistic theory. Popper says, after having had Berkeley instrumentalise Newtonian theory, that

"These results clearly apply to cases other than Newton's theory, for example to atomism (corpuscular theory). In so far as this theory attempts to explain the world of appearances by constructing an invisible world of "inward essences" behind the world of appearances, it must be rejected." (C+R Pg170)

He quotes Principles 50 and 102 in support of this, along with Siris 232 and 235. In so far as Berkeley does admit that there are "ideas ... which seem like so many instruments in the hand of Nature, that being hid as it were behind the scenes, have a secret operation in producing these appearances which are seen on the theatre of the world" (P 64), Poppers interpretation seems to be flatly contradicted by the textual evidence. We have also seen how the two quotes from the Principles only reject the atomistic hypothesis in so far as it assigns causal powers to anything other than God. This, though, is perhaps by the by. What is truly very interesting are the quotes from Siris. I did mention these in Section Two, but omitted them there for brevity. Let us

consider one now. Berkeley says:

"We are not therefore seriously to suppose, with certain mechanic philosophers, that the minute particles of bodies have real forces or powers, by which they act on each other, to produce the various phenomena of nature. The minute corpuscles are impelled and directed, that is to say, moved to and from each other, according to various rules or laws of Motion." (S 235)

Popper apparently thinks that this quote counts for the claim that Berkeley rejected the reality of atoms, but I just cannot see how it does. All it says is that there are little particles that move around. The issue is not whether they are there or not, as they clearly are in this passage, but whether they move themselves. Berkeley's point is that these "mechanic philosophers" attribute "real forces" to the particles, something anathema to his point of view, what is not called into doubt is that there are these little things. How Popper thought that this passage counts for his interpretation, I cannot claim to know. Berkeley settles the question here raised in the next section of Siris. Noting that all the diverse phenomena of nature in which these particles play a part,

"in all this we know or understand no more than that bodies are moved according to a certain order, and that they do not move themselves." (S 236)

Berkeley answers the question regarding causation in the same way as he ever did and he treats corpuscles as he always did: they are real things.

Popper, then, has radically misconstrued a whole swathe of Berkeley's work. The reason for this is that his whole mind set is geared toward the modern philosophy of science debate. There are indeed interesting and informative parallels between Berkeley's views of science and views from the late nineteenth and early twentieth centuries. But that is all they are, just similarities. Popper though sees the similarities and parallels on some points and infers to a similarity on all points. For example, he says that

"Schlick, under the influence of Wittgenstein, suggested an instrumentalist interpretation of universal laws which was practically equivalent to Berkeley's "mathematical hypotheses"." (C+R Pg166)

He also attributes to Berkeley a positivistic meaning criterion; according to Popper, for Berkeley, "The meaning of a word is the idea or sense quality with which it is associated" (C+R Pg167). This, again, is just false. Berkeley can never have held this view as a huge part of his ontology would be ruled out, the words used to refer to it do not stand for any ideas:



"the words *will, soul, spirit* do not stand for different ideas, or in truth any ideas at all, but for something very different from ideas, and which being an agent cannot be like unto, or be represented by, any idea whatsoever." (P 27)

Popper is simply reading Berkeley as a proto-positivist, and attributing to him the whole of the positivist philosophy. For all the difference it would make to his interpretation, the word "Berkeley" could refer to Ernst Mach or Moritz Schlick. Seeing Berkeley as a modern instrumentalist leads Popper to lumbering Berkeley with all of their particular prejudices and problems. So, he infers back from the modern thought that atoms are theoretical fictions to saying that the same is true for Berkeley too. This, of course, leads to his terrible misreading of passages like the ones we have just seen, as he is not paying attention to the proper reasoning behind the positions. For Popper, if the positivists rejected it, Berkeley did too.

All of this, of course, is hugely historically unjust because the issues and problems that faced Berkeley were very, very different from those that the positivists dealt with at the beginning of the century. Berkeley had his own anti-materialist agenda, and this was contributory to his huge causal restrictions. The positivists, on the other hand, with their verification criterion of meaning, had a very difficult time with the unobservables posited in modern physics. Berkeley had no such criterion, and no such problem. Indeed, given the diversities of the problems faced, it is surprising that there is as much similarity as there is.

