

Environmental Policy Discourse and its Material Objects: Bridging the Gap with ‘Modest Realism’

Ray Galvin

University of East Anglia, School of Environmental Sciences

r.galvin@uea.ac.uk

ABSTRACT

Discourse theories offer a penetrating approach to environmental policy analysis, as they focus on the interpretive worlds produced in policy actors’ utterances and writings, and the argumentative struggles that lead to one view dominating over others in a policy domain. However they fail to theorise the relationships between policy discourse and the material realities that are the objects of policy. This is because their social constructivist epistemology deprives them of criteria for judging the comparative reliability of scientists’ and others’ knowledge of these material objects. This limits their explanatory power, since the material world is a certain way, and therefore influences what policymakers can successfully do. This paper offers a ‘modest realist’ approach to fill this gap. It defends a thoroughly social constructivist understanding of knowledge, yet argues there are good grounds for maintaining that the knowledge of material objects produced in the natural sciences is far more reliable than that produced elsewhere. But such an approach demands trans-disciplinary skills of the policy analyst, including detailed engagement with the relevant area of natural science and its global peer-review community. When done carefully, this approach can add a further explanatory variable to policy analysis, namely the behaviour of the materiality the policy is aimed at.

Key Words: policy discourse theory; materiality; modest realism; environmental policy analysis

INTRODUCTION

The field of policy discourse theory is now well developed, has a broad and diverse base, and has made a place for itself in policy studies (e.g. Chouliaraki and Fairclough, 1999; Feindt and Oels, 2005; Fischer, 2003a; 2003b; Hajer, 1995; Howarth and Torfing, 2005; Laclau, 1993; 1993a; 1995; Laclau and Mouffe, 1985). Policy discourse theory focuses on the worlds people produce in their semiotic activities – speech, writings, graphics, symbols, and demonstration objects. It acknowledges that this aspect of human functioning drives much of what we do, how we order our lives and institutional arrangements, who gets to govern whom, who controls what resources, how our background social milieu gets formed and re-formed, and how this presses back on what this person or that can credibly say and do.

The valuable insights policy discourse approaches bring to policy analysis have only been possible because of their social constructivist world-view: that all knowledge is an act of interpretation performed by free agents through the social construction of psychological reality (Berger and Luckmann, 1966: 149ff). But this has brought a consistent difficulty: their under-theorising of the place of materiality in policy

domains (Lovell, 2007; Jones, 2002). It leads to the view that any statement about materiality, by anyone (politician, practitioner, consumer, cutting-edge scientist or, indeed, policy discourse analyst) is just another person's interpretive, socially constructed, discursive production, and that there is no basis for claiming that one statement about materiality is closer to the truth than any other.

Yet all government policies, particularly environmental policies, have to do with material objects at some point or other. Such policies are intended to bring about effects in the material world: protecting trees, reducing greenhouse gas (GHG) emissions, insulating homes, purifying water, shielding citizens from radioactive waste. These material things are 'obdurate': they will not do just anything we want them to, but can be managed only in conformity with the natural laws that constrain them. For example, German Federal aims to reduce GHG emissions from home heating by 80% by 2050 could be achieved only if the laws of thermodynamics allow this, at whatever level of thermal technology people are prepared to pay for (Galvin, 2010a). Similarly, the achievement of renewable energy targets is subject to what sunlight can do to photovoltaics (Fronzel, et al. 2008), or wind to rotor blades (DIWA, 2009).

So the obduracy of the material objects of policy influences how well a policy can be implemented. But it also affects the way a policy can be credibly formulated, or at least how long it can stay the way it is.

For example, in September 2010 a workgroup of German Federal MPs chaired by Michael Fuchs, the vice-chair of the governing centre-right caucus, proposed that the goal of reducing GHG emissions from home heating be lowered from 80% to 60% (Stern, 2010). In one sense, these politicians can be seen as exercising power by means of discourse, in seeking to persuade other policymakers of their view of their world. As Hajer (1995: 58-68) argues, policymaking is an argumentative activity where various formulations of the problem and its solution compete for discursive dominance.

But on another level, Fuchs and his colleagues are acting as spokespersons for the material objects that Federal policy on thermal refits is aimed at. They claim there is good scientific evidence that home refits cannot achieve the 80% goal. If this is so, analysing their discourse only in terms of discursive power plays does not give a full explanation of what is influencing what in the policy realm. If the policy goal is lowered from 80% to 60%, this might not be merely because of a discourse coalition's successful rhetoric, but because reliable knowledge of the material world overwhelmed less credible discourse.

Hence policy analysis needs to look at both the discourse within the policy discussion, and the characteristics of the material objects of the policy, if it is to fully understand what is causing what in policy development.

I will argue, here, that the strengths of policy discourse theory come from the same intellectual roots that lead to its weakness with regard to materiality. I will then outline five proposed solutions to the problem, and their shortcomings. Then, using insights from philosophy of science, I will propose a 'modest realist' solution that

preserves the social constructivist base of discourse analysis, yet also enables us to produce knowledge of materiality that is reliable for most practical purposes.

1. THE EPISTEMOLOGY OF DISCOURSE ANALYSIS

Discourse analysis has its roots in currents of thought associated with shifts in social and ontological theory over the last 150 years (Baert and da Silva, 2010; Torfing, 1999; 2005). Of these, the three most relevant to this paper are postmodernism, post-positivism and social constructivism. These strands of thought are by no means discreet or self-contained, and have overlapped and intermingled in complex ways in 20th century social theory. However, the following, somewhat simplified explanation should identify the key points at issue for this discussion.

1.1. Postmodernism and the decentring of truth

Policy discourse approaches situate themselves within *post-modernism*, a cultural and intellectual critique which ‘... can be traced to nineteenth century reactions against the Enlightenment and [against] modern notions that saw society as properly organised on the basis of reason ...’ (Dryzek and Dunleavy, 2009: 290). Friedrich Nietzsche (1844-1900), who radically questioned the notions of objectivity and truth, is often seen as one of its earliest exponents. His remark, ‘there are no facts, only interpretations’ (Howarth, 2005: 347), exemplifies this stance.

Accepting Nietzsche’s maxim allows us to consider knowledge as the product of acts of interpretation rather than an ensemble of facts, or true things about the world. ‘In this line of reasoning,’ note Feindt and Oels (2005), ‘the idea of a single rationality is abandoned in favour of a close analysis of how texts produce effects through establishing differences or disguising alternatives’ (cf. Dingler, 2005; Shapiro, 1981). The main interest of policy discourse theory is therefore the ways people are interpreting their world, rather than the way their world actually is. This effectively ‘decentres’ truth, as it shifts consideration from the solid stuff of the world, to *interpretations* of the world.

However, this approach pushes the material objects of policy out of the field of consideration. If all truth is decentred, we have no consistent methodology for judging the nearness to truth of one statement about such things from another.

This comes sharply into focus in debates about science, which I now turn to consider.

