Ruminating on the Stephen Hawking phenomenon

the origin of the universe, and the "Two Cultures"

by Colin Bower (Aug. 2006)

> *"An exact mathematical theory means nothing unless we recognize an inexact non-mathematical knowledge on which it bears..."* Michael Polanyi

Let me start my thesis with a bang, hopefully a big one. The cosmologies of quantum physics and of deistic religions have much in common. But since quantum physics bases its discoveries on evidence and deistic religion draws its knowledge from faith, it must be assumed that these commonalities are unintentional.

They both offer "explanations" of the origin of the universe that are no explanations at all, and both "solve" the mysteries of our origin only by creating others. The religious explanation posits a god or gods who created the universe, but doesn't explain who created the god or the gods. The scientific cosmologists explain the universe by reference to a big bang, but they don't explain what existed before the big bang, nor what it was that "exploded" in the big bang, nor why such an explosion – as opposed to a non-explosion – happened in the first place. Conveniently, they claim that such questions are illegitimate. For instance, Hawking says: "As far as we are concerned, events before the big bang can have no consequences and so should not form part of a scientific model of the universe. We should therefore cut them out of the model and say that the big bang was the beginning of time. This means that questions such as who set up the conditions for the big bang are not questions that science addresses." This allows them to evade any obligation to provide an answer to them, and puts scientific cosmologists in much the same ontological corner as the faith-based cosmologists, who also reject the legitimacy of a similar question: "But what existed before God created the universe, and what was God doing with himself during this time?"

These evasions unashamedly take place in the context of a clearly articulated intention of describing the origins of the universe, the history of all time – a history which must presumably include the origin of time – and the meaning and purpose of everything. In the case of scientific cosmology, this context is readily apparent in such Hawking formulations as: "The eventual goal of science is to provide a single theory that describes the whole universe...our goal is nothing less than a complete description of the universe...if we discover a complete theory...then we shall all...be able to take part in the discussion of the question of why it is that we and the universe exist...". Avoiding just for the moment the non-sequitur buried in that last phrase (if we had a complete theory of everything, the discussion that Hawking envisages wouldn't be necessary), it is clear that Hawking entertains the view that a complete and universal knowledge *is*

possible, and of course his promise to the reader of a cosmic explanation is explicit in the hubristic titles he gives to his books. I find no evidence in the text of *A Briefer History of Time* that Hawking is aware of this disabling contradiction. He doesn't provide a history of time, nor any explanation of anything that can remotely be regarded as an explanation, nor even an argument worth having, and I am hard pressed to understand why so many millions of people buy his books, unless it is to own them, rather than to read them.

I see I have taken Hawking as representing all scientific cosmologists. This may be unfair. But what he may lack in representivity he more than makes up for in reach, for his books have together sold more than 18 million copies, and Paul Davies, a theoretical physicist and author of such books as *About Time*, *God and the New Physics* and – significantly as we shall later see – *The Mind of God*, says "Stephen managed to reach parts of the reading public that no other scientist or science writer ever approached, Einstein included. There must be many people who have read – or attempted to read – only one science book, and that is *A Brief History of Time*".

What benefit they may have achieved from such an attempt by way of an enhanced understanding of the scientific discoveries of modern cosmology is not in the least clear, and – were it possible – I would be pleased to make a handsome bet that, based solely on the knowledge they have acquired from Hawking's books, not a single general reader would be able to fill half a blank sheet of paper with a defensible description of string theory, an argument in support of the possibility of time travel, or an explanation of why it is that two clocks traveling at different speeds would record elapsed time differently, nor would they be able to provide a half convincing explanation of these phenomena to a class of 15-year-old children. And if not, what can we say about Hawking's achievement? As the best modern educational methodology now has it, if no learning has taken place, no teaching has taken place. And if no teaching has taken place, there's only one person to blame, and that's the teacher.

