

Above the treetops: nature, history and the limits to philosophical naturalism

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Abstract

This paper suggests that the idea of “nature” remains a thematic leitmotif within interdisciplinary debates because it provides a potential bridge between the natural sciences, the social sciences and the humanities. Yet the development of new kinds of interdisciplinary insights into nature–society relations risks a renewed form of philosophical naturalism within which the epistemological tensions between bio-physical and social domains become blurred. In the fields of architecture, planning and urban studies, for example, we find instances where the idea of nature has mutated into a form of “neo-organicism” in which the ideological and historical context for contrasting ideas of nature remain obscured. If we re-examine our understanding of nature, however, drawing on recent insights in ecology, evolutionary biology and other scientific developments we uncover new possibilities for an interdisciplinary exchange of ideas that may avoid the crude determinisms of the past.

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1. Introduction

12.45. Restate my assumptions.

One: mathematics is the language of nature.

Two: everything around us can be represented and understood through numbers.

Three: if you graph the numbers of any system patterns emerge.

Therefore: there are patterns everywhere in nature.

Evidence: the cycling of disease epidemics; the wax and wane of caribou populations; sun spot cycles; the rise and fall of the Nile.

So what about the stock market?

Darren Aronofsky *Pi* (1998)

In the opening sequence of Darren Aronofsky’s film *Pi* the principal character, a gifted yet deeply troubled math-

ematician, leaves his apartment in an agitated state. He restates his “basic assumptions” about the mathematical basis of reality and decides to apply his skills to the understanding of the stock market. We trace his observations from the seeming disorder of the city – a formation of slowly moving t’ai chi practitioners in a park, a rush of people crossing a busy road and an array of street signs in different languages – towards the fluttering of leaves in bright sunlight: the motif of urban nature provides a pretext for his conviction that there must be an underlying structure behind ostensibly disparate events. As a result of his pioneering investigations into share price fluctuations he attracts the persistent and ultimately menacing attention of a powerful firm of brokers who wish to utilize his insights. Meanwhile, his pursuit of an elusive number that might account for all observable phenomena begins to threaten his fragile mental state.

Although the representation of mathematics in *Pi* lies in the realm of science fiction there lingers none the less a popular fascination with new forms of mathematical abstraction that might simplify all phenomena into a coded

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or digitized form. The existence of Fibonacci numbers, for example, reveals the mathematical basis for many shapes and patterns found in nature. These number sequences, named after their discoverer, the 13th-century Italian mathematician Leonardo Fibonacci, show the underlying similarities between natural forms such as the arrangement of petals, the development of spirals in fir cones and the growth of sea shells. Similarly, the existence of the so-called “golden ratio” points to common aesthetic principles between the proportions of buildings and the shape of the human body which have been a recurring element in architectural design since antiquity (see, for example, Devlin, 1994; du Sautoy, 2003). The principles of mathematics are thus not restricted to the natural world but point explicitly to the realm of human artifice and the built environment. But how far can these mathematical principles be applied? Does the recognition of recurring patterns have any wider significance for the relationship between the bio-physical sciences and other branches of the human sciences? The depiction of mathematics in Aronofsky’s *Pi* is deeply rooted in the doctrine of philosophical naturalism whereby all phenomena – both natural and social – can be understood by reference to a common set of analytical principles. Indeed, the radicalism of *Pi* lies closer to the logical empiricism of the Vienna Circle – notwithstanding its nod to numerology and Jewish mysticism – than to the more generalized origins of Comtean positivism in scientific epistemology. The growing sophistication of digitized representations of reality has breathed new life into the unificatory impulse behind philosophical naturalism: in essence, the technical sophistication of new ways of modelling reality has engendered a renewed form of naturalism in which the virtual or speculative domain of new digitized environments has come to be seen as analogous to representations of concrete phenomena.