1.2 Post-positivism

The twentieth century’s dominant theory of scientific truth was logical positivism¹. This argued that only detached observational evidence was valid for forming knowledge, and that truth about the world could be arrived at by rational constructs based on these observations. The facts being studied were rigorously separated from the values of the researcher, who was confident of maintaining this distinction.

¹ For an insider account of logical positivism see Ayer (1952).

In the post-war era many universities made a concerted effort to develop social science along these lines, and policy science eagerly took this up, seeing itself as ‘...part of the development of world history, devoted to promoting the realisation of a mature and orderly industrial civilisation’ (Torgerson, 1986: 36).

Policy discourse theorists reject this approach. Fischer (1998; 2003a: 1-20; 2003b) argues that social science cannot be value-free because the observer cannot form meaningful knowledge without adopting an interpretive position. Further, as Danziger (1995: 435ff) argues, such interpretive positions are not merely the individual researcher’s bias, but are inherent in a research discipline’s ‘philosophical point of departure’².

Hence policy discourse theorists do not claim to be producing objective, detached knowledge of what is happening in a policy realm. Instead, they identify their assumptions and points of departure openly, and admit that their findings are an interpretation based on these vantage points.

They go further, however, and apply this reasoning to the *natural* sciences – which produce knowledge of the material world. Natural science, says Fischer, is permeated with the values of the researcher (Fischer, 2003a: 122-132). In Fischer’s ‘decentring’ of science he cites well-known arguments against logical positivism: its internal philosophical inconsistency; the falsification principle (Popper, 1959); the shifts within some biological sciences from a ‘fixed’ Parmenidean world-view to the Heraclitean conception of flux (Toulmin (1990); and the apparent arbitrariness of scientific paradigm shift (Kuhn, 1970 [1962]). He then dismisses the objectivity of natural science with Latour’s (1987) argument that science does not discover what is there, but constructs an understanding of the world that fits the research tools available (Fischer, 2003a: 126).

Fischer concludes that ‘... a proper assessment of research results has to go beyond empirical data to examine the practical judgements that shape both the instrument and the object’ (*ibid*: 126). This is reminiscent of the ‘strong programme’ tenet (e.g. Barnes, 1977; Bloor, 1976; 1999a; Pickering, 1984, 1995) that to judge the value of scientists’ claims we have to understand the sociology of the laboratory and the scientific community, rather than the physical material they claim to be investigating³.

Along similar lines, Torfing asserts:

Truth is not a feature of externally existing reality, but a feature of language. Hence there is no extra-discursive instance, in terms of empirical facts, methodological rules, or privileged scientific criteria, which can safeguard either Truth or Science. Truth is always local and flexible, as it is conditioned by a discursive truth regime which specifies the criteria for judging something to be true or false. (Torfing, 2005: 13-14)

Dingler concurs, maintaining that:

² For a fuller account of the positivist/post-positivist division in social science see deLeon (1998), and for a defence of mainstream policy analysis against post-positivist critique see Lynn (1999).

³ See discussion in Hacking, 1999: 63-99, and a lucid and succinct critique of the core logic of the strong programme by Harré, 1986: 13-14.

... the perception of materiality shifts from an essentialist account of static matter to a perspective where matter is a temporary manifestation of the performative practices of human and non-human actants. (Dingler, 2005: 223)

While this view might foster healthy critique the practices of scientists and their allegedly objective statements, it also puts the characteristics of the material objects of both science and policy beyond the reach of what can be considered in policy analysis. This is exemplified in Feindt and Oels's (2005: 168) remark that 'scientific knowledge about nature is as valid as, for example, any poetic concept of nature, depending on the discursive setting.'

1.3 Social constructivism

Policy discourse theorists maintain that the realities people deal with every day are socially 'constructed' through language and other semiotic forms (such as the use of graphs, schematic diagrams, and symbols like 'stop' signs and national flags). Instead of language (and other semiotic forms) being a system of signs that point to referents outside of conversation, it is seen as a practice in which people construct meaning through linguistic interactions.

This view has roots in the linguistic theory of Saussure (1974), the experimental psychology of Vygotsky (1986 [1934]) and the social theorising of Voloshinov (1973) and Bakhtin (1986). It was popularised in social science through Berger and Luckmann's (1966) phenomenological analysis of human knowledge of the social. The foundations laid here are evident, either implicitly or explicitly, in the works of major policy discourse analysts (e.g. Hajer, 1995: 43; Fischer, 2003a: 50; Laclau and Moufe, 1985: 107).

In this understanding, policymaking happens by means of subjective psychological realities constructed in the utterances, discussions and pronouncements of policy actors. Language 'becomes part of data analysis for inquiry, rather than simply a tool for speaking about an extra-linguistic reality' (Shapiro, 1981: 14). Since speech acts and other semiotic productions construct the realities that form the worlds of the policymakers, studying these semiotic productions gives a researcher direct access to what is driving what in a policy realm.

So, for example, in Hajer's (1995) study of acid rain policy, a crucial theme is the way the problem, and its solution, were constructed among Dutch and British interest groups. Hajer shows that policy change can be understood in relation to the ways these social constructions developed, not simply in relation to the specific material features and effects of what we now call 'acid rain'.

A limitation of this approach, however, is that it leads back to the scientific scepticism outlined in Section 1.2, above. How is a policy analyst to know whether one group's social construction of the material objects of policy is closer to the way the world is than any other group's? While remaining social constructivist, we also have to be able to produce reliable knowledge of the material realities that are the objects of policy.

2. PROPOSED SOLUTIONS AND THEIR LIMITATIONS

Within policy discourse theorising there have been several attempts to address this issue. As a heuristic device I classify the main ones as: ‘Relativism is OK’, ‘Degrees of social constructedness’, ‘Democratising science’, ‘Human and material symmetry’, and ‘Critical realism’.

2.1 ‘Relativism is OK’

One group of discourse approaches addresses the problem by arguing it is *not* a problem if seen in a certain way. Torfing (2005: 18-19) notes the ‘common objection to discourse theory that it is adrift in a relativist gloom’ or, in the words of Geras (1987) and Howard (1989), that it entails ‘nihilistic relativism’. Following Rorty (1989) and Mouffe (1996), Torfing accepts that ‘since there are no bedrock foundations, and everything is discursive, it is impossible to defend any particular set of claims about what is true, right, or good’ (Torfing 2005: 19).

However, he argues, we cannot simply assert anything we like, as we are continually exposed to the conceptual frames of other cultures, traditions and contexts. This, he says, leads to ‘agonistic dialogue’, in which our frameworks are contested and ‘contaminated’, and their boundaries ‘continuously breached and redrawn’. This happens through mutual learning, political struggles, or violent conflicts.

