Dialogue and the Discursive Character of the Academic Discipline: Re-thinking widening participation from the 'inside-out'

Mark O’Brien
with a foreword by Mary Midgley
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FOREWORD

*Docendo discimus*; by teaching we learn. This is one of those ancient truths that are constantly getting forgotten, as witness all those distinguished academics who avoid wasting valuable time by handing as much of their teaching work as possible over to graduate students, and those lecturers – even among those who are willing to teach – who are so fascinated by their own power-point display, or the equations they are writing up, that they haven’t time to look round and see how their hearers are taking the message.

In this essay, Mark O’Brien asks just what it is that we lose in this situation. What goes missing when teaching is seen as essentially a repetitious one-way process of pouring information into jugs laid out to receive it? He suggests that the damage here is not just a loss to the people involved, but also a loss to the subject - to the body of knowledge that is supposed to be being taught. That body of knowledge is not a fixed, inert set of propositions but something much more organic – an active way of thinking, a system which is constantly growing. And it does not just grow by adding more propositions, but by an ongoing, profitable interchange of methods with the culture around it. That culture constantly raises new problems for the enquiry and suggests new approaches that may enrich it.

O’Brien cites a fascinating range of examples showing how this has actually happened in the past, - how new problems and new imagery from contemporary life have repeatedly stirred up important developments of thought, even in the physical sciences, which are sometimes treated as if they
were immune to such disturbance. In the social sciences, of course, this kind of interchange is much more obvious, but there it raises fascinating problems about objectivity.

Some postmodern thought has dodged these problems by a spineless relativism. But, as he shows, that panicky evasion is not necessary. What we need is to be more aware of the culture’s contribution and to assess it on its own terms. To do this we need to see each enquiry, not as isolated from its neighbours, aiming only at its own peculiar, fixed kind of expertise, but as part of the whole panorama of thought. And in the conversation that reveals this, the voices of students crucially need to be heard.

Mary Midgley,
Newcastle-upon-Tyne,
November 2008
This paper is, in part, a reflection upon context. A recurring theme in particular, is the importance of an appreciation of the social and cultural contexts in which academic subject areas have developed historically. The reader might then like to know something of the context from which this paper has emerged. In the early part of 2008, following discussions with colleagues in the Centre of Lifelong Learning at the University of Liverpool, I became interested in what is known broadly as the ‘widening participation agenda’. I was greatly impressed (daunted even) by the quantity of academic writing connected with issues of higher education access and participation, stretching back, at least to the 1960’s. An extensive literature, focusing upon reasons for participation or non-participation, psychological motivation, meanings of learning for the learner, life-cycle analysis etc. provides a plentiful stock of insight into why young (and not so young) people from disadvantaged backgrounds aspire (or do not aspire) to higher education, and, if they do, why they succeed (or do not succeed) . There is also a great deal that has been written on the institutional aspects of access to the university that focuses upon admissions policy, course design, student experience and support and so on.

I was struck also by the sense of frustration that often accompanied the calls for greater social equity at the heart of the papers I read. Indeed some recent assessments of the widening participation agenda in the UK seemed distinctly down-beat. The picture with respect to social class, for instance, has been described as the “most persistent failing of the post-compulsory education system in the UK” (Thomas
2001: 67, quoted by Greenbank 2006: 1). A recent assessment of the performance of the widening participation agenda in the UK has also concluded:

“Although the issue of widening participation has been on the agenda for more than half a century, the rates of participation by lower socio-economic groups do not match that of the higher social groups.” Bowers-Brown (2006)

Similarly pessimistic prognoses apply across the EU (Osborne 2003a: 45). Moreover, it appears that research-led institutions are having the greatest difficulty in attracting students from the groups that widening participation strategies are oriented towards (Franklin 2006). There are structural implications also. In the UK, these trends, combined with those of a shifting of the boundaries between the Higher Education and Further Education sectors, are producing a new institutional stratification not unlike that found in the US (Osborne 2003b: 8).

Naturally, many of the studies I looked at were underpinned by a normative stance that saw access to higher education as a social good: ‘good’ that is, for the student, for the community, for society in general, and, in short, as a matter of entitlement. What I did not see so often however, were studies that focussed upon how academic work itself could benefit from more diverse and socially representative students attending institutions of higher education. This has led me to ask a simple question: are there ways in which greater student diversity can be enriching to the academic subject? What I have discovered in the course of this work
however is that the ‘simplicity’ of my question is deceptive. I have found myself having to dig back into questions that are more philosophical. In what sense is the student important to the academic discipline in a research-led environment? Can society be seen as constitutive within the natural sciences? Is it meaningful to talk about such subjects having cultural characteristics? If it is, does this undermine their ostensible special status as sources of truth. It is these questions and the issues they throw up, that I address in this paper.

Traditionally, students enter the university having demonstrated their ability to assimilate and re-present knowledge to a required level. The process is underpinned by a particular conceptualisation of the relationship between the prospective student and the body of learning that constitutes the discipline. This conceptualisation is built around the notion of historically accumulated subject-knowledge as something that the student must, by steps, conquer. In this scenario, the student is not regarded as contributing to the discipline. More creative involvement, for a very few, comes later as they enter the upper levels of their studentship, usually as supervised PhD candidates. The form of pedagogy that is most associated with this familiar framing of the relationship between student and subject is that of the didactic model. In reality, in most university departments a mixed menu of pedagogical styles will be on offer. Dialogical and problem-based models of teaching and learning are often in evidence, for example. Nonetheless, such approaches generally remain vehicles for the transmission of received knowledge, as opposed to providing spaces for creative student contribution.
The argument developed here, in a very condensed form is this. For the university to turn its face more authentically towards the non-traditional student, a re-thinking of the relationship between the student and the subject is needed. Prospective students from non-academic social backgrounds need to be appreciated not only for their recall abilities in the formal examination setting, but for what they can, by virtue of their heritage, cross-national life experience, family traditions, cultural identity, occupational background and so on, offer to the discipline. The re-thinking involved in this kind of shift needs to focus upon how the discipline itself is understood. The notion of the discipline only as a given body of empirical data and established theoretical insight, offers no way for the student to play an active part in the life of their chosen subject. This paper suggests that this situation is both an obstacle to engaging non-traditional students and is unnecessary. Rather than being seen as a ‘mountain-to-climb’, fixed in form and immobile, the academic discipline can normally be regarded as being also the result of complicated and contradictory processes that have themselves been influenced by social context, personality, culture and accident.

The distinction then is between: what can be termed a ‘positivist’ view of the academic discipline that highlights only its technical aspects and formal canon organised around an outwardly unified object of study; and a ‘discursive’ view in the broad sense of drawing attention, not only to the rhetorical tropes of the discipline, but also to its cultural modes of expression, the conceptual ecology from which its has emerged and the social processes that have created it.
Itself a historical construct (Turner 2006), the discipline, conceptualised and presented in the discursive fashion, becomes at once more open in its appeal and more honest in its account of itself.

In one sense the approach outlined above might be seen as representing merely a laudable stance. The idea that has motivated this paper however is that there is mileage beyond this, and that such discursive conceptualisations may enable academic departments to focus purposively upon the particular mix of the student body within them. In the discussion that follows I develop an argument that academic subjects across the range do indeed have cultural and contextual dimensions that are often overlooked within their self-narratives.

The core critique of the paper is that internalist subject-narratives - that is accounts of a discipline that focus only upon its body of ideas, as well as upon the procedures and techniques by which it develops, to the exclusion of social and cultural factors – blind us to the ways in which any and all subject areas interact continuously with their social milieu. Such accounts, eclipsing the constitutive role of these interactions, in effect screen out, not just the cultural influences of the past, but also those of the present. In so doing, they render questions regarding the social and cultural mix of the scholarly community of the discipline as, at best, secondary to technical notions of excellence that define the discipline for academic audit.

This paper is limited in which it can achieve. Some of the comments above may be taken as suggesting a new starting
point for access studies, or some such thing. Nothing so
grandiose is presented here: merely some thoughts on a
discursive perspective. More specifically, what I do is:
present critical pedagogy as a source of concepts that may be
useful for the participation agenda; explore what a discursive
understanding of academic disciplines might mean,
illustrated by the use of a range of examples taken from their
histories, and by a critique of positivism; and, with respect to
the natural sciences, address the issue of relativism as an
anticipated objection to discursive analysis. If our analogy is
that of architecture, then what is offered here is a small set
of draft blueprint sketches of just some of the building blocks
that would be needed before we could begin talking of a
‘starting-point’. Some other required building blocks would
be: a proper account of the meaning of the term ‘scholarly
community’ in the modern university; more concrete
explorations of the discursive aspects of particular subject
areas; social-cultural analysis of the ways in which particular
communities can be seen as having a connection with a
subject area, whether historically and implicitly or in some
more currently active and explicit sense; and some
conceptualisation of how discursive approaches might be
worked into strategies of subject promotion, marketing,
student recruitment and pedagogical style.

The provisional status of the ideas put forward in this paper
is also reflected in the end-notes, many of which hint at lines
of thinking and inquiry that could be developed further.
Appendices I and II again offer necessarily tentative
suggestions respectively for one possible developmental
programme for a cultural approach to student engagement,
and for one possible research programme premised upon a
discursive understanding of the academic discipline.

There is one sense in which the case this paper is making might be seen as being, at the most general level, distinctive. Whereas much of the existing literature proceeds, in a sense, from the ‘outside-in’, that is from social and institutional critique towards the academic discipline, this paper reverses this direction of analysis. Taking a cue from Greenbank (2006:160) who seeks to put: “the onus on institutions to consider how they might change”, and by beginning with the discipline, the analysis presented here works rather from the ‘inside-out’ in order to find academically-linked reasons to meet widening participation officers working with schools and community groups, half way on this agenda. This also of course entails a shift of the focus of the analysis. As opposed to the learner (potential or actual), the community, the university etc., our attention is now on the discipline itself, considered for its cultural characteristics and connectivity.

In the course of this discussion ideas are borrowed from a range of fields. This ‘magpie’ approach means that there are no entirely new ideas on offer here. In other words, points taken from the philosophy of science will be familiar to philosophers of science and references to pedagogy, familiar to education theorists. Equally, scientists will not be surprised to hear that their work has a social context. What is hopefully novel in the paper however, is the marshalling of these different elements for an audience engaged with the current widening participation agenda. In this way it signposts to sources of potentially useful perspective and conceptualisation. That said, if the only outcome is to have persuaded the reader that an appreciation of the discursive
aspects of subject disciplines may have some relevance for this topic, then it will have achieved what I intended.

Mark O’Brien,
Liverpool,
November 2008.
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INTRODUCTION

In her book *Estates: An intimate history* (2007) Lynsey Hanley recalls the sense of exhilaration she felt at the realisation that there was a social world beyond ‘the Wood’, where she had grown up. Chelmsley Wood, the sprawling housing estate that is a part of North Solihull outside of Birmingham, had offered Hanley little in the way of personal horizons and her imagination was limited by what she describes as the ‘Wall in the Head’. That is until, in her late teens, with her move to a sixth form college, a new friend called Richard, and through the lyrics of the Pet Shop Boys, she realised that there was more to life. Before this though, along with thousands of young working class people like her, she had scarcely been able to conceive that she might have choices beyond the menu on offer.

“You don’t know what your potential is, because no one has told you about it. Nobody tells you there are universities, where you can learn about more things than ever knew existed, because it’s simply assumed that you’ll never get that far...

... The wall is about not knowing what is out there, or believing that what is out there is either entirely irrelevant to your life, or so complicated that it would go right over your head if you made an attempt to understand it. It’s hard to articulate: it’s sort of like living in a black and white television and colour TV hasn’t been invented yet, and even if it had, it wouldn’t be any better because it’s just the same pictures, only in
This discovery of, as Hanley puts it, The World Beyond the Wall\textsuperscript{4}, can be a powerful thing. Most who look back on the anticipation they felt ahead of going to university for the first time, will recognise in themselves the sense of new beginnings and the excitement of widening personal horizons. But these are things that are felt all the more keenly by those whose roads to the opportunities offered by higher education have been littered by obstacles of disadvantage. Those for whom the university is not only a route to fulfilment and professional success, but also a symbol of personal triumph against adversity – as well as being a way out of that adversity - will relate also to the sense of leaving one’s ‘old self’ behind and of embracing the possibility of personal change on a potentially upward moving social escalator.