The idea of “nature” lies at the core of this philosophical dilemma because the concept appears to encompass a vast spectrum of research activity ranging from the carbon dating of ice cores to the iconographic analysis of landscape art. The problem of nature is not, however, merely an issue of semantic imprecision but is grounded in the analytical and explanatory limits of knowledge itself. One of the most profound consequences of the movement away from so-called Grand Theory – a development that now extends far outside the original nucleus of disciplines first challenged by the emergence of post-structuralism in the 1970s – is a recognition that all forms of scientific explanation remain limited and partial in their scope. The morphological investigations of the Chicago School of urban sociology or the influence of structuralism in fields such as anthropology and linguistics, for example, will never again enjoy the kind of intellectual cachet that has attached to the search for some kind of over-arching explanation that might magically reveal the interconnections between all things. And similarly, within the bio-physical and mathematical sciences, the earlier dominance of Euclidean geometry and Newtonian physics, for instance, has been

challenged by a new and increasingly multi-paradigmatic set of analytical tools including developments such as Boolean geometry, quantum mechanics and string theory. Common to these changes across the sciences is a greater emphasis on complexity, indeterminacy and more sophisticated conceptions of space and time. There is now a wider acceptance of the limits to knowledge and the presence of uncertainty in scientific explanation since our objects of analysis – whether they be geometrical shapes or aspects of 18th-century cultural history – represent only partial perspectives of an elusive totality.

The search for new forms of interdisciplinarity in environmental research thus emerges in the context of a critical reaction against general or universal forms of scientific explanation. Yet at the same time the boundaries between different bodies of knowledge have become more porous. There is, therefore, something of a paradoxical context within which to develop new research agendas and strategies: whilst the “idea of nature” appears to transgress neat demarcations in the division of intellectual labour there is nonetheless an intense set of political, economic and institutional pressures to develop defensible enclaves of research activity which remain firmly embedded in existing disciplinary structures.

2. The matter of nature reconsidered

When Margaret FitzSimmons published her influential article entitled “The matter of nature” in 1989 the institutional separation between the natural and social sciences was much more entrenched than it is today. The Cartesian hierarchy of knowledge with physics as its apex appeared unassailable and social scientists struggled to justify their “scientific credentials” in the face of a seemingly monolithic positivist orthodoxy extending across the bio-physical sciences. FitzSimmons noted how human geography in particular was left with “no allies to support a position that the world was complex and not simply additive: that higher-order systems (be they organism, ecosystem or human society) were organised by their own distinguishing laws and tendencies” (FitzSimmons, 1989: 112). As a consequence of these institutional arrangements she suggested that any attempt by social scientists to tackle the social ontology of nature must necessarily confront the power and authority of the natural sciences. A range of intellectual developments since the 1980s, however, have reframed the “matter of nature” as a critical intellectual terrain that breaks down divisions between the arts and the sciences yet also raises new challenges for disciplinary coherence (see, for example, Clifford, 2002; Turner, 2002).

Previous attempts to explore the socio-ecological dimensions to human societies have tended to emphasize ostensibly functional and homeostatic interactions between nature and what were often isolated, pre-modern or non-Western human societies only tangentially linked with wider processes of economic and political transformation such as the commodification of agriculture, the growth of literacy