Similarly, Fischer (e.g. 2003: 136-138) maintains there are ‘socially liberating effects’ in recognising that ‘multiple realities necessarily characterise the social world’ (*ibid*: 137). Drawing on Haraway (1991: 188-201), he argues that ‘the issue of relativism can be redefined as a question of *location* rather than *criteria*’ (Fischer, 2003a: 137, emphasis added). Those located at the bottom of the social hierarchy see the world differently from those at the top, whose power affords their world-view a privileged position as the truth. Hence ‘the local knowledge of those on the periphery provide the key’ (*ibid*: 137) to transforming social reality. Fischer notes that Foucault (1985 [1969]), too, urges us to ‘focus on the “marginal man” standing outside the mainstream of events’. The alternative, Fischer says, to the ‘single-visioned relativism of universal theory’ is ‘the partial, locatable, critical knowledge’ that makes for shared conversations leading to solidarity in politics (Fischer, 2003a: 138).

This view, also expressed by Bobrow and Dryzek (1987: 161-182, esp. 171), has much to offer, in that the environment and society can look very different from the perspectives of different social groups. However it does not solve the problem of materiality and discourse, in that it does not offer the means to compare discourses with the actual nature of the materiality that is the object of the policy. Dialogue of this kind will not necessarily come to reliable conclusions about, for example, the way insulation materials affect the thermal performance of buildings, or how much atmospheric CO₂ and methane will cause what rise in global average temperature.

We still need a way of judging which statements about the material objects of policy are the most reliable.

2.2 Degrees of social constructedness

A second proposed solution involves dividing discourse into two discrete categories. In the first are statements that are regarded as so straightforward that they simply describe the material things that are there, without any overlay of social construction. In the second are statements that contain values and judgements.

The most explicit expression of this view is in Jones (2002), who speaks of ‘levels’ of ‘constructedness’ (*ibid*: 249, 250) of various material realities. Quoting Blaikie (1984) she notes that ‘there are aspects of the environment that are, as it were, more socially constructed than others’ (Jones, 2002: 249). In a similar vein she draws upon Dear’s (1988) suggestion that some parts of science have relatively few ‘degrees of freedom’ around their explanations, while others, especially the social sciences, are ‘beset by varying degrees of ambiguity’ (Jones, 2002: 249).

To make her point she uses the example of trees and soil:

The direct observation of a tree being cut down is highly unlikely to be disputed. Satellite imagery used to measure deforestation is likely to generate very slightly different results depending on the researcher and methodology employed. The view that such deforestation is unsustainable is even more contested. Similarly, the direct observation of soil movement downslope is less socially constructed than the labelling of it as soil erosion and further, the view that it is a problem. (*ibid*: 249)

Here there is a three-stage progression: a simple description of the event itself (a tree being cut down; soil movement downslope); an interpretation of the event in a category of environmental discourse (deforestation; erosion); and a value judgement (unsustainable; a problem). She argues that people can describe something without adding any social constructedness – so that everybody would agree on the description – and they can also describe the same events with increasing layers of judgement, or social constructedness, as to what is happening.

In support of this reasoning Jones draws upon Little’s (1991) distinction between ‘concepts’, which define or refer to ‘ordinary objects’, and ‘higher level beliefs’ about the ‘properties’ of those objects.

Fischer (2003a) offers similar reasoning. He maintains that ‘...all knowledge can be located across a continuum according to the degree to which it is based on subjective assumptions’ (*ibid*: 152). Hence, ‘instead of simply uncovering reality, scientific work is better understood as a mix of discovery and construction of reality’ (*ibid*, 124).

There are two main difficulties here. Firstly, we would still need criteria to decide where the boundary lies between a ‘simple description’ of ‘ordinary objects’, and a ‘higher level belief’ about these objects ‘properties’ or the values associated with them. Or, in Fischer’s terms, which parts of science are ‘discovery’ and which are ‘social construction’. All this approach does, then, is re-state the problem.

Secondly, the internal logic of this approach is flawed, in its claim that people can describe an event or object without socially constructing it. As Laclau and Mouffe (1985) explain, material realities do indeed exist independently of human thought, but they cannot ‘constitute themselves as objects outside any discursive conditions of emergence’ (*ibid*: 108). It is *we* who constitute them as objects, i.e. as discrete, simplified, useful, communicatively effective selections, by means of words (cf. Wittgenstein, 1967 [1953]: § 8e). How these words’ meanings stabilise is culturally and contextually dependent. Consider, for example, the different realities implied in the expressions, ‘cutting down a tree’, ‘thinning a plantation’, and ‘clearing the bush’. In all three cases the same things may be happening in time and space, but the worlds being discursively constructed are different even at this apparently basic, value-free level.

This only highlights the problem being addressed in this paper: that we need to find some way of judging how well or poorly statements in the policy realm relate to the material objects of the policy.

2.3 Democratising science

A third solution involves what may be termed ‘democratising’ science in environmental policymaking. This is exemplified in Lövbrand and Ölberg’s (2005) response to calls for a more constructive role for science in the policy process than simply as the authoritative spokesperson of the material world (Harrison, 2004, Herrick, 2004; Oreskes, 2004, Pielke, 2004; Sarewitz, 2004). Since all knowledge is socially constructed, science, it is argued, can only ever offer a provisional account of the truth about the material objects of environmental policy. Lövbrand and Ölberg (2005) argue that therefore the notion of science having a privileged position as a provider of authoritative knowledge needs to be abandoned. The boundaries between science and non-science need to be removed, so that the public can more fully participate in the scientific process. This will produce knowledge that is more attuned to the needs of the wider community and ‘build a more socially accountable science’ (*ibid*: 197). Drawing on Nowotny, et al. (2001), Lövbrand and Ölberg (2005: 197) conclude that a ‘socially robust science’ needs to involve ‘social scrutiny of scientific results’.

There is, indeed, much to be gained from wide participation in providing input to questions that are traditionally the preserve of the natural sciences (Callon, et al., 2009 [2001]).

But there are serious problems with Lövbrand and Ölberg’s call for social scrutiny of ‘scientific results’, if by this they mean the knowledge natural scientists produce in their investigations of the material world and their refining of this through their consultation and peer-review processes. For example, no matter how well-meaning the public is, only a person trained and skilled in biology, and submitting her work to the scrutiny of her peers, can produce reliable knowledge on, say, the sensitivities of worms to various chemicals in the soil. The worms might not do very well if this knowledge becomes modified with knowledges produced outside this community, for example by groups who have an interest in promoting or suppressing the use of various fertilisers. The question for environmental policy is not whether science’s

descriptions of the material world suit people, but whether they represent uniquely reliable knowledge. If they do, then we ignore or override them at our peril.

2.4 Human and material symmetry

A fourth proposed solution, found in Actor-Network Theory (ANT), otherwise known as ‘the sociology of translation’ rejects the distinction between discourse and materiality (Callon, 1986; Latour, 1983; 1987; 2005; Law, 1989). More widely, it rejects the ‘divisions traditionally thought to prevail between humans and non-humans’ and therefore of ‘the traditionally accepted division between natural and/or social explanations of environmental change’ (Murdoch, 2001: 115-116). ANT analyses social phenomena as consisting of ‘networks’ that include all the human and non-human entities that influence each other. There is ‘symmetry’ between these entities (called ‘actors’, or ‘actants’) in that no distinction is allowed between the types of causal powers⁴ they exercise. Human actors, and inanimate actors such as metals and bacteria, are all spoken of in both human-like, and inanimate terms. For example, Callon (1991) maintains that inanimate things ‘make’, ‘seek’, ‘rework’, ‘test their identities,’ and ‘are not as dumb as we think’ (*ibid*: 135-136). A nuclear power station, he says, has the ‘right’ to be an ‘actor’ (*ibid*: 141), and it is ‘increasingly difficult to distinguish between humans and non-humans’ (*ibid*: 139).