And yet this image is also flawed. It sustains the stereotype of the ‘campus-on-the-hill’, set above the town, whether, as is sometimes the case, literally in geographical space, or as a social metaphor. It reproduces also a popular notion of the university as a place that is known only from the outside, that others may attend and that remains unquestioned as a signifier (and legitimiser) of social hierarchy. Looked at in this way, this conception of the university, as standing above society in some way, as offering a way out to the disadvantaged, and as an escape to those otherwise trapped by social constraints, is perhaps also a part of the ‘wall-in-the-head’. There are those within the university who are all too aware of the problem. Admissions officers concerned with issues of access, widening participation professionals, and

\textit{colour.”} (Hanley 2007: 152-3)
course leaders responsible for recruitment, struggle year by year with the problem of the narrow social and cultural base from which many universities, especially those considered as the elite and the Russell Group universities in the UK, draw their student body.

This all raises the question: ‘why?’ Why is it, despite the best efforts of very committed professionals, that the university system remains one that is marred by the label of ‘elitism’? One obvious response is that society is less fair and more class-ridden after two generations of neo-liberal government. It is simply harder for those from low-income families to engage in post-compulsory education. Our focus here however, is upon the university as an institution and the work conducted within it. Considering the widening participation agenda, much of the energy and professional expertise associated with it has taken the form of work that seeks to raise the educational and social aspirations of youngsters and later returners to learning, or with course design and student support. Yet, whilst this work has achieved much to ensure that the gates of the academy do not become forever locked in terms of class and disadvantage, it seems that the problem is deeper, more embedded and harder to discern at a cursory glance, than we may suppose.

Is it perhaps, that the structural impediments to access that operate within the university are the outward expression of something more cultural and therefore more difficult to challenge? The thought here is not so much that of the social differences at play in the society-university interface. It is rather to do with the nature of academic work itself,
understood as a specialist occupation that requires a prolonged period of training, apprenticeship and acculturation into a professionally boundaried world, defined by tradition, social protocol and mastery of technique. This paper takes this internalised understanding of academic disciplines as its starting point. Any subject area naturally must operate through the bodies of ideas, histories of practice and special procedures that define it, and that provide its internal coherence. Nonetheless, this represents only one side of a much more complicated relationship between academic work and society. Academic disciplines have histories that have been shaped by myriad social and cultural themes. They have, in this sense, been discursively formed by the host of actors that have created them. Accounts of the academic discipline that miss this complexity, focusing only upon its internal narrative, effectively de-culture it. In-so-doing they present a cleaned-up version of the discipline, tidied of its loose ends and robbed of its cultural connectivity. This internalism can be a part of what Bernstein (1971; 1977), talking of school teaching, called the ‘hidden curriculum’. Within higher education, the hidden curricula that flow from such conceptualisations can be seen as connected to a similarly internalised, and generationally reproduced, cultural homogeneity. One feature of this cultural homogeneity may also be walls-in-the-head of a different kind, operating at the level of the discipline, and working against opportunities and benefits that wider cultural engagement could bring.

This paper argues for a relationship between the student and the discipline that is both more socially inclusive and more pedagogically including. It does this by drawing upon
disparate fields that, whilst perhaps not having been employed traditionally in access studies, may be of use for the current agenda. Crucially, concepts of academic rationality, critical pedagogy, critiques of positivism, and the history and philosophy of science, are all referred to at various points to help develop the case. In Part I of the paper, the themes of academic rationality and critical pedagogy are explored and presented for examination with respect to the social accessibility of the university. This frames the key argument being made. Part II of the paper provides some illustration of discursive aspects of the social and natural sciences. It also anticipates one objection to this kind of approach: namely the problem of relativism arising from a foregrounding of the discursive element in the natural sciences. Part II can then, if it suits the reader, be read as an ancillary supporting section to the argument presented in the first part of the paper.
PART I: ACADEMIC CULTURE, PARTICIPATION AND PEDAGOGY

Conceptualising academic work: positivism versus discursivism

The term ‘positivism’ has meanings that are, on the one hand, precise and well defined (especially within the philosophy of science), and on the other have vaguer and more popular connotations. Within the philosophy of science, the formation of the group that became known as the logical positivists of the Vienna Circle⁵ in the 1920s represented an attempt to boil down the processes of science to irreducible and logically formulated elements. Scientific work was thought of by this group as something that could be made to adhere to the standards of mathematical demonstration and certitude. A corollary of this was that metaphysical, imaginative, intuitive and broadly cultural influences were ruled out of court, either for any proper account of science or, and more to the point, of soundly conducted science itself.

‘Positivism’ is used also in a broader sense that does not rely on a close understanding of the intricacies of logical positivism⁶. Giroux (1981) gives us the useful idea of a ‘culture of positivism’ which encompasses two related senses of the term: quantification used as a measure of quality; and a technical-expert dominated view of the production and dissemination of knowledge. These meanings are often found within the social sciences and humanities. Usually this is where the term refers to methodologies and research frameworks that are seen as disregarding of areas of human
experience that are complex, impossible to quantify and even intangible. Meaning formation, sense making, perception, judgement and so on, that form the substance of interpretive, hermeneutic and phenomenological approaches, are all seen as things that positivist (or sometimes ‘scientistic’) approaches are ill-equipped to recognise, let alone explore or comprehend. Applied to academic work, positivism then represents an often unconscious perspective upon the discipline that sees it as detached from society, expert dominated and concerned only with its outward manifestations of institutional life, technique and professional protocol.

Against an a-cultural positivist view of academic subject areas, we can differentiate the discursive perspective. This approach focuses upon the styles, rhetoric, cultural forms, and the full range of extra-disciplinary influences that inform and inhabit academic work. Such factors have played often powerful creative roles in the origin and evolution of any given discipline. Discursive features will often be geographical, cultural and/or historical in origin. It is this aspect of the discursive qualities of a discipline that can produce a kind of cultural connectivity, linking it to the world from which it has emerged, and to that in which it exists. Conceptualisations of the academic discipline that eclipse its discursive features have the effect of closing down the potential both for the student to relate to the subject by virtue of their own cultural identity, and of the discipline itself to benefit from what they could contribute to it. They effectively counter-pose the academic as expert to an abstract notion of the student valued only by learning ability. The voice of the student then, is something that belongs
perhaps in the debating chamber, in campus politics and on the departmental committee\textsuperscript{7}. It is not though, something that the discipline can gain from in the more intrinsic sense of enhancing its specialist work. Such notions result in a kind of locking-out of the student from creative life of the discipline. On this theme Hughes (2005) has called for a more open articulation of the various activities of the university with one another. In a sceptical discussion of what he calls the myths of the relationship between research and teaching (including that of a mutually beneficial relationship) he comments that:

“... spaces and shapes of the university are locked tight. It is difficult for them to be prised open, and new spaces found or formed ... It may be that a wide variety of relationships between key activities of the university may be feasible, and even new activities or existing ones reshaped so as to open new spaces, new configurations.” (Hughes 2005)

By foregrounding critical reflection and dialogue within a discipline, in the context of a critically minded scholarly community, the student can be seen as having something of great value to offer. Indeed these sorts of approaches have been linked to dialogic pedagogies and discursive understandings of academic disciplines (\textit{e.g.} Dysthe 2002). Such a perspective does not sit well however, with a positivist view that maintains the elevated position of the technical aspects of the discipline to the exclusion of cultural themes. This raises the question of how quality is assessed within academic work. Issues relating to what is valued
within a discipline, how its internal processes are organised, how professional incentives are structured and the ways in which judgements are made about the worth of academic outputs, all flow from our response to this question. These issues relate to the underlying principles that premise the rationality of the discipline. Where these effectively shut out the role of wider culture they lead to the positivist conceptions of academic rationality that this paper rejects. Where they are open to cultural factors they lead to a conception that is far more amenable to the discursivist case being argued for here. We will move on then to some thoughts on how rationality itself might be conceptualised in ways that are more open and conducive to student participation, before considering questions of pedagogy.

Midgley (2001: 248-249) has made the point that the Enlightenment notion of Reason is itself a historical creation. This resonates with Foucault (2007) who, in his *Madness and Civilisation*, famously documents the building of hôpitaux généraux and the ‘Great Confinement’ of the insane in 17th Century France, as the suppression of unreason in the construction of a new moral order. For Midgley, this construction is conceptually organised through an essentially Cartesian separation between the mind as a house of order, and the passions and emotions as the tangle of an as yet unmastered nature. What is lost in this construction is the inter-relationship between mental processes - particularly when understood in the positivist academic sense - and the array of cultural factors that inevitably inform them. The formation of hypotheses is shaped by data, by established procedure and so on, as well as by culture – but it *is* shaped by culture as the examples given in Part II of this paper show. This is not
to suggest that scientific reasoning is in the end reducible to the prevailing form of society or, to hold with anthropological and constructionist theorists such as Latour, that science is simply an expression of culture in a particular form. There is no intention here either to usurp the realist view of science. The idea of the atom may have cultural roots (as one example in this paper will illustrate), but the reality that the theory addresses corresponds to the available evidence and approximates to the theory – probably.

Often what characterises the systematic modes of thinking that define academic work however, are strategies of inquiry designed to eliminate the influence of the complexities of culture and wider society. The minimising of variance across samples, the control of variables, the standardisation of procedures, the design of a laboratory, etc. are all intended to simplify reality in order to analyse and understand its parts. These intellectual and practical strategies, whilst methodologically essential, are also imbued with a cultural heritage and meaning. They are part of a tradition of thought that, following Midgley and Foucault, we can trace back to Descartes. In the Cartesian tradition the world is divided into the mental-spiritual realm that is non-extensive and non-divisible, and the corporeal, physical and material realm that is both extensive and divisible – and therefore amenable to analysis. This cosmology was important in drawing a line around the burgeoning sciences of the day that protected them from religious stricture. With the systematising modes of thought associated with the scientific world view, scientists were able, within this philosophical framing of the world, to achieve new levels of mastery over nature.
A similar approach of locating science in its wider context is found in the Marxist tradition. Here analysis of modes of thinking and more generally of consciousness, are related to the economic processes at play in any given era. A noteworthy example of this approach is the group of papers presented by the Soviet delegation to the 1931 International Congress of the History of Science and Technology held in London. This delegation represented one of the last gasps of free and critical scientific thought before the deep freeze of Lysenkoism and ideological orthodoxy descended upon science in the Soviet Union. Of particular interest in this extraordinary collection of papers is that of one Professor B. Hessen entitled ‘The Social and Economic Roots of Newton’s ‘Principia’’. This paper locates the origins of Newton’s laws of motion in the scientific and technical needs of the time. Key developments and technical challenges in Newton’s day included those in the areas of ballistics, ship ballast, maritime navigation, tidal mapping, deep mining, the raising of tonnage by lever and water pressure, the motion of the pendulum etc. It was mechanics then that represented what Hessen termed the ‘key problematic’ of the era. Thus, in the same way that in our own time, the key problematic might be considered as that of energy, in Newton’s it was motion. This analysis does not diminish the status of Newtonianism as one of the great achievements of the Enlightenment. It does however, emphasise the necessarily historical context of Newton’s thought for a proper understanding of its later supersession by twentieth century physics in the areas of relativity and quantum mechanics.