or the spread of urbanization. The analytical strategies adopted by anthropologists such as Marshall Sahlins or Claude Lévi-Strauss were focused on socio-ecological systems isolated from the epistemological challenge of historical change. If we consider the concept of “nature” to lie at the heart of a revived interdisciplinary agenda then what kinds of theoretical approaches might be adopted? The idea of “landscape”, for example, cannot be conceived as a static entity either in terms of its bio-physical constitution or its cultural meaning but how can these different elements be combined within a common explanatory framework? The Berkeley School of “cultural ecology”, which evolved under the influence of Carl Sauer, made some attempts to bring the human presence into the heart of what was an avowedly empiricist intellectual enterprise. Sauer sought to develop a form of historically informed earth science within which human culture played a pivotal role in long-term processes of landscape change. Yet the origins of human culture within this intellectual schema remained obscure and the corpus of work associated with the Berkeley School has over time appeared increasingly anachronistic (see Duncan, 1980). More recently, William Cronon has sought to combine aspects of ecological science with anthropology, geography, history and other disciplines to produce an influential synthesis for the analysis of both landscape change and the growth of cities (Cronon, 1983, 1989, 1991). In the case of New England, for example, Cronon (1983: 170) shows how the interaction between regional ecosystems and an emerging global capitalist economy produced “a dynamic and unstable process of ecological change”. Similarly, his exploration of the growth of Chicago meticulously documents how the development of commodity markets for agricultural produce accelerated processes of environmental change across the city’s rural hinterland (Cronon, 1991). The intellectual appeal of Cronon’s model lies in its simplicity yet the study of cities and landscapes is moving towards a greater emphasis on complexity. Both the socio-ecological processes of landscape change and the production of modern cultures associated with this transition are now subject to an increasingly multi-faceted set of analytical tools ranging from new approaches in the history of science to enlarged understandings of power and the particularities of modern state formation at different geographical scales. Cronon’s central observation concerning the relationship between urbanization and the commodification of first nature – to use Marx’s original distinction – remains relevant to the contemporary urban transition now underway at a global scale but needs to be supplemented by further interdisciplinary insights into the growth and development of cities. The relationships between nature, technology and space appear far more complex than the concentric or zonal models of the past but we have yet to develop a conceptual vocabulary that can capture this transition effectively (see Gandy, 2005a).

Recent developments within the bio-physical sciences offer possibilities for further explorations of the ecological

dimensions to history, geography and other fields. The emergence of the so-called “new ecology”, for example, has replaced notions of equilibrium and homeostasis with an emphasis on instability within both ecological and socio-ecological systems (see Botkin, 1990; Zimmerer, 1994, 2000; Scoones, 1999). The shift in emphasis from cyclical to historical (non-cyclical) conceptions of time in combination with relational rather than fixed conceptions of scale suggests a degree of conceptual convergence between the latest insights in ecological science and a variety of developments within human geography and cognate disciplines including an emphasis on non-hierarchical patterns of spatial difference, extended conceptions of agency and a wide-ranging engagement with new philosophies of social and spatial complexity. Central to this shift is a movement away from “ahistorical systems ecology” (Zimmerer, 1994: 111) towards an emphasis on the dynamic and heterogeneous characteristics of bio-physical systems.

The shift in emphasis from simplicity to complexity, from teleology to indeterminacy, and from steady state to more historical conceptions of time, brings a range of previously disparate scientific discourses into closer proximity. In a sense we could argue that the “new ecology” makes much more modest scientific claims than the systems-based approaches of the past and hence its potential contribution to public policy is of necessity different in its scope but arguably more accurate, realistic and epistemologically nuanced, including a fuller recognition of the role of different forms of technical expertise within political discourse (see Zimmerer, 1994). Most critically, however, the shift towards dynamic and heterogeneous conceptions of bio-physical systems enables a much more substantive degree of epistemological dialogue with the social and historical sciences. One significant development has been the emergence of various strands of “political ecology” which combine neo-Marxian perspectives on social relations with insights gained from the ecological sciences (see, for example, Bryant and Bailey, 1997; Davis, 2001; Forsyth, 2003; Heynen et al., 2006; Peet and Watts, 1996).

What is less clear, however, with the emergence of political ecology, is the degree to which this new conceptual synthesis takes full account of the epistemological transformations underway in the “new ecology” or simply draws on the systems-based models of the past. The anthropologist Arturo Escobar (1996), for example, advances what he terms a “post-structuralist political ecology” without actually engaging with the conceptual challenges posed by new developments in the ecological sciences: his aim is rather to extend a version of “discourse analysis” into a constricted conception of the scope of the bio-physical sciences. In an essay on biodiversity, for instance, Escobar (1998: 55) somewhat misleadingly claims that “biodiversity does not exist in an absolute sense” but is in fact a kind of techno-scientific network emanating from the conjunction of ecological science and environmental advocacy. Whilst Escobar is right to stress the social and institutional context for the emergence of contrasting biodiversity discourses,

including grassroots interventions within the global South, he appears to blur the relationship between ontology and epistemology. What we are left with is a highly unsatisfactory pot-pourri of different theoretical approaches that does not distinguish carefully between different strands of environmental thought let alone ecological science.