Further, ANT rejects a social constructionist paradigm and argues instead for ‘co-construction’ (Haraway, 1991; Latour, 1993; Pickering, 1995, see Murdoch, 2001: 117) of society, in which humans and non-humans together form the complex interdependencies that we all live within.

Such an approach can shed much light on how and why certain configurations of scientific knowledge become dominant in a policy arena while others are marginalized. It could, conceivably, illuminate the complex linkages and interplays between the substance of policy and its material objects. It might, for example, help us see why economically inefficient solutions to household GHG emissions, such as on-site photovoltaic (PV) panels, have attained such a high level of Federal policy support in Germany (Dohmen, et al., 2010; Frondel et al, 2008; Galvin, 2009).

However, aside from the highly contested issue of human/non-human symmetry in ANT (on which see Bloor, 1999a; 1999b; Latour and Akrich, 1992; Murdoch, 2001), this still leaves us with the problem of how to attain reliable knowledge of the material objects of policy. As policy analysts we do not only want to investigate why a particular understanding of some aspect of the material environment becomes the dominant one in the policy discourse. We also need to see which of the competing discursive configurations of this materiality is closest to the way the materiality actually is. We need to ask, for example, not just, ‘Why is this view of PV so dominant,’ but ‘Why is this view of PV so dominant, *when it is such a misrepresentation of what PV actually is and can do?*’

Hence, again, we need a way of producing reliable knowledge of material realities such as this – or at least of judging between the knowledges of offer.

⁴ For an account of discussions on the concept of causal powers see Harré and Madden (1975).

2.5 Critical realism

An influential strand of policy discourse theorising is the ‘critical discourse analysis’ (CDA) of Norman Fairclough and colleagues (Fairclough, 1989; 1992; 2005; 2008; Chouliaraki and Fairclough, 1989). In many respects CDA is similar to the broadly-based approach of Laclau and Mouffe (1985), though it also argues that both discursive and non-discursive realities need to be considered in the ‘lifeworld’. This includes material elements, in the context of the social practices of the people producing policy-related discourse. Fairclough and colleagues suggest using Bhaskar’s (1978a; 1989; 1998[1979]) ‘critical realist⁵’ insights to weave together the semiotic and non-semiotic aspects of social reality. ‘Indeed,’ they conclude, ‘one might be able to construct a continuum ranging from technological systems through to religion in terms of the relative weight of semiosis and materiality in their overall logic’ (Fairclough, et al., 2001:10).

The central tenet of critical realism, drawn upon in CDA, is that, while all utterances are social constructions through and through, humans are also skilled at matching their utterances to the way the social world and material worlds really are. Further, it is argued, people can be trained to do this to a high level of competence using scientific methodologies (Bhaskar, 1989).

These claims, with respect to the social world, are highly contested (for a discussion of the sticking points see Harré, 2009; Harré and Bhaskar, 2001; King, 1999; Patomäki and Wight, 2000; Steinmetz, 1998; Varela, 2002). As I will argue below, such claims with respect to knowledge of *material* realities are more compelling. However it is not clear that Fairclough and other CDA advocates have woven them credibly into their policy discourse theorising. It is one thing to proclaim, ‘We can take materiality seriously because we are critical realists’. It is quite another to unpack the term ‘critical realism’ and show quite specifically how it might enable us to bridge the gap between the socially constructed realities that exist subjectively in people’s minds, and the objective realities, material or social, which might exist regardless of what people think or say. A methodology for producing reliable knowledge of material objects, while remaining thoroughly social constructivist, is still wanting. In the following section I propose an approach which, I would argue, can begin to fill the gap.

3. ‘MODEST REALISM’ AS A PROPOSED SOLUTION

The solution I am proposing is *realist*, in that it regards the world as not only ‘there’, but also knowable, at least to a certain degree and for most practical purposes. It is *modest*, in that it does not make the high claim that we can know things about the world perfectly, completely or infallibly, or that we can be 100% sure that one piece of knowledge is closer to the truth than another. It thereby avoids the ‘fallacy of high redefinition’ (Harré 1986: 6), in that, unlike logical positivism, it does not claim that there is a *deductive* certainty about knowledge of the world. Hence it does not seek logically tight solutions to the problems of verification and falsification that beset

⁵ ‘Critical realism’ is a term coined by Roy Bhaskar’s interpreters to describe the second phase of Bhaskar’s philosophy, which dealt with social structure. It is often incorrectly applied to the first phase of his work, which dealt with natural science, and which he called ‘transcendental realism’. See Bhaskar (1998[1979]; 1978; 1993).

logical positivism⁶. The ‘modest’ nature of this solution should become clear in the exposition that follows.

My solution is in two main parts. I begin with ‘transcendental realism’, a philosophy of the natural sciences developed by Bhaskar in his early work (Bhaskar, 1978 [1975]), and recently refined by Harré (2009). I also suggest how this can be made more rigorous, in places, with Archer’s (2000) phenomenological understanding of how humans learn language in relation to material things. I then overlay this with Rom Harré’s (1986) understanding of science as a ‘morally’ grounded discipline.

3.1 Transcendental realism

Bhaskar’s argument starts with the prosaic observation that, over the last 500 years, the natural sciences have produced an enormous body of knowledge of the workings of the material world that has proven reliable for all people everywhere. It is not logically or contingently *necessary*, he observes, for a project such as natural science to arise in the universe, but it *has* arisen, and therefore we must explain ‘what must be the case for science to be possible’ (Bhaskar, 1978[1975]: 29). Clearly, he says, ‘the world is such that science can occur’ (*ibid*: 29). Therefore, ‘given that science does or could occur, the world *must* be a certain way’ (*ibid*: 29).

One possible explanation for this historical success, Bhaskar argues, is that the mental models scientists produce, to interpret the natural world, are descriptions, however tentative or partial, of ‘mechanisms’ or ‘tendencies’ that do actually exist in nature (Bhaskar, 1978[1975]: 25, 145-148). Here Bhaskar is drawing upon earlier work in the philosophy of science by Anscombe and Geach (1961), further elaborated by Hesse (1974) and Harré and Secord (1975). For Anscombe and Geach, a ‘law of nature’ is not merely a ‘Humean description’ of an empirically observed regularity (two things that just happen to happen in sequence with each other), but ‘a tendency of natural agents to act in certain ways when impediments to their action are removed’ (Harré, 1976: 628). Hence when looking at closed systems – i.e. in careful experiments designed to nullify the effects of countervailing or interfering tendencies – we can observe the effects of, and thereby infer the existence of, specific tendencies which operate at all times and places but are normally hidden. It is the job of natural science to identify these tendencies, and report them to the wider world.