I have criticised Hawking's explanation of the origin of the universe as being "evasive". I think this is too kind to him, for it is more like an ontological form of fascism. "We can brilliantly explain everything down to the big bang (although not the big bang itself), but nothing before the big bang. Therefore we protect the integrity of our explanation by prohibiting questions that probe the pre-big bang cosmos." What kind of explanation is it that cuts itself so much slack? On what grounds can you *ever* forbid either the "why" or the "how" questions, as he instructs us to do?

Oddly – and this is characteristic of Hawking's procedure throughout his book – he provides qualifications or even objections to the theory he propounds, and then continues with the main line of his argument as though those qualifications and objections had not been raised. For instance, he gives the reader every reason to be skeptical about the big bang, but he never explores the consequences of this for the cosmology that, in the main, he presents, nor does he display any sense of occupying a contradictory

position. “General relativity is an incomplete theory because it cannot tell us how the universe started off… All our theories break down at the big bang…” He also tells us that the general theory of relativity on the one hand and quantum mechanics on the other are mutually exclusive theories: “…they cannot both be correct” is his forthright declaration. If the theories are mutually exclusive this means that at least one of them must be wrong, and possibly both of them can be wrong. This is an admission of some weight and consequence, and it must presumably have some considerable implication for his avowed purpose of talking about the nature of the universe, and its “beginning” in a big bang.

Does Hawking contradict himself? Compare the above two quotations with another: “According to the general theory of relativity, there must have been a state of infinite density in the past, the big bang, which would have been an effective beginning of time”. I am unsure whether my criticism of Hawking should be directed at the contradictory positions he occupies, or at his incompetence with the language. (What on earth makes him believe he has the qualifications as a writer to justify him in the enterprise of explaining complex matters in logical formulations of thought?) We need to take a deep breath, slow down a little, and really attempt to get to grips with what he is saying. What does he mean, “…*at* the big bang”? Is this before, during, or after? Does he mean that “infinite density” is actually the same phenomenon as the big bang? If the universe “started off” with the big bang, and if the general theory of relativity cannot tell us how the universe started off, then how can the big bang derive from the general theory of relativity?

I’m guessing he is suggesting that the general theory of relativity explains everything at some notional moment after the big bang has started, which he takes to be the beginning of time and the beginning of the universe, but not the notional moment of commencement of the big bang. But he does not say so, and we have here a crucial *lacuna* in the argument. I can only guess from the information he has provided that we must assume a big bang already under way as the earliest point in time we can get to from relativity theory. This strikes me as being a theory of limited value in describing the origin of our universe and the beginning of time, vulnerable to that most simple of child-like questions: “But what happened before?”, in answer to which Hawking merely says: “You’re not allowed to ask that question”. As explanations go, this doesn’t seem to carry our knowledge of the universe and its origins a great deal further than Genesis does.

Perhaps more to the point, Hawking’s difficulties in rising to the challenge of articulation occur because, as he reaches towards the limits of the cosmos, he crosses a boundary from physics to metaphysics (example: the phrase “the beginning of time” is inherently metaphysical; it is the defining characteristic of time that it effluxes, it does not begin), and, having crossed such a boundary, an entirely different kind of discourse is required of him. Hawking has an obligation to come to grips with this metaphysical world, and to display the ontological tools necessary to engage with it. This he signally fails to do.

Let us continue with this theme: contradiction, obscurity and *lacunae*. When Hawking writes: “According to the general theory of relativity, there must have been a state of infinite density in the past, the big bang,

which would have been an effective beginning of time" he fulfils the easiest of duties. An intelligent reader wants to know more, wants an answer to the questions his report so obviously provokes. Is the general theory of relativity, then, a good theory, if it can lead to such a conclusion? Is it plausible? Does it command his respect? Does he believe it? And *why* does he believe it, if – as he has previously told us – the general theory of relativity "breaks down" at the moment of the big bang? What can be meant by "infinite density", and those other two conditions that occur at the beginning of time "a sphere with a radius of zero" and "a single point with zero size"? I would love to know what thoughts occupy Hawking's mind when he himself contemplates infinite density, a sphere with no radius, and a point that does not exists (an entity of infinite density having neither location nor size), and it behoves him to work far more strenuously than he does to tell us.

