In 1929, Eugen Jolas, the editor of transition (the avant-garde literary magazine which was publishing Joyce’s *Work in Progress*) announced what he called the new Revolution of Language. His essay on ‘James Joyce and the Revolution of Language’, however, was also intended to ease into history the verbal macaronics of Joyce’s experimental fiction as a monument to the latest revolution in science which had given birth to a new cosmos. The autonomy of the literary word would, he argued, similarly ‘hammer out a verbal vision that destroys time and space’. By 1933 the physicist Max Planck had published his popular book on the new science *Where is Science Going?*. Its theme was that scientists too had destroyed time and space. Planck wrote of the revolution in knowledge which proceeded from the work of scientists such as Heisenberg, Einstein and his own theory of the quantum: ‘Now the iconoclast has invaded the temple of science. There is scarcely a scientific axiom that is not nowadays denied by somebody’. In 1929 writers and scientists were struggling to reconcile the worlds of ordinary sensory experience with the strange universes opened up by the New Science.

Fifty years later, in 1979, Jean-Francois Lyotard published his famous ‘report on knowledge’, an enquiry into the state of science, entitled *The Postmodern Condition*, and in so doing he declared modernity to be exhausted: the emancipatory and progressivist narratives of the Enlightenment could no longer be grounded in the certainties of classical realist science, for which Newtonian mechanics, Baconian method and Cartesian rationalism had provided the foundations. Physics had provided the paradigm for this ‘modern science’, combining rigorous deductive analysis with empirical induction from controlled experiment. However, according to Lyotard’s analysis, logic had now fallen prey

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to the subversive energies of rhetoric, and the model of a detached scientist collecting the data of an inert nature had been banished by developments in the newest science: in cosmology, chaos and catastrophe theory. In 1979, as in 1929, it would seem that writers and scientists were again engaged in overlapping epistemic activity.

If this is the case then, firstly, why has there been so much ongoing investment in the idea of the two cultures’, so named in the Cambridge Reid lecture of 1959, when C.P. Snow attacked literary intellectuals for their aversion to scientific knowledge and for their cultural pessimism? (F.R. Leavis replied by deriding scientists as philistine technologico-Benthamites who were destroying the organic richness of twentieth-century culture.) Secondly, what is the relationship between literary and scientific cultures in the twentieth century: can we identify a distinctively postmodern turn in this, a second Revolution of the World and a second Revolution in Scientific Knowledge? In this paper, I will approach these issues from three major perspectives: first, to examine the ‘two cultures’ debate and to look at its representation of the relationship between literary and scientific cultures; secondly, to examine the postmodern reading of the New Science offered by theorists such as Lyotard and to compare this with the way in which scientists themselves have tended to represent their own work; and thirdly, to return to that earlier moment in the emergence of literary Modernism and to examine the relations between modernist writing and the New Science of that period: the work of scientists such as Max Planck, Werner Heisenberg and Neils Bohr.

What most distinguishes the ‘postmodern’ reading of the newest sciences is a kind of Utopianism which, for all Jolas’s excitement, is not the dominant mood reflected by writers and theorists who engaged with science in the 1920s. As books by scientists such as Stephen Hawking, Paul Davies and James Gleick would suggest, the latest versions of the New Science are mediated in antimatериалist and even spiritualist vocabularies previously the preserve of New Age pseudo-science. One detects in such manifestations of the ‘postmodern condition’ a distinct yearning for a remarriage of natural science and natural theology which would actually produce the grandest narrative of all: a reconciliation of cosmos and consciousness, subject and object, fact and value. Cosmology has become the site of a rejuvenated Utopianism which has seeped into the work of postmodern theorists and writers such as Italo Calvino and Jeanette Winterson. Since the period of High Romanticism, the idea of the aesthetic as a space of redemption and reconciliation has been a powerful ideology and one generally opposed by those on the science side of the ‘two cultures’ debate. In Lyotard’s reading, however, not only do the epistemic spaces of science and literature begin to leak into each other, but the worlds of science and those of the aesthetic begin to look ontologically indistinguishable too. In the postmodern worlds of Indeterminacy, Chaos and Catastrophe, as in the virtual realities of cyberspace, science would seem to be as aestheticised as everything else in the postmodern condition.

Paul de Man once argued that the struggle for reconciliation was the defining feature of twentieth century art; if we are to believe the postmodern readings of the Newest Science then we have arrived at last in Utopia as that No-place which is the other side of nihilism. It will be my argument, however, that announcements of Paradise Regained are premature, to say the least: instead of embracing postmodern Uncertainty tout cour we should continue to take heed of the more sceptical and more painful condition of modern Doubt which is the legacy to us of Enlightenment thought and classical science.