Further, the knowledge so gained is never final or complete, but can be continually improved and ‘deepened’. While Kuhn (1962) argued that scientific knowledge lurches from one paradigm shift to another, Bhaskar argues that we must not mistake a discovery of a new *level* of natural tendency, for a newly fashionable theory. For example, as Barrow (2010) points out:

In practice, the process of improving central theories of physics usually involves a process of replacing the theory by a deeper or broader version that contains the original as a special or limiting case. Thus, Newton’s theory of gravity has been superseded by Einstein’s theory of general relativity but not replaced in some type of scientific “revolution”. (Barrow, 2010: 374)

⁶ On these see Popper, 1959, Chapters 3 and 4

Hence, Bhaskar notes that most change in scientific theories is a deepening and broadening, where each stage brings a better description of what drives some natural phenomenon, but there is no guarantee we will ever describe it fully or perfectly.

Further, although Bhaskar argues that the tendencies of nature, which science discovers, exist independently of the humans who discover them (Bhaskar, 1978[1975]: 16), he also argues that our knowledge of these tendencies is a *social* product. Scientific knowledge is a social construction, formed by human effort and interpretation.

Bhaskar takes this point a step further, observing that the material world does not *cause* scientists to know what it is like. Rather, scientists have to produce knowledge of it, as a free, responsible act of interpretation, in a specific social context. They have to interpret the sensory shifts in their vision, hearing, smell, taste and touch in such a way that they match their knowledge to the way the world is.

But there is nothing mysterious about this ability. Bhaskar again appeals to a contingent (not a logico-deductive) phenomenon: human beings regularly develop the skill of matching their interpretations of reality, to the reality in the world, in a good-enough way, such that they are able to get about in the world. More recently Archer (2000), following Merleau-Ponty (1962: e.g. 326), has made a strong phenomenological argument for this point. Children, she argues, learn language in practical, everyday situations in which they are seeking to achieve goals in relation to material objects and events. They need to match their language to the materiality effectively in order to get what they want from the adults around them. From its very beginning, then, language is tied to material things, a point also argued in some detail in Harré and Gillett (1994). Language must not be treated, in our discourse theorising, as if it arrived yesterday, with no historical relationship, in an individual or a society, to the material things it purports to refer to. It always has a longstanding connectedness, in every speaker, with everyday situations in which words and material things have been related in practical ways.

For Bhaskar, the social project of natural science involves rigorous training in refining this natural ability for use in controlled, laboratory-type situations. Employing this ability, he says, is ‘work, and hard work at that’ (Bhaskar, 1978[1975]: 57).

Of course this provides no firm guarantee that the knowledge science produces of the world will be totally correct, or even sufficiently reliable for all practical purposes. Even if there are ‘mechanisms’ causing material things to behave the way they do, and even if scientists are well-trained in matching their discourse to these things in laboratory situations, they can still make catastrophic mistakes, or even behave like charlatans. A further step is needed, hence I turn now to consider Harré’s view of the ‘moral’ basis of science.

3.2 A moral basis for science

Science happens in a specific community that aims to produce knowledge about the world. Harré (1986) argues that the scientific community ‘exercises quality control over its products... by the informal yet vigorous maintenance of a *moral order*’ (*ibid*: 12, emphasis added). Hence:

... ‘science’ is not a logically coherent body of knowledge in the strict, unforgiving sense of the philosopher’s high redefinition, but a cluster of material and cognitive *practices*, carried out within a distinctive moral order, whose main characteristic is the trust that obtains among its members and should obtain between that community and the larger lay community with which it is interdependent. (*ibid*: 6)

The abiding and overarching characteristic of the scientific community is this moral commitment. While there are huge variations in method and worldview among different branches of science, as Feyerabend (1979) has shown, the one thing common to them all is that they put themselves under the moral imperative of producing knowledge which is reliable and trustworthy for everybody everywhere: ‘knowledge on which one can rely’ (Harré, 1986: 13). This is ‘a remarkable and rigid morality’ (*ibid*: 6). Even though individuals and sub-groups within the ‘science tribe’ may err and stray from this imperative at times, their colleagues in the wider scientific community continually and consistently distain such waywardness, shaming and disciplining ‘sinners’ so as to keep the moral project on track. Harré comments:

I believe [science] to have been the most remarkable moral achievement of mankind, and that antirealism⁷, which, like it or not, seeps out into the lay world as antiscience, is not only false but morally obnoxious as a denigration of that amazing moral phenomenon. Alongside the moral order of the scientific community our social and commercial moralities look pretty squalid. (*ibid*: 6)

An example of how this morality works may be found in the response to the ‘climategate’ affair at the University of East Anglia of late 2009. The implied accusations, of subverting the peer review process and suppressing data and evidence, were of *moral* import. If climate scientists had used power and position to exclude contrary views from publication, they would have seriously tainted the credibility of the climate science community. However the moral commitment of the scientific community was demonstrated in its willing acceptance of three separate commissions of enquiry.

Of course, this moral commitment does not guarantee that all scientific knowledge will match its material objects better than all other knowledge. However, combined with a transcendental realist understanding of what science is, it should give us far more reason to look to the scientific community for our knowledge of how material objects behave, than to other communities. For the past 500 years the scientific community has been producing knowledge that has accumulated huge successes in providing technological and everyday benefits (and new risks and damage) that we all feel. The community that produces this knowledge is fiercely committed to producing a quality product: knowledge that is reliable and trustworthy for everybody everywhere (it even worked on the moon!⁸). No other community dealing with

⁷ The ‘antirealism’ Harré refers to here covers a major tradition in the history of philosophy, with a number of branches, in which, generally, there is strong denial that human beings can produce knowledge that maps more or less to the way the world is. This tradition is strongly represented among policy discourse theorists.

⁸ The failure of Apollo 13 enhances the ‘modest’ side of the ‘modest realism’ advocated here. Science is by no means infallible. *Caveat emptor!*

knowledge of material things has a moral commitment that comes anywhere near this. There is no such code among, for example, homoeopaths, acupuncturists, creationists, journalists, or those who call themselves climate change sceptics (see discussion in Goldacre, 2009). Further, science as a community is sufficiently open that anyone can read its publications, and it can be made to open up its everyday procedures for public scrutiny.

These points do not add up to a logically tight argument for the truth of scientific propositions – if such a thing could ever be produced. The realism espoused here is modest and pragmatic. It rests on an interpretation of aspects of the history of the last 500 years; on phenomenological observations as to how people learn to produce knowledge that accords with the material world; on the observation that science is governed by a strict moral code; and on a proposed ontology of what the universe must be like for such a thing as science to have been able to occur.

Importantly, for policy discourse theorists, it is thoroughly social constructionist. It claims there is no formal, epistemological distinction between the knowledge of natural processes produced by science, and the knowledge of these processes produced by, say, a poorly briefed journalist. It also claims, however, that there are very good reasons for believing that the content of the former is far more reliable than that of the latter.