This modern re-constitution of the thinking of Berkeley is even more evident in the article "Berkeley's Philosophy of Science" by W.H. Newton-Smith. Here in a thirteen page article, with only four quotes from any of Berkeley's work, Newton-Smith maintains that the whole of Berkeley's views "rests on a speculative idea, that of the underdetermination of theory by data (UTD)." (EOB Pg149) This argument, we are told "is of considerable contemporary interest [as] is illustrated by the crucial role it has played in the writings on science of Duhem and Quine." (Ibid) Here again we see a modern notion being thrust backward in time and having it imposed on another philosopher's position. Newton-Smith does consider the textual evidence for the case that Berkeley's views might have come from the strong restrictions he places on causal agency, but concludes that,

"If this were his position, resting on this engaging but utterly implausible doctrine

concerning spirits and causation, it would be of little interest." (EOB Pg155)

What seems to be of interest in Berkeley's views is only that which is related to the current debate. While this is surely the wrong way to go about historical research, it also has the nasty consequence that all of the textual evidence we have seen from a wide variety of Berkeley's works, whole stretches of the Principles and Siris, all of this has nothing to do with Berkeley's philosophical position. Even if it did, it is "utterly implausible" and "of little interest". This is so because

"Berkeley has another argument, an argument which rests on a major premise which has seemed and still seems to many philosophers of science to be true, or at least plausible. This is the underdetermination of theory by data." (EOB Pg155-6)

This thesis, that for every set of empirical data there are an infinite number of possible theoretical accounts of it, is indeed of considerable contemporary interest, as it is a potentially useful stick for instrumentalists to beat realists with. According to Newton-Smith "Berkeley rests his case on an argument from UTD." (EOB Pg157) He then goes on to quote from De Motu 67 to support his argument. This is a passage where Berkeley is showing that forces are not stable entities in the things themselves, but are rather dependant on the definer of a theoretical system that accounts for them. That this is the case can be seen when two accounts using different notions of force can account for the same empirical data, "whence the same thing can be explained in different ways." There is, in a sense, underdetermination here, but Berkeley is far from arguing that it is always the case that there is UTD, rather, it can happen, and when it does it illustrates the non-sensible character of the laws of nature. Does Berkeley rest his entire case upon this argument? Is his whole position based upon it? The answer is transparently "No".

If this was the sole basis of his position in De Motu, and indeed, in all his other writings, why does it occur only six sections from the end of the tract, and not at the beginning, as a premise, from which to develop his thought? And if it is the basis of all the books conclusions, why did Berkeley summarise all his main points regarding "mathematical hypotheses" and relational measures the paragraph before De Motu 67? He then ends paragraph 66 with the thought that "these words will suffice about the nature of motion.". If the foundation is in DM 67, why is the main work concluded in DM 66? At the very best the argument that Newton-Smith claims as the key to Berkeley's position is not much more than an interesting footnote to the points Berkeley is making elsewhere,

a footnote that ends with the thought that "Mind ... is the true efficient cause of motion." Newton-Smith's mis-conception of Berkeley's arguments does so much damage to the latter's true position that it is just perverse.

Again, Newton-Smith has read intellectual history backwards - just because we find UTD to be of especial interest to us, and see it as foundational in an instrumentalist position, it doesn't mean that Berkeley saw things in the same way. This passage of Berkeley's is an interesting point that does anticipate a lot of what would come later, but it doesn't mean that Berkeley saw it as that important to his own arguments. Newton-Smith is seeing this small point and reading into it the idea that Berkeley thought the same as Duhem or Quine. Indeed, Newton-Smith seems to think that it is only the fact that Berkeley wrote something similar to these men that gives his view any worth at all. It is "the arguments of Duhem and Quine [that] have generated sufficient interest in UTD to give Berkeley's philosophy of science contemporary significance." (EOB Pg159) It is my view that Berkeley's views are independently interesting from a historical perspective and that the sort of intellectual press-ganging that Newton-Smith engages in is simply not on. Berkeley is not Quine or Duhem and didn't face their problems, his views aren't theirs and his writings aren't intended to settle any debate of the twentieth century. To make him do any of these things is to do him a great injustice.