There are many other examples of the kind of inconsistency that entails his raising legitimate objections to a theory or a position – and then proceeding with the cosmological investigation as if the objection had not been raised in the first place. Hawking gives fulsome support to the possibility of arriving at a complete theory of everything. But he also poses an appropriate objection to it. "Yet if there really were a complete unified theory, it would determine our actions – so the theory itself would determine the outcome of our search for it!". "Quite so", one is tempted to murmur approvingly; a mind self-evidently cannot be both a means of knowing and the thing that is known. But this doesn't deter Hawking – inexplicably given his neatly stated rider – from taking the possibility of a complete theory of everything with unselfconscious seriousness. Indeed, the possibility of knowing everything constitutes the conclusion of his book.

Separately we read: "The usual approach of science of constructing a mathematical model cannot answer the questions of why there should be a universe for the model to describe." Again, quite so. But he ruins the effect of this graceful formulation by continuing: "Why does the universe go to all the bother of existing?" This anthropomorphically-shaped question is a shade less impressive. But things get worse: "Is the unified theory so compelling that it brings about its own existence?" This has no more ontological weight than the creationist argument, "God brings himself into existence on account of being so god-like". And then we degenerate completely into: "Or does it need a creator, and if so, does He have any other effect on the universe? And who created him?" By so short a journey does the world-acclaimed cosmologist descend from high-level philosophical enquiry to an inane question about God's creator, a question that a drunken atheist in a bush pub late on a Saturday night could also ask, and fail to answer. He raises a telling and wholly appropriate enquiry about the limits of scientific knowledge, but he never allows it to destabilize or problematize the kind of scientific knowledge he otherwise uses as a means to know the entire universe, its origin and end, nor does he question its adequacy as a method for doing the job he has set for himself.

Errors of logic are painfully exposed in Hawking's book. He repeatedly refers to what he calls "the laws of the universe". Now we know that physicists have formulated many accurate and helpful descriptions of naturally occurring phenomena that, by convention, they call "laws". But it is a word that should be used

circumspectly. There is, it seems to me, a world of difference between the semantic weight and significance of a formulation such as “Boyle’s Law”, and a formulation such as this one by Hawking, for instance: “…if you believe that the universe is not arbitrary, but is governed by definite laws”. If a phenomenon is “governed” by a law, the law must pre-date the phenomenon it governs. Do we have any justification for reaching such a conclusion? Where do these laws come from? Why do they exist? That we can devise mathematical models to describe naturally occurring phenomena of the physical world is not for one moment to be confused with having discovered a “law”. A friend who studied Noam Chomsky’s linguistics in the course of writing a PhD thesis accuses Chomsky of the same error: mistaking the conventions of grammar for pre-existing laws. Chomsky describes these conventions (in arcane algorithms), and then claims that his description represents the laws speakers obey when producing language. In other words, he has not just *described* something, he has *discovered* something: he is not merely a grammarian, he is a scientist. But could it not be the case, for instance, that gravity, simply by existing, creates the law that appears to govern it? If we “explain” the existence of gravity in terms of a “law”, then are we then not also under an obligation to explain the existence of the law? To refer to the government of the naturally occurring universe by “laws” seems to me an epistemological error of some magnitude.

Hawking is not impressive on the subject of evolution, and makes a leap in reasoning analogous to vaulting the Grand Canyon when he links the possibility of arriving at a complete unified theory of the universe with evolutionary natural selection. “It has certainly been true in the past that what we call intelligence and scientific discovery have conveyed a survival advantage”. Is this true? What then explains the collapse of the intelligent and scientifically advanced civilization of Egypt, Greece and Rome? What explains the hegemony of the so-called “barbarians” of the so-called “Dark Ages”? Are we so sure that science and our best intelligence will save rather than destroy our planet, or parts of it? Have the leading lights in science been produced by anything that can remotely be connected to natural selection? Can we credit the view that natural selection (which must presumably be differentiated from a programme of eugenics) breeds better and better scientists? Does natural selection have as its goal – as Hawking implies – the production of intelligence adequate to the task of understanding the process that brought it to that point? As general readers discovered from Dawkins’s book *The Blind Watchmaker*, evolution serves no goal, so it hardly seems likely.