4. IMPLICATIONS FOR POLICY DISCOURSE THEORY

If a view of science such as the one outlined above is incorporated into policy discourse theory, several things follow.

4.1 A special place for natural science knowledge

In doing policy analysis, the knowledge produced in natural science cannot be treated as on a par with knowledge produced non-scientifically. On the one hand it is important to examine the functional roles of all the knowledges within policy discourse, noting how policy actors use them to win arguments, discredit opponents, and position people within constellations of power. But it is also important to see which of these knowledges are reliable for all people everywhere, and which are merely, to recast Torfing's words 'local and flexible' (Torfing, 2005: 14).

This can help us to see where the materiality, at which policy is aimed, is itself having influence on the policy – even though this influence is likely to come through people's discursive productions regarding it. Modest realism gives us a methodology for checking out the reliability of the knowledges expressed within policy discourse. Those produced by legitimate natural science are likely to represent the materiality most accurately (though this is not inevitable). Recognising them can often help us to see where policy discourse is in or out of step with its material objects, and can add to our understanding of why a policy is succeeding or failing. They can also help us see why some policies drift in certain directions despite opposing rhetoric: given time, a policy that is out of step with its material objects will have to change, to remain credible. I would expect, for example, that German and British policies of attaining an 80% reduction in GHG emissions from home heating by 2050 will change, if more scientific evidence accumulates that this goal is technically unattainable (Galvin,

2010a; Cambridge Architectural Research, et al., 2009: 87ff). The obduracy of the material objects will win out, not just in the material realm, but also, eventually, in the discursive.

4.2 Uncertainties in natural science

Not all domains of science are as certain as the physics of buildings or the chemical constituents of a lake. Environmental policy often takes place against a background of incomplete science and contested paradigms, amidst great physical complexity. But we must avoid the assumption that this means there is a level playing field amongst all discourses. For example, while the science of climate change is incomplete, there are some areas of scientific knowledge in this field that are robustly reliable: that CO₂ absorbs outgoing infra-red radiation and thereby warms the earth; that human activities are increasing the earth's annual production of GHGs; that heat melts ice; that sea level rises when heat expands the oceans and when their mass increases from melting land-based ice. On the other hand, the knowledge of how hurricane intensity correlates with global average temperature is far less certain, and there is great uncertainty about the likely rate of sea level rise from the possible breakup of Greenland's and West Antarctica's glaciers. The modest realist approach can help us tease out the natural mechanisms that are already scientifically established, from theories that are candidates for mechanisms, and yet others that are currently mere hypotheses. We can then get a better picture of the degree to which power plays and rhetoric are driving policy, and how much it is being influenced by reliable, relatively certain scientific knowledge.

4.3 Expert reports, expert knowledge

Policymakers routinely look to scientific expert advice to inform their decision-making (Jasanoff, 1990; Peterson, et al., 2010). Policy discourse analysts can explore the types of knowledge conveyed to policymakers in this process, by critically examining the expert reports that governments commission scientists to produce. These reports often contain more than the bare findings of science, if only because of the broadness of the questions governments ask them to report on. Hence scientists are often called upon to produce more than scientific knowledge. A modest realist framework can equip policy discourse analysts to discern which aspects of the discourse of expert reports are which kind of knowledge: which are universally reliable, stemming from science, and which are values-based. This is illustrated in a recent study of the expert reports that inform German Federal policymakers on the economic viability of thermal refits of homes (Galvin, 2010b). Here it is shown that much of the expert argument for the economic viability of refits to extremely high thermal standards rests upon the values and politics of the experts, not their physics and micro-economics. Further, these values and politics are found to be key narratives in the wider discourse that drives the policy. Hence it is suggested that one explanation for mismatches between the policy and its material objects is the recycling of values-based discourse around the loop of policymakers and scientific expert advisors. In more general terms, the modest realist approach can help policy discourse analysts see where the scientific expert advisors within the policy community are acting as scientists, and where their offerings are simply adding to or reinforcing the discourse of values.

4.4 The challenge of trans-disciplinary research

The modest realist approach offers policy discourse analysts the option of researching not just the discourse that drives a policy, but also the degree of reliability of knowledge claims within the policy discourse, with respect to the material objects of the policy. But to do this effectively the policy discourse analyst has to be knowledgeable and competent in the relevant branch of natural science. She has to be able to judge which statements about material objects are good science, i.e. represent knowledge that is reliable (or the most reliable on offer) for all people everywhere. To do this, she has to engage fully with the relevant scientific community, and submit her own findings and critiques to their peer-review scrutiny. In this way she is not only utilising the methodologies appropriate for that branch of research, but also accepting the moral imperative of being extremely careful to produce ‘a quality product’ (Harré, 1986: 12), namely knowledge that is as universally reliable as can currently be produced. With this knowledge, she is better equipped to discern, in her policy discourse analysis, what the configurations are of values, politics, material obduracy, and reliable knowledge about materiality, that are driving the policy.

It may seem excessively demanding to expect researchers to have academic competence in two quite different fields, one in the humanities and one in the natural sciences. However, there is increasing interest in the value of trans-disciplinary research (e.g. Hirsch Hadorn, et al., 2008), and environmental science faculties now often foster such an approach. Further, environmental policy simply does have to do with both values and material objects. If we genuinely want to find what drives what in such policy domains (in relation to our necessarily values-based research questions), it is difficult to see how a full trans-disciplinary approach can be avoided.

CONCLUSIONS

Policy discourse theory provides an intellectual framework for investigating the discursive influences that drive policy development. Its great strength is its social constructivist understanding of knowledge. This focuses its research on the worlds of meaning that policy actors produce in their utterances and writings, and how these lead to specific formulations, of social and environmental problems and their solutions, coming to dominant a policy domain. It also frees research from the illusion that knowledge of social realities can be obtained by detached, value-free observations from some neutral standpoint, and hence policy discourse research locates its interpretations of policy development in the context of questions and (values-based) concerns which it makes explicit up front.

Its weakness is its avoidance of direct questions of the reliability of the various knowledges, found within policy discourse, of the material objects of policy. This would entail a seeking after truth, which its post-positivist roots drive it away from. Attempts to compensate for this weakness have not been convincing, as they fail to engage fully with the question as to whether and how we can remain social constructivist while positing criteria for judging which statements about material reality are the most reliable.

The modest realist understanding of natural science, developed here, offers an extension to policy discourse theory that identifies how, and in what circumstances,

natural science produces knowledge that is reliable and can be trusted for most practical purposes. If policy discourse analysts become trans-disciplinary, this modest realism gives them the means to discern the reliability of statements, within policy discourse, about the policy's material objects. It also enables them to distinguish between genuine science and the personal values that are found deep within the expert reports that policymakers rely on for their knowledge of these material objects. It thereby enriches their understanding of what is driving what in a policy domain.

Policy discourse theory is making a strong and challenging contribution to policy studies. If modified so as to deal more adequately with the material objects of policy it would be even more effective in its scope and critique⁹.