The two cultures

First then, we should examine the two cultures debate independently, for a moment, of the relations between Modernism and Postmodernism. In a recent introduction to the Faber Book of Science, its editor (a professor of English Literature), John Carey, observes that ‘given the boundless implications of science, it seems strange that poets have not used it more’. A few pages later, the note of apocalypse enters: ‘As science has grown, so, inevitably, has the ignorance of those who do not know about it. Within
the mind of anyone educated exclusively in artistic and literary disciplines, the area of darkness has spread enormously during the later twentieth century, blotting out most of modern knowledge. A new species of educated but benighted being has come into existence - a creature unprecedented in the history of learning, where education has usually aimed to eradicate ignorance'. Carey is only the most recent of a line of combatants in what C.P. Snow termed the 'Two Cultures Debate'. Both Snow and Carey, in fact, share an antipathy towards intellectualism (see Carey's 'The Intellectuals and the Masses, for example), a distrust of positivist philosophy, and a decidedly positivistic interpretation of science, literature and knowledge. In his Cambridge lecture, Snow advanced a defence of the moral health of the scientific culture as opposed to the degenerate and self-indulgently tragic view of life promulgated by the literary intellectual. Modernists such as Pound and Lewis, with their 'ambiguous relations with Fascism' and their narcissistic moral vanity, were viewed as particularly representative of twentieth-century literary trends. However, this view of the literary intellectual as a moral degenerate to be compared unfavourably with the plain-speaking philanthropic scientist, is actually a cultural construction which reaches back to the late nineteenth century. Max Nordau's infamous Degeneration was translated into English in 1895 and advanced an image of the avant-garde artist as a decadent carrier of moral pathology, host to a morbid virus which was undermining the health of Western culture and precipitating its decline. The image was reiterated in a variety of contexts: in Wells's The Time Machine (1895), for example, where the over-refined, ennervated and decadent aestheticism of the Eloi has provided perfect conditions for the proliferation of the race of worm-like but evolutionary adapted and scientific Morlocks whose base intellectual existence will, for at least some time, inherit the earth (the story, of course, reflecting Wells' own ambivalent position on the two cultures issue). In Nordau's book, writers and artists such as Wagner, Nietzsche, Zola, Ibsen and the French Symbolists take the place of the Eloi: hysterical and neurasthenic representatives of a negative genetic strain blossoming in the hothouse atmosphere of the new metropolitan cultures. Like Snow later, Nordau (a Lamarkian) also regarded science as the means by which to control such threatening evolutionary tendencies: science, that is, conceived in the image of a robust positivism or 'method'. Only this kind of sturdy positivism might quell the rising tide of relativisms and the impending nihilism of a Dusk of Nations. For Nordau, aestheticism was seen to involve a morbid selfdestructiveness inimical to cultural health. It is hardly surprising that Nordau turns to science as a source of social salvation. In place of the morbid, introverted and neurasthenic artist, he-upholds the salutary common sense of the scientist following the clear path set out by Newtonian mechanics, arriving at truth through careful experiment and inductive reasoning.

From the other side of the debate, however, the picture looks considerably different. Defenders of the aesthetic continually represent literary and artistic culture as the locus of an oppositional and conserving humanist value structure in a scientific and technocratic world. In The Other Voice (1992), for example, Octavio Paz concludes with an essentially Romantic celebration of the (continuing) organic power of the imagination: 'Mirror of the fraternity of the cosmos, the poem is a model of what human society might be. In the face of the destruction of nature, it offers living proof of the brotherhood of the stars and elementary particles, of chemicals and consciousness... The universe is a tissue of live affinities and oppositions, and each poem is a practical lesson in harmony and discord'. Paz looks to the 'organic form' of the poem as a surrogate for that harmony of the spheres banished by modern realist science (and which postmodern science has promised to give back). Art becomes the locus of recovery of a reconciled universe where consciousness and cosmos, mind and nature, language and experience, no longer face each other across a gaping void. The spheres which were so radically separated at the birth of the modern world, in the first moments of Cartesian doubt, and with the foundational enumerations of Newton's Principia Mathematica, may once again be conjoined in the paradise regained of the poetic space. Literary culture,
therefore, in the familiar Eliot/Leavis account of it, comes to represent the possibility of a healing of that 'dissociation of sensibility' originating in the first scientific revolution of the seventeenth century. In this myth of origins, the moment of the birth of modern science is seen also to deliver into history a twin - a redemptive aesthetic which would compensate for science's disenchantment of the world, its projection of the human race into the blankness of interstellar cold.

Nordau's account is, of course, as simplified as Snow's, and both Leavis and Paz are actually attacking scientism rather than science per se. In fact, both sides offer a distorted perception of the relations between literature and science. Even by the end of the nineteenth century, important shifts were occurring within science itself which were beginning to leave common sense and positivism high and dry as either guarantors or reflectors of truth. By 1900, science would collapse certainty far more dramatically and effectively than Paterian aesthetics or Wildean wit. Between 1900 and 1930, in particular, the battle between idealists and realists, positivists and pragmatists, would be complicated and immensely sharpened by a series of scientific discoveries: Planck's account of the quantum in 1900, the development of the wave theory of light, the kinetic theory of gases, Bohr's theory of the atom and principle of complementarity, Einstein's papers on special and general relativity, Heisenberg's Uncertainty Principle. Similarly, in philosophy too, Russell and Moore initiated a decisive break with Bradley's Absolute Idealism in the publication of the *Principia Mathematica* and the *Principia Ethica*, and between 1910 and 1915, Russell developed his theory of knowledge and published *The Problems of Philosophe* in 1912. Wittgenstein would challenge epistemology with logic in *The Tractatus*. Each of them, and Whitehead too, wrote about and engaged with the new scientific discoveries, recognising that philosophy itself, as a critique of knowledge, would forever be changed by the New Science. We will examine shortly the legacy to Postmodernism of this paradigmatic shift in knowledge, but first of all, it is worth pausing to consider some of the important ways in which scientists themselves contested the positivist version of science in the earlier part of the twentieth century.