Hawking expresses a view indistinguishable from that of the Intelligent Design lobby: “…the remarkable fact is that the values of these numbers (the size of the electric charge of the electron and ratio of the masses of the proton and the electron, for example) seem to have been very finely adjusted to make possible the development of life”. “Adjusted…?” Who or what would have done the adjusting? “Remarkable…?” Well, only of you posit the view that the electrons and the protons that we have identified represent the attainment of some aim or goal; we can hardly call them remarkable if we regard life as being contingent, co-incidental and undesigned. And if remarkable, remarkable by comparison with what? This is

a bit like saying: “How astonishing this creation is: not only are our eyes perfect for seeing things, they have been separated by a nose expressly designed to hold up our spectacles…there must be a purpose to it all!” Separately, Hawking writes: “Moreover, the initial rate of expansion [of the universe] would have had to be to be chosen precisely for the rate of expansion still to be so close to the critical rate needed to avoid collapse.” “Chosen” by whom, pray? Chalk up another error of epistemology to Hawking.

Well, perhaps not an error from Hawking’s point of view. Because, actually, he is not a covert protagonist of Intelligent Design, he is quite brazenly explicit: the designer was God, with a capital “G”. So, the above quotation continues: “It would be very difficult to explain why the universe should have begun in this way, except as an act of God who intended to create beings like us”. Elsewhere he writes: “Yet it appears that God chose to make it [the universe] evolve in a very regular way, according to certain laws”.

Hawking’s frequent references to God are quite untrammeled by any sense that the notion of “God” is problematic; that the word has no meaning for millions of the world’s inhabitants, and particularly for members of the scientific community to which Hawking himself belongs; that many regard it as a social construct; that for many others, some even of a religious susceptibility, it represents something evil, and is therefore objectionable; that for millions of Christians and Jews it represents a male sky divinity specialising in crime and punishment; that for millions of Muslims it represents a deity whose utterance and command is unquestionable; and finally, that for all of those who profess belief in it, it represents a foggy notion they could not adequately or sensibly describe or explain either in a single sentence nor in a tome the length of *War and Peace*. None of this seems to deter Hawking from invoking “God” as an ever present point of reference in his book. Why would he do so inane a thing? How does he get away with it?

Needless to say, everyone is entitled to his or her chosen belief system, provided of course it does not impinge upon the rights of others to theirs. Moreover, it would generally be acknowledged that belief systems are a private matter. The lady at the check-out counter at my local supermarket can be a Rosicrucian, a fascist, a libertarian, or indeed even a libertine, and this need not affect the brief transaction we conduct every day. But you can’t get away from the fact that it *does* matter if you’re a cosmologist endeavouring to set out a well considered view of the origin of the universe, and if you advertise yourself as the Lucasian Professor of Mathematics at Cambridge in so doing.

Inexplicably, Hawking has also decided to capitalize the pronoun referring to God. – not “he”, but “He”. Orthographically, this lifts his writing out of the category of Christian apologetics and into the category of Christian liturgy. He also uses the Christian dating convention, “BC”, meaning Before Christ rather than the universally accepted scientific convention, “BCE”, which means Before Common Era. Hawking then is a Christian writer. Shouldn’t he declare himself more openly?