These historicised conceptualisations are not themselves merely of historical significance. The ways in which academic
disciplines originated, and the processes by which they were constructed continue to be relevant, and to frame the academic work within them in ways that are not always obvious to the uncritical eye. In his *The Archaeology of Knowledge*, for instance, Foucault (2008: 63) traces the origins of biology in the disaggregation of a unified object of study, namely ‘life’, that was common across the range of activities that comprised ‘natural history’. This separation into the distinct disciplines of medical practice, pathology, taxonomy and so on was more than simply the result of specialisation. It was (crucially for Foucault) a discursive process by which emergent disciplines evolved their own conceptual formations, styles and rules. As these disciplines became ‘discursive formations’ they assumed languages and terminologies that had cultural as well as technical meanings.¹²

According to these perspectives, the Enlightenment idea of Reason is itself best understood historically as a discursive formation. A more culturally integrated notion of rationality, that subsumes (rather than replaces) positivism, and that acknowledges the influence of culture within the discipline rather than seeking to eliminate it, may also allow for a greater appreciation of the contribution the student (and especially the non-traditional student) can make. Such an understanding of ‘the rational’ might also soften the divide between the C.P. Snow’s ‘two tribes’ of the sciences and of the humanities, not in terms of their procedures and techniques, but in terms of recognition of the intellectual-cultural affinities between them. Indeed this point has been explored through the historical analysis of discipline formation, with particular focus upon the schism between
the natural and historical sciences, by Veit-Brause (2001). Something of this kind of understanding is also found within the *Swadeshi* science movement in India, in which there is a philosophical tendency to conceptualise science as the quest for truth whether this is through scientific inquiry or introspection. In the German language, the use of the term ‘wissenschaft’ for most areas of academic work points to a difference of conceptualisations in the Anglo-American tradition compared to those found across continental Europe. The term both connects the sciences to the humanities and conveys a greater sense of the social and cultural meaning of academic work than does the term ‘academic’ itself. Finally, Marcuse, in his critique of what he terms ‘technological rationality’ recalls the largely forgotten distinction made by Aristotle between formal logical systems and the apophantic logos (Marcuse 1964: 130). Apophantic logic covers such things as speech, modes of communication, and judgement. The integration of analytical modes of thought (logic) within larger, synthesising intellectual processes (rationality) in which there is openness to affective, intuitive, evaluative and cultural factors and themes, may provide one way in which we can begin to reframe the relationship between academic work and society. This does not call for an abandonment of the Enlightenment notion of Reason and its achievements. It is however, a call for a more active consideration of the relationships with society upon which academic work depends.¹³

Such an understanding of academic rationality would need to build upon active dialogue and critical reflection for its procedures and protocols. Speaking of science (though we
could say the same for any discipline) Bourdieu says that:

“One of the foundations of [...] scientific competence, commonly called ‘intuition’ or ‘creative imagination’, is no doubt to be found in the scientific use of a social experience previously subjected to sociological critique. [...] But, while there is value in self-awareness, sociological vigilance is not enough. Reflexivity takes on its full efficacy only when it is embodied in collectives which have so incorporated it that they practice it as a reflex. In a research group of that kind, the collective censorship is very strong, but it is a liberating censorship, which leads one to dream of the censorship of an ideally constituted field that would free each of the participants from the ‘biases’ linked to his or her position and dispositions.” (Bourdieu 2004: 113-4)

This kind of reflexivity, critical of otherwise unconscious assumptions and presuppositions, open to challenge and with the capacity for collaborative reflection on academic practice, could become a part of the broader methodologies of academic work. Indeed some scholars have made more urgent calls for vigilance against the effects of corporatism, marketisation and what they see as a fundamentalist neo-liberalism on not only the quality of the science that is conducted within universities, but even its nature (Cannella and Miller 2008). In this sense, critical debate within a scholarly community regarding the conduct and direction of the discipline, would enhance the prospects for good science, as well as good sociology, good cultural studies etc. Such
reflexivity can however only prevail within a community that is deliberately premised upon this principle. Without the employing of strategies and the creation of fora that are conducive to it, these kinds of dialogical academic communities would never come about. This is an area for which diversity of experience and perspectives within the student body, as elements within a critically minded scholarly community, could play a powerful role.

The notion of ‘community’ here is also important. The academic needs to be viewed, not according to the stereotype of the of the lonely specialist, but rather as one figure in a far more collective endeavour comprised of a range of academics at different stages of their careers, technical and other support staff, students (both post-graduate and undergraduate) and the public discourses and controversies that mediate the discipline’s place in its society and that animate its concerns. Furthermore, this community needs to be seen as one crucial nodal point at which the relationship between the work of the academic and society is articulated. Whilst normally regarded as an almost taken-for-granted supporting vehicle for academic work (or even as a distraction from it) the scholarly community should rather be seen as a field-of-action in its own right. When appreciated for the ways in which it shapes as well as supports academic work, and when properly cultivated in cultural as well as in technical terms, it may also be an arena that is stimulating to the intellectual atmosphere of the academic discipline.

This sort of thinking continues to be influential in learning theory today and can be found in the concepts and
theoretical categories of social-constructivism. Notions such as ‘situated learning’ (Lave and Wenger 1991) and ‘communities of practice’ (Rogoff 2001; Wenger 1999) emphasise the social environment in which learning processes occur and that frame cognitive development. The concept of ‘collaborative learning’ (Slavin 1995) that has become so influential in education circles draws from this tradition, with its underlying conceptualisation of learning as an actively social process. From within the world of science, we also have the notion of dialogue conceived by the physicist Daniel Bohm as a structured, non-hierarchical and communicative group interaction (Bohm 1996).

As well as countering the image of the isolated academic, the idea of community, understood as something that is open to society and that creates a milieu that is porous to cultural influence, also cuts against the positivist notion that knowledge is produced from within a discipline only. Acknowledging the importance of social and cultural factors from without a discipline, as things that play not merely a contingent and environmental role, but rather are central to it, means that the processes of knowledge production are understood to be more complex than its technical aspects alone would suggest. An exclusive emphasis on intra-disciplinary procedures misses this complexity. There are two broad stances here. On the one hand we have what we have termed the ‘positivist’ (discipline-focussed) stance. On the other, we have the ‘discursive’ (culturally-interactive) stance. The two outlooks can be summarised in the following way:
It is this emphasis on the role of expertise (symbolised by the academic) to the exclusion of the potential contribution of wider culture (symbolised by the student), that frames the core problematic this paper is addressing. One field that is well positioned to help here in conceptual terms, with its emphasis upon the active involvement of the student in learning relationships, as well as on the importance of dialogue, is that of critical pedagogy within educational theory\textsuperscript{16}.

**A participative pedagogy**

The didactic or transmission model of the relationship between the teacher (as the source of knowledge) and the student (as the receiver of knowledge) can be taken as representing a traditional model. Again stretching the normal use of the term, we can regard this as, if not a positivist model of pedagogy, at least one that is a part of the cultural legacy of positivism\textsuperscript{17}. As we will see, it is a model that has been challenged politically and ideologically as well

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<td>Knowledge is the product of the work of the specialist.</td>
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<td>Specialist knowledge is produced independently of (or even against) cultural factors.</td>
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pedagogically. This is important for widening participation agendas in that it draws attention to the nature of the relationship between educators and students. It also begs further questions. What should be the chief characteristics of this relationship? What values ought to inform it? How should it be organised?

The kinds of questions asked above are central to the concerns of educators at all levels. The academic department in which such issues were never addressed would surely be a source of worry for individual academics, students and university administrators. University educators in many departments will be familiar with various kinds of non-didactic modes of educational delivery. We need to go further, however. Teaching styles that encourage critical reasoning, that are participative for the student, and that employ collaborative learning approaches, can be seen as conducive to good quality teaching and certainly often add to the enjoyment of learning for the student. However, this avoids the question of if (and if so, how) such approaches can shape the work of the discipline itself.

To put the question more directly: can, for example, the mathematics student – or perhaps more precisely, the relationship between students and the academic, understood as a scholarly community – affect the mathematics that is produced? Asking the question differently again, and considering the student-academic relationship as one important (in some ways the most immediate) point of contact between the academic and society: are the cultures, the life experiences, the viewpoints and even the attitudes of students relevant to the discipline
itself – can the intellectual environment that they foment be of creative significance? If the answer to this question is ‘yes’ - and that is position of this paper - then what kinds of pedagogy are most appropriate to this conceptualisation of the academic-student relationship?

The ways in which learning is organised has always been connected to the nature of society. Moreover, social structure, cultural context and inter-generational dynamics inevitably play a role in how such processes are articulated. In the 1960s students in the West rebelled against a didactic, top-down pedagogical model in which knowledge was transmitted from teacher to student. Knowledge was seen as something that teachers had - in an objective sense - and that students received. In the challenge to this model, new conceptions arose that saw knowledge as something that emerged through dialogue and intellectual exchange. This understanding suggested a different sort of relationship based upon collaboration between teacher and student. These ideas were not new\(^\text{18}\). The ancient Indian concept of the Ashram embodied this ideal. In the Ashram, the teacher (also the Ashram) and students form a kind of community of learning premised upon dialogic co-discovery conducted within a culture of mutual respect. Of his own Ashram for boys Rabindranath Tagore wrote:

“... the most important element of it is the atmosphere, and the fact that it is not a school which is imposed upon the boys by autocratic authorities. I always try to impress upon their minds that it is their own world, upon which their life ought fully and freely to react.” (Tagore
And again, this time writing about the Visva-Bhatari university founded upon his principles in 1921:

“... this institution should be a perpetual creation by the co-operative enthusiasm of teachers and students” (Tagore 2003b: 668)

This educational philosophy became popular in the West through the ideas of Paulo Freire and Herbert Marcuse amongst others. These two thinkers shared a belief that the student should not be seen as a passive receiver of knowledge but rather as bringing their own knowledge to the learning relationship.

Freire was to systematise such approaches to produce a widely celebrated emancipatory pedagogy that revolved around the organic notion of the ‘teacher/student’. Freire’s pedagogy insists upon learning as an activity that is situated in lived experience and that is connected to a greater social purpose. The student brings their whole life experience, culture and personality to the learning dialogue. Rather than being taught according to a pre-set curriculum in the manner of a bank into which deposits are made, they define the problems they wish to solve through a process of reflective discourse. In this process the prior theorisations of the student are seen, not as a problem, nor as an obstacle to be removed before real learning can occur, but rather as a resource, and as material for reflection and self-critique.
“Liberating education consists in acts of cognition, not transferrals of information. It is a learning situation in which the cognizable object intermediates the cognitive actors-teacher on the one hand and the students on the other ... Through dialogue, the teacher-of-the-students and the student-of-the-teacher cease to exist and a new term emerges: teacher-student with students-teachers. The teacher is no longer merely the one-who-teaches, but one who is himself taught in dialogue with students, who in turn while being taught also teaches. They become jointly responsible for a process in which all grow.” (Freire 2000: 79-80)

Freire’s ideas, popularised in his key work, Pedagogy of the Oppressed, represented a radical political enterprise of personal and social transformation. Along with the idea of dialogic learning, that of social purpose is central. In this sense, Freire’s ideas can be seen as having a forerunner in the underlying principles of action research. In the years following the Second World War Kurt Lewin, working at the Research Centre for Group Dynamics at the Massachusetts Institute of Technology, conducted action research work in factories and with tenants and residents in housing programmes, using methods of community empowerment achieved through a learning process of cyclical reflection and self-critique.

The ideas of Marcuse and the critical pedagogy that grew out of the social justice struggles of the 1960s, were also connected to larger aims of personal and social
Marcuse (1964; 1972; 1991), drawing upon his reading of the ‘master and slave’ dialectic in Hegel, saw the dynamics of domination and subjugation as pervading the fabric of the traditional university. In Hegel’s formulation the slave internalises the desires and moralities of their masters within their own identity. This complex psychological interaction involves multiple moments of misrecognition between master and slave, in which the humanity of both is lost. Only in the Great Refusal, in which the slave throws off their shackles, is the humanity of both the oppressed – and the oppressor – redeemed.

Translating Hegel’s insights into the society of his day Marcuse identified the ways in which the commoditisation of life created a maze of hidden and repressed sub-identities, subjugations and silences. Marcuse’s pedagogy was linked to a project that aimed to unearth and reveal this psychological sub-terrain in ways that were linked to the radical political movements of his day. For Marcuse the conceptualisation of the student as passive was part and parcel of an oppressive educational system that stultified the imagination and that reified thought. The metaphor of ‘walls in the head’ (but now within the university) seems apt here. Marcuse’s deepest pedagogical concerns were those of liberating critical thought and the potential for forms of imagination that transcended the dictates and requirements of functionalist, technical and instrumental forms of rationality and mental life (Van Heertum 2006).