Why did the discoveries listed above carry this kind of impact? Three, in particular, were central: Planck's observation that electromagnetic radiation is emitted in discrete packets or quanta introduced the notion of discontinuity, acausality and randomness into the understanding of the fundamental composition and activity of matter. Further, Heisenberg's Uncertainty Principle suggested that all physical qualities that can be observed are subject to unpredictable fluctuations there is an inherent indeterminism in the behaviour of the fundamental particles of life, for at the quantum level no definite predictions can be made about the behaviour of any system (the founding principle for later chaos and catastrophe theories). In his book of 1930 *The Physical Principles of the Quantum Theory*, Heisenberg spelled out the implications of this insight: 'the traditional requirement of science ... permits a division of the world into subject and object (observer and observed) ... The assumption is not permissible in atomic physics: the interaction between observer and object causes large changes in the systems being observed, because of the discontinuous changes characteristic of the atomic processes'.

Heisenberg's grammar is noticeably inexact, for he wants to move beyond the division into subject and object, beyond saying that it is either matter which is discontinuous or perception which is uncertain (beyond positivism and impressionism), but language tends to reinforce the very categories which he is trying to reject. Even as a scientist, however, Heisenberg recognises the primacy of language in the formulation of communicable knowledge.

Neils Bohr's Principle of Complementarity (my third example) was actually taken directly into literary criticism by I.A. Richards and Willam Empson, as both developed concepts of irony, ambiguity and paradox which would dominate the criticism of poetry for the next fifty years. As we shall see later, the more radical implications of Uncertainty and Complementarity would also
provide an epistemological justification for the abandonment of epistemology in the poststructuralist and postmodernist turn which displaced the New Critical hegemony of the forties and fifties. According to Bohr's thesis, there is an ineradicable ambiguity in all quantum systems. An electron can be a wave or a particle, depending on the experimental situation, but cannot be defined exclusively as either one or the other. As in Heisenberg's theory, observation is implicated in, rather than outside of, any experiment and is crucial to the creation of form: ambiguity is an inherent property of matter and not simply an effect of perceptual limitation. Of the wave/particle thesis, Bohr claimed that its discovery necessitated the 'final renunciation of the classical ideal and a radical revision of our attitude towards the problem of physical reality'.

What he promised was the end of Cartesian dualism, of materialist science and the treadmill of Newtonian determinism. It appeared that consciousness might then be reconciled with matter not simply in the spaces of the organicist work of art, but as elements in the actual cosmos. If both are built out of the same fundamental particles, mutually partake of the same condition of virtuality, then the universe seems closer to a Heraclitean rather than a Newtonian model. Classical science is no longer 'true' but simply intelligible with reference to its own conceptual frame: what is true in the world of Newtonian mechanics cannot be true in that of quantum mechanics. Science no longer represents one method of investigation of a realm of universal truth. Like the work of art, the quantum world is argued to be fundamentally indeterminate: the free space of the aesthetic seems now to be integral to the previously separate and deterministic world of physical science.

Heisenberg would come to express the problem in terms of language: 'Any concepts or words which have been formed in the past through the interplay between the world and ourselves are not really sharply defined with respect to their meaning ... we practically never know precisely the limits of their applicability ... The concepts may, however, be sharply defined with regard to their connections ... which can be expressed by a mathematical scheme ... But the limits of their applicability will in general not be known'.

Internal coherence rather than external correspondence may be our only source of certain meaning and, perhaps more significantly, might provide the means by which to wrest freedom from external determinisms. Of course, not all New Physicists accepted this. Einstein continued to resist the more radical interpretations of the New Physics. He continued to believe that science must remain a realism and that matter continues to exist with welldefined properties - whether we can see it or not. The world is ultimately stable and only apparently affected by our apprehensions. For him, quantum mechanics was incomplete and, like many another modern, he believed there must exist a deeper level of dynamic variables which bestow an apparent indeterminism at the surface level whilst maintaining their own core structural form.

What must be evident, even from this absurdly brief account of the scientific revolution of the early twentieth century, is that the science in it bears little resemblance to the version represented in the "Two Cultures" debate - whether it is the version offered by Snow or by Leavis. Snow's science is modelled on nineteenth-century positivism and Leavis's attack is actually on the scientism which has followed from this positivist model. The epistemological implications of the early twentieth century revolution, however, have only recently (and within the rather different terms of the postmodern debate) come to take on the enormous significance in the wider culture first registered in the more narrowly scientific one as early as the 1920s by physicists such as Heisenberg and Neils Bohr. Certainly the Utopian claims for this kind of science have blossomed as part of the postmodern agenda. That it has taken so long for the implications of the New Science to impact on the general culture is the consequence of a range of cultural and historical factors chief of which must be the significant return to positivist epistemologies in the 1950s as suggested by the enormous success and popularity of A.J. Ayer's Language, Truth and Logic (1936) which was reissued in 1950. Ayer's book indeed set the tone for the common sense empiricism and pragmatism of that decade. A revival of philosophical interest in the New
Science did not emerge until the various critiques of method gathered force in the sixties, and even then it was initially overshadowed by the countercultural focus of critique of technology as the strong arm of capitalism, rather than on the demise of positivism as the universal basis of modern epistemology. The Counterculture was anti-science, but more in the spirit of Leavis's celebration of 'Life' than as a sustained epistemological critique of method. By the 1980s, however, the cultural mood finally responded to the full implications of the earlier scientific revolution and science, like everything else, began to be postmodernised. C. P. Snow's vision of a robust positivist kind of science has been radically challenged: far from being regarded as a source of moral health and growth, applied science would now come to be regarded by many as the scapegoat for every moral evil of the century. The official markers of liberal progress in the period have been precisely those developments (in applied science and technology) which have most clearly signalled the inadequacies of its rational ethics-genetic engineering, the splitting of the atom and its consequences, in vitro fertilisation, etc. Increasingly too, scientific method or knowledge has been regarded as unable to provide for (or even, on occasion, to acknowledge the existence of) all those human needs, spiritual, communal and affective, which seem to resist or exceed quantification.