A further area of contention within interdisciplinary research is the analysis of power. It is no longer possible to conceive of policy discourse simply in terms of juridical and administrative dilemmas manifested in formal structures of power and legal authority. Attempts to extend the ecological sciences, for example, into the social and political arena have often rested on a highly restricted conception of both political practice and the public sphere: in some cases the technocratic impulse behind deleterious environmental actions has simply been supplanted by different forms of technical expertise ostensibly more closely connected to new scientific developments in fields such as climate change research or the study of biodiversity. Technocratic or science-based conceptions of the public realm have routinely relied on an expert led definition of the public interest irrespective of whether these scientific programmes share a commonality with dominant political or economic interests. Yet we find that an assumed rationality or universality lies in tension with the heterogeneous character of social and political realities so that the idea of the “public” or the “public realm” is far more complex than it may at first appear. An emphasis on what Deleuze terms the “multitude”, for example, holds very different implications for how we might conceptualize processes of governance and legitimation in modern societies (see [Deleuze and Guattari, 1987](#); [Hardt and Negri, 2000](#); [Virno, 2004](#)). The presence of the “multitude” also poses a challenge to Habermasian conceptions of discursive democracy and the foundations for rational social and political discourse: there is, in other words, a need to recognize the limits within which any form of scientific or political consensus can emerge.

The growing significance of an historical perspective within interdisciplinary research has also been enhanced by developments within evolutionary biology. The historian [Hobsbawm \(2004\)](#), for example, draws on the latest developments in the study of evolution to posit that the pace of historical change over the last 10,000 years cannot be ascribed to any reductionist variant of neo-Darwinian socio-biology. Human history represents an accelerated acquisition of cultural capabilities rather than the purely blind mechanisms of Darwinian selection. “History”, avers Hobsbawm, “is the continuance of the biological evolution of *Homo sapiens* by other means”. New developments in evolutionary biology – to an even greater extent than the “new ecology” – effectively eliminate the boundary between history and the natural sciences so that any continuing distinction between these fields is rendered non-sensical. Hobsbawm invokes the idea of science in its broadest sense as a means to advance our understanding of the world but also as a means to defend the possibilities for

critical objectivity against its detractors. He also rejects any crude attempt to re-introduce neo-Darwinian forms of biological explanation in the historical sciences through, for example, Richard Dawkin’s conception of “memes” as the basic units of memory that denote the cultural counterpart to the natural selection of genetic characteristics. In contrast, Hobsbawm draws on the work of the geneticist Luigi Cavalli-Sforza to illustrate how human evolution is as much driven by the “horizontal transmission” of language as the passing of genetic information from parent to child. If evolutionary change is recast as a cultural process operating in combination with genetic factors but not reducible to molecular code alone then it is possible to conceive of history as a long-term process of transformation within which the cultural dimension has taken an increasingly catalytic and dominant role.

3. Science, complexity and the public realm

The sense of optimism and intellectual exuberance surrounding the bio-physical sciences has given added impetus to the role of nature as a focal point for intellectual debate over the future direction of human societies. The urgency of scientific debate in the public arena across a range of themes from stem cell research to nanotechnology provides a worrying contrast with the diminished role for the social sciences and the humanities in public policy. [Davis \(2002: 309\)](#), for example, compares the vitality of the natural sciences that “have once again, as in the time of Darwin, Wallace, Huxley, and Marx, become the sites of extraordinary debates that resonate at the deepest levels of human culture” with what he sees as the self-imposed marginality of the social sciences and humanities. The growing strength of the natural sciences has contributed towards renewed attempts to bring the arts and the sciences under a common analytical framework within which the idea of nature has been radically reworked. Emerging developments in fields such as cybernetics, advanced prosthetics and the latest forms of artificial intelligence have underpinned a sense in which long-standing distinctions between nature and culture, and in particular between human nature and other kinds of complex bio-physical systems, must be re-evaluated.