It is my contention that the reason for the errant interpretations of Section One more or less all stem from a modernist slant in the thinking of the interpreters. Rather than concentrate on the textual evidence of what the historical figure meant, they wheel out a version of their subject's thought in order to justify some position in a modern debate. Mackie, for example, is guilty of this in discussing the representationalism that is inherent in the primary and secondary quality distinction. The question is whether Locke held such a theory. The method Mackie employs in order to find an answer is unique:

"[I]f we find some representative theory that is defensible, it will make it easier to believe that Locke adopted it." (PFL Pg37)

This is surely not the way to determine Locke's position. Rather than wandering through a modern debate and imposing on Locke the most defensible theory, as Locke, being a great philosopher, will have settled for no less than the best, rather, I say, than this, we should look at what Locke said and then see if it can be defended. Mackie has

got it completely the wrong way around. Similar criticism could be levelled at Mandlebaum and Warnock, but for brevity I shall cut short my invective.

I would, however, like to exclude Peter Alexander from this critique. His work is, I believe, a very substantial contribution to the exposition of Locke's primary and secondary quality distinction and Boyle's foundational role in it. But it suffers from not fully explaining the extra thought and work that Locke put into the distinction. Alexander is too quick, in my opinion, to say that Locke just adopted the distinction from Boyle, and he missed out the fact that some of the points that Locke makes are directed against the scholastic theory. He has not strayed from the path of a full and clear historical interpretation, he has just missed a few stepping stones on his journey.

With all this in mind I think that we can conclude something substantive from the mistakes that have been made. Put simply, don't let modern considerations influence the proper interpretations of historical figures. In most of the commentators we have seen that they aren't able to grasp full the subtleties of the positions adopted and see that the problems faced by the historical object of study are just not the same as those faced today. There might be broad similarities, but the differences in detail can easily preclude there being an identity in the solutions proposed now and those given three hundred years ago. Trying to make Berkeley or Locke wear the clothes of a twentieth century philosopher of science will leave you with a very odd looking figure in a very ill-fitting outfit.

In order to consider how to remedy this it is perhaps in order to ask why we study the history of philosophy at all. One reason might be that the current debate is defined by its history and that the great dead philosophers represent the canon by which we define what a philosophical problem is. We delineate the area of philosophy as that which those from Bacon to Kant wrote about. So in studying the history we can see where we are in the philosophical terrain, or indeed, whether we are on that terrain at all. We might also study philosophy's history in order to become acquainted with some "Class A" minds, and see how they perform in their given historical contexts. This may give us something to emulate or aim for in our own work, or at the very least we can learn the practice of philosophical analysis from some great practitioners of the art. We might also want to see how they argued a particular point, or set out a specific issue and indeed, the substance of this point will infect the previous two; they define the subject by the argumentation they present, and they are called "Class A" minds because of the great acumen in the

argumentation presented. The arguments of the philosophers are of paramount importance in the study of the history of philosophy. In fact, if you wish to use older argumentation in order to decide a point in the modern era, you need to know what these older arguments actually were. The whole enterprise of the history of philosophy is getting a correct interpretation of the arguments as they were presented in the subjects work. We need to have as full as possible a grasp of what it was Locke, or Berkeley, or Descartes, or Kant meant when they said such and such before we start to apply it, or criticise it, or use it to define a philosophical problem.

So, I would argue, it is a basic pre-requisite, whatever your reasons for engaging in a historical study, that you fully outline the positions that are being put forward. The simplest way to do this, of course, is to let the philosophers speak for themselves as much as possible, and for you to give as much weight to a point in their interpretation, as they give it in their work. You need to have as large a grasp as possible on the texts and the contexts in which they were written. In isolation the passage making the primary and secondary quality distinction in Locke might seem to require support from physics. In the context of the Essay, though, it is seen as part of a larger program of intelligibility, whose significance only becomes clear when we consider the scholastic background against which the Essay is set. This means that a thoroughly historical approach is necessary first in explicating a philosophers work.