However, whilst positivist scientism and technology have moved more on the defensive, pure scientists have begun to reconstruct their activities in the terms of a new Utopian vocabulary of reconciliation, open-endedness, indeterminacy and creative freedom, a vocabulary uncannily close to the Romantic language of the sublime and to the German Idealist presentation of the aesthetic as a space which might resist the mechanical world of scientific method and determinism. Is this return of the sublime in the new Utopian language of science simply the consequence of the collapse of other kinds of Utopian discourse? Certainly, the post-1945 period has witnessed the collapse of the Utopian discourses of socialism, counterculturalism, libertarianism or even of welfare statism. A generation of post-war writers and intellectuals expressed a general retreat from social or political Prometheus and novelists such as Murdoch, Golding, Spark and Fowles ironically and metafictionally framed the heroic pretensions of their various enchanter protagonists with the explicit aim of exploring the dangerous consequences of projecting heroic fictions onto life. Walter Benjamin too had argued that the projection of a decadent aestheticism onto the sphere of history had created the barbarous idealisms of Nazism. Auden's 1963 essay 'The Poet and the City' developed a similar argument. However, if such irony had seemed morally necessary during the fifties and sixties, it has come to seem aesthetically constraining for a new generation of writers now. Is it surprising, therefore, that there seems to be a growing tendency in the post-sixties' generation of writers and literary intellectuals (a generation often cynical about its parents' dreams of erotic or political or cultural liberation) to turn toward the Utopian potential of the anti-materialist, indeterminate, undecidable new sciences of the late twentieth century? For when Utopia does exist in this contemporary space, it seems to emerge out of the fantastic worlds of cyberspace, or the idealisations of the semiotic body in post-structuralist feminism, or the self-conscious experiments with relations between time and space in writers such as Calvino or Borges. So too, the newest cosmologies of science, anti-materialist, beyond common sense, promise to assuage what Hardy called the 'ache of the modern', the Newtonian split between an alienated consciousness and a bleakly mechanistic cosmos. They seduce with the Hegelian promise of ultimate reconciliation: of individual freedom with rootedness in community, of change with permanence, offering a home but not a prison for the 'nomad', 'hybrid', 'migrant', 'vagabond' and all the other versions of the postmodern self.

It might seem from this account, therefore, that the most recent developments in science have not only healed the quarrel between the 'two cultures', but have also eroded the classic distinctions between the methods and truths of science and those of art. However, what this ignores is the fact that science and art have never existed in neatly packaged realms of fact versus value.
Indeed, science is never even simply narrativised within a culture (as Lyotard argues), but has always been continually mythologised. Its metaphors have always taken on powerful cultural lives of their own and, as we shall see, the construction of science within postmodern culture is no exception. Since the scientific revolution of the seventeenth century, human beings have felt compelled to seek their purposes and values in science and to transfer onto what is claimed to be a value-free discourse vocabularies more appropriate to the realms of ethics or metaphysics. Biology, from Romanticism to the ecology movement, has been plundered for metaphors of organicism and creativity, physics for those of deadly mechanisation, exclusion and alienation - and this in writers as diverse as Thomas Carlyle and D.H. Lawrence. In a review of 1930 of Joseph Needham's The Sceptical Biologist, William Empson, a writer whose own poetry explores the proclaimed 'queerness' of a universe constantly transforming itself, observed that 'in the nineteenth century, one was only a pile of billiard balls, jerking about according to mathematical rules; scientific determinism spelled horror and despair'. We cannot seem to accept that nature is simply 'something' which is 'taking its course', as Clow repeatedly tells Hamm in Beckett's Endgame, but are driven to that continuous effort to 'sublimate a disparity' which Robbe-Grillet names as our most absurd category error. The impulse gave Joyce his famous definition of Cartesian and Newtonian man in the Ithaca section of Ulysses: 'A conscious rational reagent between a micro- and a macrocosm ineluctably constructed upon the incertitude of the void'. The idea of a mechanistic physics provided for Victorians such as Carlyle, Arnold, Ruskin, Spenser and Meredith an umbrella under which could be collected most of the cultural and social ills of the age, and a convenient means of reformulating Christian debates about freewill and determinism in the secular vocabularies of modern science. Similarly, the newest science, with its vocabulary of indeterminacy and undecidability might even begin to sound as if it had been invented by poststructuralist intellectuals seeking a new mimesis of the anti-mimetic. How do we evaluate this kind of cultural myth-making?

Apocalyptically-minded writers and critics, for example, have mined the older mechanistic concept of entropy for their pessimistic projections of cultural decline (Herbert Spenser in the nineteenth- and Freud in the twentieth century) and so too have a host of novelists from Beckett to Pynchon to Golding, yet scientists protest and inform us that entropy is a restrictive term within science referring purely to the distribution of energy within thermally insulated systems (the latter can hardly function as a description of cultures, history or even the universe itself). So is late twentieth century science, the new sublime of quantum physics, chaos and catastrophe theory, superstrings and the like, a potential basis for a genuinely Utopian reconciliation, a healing of the Newtonian and Cartesian wound, or is it just the latest in a series of questionable cultural mythologisations where the realms of the aesthetic and the scientific are dangerously conflated in a kind of fin-de-siecle soul sickness seeking its cure in irrationalism and New Age mysticism? The new heavens, new earth, of contemporary cosmology certainly provide an interesting and as yet relatively unexplored twist to the two cultures debate.