The long-standing deployment of scientific metaphors within the social sciences has been enhanced by a welter of neo-Darwinian formulations that range across disparate fields from architectural design to criminology. The controversies sparked by leading socio-biologists such as David Barash and Edward O. Wilson in the 1970s have resurfaced in the context of a political shift towards neo-liberal conceptions of public policy. The political scientist [Larry Arnhart \(1995\)](#), for example, proposes a “Darwinian naturalism” in which he rejects the Kantian distinction between nature and morality. Arnhart, along with other leading exponents of a biologically based ethics such as Roger Masters and Robert Wright, proposes a form of “human behavioural ecology” whereby social and political ques-

tions are to be explained by a “science of human nature”. Similar developments can be detected in the field of urban research, for instance, where there is an emergence of what one might term “neo-organicist” thinking whereby analytical and epistemological strategies derived from the biophysical sciences are deployed in order to explore processes of capitalist urbanization. In architecture, for example, Haresh Lalvani has explored the manipulation of digitally produced spatial forms that he terms “architectural genomes” based on design principles derived from nature. Lalvani (2002: 116) argues for an architecture that is “more organic in its scope, intent and realization” based on a merger between nature and “human-made constructions”. He posits a new variant on philosophical naturalism – echoing de Landa, Prigogine and others – in his search for a “single unifying law for everything” so that “architecture and biology will become one” (Lalvani, 2002: 124; see also De Landa, 1997; Prigogine, 1997). Similarly, the Harvard Project on the City, led by Koolhaas et al. (2001), in attempting to redefine the parameters of contemporary urbanization, has fallen back on systems-based ecological metaphors such as the “steady state” in attempting to account for ostensibly unfamiliar aspects to African urbanism. Such a perspective effectively locates “non-Western” spaces outside of history where chaos and complexity are viewed as interrelated facets of a fundamentally different kind of urban dynamic. An ethological view emerges in which the analytical distinctions between the natural and social sciences become merged and the role of historical change is reduced to a morphological emphasis on the growth of informal settlements, the proliferation of market space and other manifestations of the asymptotic city. The political and economic dimensions to African urbanism are systematically downplayed – not least the colonial legacy of bifurcated and dysfunctional structures of urban governance (see Gandy, 2005b). In essence the theme of social complexity has been transposed into one of morphological complexity so that concern with historical process is transformed into a search for identifiable patterns (examples include Frankhauser, 1997; Sobreira and Gomes, 2000). The emphasis on complexity as autonomous self-organization – sometimes referred to as “anti-chaos theory” – which draws on the insights of biologists such as Brian Goodwin and Stuart Kauffmann is quite different from post-structuralist philosophies of complexity yet it appears that in some architectural writings at least three forms of complexity have been elided – the morphological, the self-organizational and the epistemological.

The theme of complexity extends not only to different conceptions of spatial morphology but also to different ways of understanding agency. Recent debates over the “post-human subject”, for example, have brought human agency closer to other cognitive structures such as artificial intelligence systems and have placed greater emphasis on the independent agency of non-human nature. Since the mid-1980s a more hybridized conception of nature–culture relations has emerged in response to the intellectual input