Given his allegiance, it is unsurprising that he defends the scientific position so weakly. He writes a chapter

entitled “The Nature of a Scientific Theory”, but it seems to me, at best, a feeble effort, at worst, a betrayal of the chair he occupies, the discipline he serves, and the truth he claims to seek. A scientific theory he says is “just” a model of the universe, it “exists only in our minds and does not have any other reality…”, and he follows this up by expressing doubt about the statement he has just made, “whatever that might mean”, which only serves to compound his error. “Yes”, I’m inclined to say, “whatever *does* it mean?” And if it means nothing, as I am certain it does, why did he write it in the first place? A literary critic might equally say: “Poetry is just words…their meaning exists only in our minds and does not have any other reality”, which would be equally preposterous. He writes: “Any physical theory is always provisional…it is only a hypothesis: you can never prove it.” Technically true, yes, but the emphasis seems to me so wrong as to make the kind of truth it expresses untrue. Would it be fair, true and accurate to say that the postulation by Copernicus that the planets revolve around the Sun was “provisional…only a hypothesis…unprovable”?

In another chapter, Hawking writes about the apocryphal little old lady, who told a gathering of distinguished minds that the world was really a flat plate resting on the back of a giant turtle resting in turn upon the back of other turtles. “Most people nowadays would find the picture of our universe as an infinite tower of turtles rather ridiculous. But why should we think we know better?” he asks. Indeed, why should we? It is not a difficult question to answer, and in answering it, we would be provided with an opportunity to compare and contrast belief, on the one hand, and evidence on the other, and thereby to demonstrate the primacy of evidence in the pursuit of truth. Oddly, he is not as unambiguous in setting out his position as one might have expected. Yes, he does refer approvingly to the “powerful tools…of mathematics and the scientific method, and technological tools like computers and telescopes.” But a tool is just a piece of equipment. It is the procedure which is the source of knowing better. Surely we can expect a more spirited and better articulated argument? Hawking appears to believe he can give a brief history of the last 15 billion years, and yet he is either incapable or unwilling to set out a half decent *apologia* for the scientific method, and he resorts to startling banalities in his evasion of the issue.

> Just as an infinite tower of tortoises supporting the flat earth is (a picture of the earth), so is the theory of superstrings. Both are theories of the universe, though the latter is much more mathematical and precise than the former. Both theories lack observational evidence: no one has ever seen a giant tortoise with the earth on its back, but then, no one has ever seen a superstring either.

Surely this is infantile stuff? What do Hawking’s professional colleagues think of him when they read this? Do the tortoises and the superstrings exist at the opposing ends of a spectrum differentiated by degree but by no point of principle? Why should anyone care about super string theory if this were the case? The final sentence of *A Briefer History* reads: “If we find the answer to that (why we exist), it would be the ultimate triumph of human reason – for then we should know the mind of God”. I see no ontological difference and no difference in extent of sheer asinine stupidity between the view expressed in that sentence, and the

view he attributes to his adversary, the little old lady.

It would be a commonplace remark to say that Hawking's subject matter was "complex", and yet it is a remark I would disagree with. It may be complex, but I have no means of knowing it, for in the words and the formulations he uses, his subject matter is too obscure to be discovered to be complex. Hawking bedazzles by providing us with complex propositions, but the real complexity that we yearn to see unraveled – what is the human significance of contemporary scientific cosmology? – is left bound up in a ball of string theory. The concept of "complexity" is pivotal to my argument here. For the general reader, even the general reader having a reasonable scientific background, complexity will not lie in mathematical equations or in the existence of wormholes, but in their human consequence. The reason why the vast majority of the world's population doesn't understand the theory of relativity 100 years after it was formulated is not because they are stupid, but because people like Hawking are incapable of describing it effectively, in a way that makes sense in their lives. Take just one example: the effect of movement on time. Hawking offers us the "twins paradox", probably well known to many readers. One twin lives on Earth, the other goes off in a spaceship which travels nearly at the speed of light. When the traveler returns "…he would be much younger than the one who stayed on earth." Says Hawking of this phenomenon: "This…is a paradox only if you have the idea of absolute time at the back of your mind. In the theory of relativity there is no unique absolute time; instead, each individual has his own personal measure of time that depends on where he is and how he is moving."