At this point, I wish to leave behind, for a moment, the issue of the two cultures, but I would like also to begin to develop some of the implications for literature and literary criticism of the shifts in scientific understanding and to examine in particular the relations between Modernism and Postmodernism within this framework. Although modernist writing is often read through or related to ideas about relativity and indeterminacy which arise out of the twentieth century scientific revolution, most of it still expresses the sense of a world still very much situated in the Newtonian frame. Indeed, the quotations above from Joyce and Beckett place their writing very much in the tradition of a modern heroism which emerges as a response to scientific determinism. Newtonian science had provided a worldpicture governed by the certainty of mechanical law, but which seemed to offer no place within its materialist parameters for human consciousness. Equally Cartesian rationalism provided a model of subjectivity where an introspective consciousness creates
itself in isolation from the world around and disconnected from its own body. The incertitude of the void expressed by Joyce is the abyss which opens between the Cartesian subject and the Newtonian universe, and the great works of modernist literature can be seen to continue an heroic struggle to provide a bridge across this seemingly impossible space, an aesthetic struggle which is first named in philosophical terms in Kant’s Third Critique. The gap between consciousness and cosmos may be bridged more effectively through the sensuous embodiment of art than through the method of scientific rationalism. The gap is, of course, the fundamental space of modern doubt, for the ‘New Philosophy’, as John Donne acknowledged, precisely brings all in doubt: it gives birth to the realm of the why, of questions about value, purpose and meaning. Its literary expression has usually taken the form of a tragic humanism which haunts modernity and which is expressed in Alain Robbe-Grillet’s idea of the ‘sublimation of a disparity’: the desire to read our purposes into nature in what he regards as the futile attempt to close the gap and assuage the existential Dread of disconnection or Unheimlichkeit. It was perhaps Montaigne who first named the nature of such doubt in terms which would become definitive of the modern condition. Doubt, in this sense, could be the only intellectual equivalent to what he saw as the infinite possibility of things, and so, what is offered as cure must also be accepted as our disease. The state of restless and ever-inquiring scepticism is itself rested on the ground of a binding if hypothetical teleology: for the Doubt which is modern (and which I would like to set against that Uncertainty which seems to be definitively postmodern) takes a pre-emptive form, a scepticism which still sustains the belief that it may lead outside of itself, to a view from Nowhere, to sufficient answers if not final truths.

How to reconcile consciousness and cosmos, how to live with a sense of the impossibility of overcoming the ‘incertitude of the void’, but equally with a sense of the necessity for continuation of the heroic struggle? These are characteristic questions and activities of the modern: of philosophy from Kant to Wittgenstein and of literature from Joyce to Beckett. Virginia Woolf expressed a quintessentially modernist struggle to connect through the image of granite and rainbow: ‘If we think of truth as something of granite-like solidity and of personality as something of rainbow-like intelligibility’, then, she continues, the task of welding them together is a ‘stiff one’. Truth, conceived as a rational form may also exist as empirical being. Mr. Ramsay’s ‘think of a kitchen table when you’re not there’; but truth may not simply be ‘granite’ for it may also exist as rainbow, as the play of subjective consciousness, as Lily’s table with its texture of silvery bark and fish-shaped leaves, its evocations of lovely evenings with flamingo-like clouds. Tables, of course, have long served as exempla in philosophical discussions of the problem of knowledge, but what is significant in Woolf’s portrayal is that the table should exist simultaneously in both its granite-like and its rainbow-like forms. Woolf is clearly ambivalent about classic scientists as she is about realist philosophers, but she sees also that the classic realist conception of truth cannot simply be abandoned in order to capitulate in celebratory mode to the uncertainty of rainbow impressionism or Bergsonian irrationalism. Indeed, though Woolf is often read as a Bergsonian in her representation of subjective consciousness, she could equally be read through the framework of the Cambridge New Realism of Bertrand Russell and G.E. Moore, through what I have described as a a modern attitude of Doubt rather than a postmodern stance of Uncertainty. Lily is a post-impressionist painter: the ‘rainbow’ vision actually expresses the limits of a Paterian impressionism which is also the limit of nineteenth century positivism, and the conception of ‘granite’ expresses a notion of design closer to the rationalist logic of the new Cambridge realists. In fact, the terms ‘vision’ and ‘design’ provided the title for Roger Fry’s influential book on Post-Impressionism (written for the second Post-Impressionism exhibition and published in 1920). Fry’s training in science and aesthetics allowed him to provide an important and influential bridge between the worlds of science and art. Vision and Design presented the new Post-Impressionism as an attempt to advance beyond the limitations of Impressionism in its
search to recover a world of underlying form or design which might be reconnected to the world of immediate sensory impression. Fry's 'vision' is analogous to Woolf's 'rainbow', his 'design' the equivalent of her 'granite'. Writing on Cezanne and other post-impressionist painters, Fry argued that 'these artists do not seek to give what can, after all, be but a pale reflex of actual appearance, but to arouse the conviction of a new and definite reality. They do not seek to imitate form, but to create form; not to imitate life, but to find an equivalent for life. By that I mean that they wish to make images which by the clearness of their logical structure, and by their closely-knit unity of texture, shall appeal to our disinterested and contemplative imagination with something of the same vividness as the things of actual life appeal to our practical activities. In fact, they aim not at illusion but at reality'.

What seems to emerge from this is that reality might only be intuited through the clearness of 'logical structure', the 'disinterested imagination' and the 'closely-knit unity of texture': a description which is remarkably close to what is usually regarded as the attributes of the scientific or the analytic mind.