In terms of practical technique, Marcuse’s pedagogy involved the development of critical thinking through in-depth analysis, explorations of the students’ own interpretations of
the subject, student participation in the processes of learning and the promotion of student activism. It has also led to critiques of the use of physical space in the class-room, the development of the class-as-community through ceremony and group activity, and the drawing upon of the interdisciplinary backgrounds of the student group (Wakefield 2001). ‘Seeing beyond’ and ‘thinking beyond’ the confines of the class-room, campus and curriculum are crucial to these critical approaches. Indeed Marcuse at points, and echoing Tagore’s idyll of the forest school or Tapovan, called for teaching to occur away from the campus completely and even beyond the (mental) ‘walls’ of the city.

Giroux20 has continued to develop critical pedagogy as a philosophy and practice of education that draws upon the work of the Frankfurt School of sociology21. As has already been mentioned, Giroux links his elaboration of critical pedagogy with a critique of what he terms a ‘culture of positivism’22.

“‘Culture of positivism’, in this context, is used to make a distinction between a specific philosophic movement and a form of cultural hegemony. The distinction is important because it shifts the focus of debate about the tenets of positivism from the terrain of philosophy to the field of ideology ... the culture of positivism is not just a set of ideas, disseminated by the culture industry; it is also a material force, a set of material practices that are embedded in the routines and experiences of our daily lives ... Silent about its own ideology, [it] provides no conceptual insight into how
Giroux insists that this critique of the culture of positivism should not be confused with an acceptance of “bias, prejudice, and superstition in scientific inquiry” (1981: 44). Indeed he supports the notion of ‘objectivity’, but in the sense of its being the result of the work of a community, rather than as being something that can result from technical method alone. Cross-fertilisation between different types of community is important for Giroux who also emphasises the importance of ‘border-crossing’ as something that is conducive to “invention and construction” in intellectual work (Giroux 1994: 141). This latter perspective has been used to inform cross-national pedagogical strategies that aim to achieve shared perspectives across the student group in higher education settings (e.g. Bollinger and Crites 2003).

Pouget and Oberski (2005), in a discussion that contrasts the British APEL and French VAE systems of widening participation strategy, and that also echoes some of the thinking of critical pedagogy, have suggested a re-conceptualisation of the student that privileges the ways in which the student perceives him or herself in their own social context. They point towards a ‘hermeneutic natural phenomenology’ that they trace to the scientific studies of the German literary figure Johann Wolfgang von Goethe. In this cognitive methodology (which these authors argue informs the French system) a key, though normally unnoticed, moment of self-perception is mobilised to produce a holistic perspective that sees its object (in this case the student) ‘from within’. Such conceptualisations resonate
with models that draw upon critical reflection pedagogies and pull away from those premised upon ‘technical rationality’ (O’Brien 2006: 1-4). Critical frameworks have also been used in community settings to make explicit and validate tacit and informal knowledge (e.g. Wilson et al. 2007).

These concepts, and the framing of learning as something that is inevitably embedded in a social and cultural context, stand a long way from understandings of learning that abstract it from society and that construct the relationship between the student and the teacher as that of a one-way transmission of knowledge. They also provide a rich seam of conceptualisations that may lend themselves well to models of student recruitment that draw upon the cultural facets of academic disciplines, and that are conducive to strategies of engagement with non-traditional students.

Marx, in his third thesis on Feuerbach, asks us to consider the question: ‘who educates the educator?’ Critical pedagogy responds to this challenge by seeing the student as a bearer of their culture and as bringing something that is valuable, essential even, to the learning relationship as well as to the subject. It may be that the conceptualisations outlined here, offer something of value for models of learning that seek to acknowledge the importance of culture for all types of academic work. If the perspectives that students bring to the academy or, more to the point, the mix of perspectives, are important for the creative heart of the discipline, then such approaches may help to foreground and harness them in ways that will be of benefit to the academic community as a whole.
PART II: THE DISCURSIVE CHARACTER OF THE SOCIAL AND NATURAL SCIENCES

Historical and cultural context in understanding the academic discipline

The argument put forward in this paper has rested upon a call for an appreciation of the discursive aspects of academic subject areas. This has been counter-posed to purely internalist or positivist understandings of the nature of the discipline. Whereas we have briefly considered the meaning of positivism in with respect to our topic, there has been no developed discussion of what a discursive understanding of particular disciplines might mean. As a result some of the issues involved in this kind of approach have not been addressed. Crucially, with regard to the natural sciences, and given the emphasis upon the cultural characteristics of academic work, the issue of relativism does require some comment. This part of the paper offers some illustration by example of the ways in which subject areas can be understood as discursive constructions, affected by every kind of social and cultural influence, entering the discipline to shape them, and sometimes in profound and lasting ways.

The greater part of this section will be taken up with a discussion of the natural sciences. It is arguably in this area that the case for a cultural understanding of academic work finds its stiffest resistance. Wariness of philosophical viewpoints that tend to relativise scientific work, or suggest that is has a culturally particular nature, will raise eye-brows at what might be seen as the shadow of post-modernism passing over this discussion. Such reflexes are unwarranted.
Nonetheless, this is an issue that is acknowledged as a valid concern and one that is addressed by way of borrowing from approaches within the philosophy of science.

Before our consideration of the natural sciences we will look briefly at the social sciences. This is an area for which a discussion of cultural and social influence may seem unnecessary and superfluous to the case being made. As we will see however, the question of the interaction between social science and society lies at the heart of academic work in this area, and is a source of both intellectual challenge and tension.

Society and the social sciences

To say that there is a close interaction between society and academic disciplines that have a social dimension may seem too obvious a point to make. Yet on scrutiny the relationship is more complicated than might at first appear. On the one hand ‘society’, as the very subject matter at hand, is always present in the teaching arena and is embodied in the students and academic staff that populate it (Cant 2007). Questions of social diversity, representation and identity are, after all, generally taken very seriously indeed in social science departments. For some disciplines we can go further, in that some of the most important contributions to the academic field have come from outside of the institutional structures, bringing with them the radicalisms and critically minded social currents of their times. In social history for instance, some of the most significant names have not themselves been mainstream academic figures. Eley (2005), in his discussion of post-war social historiography, reflecting
upon the significance of the social historian Raymond Williams, makes the following observation:

“In common with such historian contemporaries as Edward Thompson, Thomas Hodgkin, Henry Collins, Royden Harrison, and J. F. C. Harrison, who helped shape the emergence of social history ... he spent the first half of his career in adult education, on the fringes of the academic world proper, only receiving his first university appointment, at Cambridge, in 1961.” (Eley 2005: 20)

On the other hand, the close overlaps between society and the study of society have not been unproblematic, indeed have been, at points, a source of major controversy. This results from a tension at the centre of sociological enquiry which, even when it is not explicitly acknowledged, nonetheless affects it. This is the tension between a sociology understood as the study of society in the disinterested or positivist sense, and a sociology that engages with its society, that is committed, that takes sides and that is openly rooted in a value system of some kind. This question lies at the heart of what sociology represents in society. It is also central to a classical debate within sociology itself – indeed it was present at the origin of the discipline. For founding thinkers such as Comte a key concern was the separation of social science from the reform agitations of their day as well as from the movements that aspired to more explicitly revolutionary aims whether of national independence or of social emancipation.
Questions of engagement or disengagement have remained a constant theme in the development of modern sociology. Anderson (1992) has argued that the conspicuous rise of sociology as an academic subject in the 1960s was part of an establishment response to the emergence of a New Left and to the eruption of new social movements. Indeed Anderson goes further in arguing that the emergence of sociology as an academic discipline in Britain was a delayed phenomenon compared to its development on the Continent. By way of explaining this asynchrony Anderson makes an explicit link with the experience of revolution. As he puts it:

“Britain ... lacking – unlike fin-de-siècle Germany, France or Italy – the spur of an insurgent socialism, missed the moment of a Weber, Durkheim or Pareto; and never knew the Marxist reprise of a Lukacs, Sartre or Gramsci.” (Anderson 1992: 87)

He goes on to argue that the British establishment in the mid-war era therefore did not feel the need for any thoroughgoing understanding of the foundations of their system. All that they required was piecemeal empirical research serving partial reform and practical adjustments to that system. For Anderson, British sociology enters a golden era in the 1970’s against the background of political and industrial strife and the rise of a robust and academically credible Marxism within the field of historiography. The work of Giddens, Mann, Runciman and Gellner, Anderson argues, represent the first British sociology written on the grand scale. In this period Giddens posits a social ontology rooted in contractual notions of social interaction and in the expansion of time and
space in the fields of production and culture. Over the course of the 1970s Mann’s concerns shifted from typologies of class and class consciousness to the role of power in society and history. Runciman drew upon the framework of a philosophy of distributive justice devised by John Rawls to offer a normative, contractarian model that was later adopted by the right wing of the Labour Party. For Gellner, society and history are understood though the medium of psycho-ethical categories of social cognition. What all have in common according to Anderson, is that they represent attempts to build alternatives to historical materialism and, by implication, to the radical politics that flowed from it.

More internationally, positivist sociology faced its most forceful and sustained challenge in the form of the critical theory of the Frankfurt School. Central to this challenge has been the question of whether neutrality or value, detachment or commitment, should be the litmus test of what constitutes good or bad sociology. Indeed we can see this question, by turns explicitly and implicitly, animating the debates between the titans of the discipline throughout the post-World War II era. At the German Sociological Association conference at Tübingen in 1961 the clash between positivist and evaluative modes of sociological practice was precisely about the differences between those who would bracket questions of value and those who make judgements on society – between those whose modus operandi was that of neutrality in the interest of scientific objectivity and those who would condemn a society that they saw as unequal and unjust. The terms of this future debate were articulated succinctly before World War II by Marcuse:
“Positivism adheres to the bourgeois idea of presuppositionless, pure theory, in which the absence of “ethical neutrality” or the commitment of taking a position signifies delinquency in rigor.” (Marcuse 1968: 34)

This debate was not resolved at the 1961 conference. Indeed it was to rumble on in various forms and with changing protagonists for the rest of the decade. A look at the protagonists themselves is one measure of the historic status of the debate. Popper, who at the 1961 conference refused to call himself a positivist, nonetheless put the case for empirical methods in the social sciences and opposed the abstractions of the dialecticians. The principal protagonist for critical sociology was Adorno who put the case against positivism that it was premised on the accumulation of social facts that were accepted uncritically at face value and on the notion that society was itself no more than the result of those facts. For Adorno, positivism employed procedures that isolated objects without reference to the totality of social relations in which they are necessarily embedded. That social totality mediated all of its parts and was an internally contradictory phenomenon that needed to be interpreted rather than deduced from the purported findings of survey based methodologies. Indeed even the very idea of truth itself was at stake. For the anti-positivists social truth, if such a term was to be used at all, was something quite different from truth in the natural sciences. The facts of consciousness, of creativity and of agency rendered the truth about human behaviour and social processes as something that was necessarily tentative and characterised more by ambiguity than by certitude.
The controversy continued throughout the 1960s with the positivist corner being occupied by the German sociologist, Albert on Popper’s behalf and a similar role being played for Adorno by a young Habermas, who in the course of the debate employed and refined his notion of a sociology based upon shared understandings and consensus. Over these years we see other giants being brought into the debate such as Kuhn, for whom science itself was something that had to understood historically and sociologically rather than being accepted uncritically as the only road to the truth - whether that be in the natural or in the social sciences.

The ways in which society shapes and affects the work of those who seek to understand it, are complex. This is not to say that the study of society must remain trapped within relativist paradigms or stand-point sociologies of various types. The comments above have been accented to highlight the tensions that have occurred within the social sciences around these questions. We have not considered more structuralist approaches, or the powerful contributions that quantitative and large scale statistical studies regularly make. It seems clear, however, that the relationship between society and the work of academics in such disciplines is something that does periodically require critical reflection. More to the point, renewed attention to the significance of the methodological and epistemological tensions described above, may also be important in relation to the accessibility of the subject itself for those whose experience, as members of socially disadvantaged groups, is so often the object of study.
The discursive character of science

Moving to the other end of a notional discipline-society spectrum from the intuitively obvious relationship between sociology and society, we may now consider the arguably less intuitively obvious relationship between the natural sciences and society. Midgley (2001) highlights the special case of physics in this regard:

“Physics, by contrast, stands, along with mathematics and logic, right at the other end of this spectrum. It is not just an immensely abstract enquiry but one which directs its abstraction specifically to shut out the peculiarities of personal experience. That is what makes it remote from ordinary thought.” (Midgley 2001: 188)

In fact there is an extensive literature covering the numerous ways in which society and culture both shape the environment and context of scientific work and enter its inner workings. Here we shall selectively use examples from this literature to illustrate the case being made. We shall proceed by looking at the ways in which social and cultural factors are said to affect the conduct – the doing - of science. Along the way we will also consider the more contentious question of how science and culture affect what science is.