of figures such as Donna Haraway and Bruno Latour. In her earlier writings Haraway seeks to locate ideas about nature within a distinctive social and political context linked to factors such as the impact of patriarchy or the needs of capital (see Haraway, 1991). She develops a philosophical framework that can tackle both the complexities of hybrid objects such as cyborgs or genetically modified organisms and also those political interests that lie behind their creation. In contrast, Latour focuses on issues of agency rather than power relations and calls for a new conception of ecological politics in which nature is able to “speak” and in which simple conceptions of reality are replaced with a more fluid set of relations between human and non-human elements. Latour (2004a: 22) calls for the category of “nature” to be replaced by a variety of dynamic “socio-natures” that are constantly undergoing processes of change so that reality is revealed to be something far more complex and interesting than conventional analysis might suggest. In this respect Latour (2004b: 458) takes issue with the implicit assumption behind philosophical naturalism that there is “a single natural world, comprehensible through Science” and argues for a degree of ontological plurality. Central to Latour’s intellectual project is the creation of new institutional and organizational settings within which non-human nature can play an active role in political life (see Latour and Weibel, 2005). Yet the incorporation of nature into political discourse – Latour’s “parliament of things” – raises complicated issues about the meaning and efficacy of political discourse (see Gandy, 2005a). Though Latour repeatedly criticizes the way in which ecological concerns have been subsumed within the aegis of the modern state, for example, he never explores the historical and political circumstances within which liberal democratic states have emerged (Wainwright, 2005). Philosophical tensions over the social construction of nature often neglect to differentiate between the processes by which ideas about nature emerge and the processes by which material entities come into being or are recognized as objects of scientific enquiry (see Castree, 2002; Demeritt, 2002). Does Latour, in other words, offer a form of naturalism that is derived from a post-structuralist rather than a positivist impulse towards the elimination of epistemological boundaries? Are we faced with a “cultural naturalism” where analytical approaches derived from the social sciences have been over extended to produce a degree of ontological confusion between different forms of human and non-human agency in scientific explanation?

An alternative way of handling the problem of agency to that of Latour is provided by Timothy Mitchell’s analysis of the role of nature in processes of social and political transformation. In colonial Egypt, for instance, Mitchell shows how the independent agency of nature – in this case represented by the spread of malaria-carrying mosquitoes in response to irrigation policy – is woven into the analytical frame but the agency of non-human nature is differentiated from that of human agency to produce a

critical epistemology within which different conceptions of sentience, rationality and political discourse can be maintained:

To put in question these distinctions, and the assumptions about agency and history that they make possible, does not mean introducing a limitless number of actors and networks, all of which are somehow of equal significance and power. Rather, it means making this issue of power and agency a question, instead of an answer known in advance. It means acknowledging something of the unresolvable tension, the inseparable mixture, the impossible multiplicity, out of which intention and expertise must emerge (Mitchell, 2002: 29).

Autonomous conceptions of human agency cannot take account of the complex entanglements between social, ecological and technological systems whereas a mutually constitutive conception of relations between nature and culture can illuminate the intersections between historical change and the emergence of new socio-ecological constellations and networks. Yet when over extended the “network” metaphor may be too amorphous and undifferentiated to adequately intersect with the ontological complexities of nature as an evolving nexus of cultural meanings as well as a material constituent of everyday life. The specific characteristics of human creativity – famously captured in Marx’s distinction between the architect and the bee – risk being elided in an over extended conception of agency that fails to distinguish between activity and critical reflection. On the question of human agency we are perhaps encountering the limits to “qualified naturalism” and the possibilities for a post-structuralist reformulation of interdisciplinary analysis (see Evans, 1997; Massey, 1999).

A further complication facing the advocacy of interdisciplinary environmental research derives from the methodological tensions between the social sciences and the humanities: the characterization of interdisciplinary research as a combination of insights drawn from only the bio-physical and social sciences ignores a vast realm of scholarship where hermeneutic approaches predominate. The extension of quantitative methodologies beyond measurable phenomena to include issues of aesthetic or ethical judgment, for example, rests on a restricted conception of human knowledge. The problem with quantification is that it not only privileges empiricist epistemologies over other research strategies but it also simplifies the basis of social explanation. A critical contribution of neo-Marxian, critical realist and structuralist approaches to social research has been the shift of emphasis towards the historical dynamics of causality where social relations and structures take precedence over fragmentary and atomistic conceptions of society. The neo-Marxian legacy, in broadest terms, emphasizes the centrality of politics and political interests to all spheres of human knowledge: even branches of mathematics such as statistics or number theory cannot

be fully understood in isolation from their social context. Equally, the latest developments in Geographic Information Systems and other sophisticated modes of spatial representation rest on a panoply of human interests. The question is not, therefore, one of epistemological elision – the need for a neo-Marxian algebra or positivist art history – but rather one of articulating the interrelationships between different fields of knowledge so that scientific explanation can incorporate different insights to produce a coherent and mutually intelligible body of knowledge.