Lily Briscoe struggles throughout Woolf's *To the Lighthouse* with the attempt to reconcile 'granite' and 'rainbow'. As she sits on the lawn attempting to complete her painting after Mrs. Ramsay's death, 'visions came', but 'there was something perhaps wrong with the design'. She recognises the need to be 'on a level with ordinary experience' and at the same time to feel 'its a miracle'. At precisely this point in her meditations, the narrative perspective shifts to a passage which articulates James's intuition of the lighthouse as a symbol of the potential reconciliation of vision and design. As always in Woolf, however, the moment of insight is fleeting, and eludes those who pursue exclusively either one or other side of the dialectic: whether that of design (in its reductive form of getting to letter R in the alphabet - which is how Mr. Ramsay describes his work), or of vision as simply an undisciplined (ordinary) response to sensation and impression. The relation between granite and rainbow defies conceptual definition and we may therefore feel that it cannot exist (the world is all that is the case). But maybe that is why art exists: as a unique way of seeing and knowing 'this other thing, this truth, this reality, which suddenly laid hands on her?' The problem, of course, is how to reconcile these worlds? Lily's painting of the purple triangle is an attempt to wed the mathematical world of form or design with the experiential, temporal and impressionistic world of the 'ordinary mind'. Russell too agonised over the problem - how to reconcile the bleached out world of mathematical forms with the colourful world of the transitory and the impermanent? More recently, the American philosopher Thomas Nagel has described this as the problem concerning the 'view from Nowhere': how might one 'combine the perspective of a particular person inside the world with an object view of that same world, the person and the view included? It is a problem that faces every creature with the impulse and the capacity to transcend its particular point of view and to conceive of the world as a whole'. Nagel immediately recognises the ethical implications arising out of this epistemological problem. If the personal might be reconciled with impersonality, the situated perspective with the view from nowhere, rainbow with granite, then that dream of reconciliation which has haunted modern writing as much as modern thought might in some way be realised. Although Woolf might be ambivalent about scientists, she is surprisingly receptive to the possibility of exploring ways in which the cosmic view of realist science might be combined with the rainbow-like and situated impressionism of the modern artist. She saw too, like Nagel, the ethical implications of such a project: Russell's logic and Moore's ethics suggest why it might be more than simply an epistemological aim, for it might be as important ethically to attempt to conceive of the world without a self, as an impersonal cosmos, as it is to grasp the world through a particular condition of situatedness within it. For Woolf, the attempt to realise a 'view from nowhere' also represents an impulse to move beyond egotistical perspectivism. In A *Room of One's Own* she observed that 'one began to get tired of the I' and at the end of *The Years*, Peggy emphatically rejects the role of mirror to male egotism characterised by the familiar Woolfian image of a bird's beak: 'She
had heard it all before, I, I, I, - he went on. It was like a vulture's beak pecking or a vacuum cleaner sucking, or a telephone bell ringing, I, I, I. But he can't help it, not with that nerve-drawn egotist's face, she thought, glancing at him. The dark bar of the 'I' which threatens ever to cast its shadow across the writer's page might be dispelled by a more cosmic perspective which offers release from egotism without capitulation or sense of absorption in an indifferent nature. The wandering egoless 'I' of 'Street Haunting' becomes the model of a cosmic and nomadic self which, like Mrs. Ramsay's core of darkness, is free to roam to the limits of horizons, to escape that necessity for social articulation which either fixes the personality like a fish caught in the tides or impels it to retreat into a private space (once described by Elaine Showalter as the room of one's own which is the grave). To attempt to articulate granite and rainbow involves the ethical imperative to transcend the narrow limits of egotism and to acknowledge the immense strangeness of the universe outside of the self. What is perceived as tragic alienation might also be viewed as heroic altruism (and I would argue that this as true in the writing of most modernists, of Joyce, Beckett, Mansfield, for example, as it is of Woolf herself). In this sense, and to borrow a phrase from Paul de Man, both modern art and science partake of a continuous impulse which is the necessary and knowing defeat of knowledge.

Perhaps the modernist writer who, more than any other, spent his life struggling with this painful modern condition of Doubt, with the effort to reconcile consciousness and cosmos, to arrive at a position outside of consciousness which might also contain consciousness, was Samuel Beckett. From his earliest writings, Beckett's work confronts the logic of the Cartesian and Newtonian world orders: articulating a series of tortured conscien­cesses split off from that defective machine which is the human body and longing to retreat into a closed world of pure rational or aesthetic order which might subsume nature through mind into the shape of a perfect Platonic circle. His characters revel in a priori games and much of the comedy is derived from the disjunction between the intensity of their pursuit and the futility of their import: the round songs, hat games, endless and circular genealogies, repetitious perambulations and permutations and combinations of numbers. Beckett again and again satirises the Cartesian project, reveals how the effort to eliminate all sensory and affective experience in order to discover truth through pure rationality, as pure geometric form, produces only that tortured solipsism which is his image of human consciousness trapped in the rusting garbage can of its own material form. Like Woolf, his project too, was to find a form in which to 'accommodate the mess', to reconcile consciousness and cosmos, to find a way out of the prison of enclosed logic. In search of it, he manages to satirise most of the great metaphysical systems of Western philosophy and as early as 1931, in the essay on Proust, he urged the artist to confront the difficult task of describing the object 'perceived as particular and unique and not merely the member of a family ... detached from the sanity of a cause, isolated and inexplicable in the light of ignorance, then and only then might it be a source of enchantment'.