The fact that scientific work must always be situated somewhere is a point that has been taken seriously by sociologists and geographers of science. Beyond being true in an obvious sense, this counters understandings of science
that regard it as having a universal status, rising above time and place in its truth-content and knowledge claims. With this in mind, examples have been selected to do three things. Firstly, there are those examples that, in suggesting that geography plays a constitutive role within science, point to possible cultural connectivity between academic subjects and communities. Secondly, there are examples that illustrate the depth at which cultural factors have affected modes of thinking within disciplines as they have evolved historically. The third group of examples highlights the consequent importance of vigilance and critical reflection within science, and so, once more gives us cause to ask ourselves how, within the scholarly community of a discipline, this might be achieved. Overall, they also demonstrate the availability of scholarship that helps our understanding of what discursive analysis may mean when applied to academic disciplines.

The historical geography of science furnishes us with many examples of the ways in which place affects not only the outward social form of science, but also its more essential features. The influence of place, for instance, is illustrated by Needham’s (1959) observations regarding the differences between how mathematics and science developed in China and in the West. In both cultural contexts Needham argues, experimentalism was present amongst what he calls a ‘higher artisanate’, in the fourteenth and fifteenth centuries. The empirical nature of the innovations associated with this social milieu, however, did not rise to the level of theoretically generalised science, with an attendant abstract mathematics, until the rise of mercantile capitalism and the consequent need for standardisation, quantification and measurement. This was something that happened in Europe
in the immediately succeeding period, but not in China. In China, Needham argues, mathematics was linked to the court and especially to the task of adjusting the calendar according to dynastic change and agricultural crisis, rather than to trade. It was for this reason, for instance, that the equivalence sign, making possible equational mathematics, appeared far later than in the West, where it became widely used in 16th Century book keeping and accounting (Needham 1959: 42). Livingstone (2003) has also argued that the influence of region upon the development of science renders the familiar notion of ‘European science’ simplistic. Comparing the growth of Italian, Iberian and English science, he throws light upon the complex social and cultural interweaving that gave each regional science its distinctive character. Differences in levels of urbanisation, military needs, trading relations, religious orthodoxies, degrees of exposure to Arabic science, courtly patronage and so on, all shaped the status, purpose and social meaning of science in each of these parts of Europe.

We might also ponder upon the significance of mercantile trade in making possible comparative geographically distant observations in the growth of astronomy, or of the British Empire and the establishment of zoological and botanical collections for Darwin’s theory of evolution. In each case the generalised thinking that allowed leaps of understanding to occur were made possible by particular histories that involved human interactions of every kind, including those of conquest, exploitation, and oppression as well as of integration and synthesis. Such histories do connect academic subjects to communities, perhaps in ways that are not always comfortable, but certainly in ways that bring
them to life and make them socially relevant. Historical excavations of academic disciplines may then begin to reveal ways in which living communities are connected to their development, perhaps even having contributed positively to them in a direct sense.

Going further in our discursive understanding of science, we can consider the role of cultural world views, and even of cosmologies and eschatologies, that inform the thinking and emotional structure of societies in different historical epochs. In the ancient world for instance the notion of change at the centre of the prevailing cosmology was quite different from that in found the modern world. We are used today to thinking of the future as open-ended and as being filled with potential. The question of whether we are hopeful or fearful of that future is not, for us here, relevant. The point is in the contrast to the outlook that prevailed, for instance, in the time of 4th Century BC Greece, whereby change, insofar as it could be described as such, and notions of the future were essentially repetitive, and did not stray far beyond agricultural cycles (Gruner 1977: 36). What Ledrièr (1977) called the ‘temporal scheme’ has a profound effect, not only on culture but also on cognition. Commenting upon the historical transition to the modern world he comments:

This transformation of the temporal scheme certainly has the most far-reaching effects on cultural equilibrium. For the way in which time is structured seems to be inextricably linked to the most fundamental determinants of culture, without it being possible to say which exerts the greater influence on the other. A scheme of
temporality represents a mere abstraction which does not of itself act; what exist concretely are representations, values experienced, and modes of action. It is the state of the cognitive system and the values associated with it which determine the scheme of temporality ... It is in this sense that the scheme of temporality ... contributes to the destructuration of traditional cultural systems, which are based on other forms of temporality. (Ledrièr 1977: 83)

The role of this background cognitive mind-set can be illustrated by example. The fact that the astronomers of ancient Greece for instance believed the heavens to be immutable meant that they did not record (did not ‘see’) extraordinary stellar events such as supernova and new comets, that were observed and recorded in other parts of the world. Looking down from the stars to the human form Cunningham (1997) has argued that the ways in which the human body was seen by pre-Renaissance anatomists was different from the ways in which it came to be seen after the Renaissance. Commenting upon the importance of Vesalius as a transitional figure of the period, Cunningham highlights the ways in which proper observation of the “non-lying book of the body” came to challenge established scholasticism and appeals to the authority of the anatomist of classical antiquity, Galen (Cunningham 1977: 136). This change was also a part of the shift from the Natural Philosophy that lasted from the 12th Century till well into the 17th century by which the study of nature and the human form was a type of worship and celebration of the wonders of God’s creation. The point that Cunningham is driving at here is that the body
of the ancient anatomists was different for them, than it was for the Moderns, and meant that observations of detail that were possible during and after the Renaissance, were impossible before.

These illustrations are useful for the ways in which they lead us to reflect upon the otherwise unquestioned assumptions that underpin our own cosmological perspectives and self-understandings in the modern world. Like the characters in Plato’s cave, only able to see the shadows of objects cast by a flickering fire, the physical and mental restrictions of our standpoint, be they those of place, culture or theoretical tradition, entrap our perspectives and modes of cognition. Framings of science that highlight only its technical aspects along with its constructed canon, do not equip us well to ask questions at this level.

This problem is all the more pressing with respect to modern science within which scientific work often involves major funding and highly engineered apparatus. Hacking (1992) highlights the dependency upon instrumentation of much modern scientific work as a problem:

“We create apparatus that generates data that confirm theories; we judge the apparatus by its ability to produce data that fit.” (Hacking 1992, quoted in Bourdieu 2004: 74)

Even prediction, often so impressive in the history of modern science, provides no guarantee of the truth of the findings it generates. The policy of swamp drainage that was based upon the belief that poisonous fumes from swamp water
caused malaria, did indeed prove effective in combating the disease (Gruner 1977). Where the 19th Century miasmic theory of disease led to the clearing of night-soil from tenements, improvements in public health followed. In both of these cases, of course, the predicted effect did not mean that the theory was correct. On this point we stand with Popper on the status of verification. We should also acknowledge the role of rational reconstruction in science historiography. This is not the same as deceit and, results from a kind of tidying up of the story of scientific discovery for the purpose of presenting expositions that are trimmed of what are thought to be extraneous detail to produce all-too-neat and actually distorted versions of what really happened29.

Acknowledging the validity of the comments made above does not entail the embracing of a philosophical relativism and more will be said later about this. Empirical findings can and do present problems for a theory and may lead to its rejection30. On this point we again stand with Popper, this time on the status of falsification as a test of theory. These observations however do raise the question of trust31. In September of 2008 the Large Hadron Collider at CERN in Switzerland commenced its work. This extraordinary piece of technology, built at a cost of €5bn, and involving over 2,000 scientists is, of necessity, based upon many kinds of trust. Along with public trust in scientists, there is also the trust of scientists in one another. Where experimental technologies are so complex that no individual scientist can fully understand the science of every element involved, each must maintain a quasi-dogmatic belief in the competence and robustness of the work of their colleagues. Indeed such
affective factors as trust, morality, and belief influence science at all levels. In the work-a-day life of a scientist a certain level of conservatism must prevail. If the working scientist were engaged in searching critique of the fundamentals of their discipline at all times, then no empirical research would get done. Blindness to the limiting factors of place, culture and epoch are not the result of personal cognitive failure. They are the result of the intrinsic positionality of any given scientific project. They are, in this sense, a condition of scientific work.

There are examples from the history of science where less subtle influences have distorted the ideal of value-neutral scientific inquiry. Of course, cases of conscious fraud do exist. Two noteworthy examples include the twin studies of the eminent British psychologist Sir Cyril Burt that provided the basis of the theory of heritability for intelligence and, from anthropology, that of Piltdown Man. We know today that none of the twins of Burt’s twin studies could, in the end be traced. We also know that the jaw of the Piltdown Man was in fact that of an orang-utan. These cases, though they do make entertaining reading, do not add to our case in their detail. Ego and roguery occur in any walk of life. They are of interest for us here in a different sense. The fact that such blatant hoaxes could have been so successful points to the ways in which the reception of a theory or discovery, by both the scientific community and its lay public, can be selective in the extreme. The concept of heritable IQ was taken up by government education departments across the developed world. It met an administrative as well as a pedagogical need in an era of expanding mass education. IQ and the notion that each individual was born with a fixed endowment of
intelligence that could be measured, was adopted unquestioningly by educational administrators concerned with issues of standardisation and large scale implementation\(^3\). It remains a part of the language of popular culture today. The ‘discovery’ of Piltdown Man was, as Gould (1980) has argued, a very English affair. Rivalry with French anthropology, for instance, which enjoyed an abundance of Neanderthal and Cro-Magnon finds, played a role. Comparisons between the small brained Peking Man (not a hoax) and the larger brained Piltdown Man (being, in fact a modern skull) also flowed unpalatably into the racial politics of the 1930s. Finally, within anthropology, there were those who advocated a brain-led theory of human evolution for whom the ‘discovery’ was very welcome indeed – and indeed too good to be true.

Another example that, though less scurrilous, nonetheless belongs within the category of types of cognitive blindness that result from national and cultural bias amongst otherwise competent scientists, comes from geology. In the 1920s advances in mapping, land survey and the measurement coastal movement were causing problems for what was, at that point, the dominant theory in geology, the planetesimal hypothesis according to which continents were fixed. T.C. Chamberlain, the foremost figure in American geology, was a firm advocate of the hypothesis. He was also a figure who promoted high standards in science, and was on public record as opposing the tyranny of the dominant thesis, advocating a far more open and pluralist model of scientific progress. In the early 1920s the work of a German geologist, A. Wegener, and his mobilist hypothesis in which the continental plates were moving on fluid magma far beneath
the Earth’s outer crust, began to receive attention in the academic press. In a study of the ensuing debate, Newman (1995) comments upon its tone. Certainly, it was not that of respectful, considered and measured scientific exchange conjured up by the Popperian ideal of scrutiny by peers. In an era of American isolationism, against the background of a recently concluded World War and of unresolved international tension, the tone was distinctly unscientific. The story that Newman reveals is one of national pride, personal attack, shady conference politics and a near hysterical refusal to acknowledge the mounting welter of empirical evidence supporting the mobilists’ case.

The facilitating and impeding consequences of cultural-historical context

If we acknowledge the role that culture, society and the whole range of contingent and environmental factors that they bring, play in science, this leads us to consider how such influences work. We will consider two types of interaction from the history of science. The first type is that in which culture plays what we will call a negative role in that cultural factors frustrate and hold back advances in scientific theorisation. Such cases, in some senses, confirm a form of positivism that sees culture as getting in the way of scientific progress – what Midgley (2001:36-50) has called the “weed-killer” view of knowledge. The second type is that in which culture, and the intellectual zeitgeist that accompanies it, plays what we will call a positive role, in that it is enhancing to science. This type is not so amenable to positivist interpretation - certainly not in its pure form - and illustrates the complexity of the relationship.
For the first case we can consider the controversies within the world of 19th Century neurology surrounding the nerve-junction - or synapse. By the 1890s observations from microscopy and from tissue injury studies had produced strong visual evidence that neurones (nerve cells) did not physically connect with one another, nor with the muscle tissues upon which they exerted their effect. This raised the vexing question of how it was that electrical impulses from one neurone were passed onto its neighbours. According to proponents of the neurone theory nervous signals were able to jump in some way from one cell to the next. Opposing this view were proponents of the reticularist theory who argued that the neurones must be physically connected in some way that had not yet been observed.