References

- Anscombe, G.E.M. and Geach, P.T. (1961) *Three Philosophers: Aristotle, Aquinas, Frege*, Oxford: Basil Blackwell.
- Archer, Margaret S. (2000) *Being Human: The Problem of Agency*, Cambridge: Cambridge University Press.
- Ayer, A.J. (1952) *Language, Truth and Logic (second edition)*, New York: Dover Publications.
- Baert, Patrick and da Silva, Filipe (2010) *Social Theory in the Twentieth Century and Beyond (second edition)*, Cambridge: Polity Press.
- Bakhtin, M. M. (1986) *Speech Genres and Other Essays*, Austin: University of Texas Press.
- Barnes, B. (1977) *Interests and the Growth of Knowledge*, London: Routledge and Kegan Paul.
- Barrow, John D. (2010) 'Simple Reality: From Simplicity to Complexity – and Back Again', in Bill Bryson (ed.) *Seeing Further: The Story of Science and the Royal Society*, London: Harper Press, pp. 360-383.
- Berger, P. and Luckmann, T. (1966) *The Social Construction of Reality: A Treatise in the Sociology of Knowledge (1984 edition)*, Harmondsworth: Penguin.
- Bhaskar, Roy (1978 [1975]) *A Realist Theory of Science: Second edition*. London: Verso.
- Bhaskar, Roy (1978a) 'On the Possibility of Social Scientific Knowledge and the Limits of Naturalism,' *Journal for the Theory of Social Behaviour* 8 (1): 1–28.

⁹ My thanks to Tom Hargreaves, Richard Baldwin and Noel Longhurst for their critical comments on an early draft of this paper.

- Bhaskar, Roy (1989) *Reclaiming Reality: A Critical Introduction to Contemporary Philosophy*, London: Verso.
- Bhaskar, Roy (1998[1979]) *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Sciences*, London: Routledge.
- Blaikie, P. (1984) 'Post-modernism and global environmental change (viewpoint),' *Global Environmental Change*, 6(2): 81-85).
- Bloor, D. (1976) *Knowledge and Social Imagery*, London: Routledge.
- Bloor, D. (1999a) 'Anti-Latour'. *Studies in the History and Philosophy of Science* 30:81–112.
- Bloor, D. (1999b) 'Reply to Bruno Latour,' *Studies in the History and Philosophy of Science*, 30:131–6.
- Bobrow, D and Dryzek, J. (1987) *Policy Analysis by Design*, Pittsburgh: University of Pittsburgh Press.
- Callon, Michel. (1986) Some elements in a sociology of translation: domestication of the scallops and fishermen of St. Brieuc Bay, in: John Law, (ed) *Power, Action, Belief: A New Sociology of Knowledge?* London: Routledge and Kegan Paul, pp. 19-34.
- Callon, Michel. (1991) 'Techno-Economic Networks and Irreversibility,' in John Law (ed.), *A Sociology of Monsters: Essays on Power, Technology and Domination*, London: Routledge.
- Callon, Michel; Lascoumes, Pierre and Barthe, Yannick (2009) *Acting in an Uncertain World: An Essay on Technical Democracy*, (original French edition 2001) Cambridge (Mass) and London: MIT Press.
- Cambridge Architectural Research, Cambridge Econometrics, Roger Talbot & Associates Ltd, Alembic Research (2009) *Modelling Greenhouse Gas Emissions from Scottish Housing: Final Report*, Edinburgh: Scottish Government Social Research. Available at <http://www.carl.co.uk/downloads/DEMScot%20Final%20Report.pdf> Accessed 16 November, 2010.
- Chouliaraki, Lilie and Fairclough, Norman (1999) *Discourse in Late Modernity: Rethinking Critical Discourse Analysis*, Edinburgh: Edinburgh University Press.
- Danziger, Mary (1995) 'Policy Analysis Postmodernized,' *Policy Studies Journal*, 23(3): 435-450.
- de Leon, Peter (1998) 'Models of Policy Discourse: Insights Versus Prediction,' *Policy Studies Journal*, 26(1): 147-161.

- Dear, M. (1988) 'The postmodern challenge: reconstructing human geography,' *Transactions of the Institute of British Geographers*, 13: 267-274.
- Dingler, Johannes (2005) 'The Discursive Nature of Nature: Towards a Post-Modern Concept of Nature,' *Journal of Environmental Policy & Planning*, 7(3): 209–225.
- Danziger, Mary (1995) 'Policy Analysis Postmodernized,' *Policy Studies Journal*, 23(3): 435-450.
- Dohmen, Frank; Klawitter, Nils and Reuter, Wolfgang (2010) 'Revolt of the Sun Kings: Solar Industry Fights to Save Subsidies,' *Der Spiegel*, 22 April, 2010.
- Dryzek, John S. and Dunleavy, Patrick (2009) *Theories of the Democratic State*, Basingstoke: Palgrave Macmillan.
- DWIA (Danish Wind Industry Association) (2009) *The Power of the Wind: Cube of Wind Speed*, DWIA website.
<http://www.windpower.org/en/tour/wres/enrspeed.htm> Accessed 14 May, 2010.
- Fairclough, Norman (1989) *Language and Power*, Harlow: Longman.
- Fairclough, Norman (1992) *Discourse and Social Change* Cambridge: Polity Press.
- Fairclough, Norman (2005) 'Critical discourse analysis,' *Marges Linguistiques*, 9: 76-94.
- Fairclough, Norman (2008) 'Critical Linguistics,' in William J. Frawley (ed.) *International Encyclopaedia of Linguistics*, Oxford: Oxford University Press.
- Fairclough, Norman, Jessop, Bob and Sayer, Andrew (2001) 'Critical Realism and Semiosis': Paper presented to International Association for Critical Realism Annual Conference, Roskilde, Denmark, 17-19th August 2001.
- Feindt, Peter and Oels, Angela (2005) 'Does Discourse Matter? Discourse Analysis in Environmental Policy Making,' *Journal of Environmental Policy & Planning*, 7(3): 161-173.
- Feyerabend, Paul (1979) *Against Method: Outline of an Anarchistic Theory of Knowledge*, London: Verso.
- Fischer, Frank (1998) 'Beyond Empiricism: Policy Inquiry in Postpositivist Perspective,' *Policy Studies Journal*, 26(1): 129-146.
- Fischer, Frank (2003a) *Reframing Public Policy: Discursive Politics and Deliberative Practice*, Oxford: Oxford University Press.
- Fischer, Frank (2003b) 'Beyond Empiricism: Policy Analysis as Deliberative Practice', in Maarten Hajer and Hendrik Wagenaar (eds), *Deliberative Policy Analysis: Understanding Governance in the Network Society*, Cambridge: Cambridge University Press, pages 209-226.