As knowledge passes from the laboratory or seminar room into society we must confront the issue of “intelligibility” in relation to the possibility of a scientifically informed public realm. The sociologist Bourdieu (1998: 65–6) has explored some of the tensions inherent in the relationship between different spheres of knowledge and cultural production and noted that “it is essential to defend both the inherent esotericism of all cutting-edge research and the necessity of de-esotericizing the esoteric”. For Bourdieu, the public intellectual must face the double challenge of both defending the autonomy of scientific enquiry and also communicating their findings in a social and political context that is radically hostile to critical scientific or artistic discourse:

There are economic and cultural conditions of access to enlightened scientific judgment. There can be no recourse to universal suffrage (or opinion polls) to decide properly scientific problems (even though this is sometimes done indirectly, with no one the wiser) without annihilating the very conditions of scientific production, that is, the entry barrier that protects the scientific (or artistic) world against the destructive invasion of external, therefore inappropriate and misplaced, principles of production and evaluation. But it should not be concluded that the barrier cannot be crossed *in the other direction*, or that it is intrinsically impossible to work for a democratic redistribution of the achievements made possible by autonomy – on the condition that it clearly be seen that every action aimed at disclosing the rarest achievements of the most advanced scientific or artistic work assumes a challenge to *the monopoly of the instruments of diffusion* of this scientific or artistic information, that is, to the monopoly held by the journalistic field (Bourdieu, 1998: 76).

The issue of interdisciplinarity thus extends to the dissemination of scientific knowledge as well as to the prospects for improving understanding between different fields of academic enquiry. Whatever the methodological tools deployed for research all scientists must contend with the political economy of the production and dissemination of knowledge. The problem of translating ideas between different disciplines needs to take account, therefore, of this tension between the epistemological demands of particular fields of enquiry – which may be highly specialized – and a wider set of barriers between the academy and

society. Whilst the case for some form of critically reflexive philosophical naturalism that takes into account the institutional and social context for the generation of scientific knowledge holds credence in relation to a specific range of research questions there remain significant realms of human experience which are not easily subsumed within even a qualified naturalism. The hermeneutic philosophical traditions that have developed within the humanities, for example, have long been hostile to the imposition of any explanatory framework that draws its impulse from the natural sciences. The traditions of interpretative understanding which have derived from the anti-positivist traditions of 20th-century philosophy and sociology appear starkly antithetical to any blurring of the distinction between nomothetic and idiographic methodological traditions. The kind of naturalism or “critical realism” which philosophers such as Bhaskar (1975, 1979, 1989) have developed remains ill-suited to explorations of cultural meaning despite his efforts to challenge a perceived duality between positivist and hermeneutic methods in which both sides appear to misunderstand each other. Although Bhaskar argues for a reflexive understanding of human agency in scientific explanation there lies something of a rationalist impasse with respect to the cultural mediation of knowledge which may suggest that the most insurmountable barrier for interdisciplinary research actually lies between the social sciences and the humanities and not between the social sciences and the natural sciences as is often supposed. A key contribution of Bhaskar to the debate over scientific methodology is to stress the power of ideas to effect causal change in observable phenomena irrespective of their logic or veracity (see Bhaskar, 1997). The power of money, for example, demonstrates that real world events are to a significant degree controlled by abstract ideas: the development of futures markets, re-insurance strategies and other financial derivatives points to the need to take ontological questions seriously because “reality” – however we wish to define this term – can never be taken as self-evident. In summary, it appears that the interdisciplinary study of nature must take account of the materiality of bio-physical processes but also recognize that these operate within another set of ontological and epistemological precepts emanating from the distinctively historical character of social relations and institutions. Whether hermeneutic traditions in combination with more recently developed post-structuralist approaches to knowledge can be satisfactorily incorporated within what one might term a critical or qualified naturalism remains unclear: it may be that the autonomy and creativity of research is not in any case best served by any attempt to produce a degree of philosophical consensus where none in reality exists. The critique of discursive democracy developed by Chantal Mouffe and others might be extended in this instance to advocate an agonistic basis for academic debate where the existence of philosophical difference remains a constant feature. The question, therefore, is whether scientific debates can be conducted on

the basis of mutual comprehension even if the methodologies and research agendas remain radically different.