The irony of this story, as well as its relevance to our theme, is that, despite the evidence, Camillo Golgi, whose staining techniques had made the most advanced observations of the time possible, was stubbornly resistant to the idea that neurones did not connect, and held determinedly to the reticularist theory. At issue for Golgi, was not simply the task of explaining nerve transmission, but rather its significance for the intellectual ferment occurring in wider society around the relationship between science and religion. Golgi was deeply concerned that the evidence for a physical gap between neurones could be used to bolster the vitalist view of the human body in which physical movement is animated by non-physical forces (Galen’s ‘little spirits’). For Golgi, during these years, and before the discovery of chemical neuro-transmitters that travel across the neuronal gap, the reticularist theory was essential to the mechanistic world view to which he held. This is an interesting example of one
of the great figures of modern science being, in the end, wrong, but - with respect to the development of science in the larger frame - for the right reasons. It was something that he referred to in his Nobel Prize speech in 1906:

“I cannot abandon the idea of a unitarian action of the nervous system without being uneasy that by doing so I shall become reconciled to old beliefs”. (Quoted by Churchland 1986: 29)

The stubbornness of the facts in this case was emphasised by Golgi’s co-Nobel Prize winner, Ramón y Cajal:

“From the analytic point of view it would be very convenient and economical if all the nerve centres formed a continuous network ... Unfortunately, nature seems to ignore our intellectual need for convenience and unity, and is often pleased with complexity and diversity”. (Quoted in Churchland 1986: 30)

Considering our second type however, the interactions between scientific advance and wider social culture are more complex than this example might suggest. The formation of hypotheses, for instance, is a creative process of the imagination that is influenced by the previously established evidence, the prevailing orthodoxies of the science and its established procedures and by the intellectual environment prevailing in society. Midgley (2001: 30) describes the way in which the atomic theory of matter was transmitted into Western thought through the philosophical poem of the 1st Century BC Epicurian poet, Lucretius. It might be objected
that whereas *De Rerum Natura* (*The Nature of the Universe*) is a passionate and poetic appeal for humans to take responsibility for their fate in a godless universe, the modern theory of the atom, described in mathematical formulae and quantum calculations, in fact bears little resemblance to the poem’s metaphysical imagery. Midgley’s point still stands however in that the very availability of the idea of the atom came, not from modern science in the first instance, but from its cultural-historical hinterland.

A similar example to the one given above comes from philosophy. The monadology of Gottfried Wilhelm Leibniz, working in the late 17th and early 18th Centuries, was a metaphysical system arising from the crisis of Aristotelian thought in the face of the rise of the physical sciences, as well as from Leibniz’s own encounter with Chinese philosophy (Perkins 2004). Simplifying what in fact is a highly elaborate philosophy, the monad for Leibniz is the irreducible cosmological unit. Each is unique but also contains within itself the entire cosmos. Such an idea may seem poetic, quixotic even35. Yet this notion of a totality within the parts of a system was to become an important part of scientific thinking. When Robert Hooke looked down his compound microscope in 1667 and observed the gross structure of cork tissue he coined the term ‘cell’ for what he saw, the structure reminding him of rows of prison cells. Through the work of Purkyně, Schleiden and Schwann two hundred years later, the modern cell theory of life was born, in which all of the process required for the life of the whole organism, replicate those at the cellular scale.
Between naïve realism and radical scepticism: keeping relativism at bay

There is a tradition of thought, now largely discredited within the philosophy of science, that facts alone, or more plausibly observation alone, can lead to truth. In such a view theorisation in science is distorting, having the status of a lens through which reality is apprehended, and which is best put aside if things are to be seen as they are. This kind of, what we might term naïve Baconianism created echoes that reached into 20th Century scientific thought. By the early 1910s, for instance, there were still notable scientists and mathematicians (Ernst Mach and Henri Poincaré amongst them) who would not accept atomic theory because of the non-observable and therefore necessarily theoretical status of the atom (Rigden 2005: 47).

This tradition, as we have seen, produced its 20th Century version in form of logical positivism. The logical positivists emphasised method. But the tradition here is that of a rejection of mental constructions that do not arise from a tightly defined and disciplined experimental or logical procedure. On this view influences that enter science from philosophy, the arts and the wider cultural context, undermine its special status as the arbiter of knowledge of the world. The weakness of the logical positivists however, lay precisely in their exclusive emphasis upon logic, and their inattention to the real history of science. When applied to the achievements of the great names of science, logical positivism would commit its adherents to some curious conclusions. The epoch-making intellectual breakthroughs of Newton (who paid scant regard to the established empirical
knowledge of his day and who was as influenced by the occult as he was by reason), and Einstein (four of whose earthshaking 1905 papers are almost entirely based upon experiments in thought, rather than appeals to the evidence) would, for instance, have failed the logical positivist test for what constitutes properly conducted science, and so would have fallen into the category of pseudo-science. It was this thread that Popper began to pull at, so (ironically given the association of his name with positivism) beginning the unravelling of the positivist position and of the notion of science as an activity governed by axiomatic logic\textsuperscript{38}.

More specifically, recognising that for instance, hypothesis formation and theorisation more generally, are not in fact processes of logic only, but also involve the imagination, Popper rejected the principle, central to the logical positivist position, that a scientific theory must be verified by positive proof. A theory, or model, representing perhaps the visualisation of an idea, and occurring as the result of an intuitive leap or creative connection, could not in Popper’s view ever be verified in some final sense. Rather, the test of a scientific theory (indeed its very status as a scientific theory in the first place) lay in the area of falsification. Whilst experiment could never ultimately prove a theory, it could (assuming that it had been correctly - that is scientifically - formulated) be proved wrong by empirical evidence that was inconsistent with it. It is in this more nuanced form that we still associate positivism with the name of Popper\textsuperscript{39}.

It was in the 1960s however that positivism faced its most sustained onslaught. The growing acknowledgment of the social, and, more to the point, the sociological, aspects of
science, began to generate questioning attitudes towards its objectivist assumptions. In 1962 Kuhn, who has already been referred to in connection to debates within German sociology, published *The Structure of Scientific Revolutions* in which he framed the science of any given epoch as existing with its own cognitive paradigm. This shift from seeing science as being rooted in universally applicable methodologies of systematic technique and observation, allowing for some measure of progress according to the knowledge accumulated from one historical era to the next, to seeing science as comprising a set of activities that were comprehensible only within the cognitive framework of a given era, represented a profound philosophical challenge. It was also one expression of a sense of popular distrust of the uses to which scientific knowledge was being put in the era of the Cold War and the atomic bomb.

In brief, Kuhn argued that science and its methodologies cannot be presented as though existing in a neutral epistemological arena or in the social vacuum suggested by the logical positivists. Rather, scientific theorisation occurs within processes that accumulate what we might call social and cultural ‘mass’. Methodologies, for instance, do not exist abstractly but in the form of equipment, buildings, laboratories, research grants, government and commercial contracts, career structures, university departments, and so on. They come to embody and represent major investments of material resources, financial support, life commitment and political interest. In other words science, or more precisely science in a given, present form exists within a world or, in Kuhn’s terminology a paradigm. This paradigm is all-encompassing, meaning that it colours the perceptions and
cognitive frameworks of those working within it. As problems accumulate within an ageing paradigm that has hitherto defined a period of normal science, and as a younger generation of scientists question its foundations, a break will eventually occur. At this point the dominant figures of that paradigm, often clinging to old orthodoxies, are unceremoniously overthrown in what Kuhn calls a ‘scientific revolution’ or, perhaps less tendentiously, a ‘paradigm-shift’. Once such a shift has occurred it alters the entire intellectual landscape of the field rendering the insights of the old paradigm incommensurable with those of the new.

The principle of incommensurability emphasises the strength of the claim that Kuhn is making. Kuhn is not offering the banal observation that conceptual change is a part of the progress of scientific knowledge. For Kuhn the paradigm-shift is transforming. Once it occurs everything looks different, and the scientist then inhabits a different world. In this view our notion of progress becomes relative. This line of reasoning was given a more radical twist with the publication in 1975 of Against Method: Outline of an Anarchistic Theory of Knowledge by Feyerabend. In Feyerabend’s sceptical outlook - in his own terms, a ‘methodological anarchism’ - , developed in part through his personal intellectual encounters with Popper and Lakatos, no one set of methodological rules can be identified as being universally applicable. In the real history of scientific breakthroughs, he argues, ‘anything goes’, as scientists struggle to make sense of their observations with inconsistent theories, pragmatic methodologies and a selective attitude to the facts. Finally, we can mention the work of the science ethnographer, Latour, whose study of the slow acceptance of Pasteur’s
ideas in microbiology again brings out the messy, conflictual and piecemeal nature of how scientific consensus emerges (Latour 1988). For Latour this leads to a cultural, and ultimately constructionist, understanding of science.

The critiques of positivism in the natural sciences sketched out above, were paving the way for the more wide-ranging subjectivist philosophies that became intellectually fashionable across many disciplines during the 1990s. The general argument that scientific theorisation has a discursive aspect can be acknowledged however, without conceding to post-modernism. On the one hand, it can be argued that the emphasis upon the complexity of the ways in which real science develops can readily be admitted without at all reducing the intellectual processes involved to those of society as a whole. The logic of a scientific breakthrough, after all is best evaluated in its final presentation rather than in the daily details of research practice. On the other hand, it seems clear that all disciplines, even those with the greatest claim to the positivist mantle, are affected by culture, social context, paradigmatic factors and internal politics to some degree.

It is the dilemma outlined above that Lakatos grappled with in his *Proofs and Refutations*, first published in a series of four pieces in the *British Journal for the Philosophy of Science* during 1963-4. In this work, students engage in dialogue with their teacher regarding some knotty problems in mathematics. During the dialogue the teacher and students employ a range of stratagems, arguments and counter-arguments, examples and counter-examples. In the course of this class-room drama - that rehearses some classical proofs
and counter-proofs in the history of mathematics - Lakatos is demonstrating his own understanding of how mathematics and science actually develop historically. Far from operating in a flawless axiomatic manner, real progress in mathematics and science is, for Lakatos, a much more human story of hunches, intuitions and lucky breaks that complement and even make possible formal procedures. It is something that can only be assessed over time as what he terms ‘research programmes’ rise or fall against other, competing ones. This heuristic model of science, Lakatos argues, provides both the best understanding of how science produces our most reliable (though always imperfect) guide to nature, and the truest picture of how scientific consensus emerges.

In his focus upon research programmes that move forward, even in the face of contradictory evidence, Lakatos distances himself from Popper with the latter’s focus upon the theory that stands or falls in the face of the evidence against it. Equally, however, he stands apart from Kuhn, for whom the paradigm, whilst defining periods of normal science in a totalising cognitive sense, is replaced entirely by the new paradigm that overthrows it. In Lakatos’s depiction of scientific progress, in both its historical and philosophical aspects, it is the complex, contradictory and all-too-human detail of its development, that stands out over and above any single rational schema.

Lakatos can then be positioned between Popper and Khun, as a figure who best reconciles the tension between historical accounts of science and the quest for a general model of scientific method. It is this that makes Lakatos’s approach both sensitive to the historical context in which
science is produced, whilst retaining a realist view of science as our best guide to the truth. It is this also, that makes Lakatos attractive for our purposes in this essay\textsuperscript{43}.

One response to the observation that context plays a role in the development and practice of science is that it is all too obvious. This easy dismissal though is either a missing of the point or it is disingenuous. Reichenbach\textsuperscript{44} (1951) distinguished between the context of discovery (regarded as of no importance to a proper assessment of a discovery) and the context of justification (representing the logic and methodological validity of the discovery). This neat separation suits internalist accounts of scientific discovery. It goes too far however, certainly in Lakatos’s view, in removing context from real scientific work. Social and cultural context enter into science as a kind of ‘stubborn substance’ that can never quite be removed. This means that the conventional aspects of science (the modes of thinking, the dominant theories, the customs, the professional rituals and so on) are not only always present, they are actually constitutive of the endeavour for theory to correspond to reality. Whilst scientific method gives us our sharpest implement for dissecting the world in order to comprehend it, it is also always a product of its time and cultural location and the tensions this creates are ever-present\textsuperscript{45}.