I am not in the least satisfied by this (I don't think "paradox" accurately captures one's innate sense of confusion caused by the proposition). Of course, Hawking must be "right" one says to oneself – I'm not going to pick an argument with him or Einstein on this. But surely the real complexity at stake here remains to be teased out? Quite in what way have the many living astronauts who traveled at great speed over extended periods returned to earth "younger" than those they left behind? Are we sure that we have a common understanding of what "age" means under these circumstances? When Hawking writes: "…relativity shows that it is possible to create a time machine…You step into (it), wait, step out, and find that much more time has passed on the earth than has passed for you". Presumably no-one can argue with the theory of relativity, but what such an observation cries out for is some investigation of the ways in which we need to adjust our lived understanding of time; what is the human, experiential truth of this startling consequence of relativity? Hawking tells us a great deal about clocks that are similarly affected by gravity and movement. "A clock on the surface of the sun would gain only about a minute a year as compared to one on the surface of the earth". But if two clocks have the same mechanical action, how do they record the effluxion of time differently? Really to set out the significance and the consequence requires gravitas, élan and finesse! In the absence of explanations that set out the human and experiential aspects of his subject matter, we have no means of knowing quite what Hawking understands by them. If we say, for instance, that the universe is of infinite size, have we in any real way advanced our knowledge of that

universe?

His case is not helped much by the evidence of formulations that clearly do not reflect a mind setting out evidence, marshalling argument, and shaping thought with elegance and precision – such as one sometimes come across, for instance, when one hears a great barrister or advocate setting out an argument. Here is an example of what I mean: to demonstrate the apparent truth of the observation made by the scientist Friedmann that the universe looks the same in every direction, Hawking offers the following analogy:

> Imagine standing in a forest in which the trees are growing in random locations. If you look in one direction, you may see the nearest tree at a distance of one metre. In another direction, the nearest tree might be three metres away. In a third direction, you might see a clump of trees at two metres. It doesn't seem as if the forest looks the same in every direction, but if you were to take into account all the trees within a one-mile radius, these kinds of difference would average out and you would find that the forest is the same in whichever direction you look

I've no doubt that Friedmann was a distinguished scientist who made a great discovery, but to extend my own previous analogy, if Hawking were to be making his living as a barrister put to the test of persuading a jury of the truth and validity of Friedmann's theory, he would surely lose both his case and his job. What he says about the forest – in the way that he says it – is simply not true!

Hawking seems to be incapable of differentiating between the things that should be said and the things that shouldn't. In effect, this means that he seems to have no inkling of his audience, what its level of comprehension might be, and what its need for explanation might be. He swings with alarming inconsistency between the blindingly obvious – not to say the downright patronizing – and the impenetrably opaque. The reader who needs to be told: "It turns out to be very difficult to devise a theory to describe the universe all in one go" is certainly not the reader who will understand: "In string theories, the basic objects are not point particles but things that have a length but no other dimension, like an infinitely thin piece of string…A particle occupies one point of space at each moment of time. A string, on the other hand, occupies a line in space at each moment of time." Well, again, what is wrong with this statement is not that it is complex, but that it is obscure, and the obscurity is caused by linguistic imprecision. What is meant by "basic objects….things…at each moment of time"? Hawking again rides roughshod over the notion of "infinite". How can we get to grips with a concept such as "…like an infinitely thin piece of string"? And ironically, this is a simile designed to help us *better* understand string theory! (I trust it is not disingenuous to protest that Hawking has previously told us about the fascinating so-called two-slit experiment, in terms of which a single electron contrives to pass through two slits simultaneously, from which I deduce that it actually *doesn't* occupy one point of space at each moment of time; the confusion is bound to be mine, not Hawking's, but it does testify to a poor explanation).

Well, one may go on, but this isn't an exercise in practical criticism. To return to a point made explicitly above, but probably implicit throughout, Hawking simply does not have the linguistic resources to do the job he sets out to do, and when he slips into banality, as he repeatedly does, the impression is of a disturbing lack of resonance of thought; I just don't feel I am in the presence of a great mind telling me something I need to know. I can't shake the view that someone who says "it is possible to travel to the future", and who speculates enthusiastically about the possibility of human travel both forwards and backwards in time must certainly know less about time and the human world within which time is experienced than I do.