Though Beckett's characters often retreat into systems of closed intelligibility, Beckett himself cannot give up the search for correspondence, the desire to reconnect subject and object and the struggle is articulated through the perpetual aesthetic negation of closed systems, through a persistently modern Doubt rather than investment in a postmodern Uncertainty which would counsel the renunciation altogether of such a quest. It is the condition of Doubt which is so lyrically articulated by Molloy as he lies helpless in the ditch, and which also stands as Beckett's refusal of any Utopian reading of the New Science: 'when already all was fading, waves and particules, there could be no things but nameless things, no names but thingless names. I say that now, but after all what do I know about them, now when the icy words hail down upon me, the icy meanings, all the world dies too, foully named. All I know is what the words know, and the dead things, and that makes a handsome little sum, with a beginning, a middle and an end as in the well-built phrase and the long sonata of the dead'.

This then is modern Doubt, sceptical, searching,
yearning to break out of linguistic self-reflexivity, pre-emptive, and in the forms which it takes in modernist writing, heroic, but rarely celebratory. If we turn now to Postmodernism, however, we shall see a shift away from such painful but hopeful scepticism toward a paradoxically joyous nihilism. Post-Newtonian science is appropriated in the elaboration of a new, postmodern Uncertainty which is now claimed to be the groundless ground of everything and which offers to close the incertitude of the void, to overcome the separation of subject and object, to appropriate in the elaboration of a new, postmodern theory, to close the incertitude of the void. Here Uncertainty replaces pre-emptive doubt for it is a condition which cannot be overcome, a new Life principle with nothing outside of itself and thus with no outside whatsoever. To accept the condition is to be liberated from anxiety, for if Uncertainty is the beginning and end of all things and all matter, then in this proposition itself lies the longed for reconciliation between consciousness and nature. If the deterministic certainties of modern science led to the painful condition of modern Doubt, then the fundamental Uncertainty of postmodern New Science produces consolation and a paradoxical kind of certainty. Uncannily like the poststructuralist text, the cosmos itself would now seem to exist in a fundamental and perpetual condition of difference.

In the postmodern extension of Heisenbergian Uncertainty, it would seem that Cartesian dualism might be effaced and a release offered from the treadmill of Newtonian determinism. Consciousness may be seen to be reconciled with matter, indeed inseparable from it, fact with value, and subject with object. It is not surprising, therefore, that postmodern theory has borrowed heavily from the vocabularies of New Science with its concepts of undecidability, uncertainty, complementarity, discontinuity, constructivism, indeterminacy, language games and possible worlds. Postmodernism was announced with Lyotard’s ‘report on knowledge’ of 1979, and The Postmodern Condition effectively updated the two cultures debate by examining the latest standing of science in relation to aesthetic form, and in particular, the expressive dependency of scientists on modes of narrative: ‘scientific knowledge cannot know and make known that it is the true knowledge without resorting to the other, narrative kind of knowledge, which from its point of view is no knowledge at all. Without such recourse it would be in a position of presupposing its own validity and would be stooping to what it condemns ... But does it not fall into the same trap by using narrative as its authority?’ One of Lyotard’s aims here was to demonstrate that the realist epistememe is at an end and with it the rule of classical science which was now unable to provide legitimating grounds for all those ‘grand narratives’ of Enlightenment thereby declared to be exhausted. Curiously though, given the premise that the postmodern condition is the consequence of a crisis in the legitimation of scientific knowledge, it could be argued that Lyotard contradictorily or perhaps sneakily introduces into his argument an effective legitimation of his own position by its mediation through the vocabulary and conceptual apparatus of New rather than Old Science. Science is still the master narrative, though now in postmodern rather than modern shape. Lyotard constructs what is effectively his own grand narrative of the contemporary condition and how we arrived at it whilst denying the validity of foundationalist knowledge claims and, in later works such as The Differend (1988), even the ethical desirability of continued belief in grand narratives: for in the absence of an overarching metanarrative which would provide the legitimating grounds for all first order knowledge claims, only a provisional and local, shifting, pragmatic and nominalist approach to questions of justice may avoid totalitarian exclusion.

Postmodernists have developed a number of claims predicated upon some version of Lyotard’s argument. These include, one: the claim that epistemology and ontology are now indistinguishable, for there can be no object of knowledge which exists outside of a particular discursive framework of knowledge; hence, two: there can be no empirical verification of a theory, simply intelligibility within the terms of particular frames of knowledge, and three: truth and fiction are indistinguishable, for it must follow that there are no fundamental differences betwe-
en the fictions of the literary imagination and those of the philosopher or mathematician. Conveniently, Lyotard even finds an appropriate vocabulary for the development of his argument in the writings of the practitioners and theorists of the New Science, which he announces to be exclusively concerned with 'undecidables, the limits of precise control, conflicts characterised by incomplete information; fracta, catastrophes, and pragmatic paradoxes'. Accordingly, New Science has pulled the carpet from under Newtonian mechanics, and scientific knowledge has now been declared as 'discontinuous, catastrophic, non-rectifiable and paradoxical'.