The examples given here suggest various ways in which academic disciplines can be seen as discursive. They give a flavour of the range of literature that approaches the history of ideas in this way, particularly with respect to the natural sciences. They provide only a snapshot however and this list could be expanded greatly. A picture of the academic
discipline then begins to emerge that is both historically resonant and culturally connected. It is also one that is more acknowledging of the active role of culture within it, and so more welcoming to what greater student diversity might contribute to its intellectual life.
CONCLUSION

This paper has argued essentially three things: the discursive aspect of the discipline provides a potential field-of-action that can be academically enriching and that may be best conceptualised for practical purposes by using categories borrowed from critical pedagogy; all academic subjects (including the natural sciences) have a discursive dimension and are socially and culturally mediated in terms of their methodologies and outputs; the issues of relativism that this potentially throws up can be dealt with by adopting approaches that are familiar within the philosophy of science.

All in all, the view outlined here is that specialist intellectual work can gain by openness to the wider cultural environment. Culture and the ideas prevalent in society are a part of all academic disciplines. This is an inevitable result of the fact that the university – as itself an institution of situated learning – is a part of the society that both supports it and that it serves. This is true beyond the obvious fact that the academic product is usually (though, thankfully, not always) oriented on one market or another. It also has implications for the intrinsic nature of academic work itself. Sometimes this can be in the sense of obstructing and holding back the intellectual advance of a discipline. It is for this reason that both critical reasoning and a critical pedagogy remain of central importance for the rational development of academic work. Often however, this can be in the sense of enhancing a discipline and of enabling theoretical advances that result in part from an exposure to intellectual trends in society.
The examples chosen for illustration have been taken from the histories of various disciplines. This reflects two things. Firstly, the aim has been to use very broad brush strokes in order to stimulate a philosophical reflection on how academic work might be conceptualised with respect to questions of cultural and social diversity. Secondly, it reflects the interests and reading of the author. If this kind of thinking about how academic work might benefit from greater social diversity were to be taken up by academics it would need to be translated into the professional idiom of any given subject area and expressed in the language of the current discipline. Moreover, the strategic development of diversity-based approaches for particular subjects would need to move beyond the historical and philosophical reflections offered here, towards more programmatic models of pedagogy and student recruitment. The rewards however, could be great. A scholarly community that is alive to the wider intellectual currents of its place and time, and that foregrounds such openness in its conceptualisations, directions and sense of purpose, can contribute much in the life of the academic department. Such contributions can, if properly cultivated, become important for both research and for pedagogy and can be professionally as well as personally rewarding.

We will finish with a comment from Simon (1994) who, in his essay ‘The University: A Place to Think?’, and by way of the intriguing notion of a ‘cynicism index’, captures with admirable brevity the attitude of this paper:

“One indication that a university has a low cynicism index would be evidence that its faculty
were actually taking time to seriously argue over the character of thought in the university” (Simon 2001: 55).

In the prevailing positivist culture of performance indicators, target setting and the tyranny of academic audit in the form of publication-rate, this is a refreshing call. It is also one that the academic cannot rise to alone, but rather as a part of a scholarly community that is socially inclusive, culturally connected and alive to its times. In the mix of perspectives, social experiences and cultural identities that can create this kind of community the non-traditional student has a distinctive contribution to make. Moreover, in responding to this challenge academics may be taking important first steps towards new types of critical theory and practice for the widening participation agenda, as well as towards more culturally accented forms of academic work.
Familiar models include: the social justice model (Burke 2002; Walker 2007); the corporate social responsibility model; and the business model (HEA 2007). The student ‘life-cycle’ model links aspiration, admission, course progression and moving into employment (Greenbank 2006: 152). McGivney (1993) provides a summary of the theoretical models informing much of the widening participation literature over its history: ‘Needs hierarchy theory’ (Miller 1967) connecting social mobility with the fulfilment of ‘higher needs’; ‘congruence theory’ (Boshier 1971) focusing upon learner identity; ‘force-field theory’ (Rubenson 1977) linking student calculations of prospects with assessments of the worth of outcomes; ‘life transitions theory’ (Aslanian and Bricknell 1980) focusing upon significant life events; and ‘reference group theory’ (Darkenwald and Merriam 1982) that considers social transitions.

There is a well established view within the relevant literature that research into widening participation needs to incorporate ‘the social’ and ‘the cultural’ (e.g. Kettley 2007; Archer 2006; Quinn 2004; Thomas 2002; Archer 2002). This does not however extend to considerations of the inherent nature of academic subjects.

There are studies that focus upon cultural factors within the context of a given subject area. See for example the study of the cultural and interpretive repertoires of the mathematic students at a UK university by Hernandez-Martinez et al. (2008). Dhingra (2007) has also explored the role of student
identity and culture in the classroom. Within mathematics the use of cultural approaches to the teaching of mathematics has been a point of dispute within the pedagogical field. Whereas Lerman (2001) for instance, highlights the value of a discursive psychology for the teaching of mathematics, Rowlands and Carson (2002) point out the danger of what they refer to as ‘ethno-mathematics’ resulting in a kind of paternalism that reinforces inequalities within education. Sheridan and Byrne (2008) have drawn attention to the ways in which Cèilidh traditions of teaching music can be beneficial in Scottish universities. Such studies do not tend to explore cultural factors as intrinsically creative elements with the subject itself, however.

4 Hanley draws upon Richard Hoggart’s self-remembrances of working class life in his *The Uses of literacy* (1957) and his depiction of the ways in which the culture of the working class neighbourhood shapes (and constrains) personal imagination.

5 Leading figures of the Vienna Circle included the physicist Ernst Mach, the philosophers Rudolf Carnap and Moritz Schlick, the philosopher and sociologist Otto Neurath and the mathematician and logician Kurt Gödel. Other notable names sympathetic to the circle include Ludwig Wittgenstein, Gottlieb Frege and Bertrand Russell. They were united in their commitment to the notion of experience as the source of knowledge and of logical analysis as the means by which to process and systematise that knowledge, as well as to their opposition to metaphysics of any kind.
6 Indeed, in this less technical usage, we return to something closer to Comte’s original meaning of the term as a kind of philosophical attitude or stance.

7 Jaques Barzun provides us with an eloquent example of the notion of a ‘proper’ relationship between the university as a bearer of the tradition of liberal-humanist enlightenment, and the student as a kind of apprentice at the feet of Reason. Barzun’s *The American University, How It Runs, Where It is Going* (1968) appeared at the height of an era of student questioning of academic authority.

8 The papers presented at this remarkable event are available today in the collection *Science at the Cross Roads* (Bukharin 1971).

9 Trofim Lysenko was director of Soviet agricultural policy under Stalin. Lysenko’s rejection of Mendel’s genetic theory, and his promotion of environmental conditioning as the basis for acquired characteristics in crops, became a matter of ideological orthodoxy with disastrous consequences for food production across the USSR.

10 Indeed a number of the names of this delegation disappear from the historical record within a few short years of the congress.

11 Hessen is not heard of again after 1931.

12 Foucault’s mode of discursive analysis has been used to trace the changing meaning of lifelong learning, from being associated with a politically Leftist critique of the exclusive
nature of higher education, to being a set of concepts connected to workforce remodelling and capitalist economic modernisation (Fejes and Nicholl 2008). For a discussion of the uses of Foucault to understand trends in lifelong learning and adult education see Fejes (2008). Other studies that have employed Foucauldian perspectives to focus upon aspects of widening participation in higher education include those of: Boréus (2006) looking at the link between language and discrimination: SØndergaard (2005) focusing upon the ways in which exclusionary forces affect academic careers; and Van Deventer Iverson (2007) exploring the processes by which diversity policies can unwittingly reproduce exclusion and inequity.

13 For a discussion of apophantic logic in the demonstration of mathematical proof that connects the subject to Husserl’s notion of ‘intentionality’ and the tensions created by the orientation of all mental objects towards the world, see Sokolowski (1973: 271-288).

14 In 1967 Habermas (1971), in his Toward a Rational Society: Student Protest, Science and Politics, called for the expansion of the role of the university beyond that of productivist functionality, through a transformation of internal structures and an embracing of a more reflective academic practice as well as student participation in the research process.

15 One theoretical perspective in which is informed by an appreciation of the collective nature of scientific achievement is Actor Network Theory. This approach highlights the social and technical infrastructures that make scientific breakthroughs possible. See Latour (2005).
Critical pedagogy offers approaches that explicitly link a ‘counter-positivist’ position to a critique of internalism in subject-narratives, as well as to an emphasis upon the ‘historicity of knowledge’. See Darder (1991:78-80) for a clear statement of this.

With respect to the sciences, this connection has been made by Trouvé (1992: 90-91), in his discussion of the problematic created for new scientists’ learning, by the tension between the ‘hierarchized contents’ of science and the ‘flexibility’ of thought required in science production. Similarly Feyerabend (1981: 164), celebrating the ‘outsider’ status of scientists such as Bohr and Einstein, distinguished between the doxa which the new scientist must absorb in order to make their way, and the ideal of the free scientific mind. Feyerabend anticipates the time when “[a new generation] will become scientists without having been taken in by the ideology of science, they will be scientists because they have made a free choice”.

An account of non-Western pedagogical concepts is offered by Merriam et al. (2007) In this work, different authors analyse of the modes of learning associated with Hinduism, Islam and Buddhism. Notions of holistic learning, lifelong learning and informal learning, all emerge as key concepts. Reviewed by Robinson-Pant (2008: 134-5).

In the UK something of this spirit also informed the reading and writing workshops within the worker education movement of the 1960s. Inspired in part by the Raphael Samuel’s History Workshop movement the role of tutor became rather that of ‘convenor’ or ‘co-ordinator’. These groups were or-
ganised along the principles of dialogue, co-learning and the notion of democratic education. See Burns (2004: 47).

The idea of a psychological sub-terrain in the preceding section connects with the theme of a ‘hidden curriculum’ within education settings in the work of Giroux (1983: 47-71). Drawing explicitly upon the work of Bernstein, Giroux sees the ‘hidden curriculum’ as something that is challenged by critical pedagogy. See also Kanpol (1999: 25-56) for a discussion of this connection.

For example, Giroux cites Habermas’s holding up of the work of Marx as being the highpoint of ‘the progressive notion of reason’ before this was split into the increasingly separate components of “positivism, historicism and pragmatism” under the impact of the reduction of science into a productive force in the later 19th Century. (Giroux 1983: 12)

Kincheloe (2008) also links a critique of positivism in education with critical pedagogy. Acknowledging the important distinction between ‘positivism’ understood as a formal position in epistemology and its lasting legacy as a potent cultural force, he has coined the term ‘FIDUROD’ as an alternative. FIDUROD is an acronym of: Formal; Intractable; Decontextualised; Universalistic; Reductionistic; One Dimensional (Kincheloe 2008: 22-23).


Learning and scholarship that takes place outside of traditional institutions forms something of a tradition in the his-
tory of pedagogy, as well as for its modern practices. For discus-
sions of contemporary reflections and experiences in this area see Edwards et al. (2006), Meighan (2005) and Jeffs and Smith (2008).

25 There is a large corpus of writing, often drawing upon phe-
nomenological approaches, that adopts ‘stand-point’ as a methodological principle. Feminist, Afro-centric, gay and post-
colonial epistemologies, for instance, have been given seri-
ous treatment by scholars in each of these culturally focused areas of social analysis. For reasons of space I do not discuss these here. A more developed form of the argument being framed in this paper would indeed however, have to engage with these perspectives.

26 We have only to think of such curious concepts as ‘non-
locality’ and ‘action at a distance’, both central to quantum physics, or to the ambiguous status of ‘the field’ in physics, to begin to wonder about the stability of our own working con-
cepts in modern science. See Lange (2002) for discussions of these philosophically evasive constructs.