It might of course be argued that I have missed one important aspect of the point of historical study, namely the fact that it can provide inspiration to later philosophers, even if it is not fully understood. This is perhaps true; in misreading Locke I might be struck with a new thought that I think I see in Locke, that solves a serious problem. If this does happen, well and good, but when you come to present this view I hope that you do not state it as Locke's, as in doing so you are saying something false. You might equally be struck by a thought upon reading the back of a cornflakes packet. Am I then to recommend the reading of these as a necessary pre-requisite for proper philosophical analysis? I think not. Inspiration can strike in the most unlikely of places, and a wrongly attributed view could be a help, but if we want to do any of the things listed above, if we want, in short, to get a little historical verity out of our study, then we need a very thorough interpretation first.

Am I not now stating the trivially obvious? Apparently not. As we have seen there

are people that have systematically obscured the views of both Locke and Berkeley by importing modern worries and items of significance back three hundred years on to their work. This thesis, then, is perhaps a lesson in the obvious, but it is a lesson that some people need to take notice of: When looking at a historical figure do not just take the odd quote out of context - you need to set up their whole position first and doing this can require a lot of material from the texts themselves. Hence my generous use of quotes in the thesis itself. Do not, above all, go looking to recruit a figure to one modern camp or other just on the basis of a few interesting parallels. This is what Locke was worried about in III.IX.10. when he notes that it takes a lot of "Attention, Study, Sagacity and Reasoning ... to find out the true meaning of *ancient Authors*."

To conclude then, I say this: Both Locke and Berkeley had interesting, fully consistent philosophies of science that are different from the positions that are taken up today. Their positions may indeed be of great interest to modern philosophers, now that we have clarified what they are. But we should not start our research in these areas looking to force a figure into a particular position, rather we should let them lead us where they want to go. If we find their final view unprofitable to the contemporary debate, so much the worse for us, we shall have at least enjoyed the journey. A proper interpretation is methodologically prior to any sort of philosophical criticism: you have to know what they said and why before you can even begin to comment upon it.

## Bibliography.

Alexander, P., *Boyle and Locke on Primary and Secondary Qualities*, in *Locke on Human Understanding*, ed. Tipton, I.C., Oxford, 1977.

Alexander, P., *Ideas, Qualities and Corpuscles*, Cambridge, 1985.

Berkeley, G., *Works of George Berkeley, Bishop of Cloyne*, ed. Luce, A.A. and Jessop, T.E., London, 1948-51.

Boyle, R., *Selected Philosophical Papers of Robert Boyle*, ed. Stewart, M.A., Manchester, 1979.

Boyle, R., *The Works of the Honourable Robert Boyle*, ed. Birch, T., London, 1744.

Chalmers, A., *The Lack of Excellency of Boyle's Mechanical Philosophy in Studies in the History and Philosophy of Science*, Volume 24, Number 4 (1993).

Lauden, L., *The Nature and Sources of Locke's views on Hypotheses in Locke on Human Understanding*, ed. Tipton, I.C., Oxford, 1977.

Locke, J., *An Essay Concerning Human Understanding*, ed. Nidditch, P.H., Oxford, 1975.

Locke, J., *Of the Conduct of the Understanding*, ed. Fowler, T., Oxford, 1901.

Locke, J., *The Educational Writings of John Locke*, ed. Axtell, J.L., Cambridge, 1968.

Mackie, J., *Problems from Locke*, Oxford, 1982.

Mandlebaum, M., *Philosophy, Science and Sense Perception*, Baltimore, 1964.

Newton-Smith, W.H., *Berkeley's Philosophy of Science*, in *Essays on Berkeley: A tercentennial celebration*, ed. Foster, J. and Robinson, H., Oxford, 1985.

Popper, K., *Conjectures and Refutations*, London, 1991.

Turbayne, C., (ed) *Berkeley Critical and Interpretive Essays*, Minneapolis, 1982.

Warnock, G.J., *Berkeley*, Oxford, 1982.

Winkler, K.P., *Berkeley: An Interpretation*, Oxford, 1989.

Yost, R.M., *Locke's Rejection of Hypotheses about Sub-Microscopic Events in Journal of the History of Ideas*, 12 (1951).