This brings me to my final point: the "two cultures" – or the supposition that there are "two cultures". Many readers will be aware that a little over 50 years ago the writer and scientist CP Snow popularised the view that it was a great tragedy that authors and intellectuals – to say nothing of the great unwashed – understood so little of the scientific world, and of the "culture" he supposed the scientific world to represent. This led to a famous riposte from the literary critic FR Leavis, who said words to the effect "there is only one culture, the human culture". A similar point has been well expressed by Michael Polanyi, himself a qualified scientist, and also a philosopher, who writes: "The mechanistic explanation of the universe is a meaningless ideal. The prediction of all atomic positions in the universe would not answer any question of interest to anybody." This may have, on the face of it, the suggestion of hyperbole. But actually Polanyi seems to me to be spot on. And if he is right, this has considerable implications for our understanding of the quality and value of Hawking's book. To go back to Davies: he endorses the "two cultures" concept when he says that Hawking's achievement has been to gain public acknowledgement that scientists have as much authority to address the great questions of existence as poets, novelists and playwrights.

This seems to me a bizarre misjudgment, because the precise problem with Hawking is that – even as he explores the extraordinary outer limits of time and the cosmos, a place where metaphysics and physics can no longer be differentiated – he insists on the disclaimer that he is a scientist, not a philosopher (or a poet). My complaint is that this is an indefensible position: that you cannot explore the outer limits of time and the cosmos *without* being philosophical about what you discover, and without being capable of describing those limits in language that will inevitably have to have the resonance of philosophical insight. By disclaiming such a role; indeed by insisting on a contradictory position (see the last page of the main section of his book [pg. 142] – too long to quote in full, and in part too fragmentary to make much sense), Hawking quite explicitly denies being the artist Davies wants him to be. But Davies is in any case wrong; scientists cannot be confused with "poets, novelists and playwrights", or not unless they write poems, novels or plays. When he writes about time travel as a practical possibility, and he fails to stop and explore the human consequences of such a possibility, Hawking loses, in my view, any authority that would give him the right to address the question in the first place.

The last page of Hawking's book is an unsalvageable mish-mash of ill-considered sentiment and half truth,

but if he is saying, as I think he is, that the scientist asks the question “how?”, and leaves it to the philosopher to answer the question “why?”, then we have here a very naive view indeed of the common pursuit of human truth that at one level or another must inform the work of all thinkers, whatever their discipline. And it is his steadfast refusal to consider that he also is responsible for eliciting the human truths out of his work as a cosmologist that disqualifies his work from being worth our attention. In his final paragraph, he envisages the “discovery” (quaint word) of a “complete theory” of the universe by scientists, after which “philosophers” will be able to commence their work, presumably of “philosophizing” about this universe.

When I read this I feel the same white heat of anger that I imagine Leavis must have felt when he read CP Snow on the “two cultures”. That Hawking should end his work on so irredeemably trivial a note represents for me good reason to discount the rest of it. How can a mind that thinks of meaning in this way have anything important to say to me about anything?

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1) The two books of Hawking’s that I refer to in this essay are *A Brief History of Time*, and the subsequent *A Briefer History of Time*.

2) *A Briefer History of Time* was written in conjunction with Leonard Mlodinow, but I have assumed that final authorial responsibility for the book rested with Hawking, obviously the senior author.

3) The quotes and the other references to Davies are drawn from a review of *A Briefer History of Time* by Tim Radford, and published in *The Guardian* on Sept 27, 2005.

4) The epigraph to this essay is taken from a quotation given in *The Living Principle* by FR Leavis and comes originally from *Knowing and Being*, a collection of Polanyi’s essays made by Marjorie Grene. The textual quotation from Polanyi is given in an essay by Paul Dean in Vol 14 No 5 of *The New Criterion Online*.

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