As I suggested earlier, however, the postmodern condition of Uncertainty begins to sound suspiciously reassuring: if science can no longer offer certain knowledge even in the sphere of the mechanical and physical, then Doubt, that painful modern condition which arose from the attempt to close the gap between consciousness and cosmos, to aspire to a view from Nowhere, clearly becomes redundant: simply the self-reflexive metadiscourse of one particular language game amongst many. All knowledge claims are now seen to be internal to the specific process of enquiry and intelligible only with reference to the particular framework of each language game. Yet again, although Lyotard suggests that no language game can claim to be more 'true' than another, he is guilty, as we have seen, of at least implying that the paradigms of the New Science are more preferable than those of classical science for legitimating his particular version of the postmodern condition. If the Newtonian cosmos did not seem to accommodate our desires and imaginations, then we can now find reconciliation, once we recognise that it was only ever the working out of a particular enclosed logic - one possible language game amongst many- within the postmodern reading of the paradigms of the New Science. As reality is, in this mode (and by definition) always awaiting completion and construction, then Uncertainty becomes the new principle of life and (as apparently confirmed in Bohr's Copenhagen Interpretation of the Uncertainty Principle) not simply the consequence of temporary limits to our powers of observation, naming or rational understanding (which would preserve a realist position).

What might be some broad implications for literary criticism of assent to this epistemological shift?

1. We can only talk about intelligibility or value within the rules or terms of a given system; thus, it is pointless (and wrong) to assume that we can criticise one language game from within the terms of another (the incommensurability thesis). We cannot compare various readings of a text and say that one is better or more true than another, only that one might be more attractive, ideologically preferable or in accord with our own ethical or epistemological orientations than available others. 'Good' now becomes what reflects our own personal interests or those of the group to which we consider ourselves to belong. Uncertainty collapses into emotivism or some form of sensus communis.

2. A language game therefore gives us more knowledge of itself than of the world or the text-Newtonian mechanics provides us with one kind of world and its rules become inoperative and inefffectual in the world provided by the discourses of quantum physics. Truth may only be relative to the theory through which it is constructed and articulated.

3. If you cannot claim that your system is true, then you can hardly believe in it, though you can 'privilege' it because it produces an interesting or formally satisfying account of things. Moreover, those who believe in their systems are imperialists who suppress the truth-effects of other systems.

4. If we cannot recognise one language game from within the terms of another, then neither can we offer judgement on it. This used to be called relativism or nihilism in its stronger form. Once we recognise it to be Uncertainty, however, we are delivered from the anxiety of choosing between what appear to be incommensurable validity claims.

5. We should, however, continue to try to recog-
nise the terms of another language game or the existence of alternative ‘possible worlds’. If such worlds are radically incommensurable though, it is pointless trying to achieve this through rational enquiry, reasoned debate or empirical testing or observation: hence the postmodern invocation of the sublime, as that ‘other’ which is outside of representation, available only through the experience of a momentary epiphany or in the linguistic disruptions of the avant-garde text. The ‘Other’ thus comes to exist as an abstract category usually appearing in post-Saussurean criticism as a relation of difference with no positive terms. It is no good believing that you can arrive at it through old-fashioned humanist empathy because this is to fall into the greatest solipsistic error of all. As soon as the ‘other’ is embodied as a living, breathing entity (in the way that you most likely experience yourself), then this embodied other of humanism must be a projection of your own values and self-preoccupations.

So, no belief, no knowledge for which to strive, no possibility of empathy?

So much for postmodern criticism and its appropriation of the New Science. To proceed cautiously therein would seem, at the very least, to be the recommendation arising from this discussion. What then of literature itself? So far, I seem to have offered a somewhat negative account of the relations between shifts in science and those in the epistemologies of literary criticism. More positively, however, it would seem that the vocabularies, visions and ideas of the New Science have stimulated an important and invigorated ‘fantastic’ turn in literature itself, in writing by magic realists such as Marquez, metafictionists such as Italo Calvino and Martin Amis, late modernists such as William Golding, post-colonial writers such as Salman Rushdie and fabulists such as Angela Carter and Jeanette Winterson. More effectively than in literary criticism, works of literary fiction (and I do wish to preserve the distinction) can, as Shakespeare put it, give to the imagination a place and habitation. Possible worlds, the radically heterogeneous, the ‘other’ can most effectively disturb our settled modes of thought and unconscious prejudices when they are embodied, fleshed out, made available for recognition and empathy. Only given such form can they linger on, continuing to disturb the familiar, leaving unresolved the implications of that disturbance in the true spirit of the Kantian sublime. Surely fiction has always existed as a space for trial without the consequences of error, for cognitive estrangement without the burden of scientific proof? Within the worlds of imaginative fiction, ideas are embodied in ways which challenge us to rethink tired and familiar categories and, as Kant recognised, in ways that actually articulate what had never existed before. It seems to me that there is an important distinction to be drawn between a cosmic Utopia constructed self-consciously as a ‘No-place’ though deriving its inspiration from actual scientific investigation, and a Utopian postmodern criticism which uses similar ideas to make knowledge claims about the literary text or the world outside. Perhaps this is why I feel happier with the magic realisms of postmodern fiction and the speculative mirrors which they hold up to the world-building activities of science. Surely it is in the end simply inappropriate to sever criticism as an activity from the identity of Enlightenment itself, or to argue in the name of a postmodern knowledge that knowledge itself, as conceived within the terms of that Enlightenment project, is now at an end. Perhaps we should remain suspended between modern Doubt and postmodern Uncertainty, for, as Virginia Woolf suggested in her essay on modern fiction, however hard we try, and ‘whether we call it life or spirit, truth or reality, this, the essential thing, has moved off, or on, and refuses to be contained any longer in such ill-fitting vestments as we provide’.  

2 Max Planck, Where is Science Going?, tr. James Murphy (London: George, Allen and Unwin, 1933).
14 *To The Lighthouse*, pp.296-97.
15 Ibid, p.236.
21 Ibid, p.60.