27 The allusion here is to the fourth book of Plato’s Republic.

28 This ‘instrumentalist’ point is extended by Popper to the include the body, when he points out that not only are theo-
ries like sense organs that colour how we see reality, but that conversely, “sense organs are like theories” that embody a certain orientation towards the world: the result of adapta-
tion (Popper 1981: 92).
On example of reconstruction for the purposes of ‘tidying-up the story’ in the standard account of a discipline can be found in treatments of the foundational work of Sherrington in neurology. Working at the Thompson Yates laboratories at the University of Liverpool, Sherrington conducted deafferentation experiments on monkeys in which the animals’ sensory nerves were cut. In the standard account Sherrington is portrayed as concluding incorrectly that all activity was dependent upon sensory input (e.g. Jeannerod 1997), with the correct interpretation left to later neuroscience researchers. In fact, in Sherrington’s published work he makes it clear that he was referring (correctly) to voluntary movement only. See Mott and Sherington (1895: 481-8).

The status of the reconstructive approach in the philosophy of science is a point of difference between Lakatos, for whom it can be a legitimate heuristic devise for the assessing of the success of the research programme, and Feyerabend, for whom represents a distortion of the real history of intellectual processes.


Although beyond the scope of this paper, we could also include the more aesthetic propensities of the scientist. For a brief discussion of the role of rhetoric in science, for instance, see Toulmin (1995). The essays contained in the collection for which this is the first chapter, provide a fuller account of various aspects of this subject. Knorr-Cetina (1981:94-135)
also offers us the notion of the ‘scientist as literary reasoner’. As an example of ‘the aesthetic’ in science, we might consider the concern that Einstein had for the ‘inner perfection’ of a scientific theory especially with respect to its ‘symmetry’ (Rigden 2005: 76). Indeed for Einstein this was a criterion of its truth, as well as being a matter of ‘personal faith’ (Reichenbach 1949: 293).

33 There is an extensive literature that focuses upon the interactions between science and politics. Irwin and Michael (2003:119-120) offer the useful concept, ‘ethno-epistemic assemblages’ for this area. Whereas the ethnological status of science emphasises the necessarily local character of its production and applications, the term ‘assemblage’ highlights the articulations between scientific work and its lay public. This ‘assemblage’ then, creates a ‘territory’ that is defined by the discourses, protocols, languages, activisms that mediate the relationship between any given area of science and society. An notorious example of such an ‘assemblage’, is provided by Ezrahi’s (1974) study of the agitation and media manipulation of William Shockley, co-inventor of the transistor and Nobel prize-winner, in seeking to influence the US Congress adopt the theory of low intelligence for blacks in the American education system. From the other end of the political spectrum there is the example of scientists in the US who campaigned against the Vietnam War through Scientists and Engineers for Political Action movement (Brown 1971: 18).

34 This episode in geology has a parallel story in the related discipline of palaeontology. For a discussion of how dogmatism, wishful thinking and arranging of the facts affected the

Indeed this notion does have its echoes in art and literature. It brings to mind, for instance, Blake’s contemplation: “To see the world in a grain of sand, and to see heaven in a wild flower, hold infinity in the palm of your hands, and eternity in an hour”, or that of Henry Thoreau for whom the Spring grass at Walden Pond brought to mind thoughts of eternity.

Francis Bacon, the empiricist philosopher and systematiser of experimentalism, puts forward this view in his *Advancement of Learning* published in 1605. In his day the emphasis upon observation represented a step forward for science in overthrowing the authority of the received wisdom of the texts of antiquity. Bacon’s appeal to the authority of the senses, the basis of the British empiricist tradition that developed through the work of Hume, Berkeley and Locke, can be seen as occupying one end of a spectrum that has the radical doubt of Descartes at the other.

As a rejoinder to this axiomatic and anti-metaphysical view, the logician and proponent of descriptive metaphysics, P.F. Strawson pointed out that even the most rigorous logical procedures are conducted within a cultural milieu of some kind: “Permanent relationships are described in an impermanent idiom, which reflects both the age’s climate of thought and the individual philosopher’s personal style” (Strawson 1959: 10).
This raising of an abstract and artificial standard against which science must be assessed brings to mind also the style of argument much loved by the tobacco industry in their denial of causal-proof for the carcinogenic effects of cigarettes, of the US Bush administration’s rejection of the causes of global warming and the creationist critique of the fossil record.

The acknowledgement of the role of affective factors in theorisation, that demarcates Popper’s conceptuaisations of science from that of the Vienna Circle, is captured in his notion of ‘World 3’ that refers to the wide array of social and cultural factors that influence theorisation in science. It is in this sense also that we can see in Popper the origins of the ‘critical realist’ philosophy of science that is being developed today through the work of the school that has grown around the writings of Roy Bhaskar.

Khun’s perspective here is bolstered by the sociological analysis found in Bourdieu’s *Homo Academus*. In this work Bourdieu (1988) traces the differentials of cultural capital and influence that characterise social relations within French university system and, in so doing, reveals the social anatomy of the campus conflicts of 1968.

One example of this that deeply impressed the author of this paper as a microbiology undergraduate student in the late 1970s, at both the philosophical and scientific levels, was the compelling logic of the ground-breaking François Jacob and Jacques Monod paper on metabolic regulation in bacteria. See Jacob, F. and Monod, J (1961), ‘Genetic regulatory mechanisms in the synthesis of proteins’, *Journal of Molecu-
The mathematical nature of Lakatos’s discussion is especially useful for the purpose of the case being developed here, since mathematics is, along with physics, a subject that has precisely the kind of axiomatic status so beloved of the Vienna logical positivists, a number of whom were themselves mathematicians. Lakatos was also drawing to a degree on the notion of ‘plausible reasoning’ used by the Hungarian mathematician, Polya, in *How To Prove It* published in 1945. Indeed within mathematics itself there is an ‘intuitionist’ body of thought that privileges intelligibility to a (non-specialist) ‘natural consciousness’ as a condition of the status of a mathematical proof as such (Fuller 1995).

This notion of a heuristic understanding of science is close to the view of science as a ‘problem-solving’ (as opposed to an ‘ideal-rational’) activity proposed by Laudan (1981). It also recalls Knorr-Cetina’s observations of the use of make-do ‘savage reasoning’ (or ‘satisficing’) in her anthropological studies of the laboratory (Knorr-Cetina 1981: 20-21).

Hans Reichenbach was closely connected to the Vienna School of logical positivism. His views on verification differed from the mainstream thought of the leading members of the Vienna School however, and he later founded his own school of logical empiricism in Berlin.

Peter Medawer made a similar point in his observation regarding the absence of any such a thing as ‘the scientific mind’: “*There is no such thing as a Scientific Mind. Scientists are people of very dissimilar temperaments doing different*
things in very different ways. Among scientists are collectors, classifiers and compulsive tidiers-up; many are detectives by temperament and many are explorers; some are artists and others artisans. There are poet-scientists and philosopher-scientists and even a few mystics. What sort of mind or temperament can all these people be supposed to have in common?” ‘Hypothesis and Imagination’. Times Literary Supplement, 25 Oct 1963.
APPENDIX I: ONE POSSIBLE DEVELOPMENTAL PROGRAMME

The department

Creating interest

Reflective seminar series. These would be for interested staff and open to students within departments. They would focus upon the sociological and historical character of the relevant subject areas. The aim of these seminars would be explore the ways in which cultural factors have influenced the development of and theorisations within the discipline.

‘Sharing research’ seminars. These would be open to staff and students. Academics would share information about their projects. Ideally, these would be critically reflective in that the presentations would focus upon problems and difficulties in methodology, interpretation and design as well as findings. More specifically, these seminars would begin to profile departmental projects in terms of the ways in which student and community participation might enhance outcomes.

Achieving change

Embedding widening participation. This is likely to have structural implications within departments. Having members of staff, for instance, who have as a part of their role profile a widening participation component, would be important in terms of tailoring the agenda to the department. Such indi-
iduals would need to have a good overview of the work of their colleagues, as well as a grasp of appropriate participation strategies. A part of their role then, would be to conduct the kinds of dialogue necessary to the blending of participation and diversity approaches into the design of courses and research projects.

**Course design.** Modules could be included on courses that explore the cultural heritage and legacy of the subject. The aim here would be to promote a culturally informed understanding of the subject, as well as an ethical concern for proper acknowledgment if the contribution of otherwise marginalised peoples throughout its history.

**Active roles for students**

**Profiling student back-grounds.** For older, returner students work backgrounds, experience in industry, skills sets *etc.* might be mapped against current and upcoming research agendas. Community back-grounds would be important to consider where research programmes have any kind of community or social dimension whether this be research *about* communities, research located *in* communities, or research conducted *with* communities. Examples from across the academy could be found for all of these scenarios.

**Students-as-researchers.** Ways in which students might contribute to research output could also be a feature of strategic development. A students-as-researchers approach may work well in situations that require short-term, intensive and large scale data collection. It would give students a taste of what research is about and would provide a source of future re-
searchers for departments as they develop their skills. For such approaches considerations of individual perspective, cultural background, demographic profile and personal characteristics would be important. Students may also be encouraged to become involved in publication.

**Linking with knowledge transfer.** Forms of academic work that involve any kind of reach-out, whether this be related to specific knowledge transfer programmes or more general research dissemination to geographical or professional communities, and whether it be to schools, communities, workplaces *etc.* could benefit from being able to draw upon student experience of particular areas of work or of particular communities. Such student input could be through involvement in the design of dissemination events, presentations, contact with and access to user and community groups *etc.*

**Enhancing recruitment**

**Subject promotion.** Students can make a contribution to departments in the promotion of the subject in question. This sort of role connects well with existing areas of widening participation work in that activities that are organised in schools by university staff do indeed often have just this kind of purpose. The point here is that the kinds of students involved will communicate a social meaning to school pupils that they will associate with the subject in question. This area could developed strategically also for work that promotes the subject in geographical communities and for workplaces. Again, for these two latter types of setting, students with personal profiles that relate positively to them could make a valuable contribution.
**Recruitment policy.** The profiling of student-categories for the purposes of subject and departmental benefits could be a priority. This would entail drawing some of the elements sketched out in this proposed developmental programme into a set of recruitment criteria. These would inform both the design and marketing of recruitment campaigns as well as admissions policy.

**The University**

**Cultural activity.** The profile of widening participation might be raised with a cultural programme that features speakers, theatre productions and film. This programme could be marketed well beyond the university, across the city and its wider region and also within specific geographical areas. This would have the effect of opening up the university and its precinct to a wider public, making it a more familiar site to local communities. Departments could also be asked to contribute to this wider programme with respect to their own subject specialisms.
APPENDIX II: ONE POSSIBLE RESEARCH PROGRAMME

New directions for research that can be seen as flowing from the discursive analysis outlined in this paper include:

Historical studies of subject areas that focus upon the role of cultural factors with respect to issues of access;

Biographical studies of significant names within specified subject areas for insight into the ways in which students of various backgrounds have contributed to knowledge production during individual careers;

Explorations of the meaning of, and critiques of cultures of positivism within disciplines;

Explorations of the value of critical pedagogy for widening participation and issues of access for social groups;

Explorations of the notion of the ‘cultural identity’ of disciplines;

Research into issues of language, terminology and their links with the cognitive framings of subject areas in relation to widening participation;

Comparative international studies of traditions of pedagogy within disciplines for insight into how notions of teaching and learning can affect perceptions amongst settled communities in the UK;

Sociological studies of subject areas with respect to issues of
access;

Modelling of practical strategies of inclusive and culturally informed pedagogy and recruitment;

Evaluation of inclusive models of pedagogy *e.g.* of student-as-researcher.
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A substantial literature already exists for the fields of widening participation and access studies. Often focusing upon personal motivations towards university entrance, student experience, institutional dynamics and social outcomes, this literature stretches back to the 1960s, and arguably earlier than this. The argument sketched out in this pamphlet suggests that an alternative approach may be to begin with the academic subject area itself, by considering its historical story and cultural characteristics. This discursive approach may then be harnessed in ways that provide points of connection for non-traditional students, as well as an incentive for academic departments to engage more fully with the widening participation agenda.

The paper employs perspectives from social theory and the history and philosophy of science. Critical pedagogy is also foregrounded as a potential source of concepts for this agenda. As a form of pedagogy that is historically rooted in concerns with oppression and empowerment it offers approaches that are valuable to educational opportunities practitioners and educational theorists alike, in their efforts to open up the university to those who have been traditionally excluded.

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