4. Conclusions

Any attempt to bring the methodological approaches of the arts and sciences into closer proximity needs to make an initial distinction between the possibility for some form of critically reflexive naturalism that can recognize its own limits and the imposition of an analytical framework beyond its original domain into philosophically incommensurate fields of study. There is, therefore, a distinction to be made between a theoretical synthesis that takes account of the ontological complexity of heterogeneous phenomena such as “nature”, “cities” or “landscapes”, and the application of a conceptual elision that blurs meaningful distinctions between, for example, human and non-human nature. The incorporation of the creative or imaginative realm into an interdisciplinary approach à la Deleuze does not necessarily conflict with the development of a qualified naturalism – at least with respect to materialist understandings of nature – but it does pose a significant challenge to any empiricist or quasi-positivist research strategies. Equally, an expanded or modified conception of time to include cyclical and non-teleological elements should not be confused with a recognition of the centrality of historical process within social explanation.

An interdisciplinary approach that succeeds in producing more than an uneasy mixture of different epistemological strategies requires the articulation of a common set of “meta theoretical” terms that have an analytical or explanatory utility beyond their specialized domains. A precondition for an effective interdisciplinary engagement between the sciences is a workable lexicon of meta concepts such as “modernity”, “rationality” and the “public realm”, which can enable a critical discourse to emerge which is both historically grounded and theoretically sophisticated. This is not merely a semantic challenge but is rooted in the need for a conceptual lexicon that is meaningful within the context of often diverse methodological strategies: the idea of historical change, for example, is pivotal to any form of meta theoretical understanding because much environmental research, if it has any historical perspective at all, remains rooted in fragmentary or idealist notions of behavioural change. A genuinely interdisciplinary approach to historical change demands some way of conceptualizing the transition between different social formations so that we can understand how in particular places and under specific historical circumstances it becomes possible for different ideas to emerge. This naturally requires intellectual effort from all sides to ensure that different scientific communities do not simply talk past one another or worse – produce some kind of multi-disciplinary soup that is of little interest to anyone. The pervasive emphasis on the shift from “simplicity” to “complexity”, for example, risks an elision between different forms of complexity. A theoretically informed interdisciplinarity requires honest recogni-

tion that some epistemological strategies will remain not simply intellectually distant but also philosophically incommensurate.

What Pierre Bourdieu, Eric Hobsbawm and other “meta-theoretical” scholars are in fact advocating is a “coalition of reason” in order to tackle pressing human problems. Such a manoeuvre is not to be confused with a lurch back to the theoretical omniscience of the past but rather a call for an extensive re-engagement both within the academy and also between the academy and wider society. The role of the “public intellectual” – for want of a better expression – is of crucial significance in facilitating this process of reconnection and critical debate. It is a commonplace to say that many critical research themes require an interdisciplinary approach but the development of a workable analytical framework within which to pursue an integrated methodological programme of work presents formidable institutional and intellectual obstacles. The academic drift towards hyper-specialization and the formation of sub-disciplinary vanguards is clearly deleterious to this task. Synthetic sciences such as anthropology, geography or history, do not generate their own corpus of theoretical ideas since their shared intellectual heritage around concepts such as “nature” and “space” is not exclusive to any one disciplinary domain. The pattern within the human sciences is one of accretion, contestation and evolutionary development in which there has always been a high degree of theoretical eclecticism and interdisciplinary dialogue. It now appears that parts of the bio-physical sciences are moving closer to this synthetic and multi-paradigmatic model but the full implications of this philosophical convergence have yet to be fully explored.

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