- Foucault, Michel (1985 [1969]) *The Archaeology of Knowledge*, London: Tavistock.
- Frondel, Manuel; Ritter, Nolan and Schmidt, Christoph M. (2008) 'Germany's solar cell promotion: Dark clouds on the horizon,' *Energy Policy* 36: 4198–4204.
- Galvin, Ray (2009) 'Modifying Actor-Network Theory to analyse the German Project of photovoltaic electrical energy generation,' CSERGE Working Paper EDM 09-02, Available at http://www.uea.ac.uk/env/cserge/pub/wp/edm/edm_2009_02.pdf Accessed 8 May, 2010.
- Galvin, Ray (2010a) 'Thermal upgrades of existing homes in Germany: The building code, subsidies, and economic efficiency,' *Energy and Buildings*, 42(6): 834-844.
- Galvin, Ray (2010b), 'The Politics of Mathematics: Modelling the Economics of Thermal Refits in the German Building Regulations.' Working Paper, available from http://justsolutions.eu/Resources/Galvin_PoliticsOfMaths_Draft_July2010.pdf Accessed 17 November, 2010; cited by permission of author.
- Geras, Norman (1987) 'Post-Marxism?' *New Left Review*, 163: 40-82.
- Goldacre, Ben (2009) *Bad Science*, London: Harper Collins (Original edition London: Fourth Estate, 2008).
- Hacking, Ian (1999) *The Social Construction of What?* Cambridge, MAS: Harvard University Press.
- Hajer, Maartin (1995) *The Politics of Environmental Discourse: Ecological Modernisation and the Policy Process*, Oxford: Clarendon.
- Haraway, Donna (1991) *Simians, Cyborgs and Women: The Reinvention of Nature*, New York: Routledge.
- Harré, Rom (1976) 'Review: A Realist Theory of Science, by Roy Bhaskar,' *Mind*, 85(340): 627-630.
- Harré, Rom (1986) *Varieties of Realism: A Rationale for the Natural Sciences*, Oxford: Blackwell.
- Harré, Rom (2009) 'Saving Critical Realism,' *Journal for the Theory of Social Behaviour*, 39(2): 129-143.
- Harré, Rom and Bhaskar, Roy (2001) 'How to Change Reality: Story V. Structure – a Debate Between Rom Harré and Roy Bhaskar,' in Jose Lopez and Gary Potter (eds.) *After Postmodernism: An Introduction to Critical Realism*, London and New York: Althone Press, pp 22-39.
- Harré, Rom and Gillett, Grant (1994) *The Discursive Mind*, London: Sage.

- Harré, Rom and Madden, E. (1975) *Causal Powers*, Oxford: Basil Blackwell.
- Harré, Rom and Secord, Paul F. (1972) *The Explanation of Social Behaviour*, Oxford: Basil Blackwell.
- Harrison, C. (2004) 'Peer review politics and pluralism,' *Environmental Science and Policy*, 7: 357–368.
- Herrick, Charles N. (2004) 'Objectivity versus narrative coherence: science, environmental policy, and the U.S. Data Quality Act,' *Environmental Science and Policy*, 7: 419-433.
- Hesse, Mary (1974) *The Structure of Scientific Inference*, Berkeley: University of California.
- Hirsch Hadorn, G.; Hoffmann-Riem, H.; Biber-Klemm, S.; Grossenbacher-Mansuy, W.; Joye, D., Pohl, C.; Wiesmann, U. and Zemp, E. (eds) (2008) *Handbook of Transdisciplinary Research*, Springer, Dordrecht.
- Howard, Dick (1987) *Defining the Political*, London: Macmillan.
- Howarth, David (2005) 'Applying Discourse Theory: The Method of Articulation,' in David Howarth and Jacob Torfing (eds) *Discourse Theory in European Politics: Identity, Policy, Governance*, Basingstoke: Palgrave, pp 316-349).
- Howarth, David and Torfing, Jacob (eds) (2005) *Discourse Theory in European Politics: Identity, Policy, Governance*, Basingstoke: Palgrave.
- Jasanoff, S. (1990) *The Fifth Branch: Science Advisors as Policymakers*, Cambridge, MA: Harvard University Press.
- Jones, Samantha (2002) 'Social constructionism and the environment: through the quagmire,' *Glocal Environmental Change*, 12: 247-251.
- King, Anthony (1999) 'The Impossibility of Naturalism: The Antinomies of Bhaskar's Realism,' *Journal for the Study of Social Behaviour*, 29(3): 267-288.
- Kuhn, T.S. (1970 [1962]) *The Structure of Scientific Revolutions*, [1970 edn] Chicago: University of Chicago Press.
- Laclau, Ernesto (1993 [1989]) 'Politics and the Limits of Modernity,' in Thomas Docherty (ed.) *Postmodernism: A Reader*. Hempstead, UK: Harvester Wheatsheaf, pp 329-343.
- Laclau, Ernesto (1993a) 'Discourse,' in Robert E. Goodin and Philip Pettit (eds.) *The Blackwell Companion to Contemporary Political Philosophy*, Oxford: Blackwell, pp. 431-437.
- Laclau, Ernesto (1995) 'Subject of Politics: Politics of the Subject,' *Differences*, 7(1): 145-164.

- Laclau, Ernest and Mouffe, Chantal (1985) *Hegemony and Socialist Strategy: Towards a Radical Democratic Politics*, London: Verso.
- Latour, Bruno (1983) 'Give me a laboratory and I will raise the world,' in K. Knorr-Cetina and M. Mulkay (eds) *Science Observed: Perspectives on the Study of Science*, London: Sage, pp. 141-170.
- Latour, Bruno (1987) *Science in Action: How to Follow Scientists and Engineers Through Society*. Cambridge, MA: Harvard University Press.
- Latour, Bruno (1993) *We Have Never Been Modern*, Hemel Hempstead: Harvester, Wheatsheaf.
- Latour, Bruno (2005) *Reassembling the Social: An Introduction to Actor-Network Theory*. Oxford and New York: Oxford University Press.
- Latour, Bruno and Akrich, Madeleine (1992) 'A Summary of a Convenient Vocabulary for the Semiotics of Human and Nonhuman Assemblies,' in Wiebe E. Bijker and John Law (eds.), *Shaping Technology/Building Society: Studies in Sociotechnical Change*, Cambridge (MA): MIT Press, pp. 259-264.
- Law, John (1989) 'Technology and Heterogeneous Engineering: The Case of Portuguese Expansion,' in Wiebe E. Bijker, Thomas P. Hughes and Trevor Pinch (eds) *The Social Construction of Technological Systems*, Cambridge, MA: MIT Press, pp. 111-134.
- Little, D. (1991) *Varieties of Social Explanation: An Introduction to the Philosophy of Social Science*, Oxford: Westview Press.
- Lovell, Heather (2007) 'Exploring the Role of Materials in Policy Change: Innovation in Low-Energy Housing in the UK,' *Environment and Planning A*, 39: 2500-2517.
- Lövbrand, Eva and Öberg, Gunilla (2005) Comment on "How science makes environmental controversies worse" by Daniel Sarewitz, *Environmental Science and Policy*, 7, 385–403 and "When Scientists politicise science: making sense of the controversy over The Skeptical Environmentalist" by Roger A. Pielke Jr., *Environmental Science and Policy*, 7, 405–417, *Environmental Science and Policy*, 8: 195–197.
- Lynn, E. Lawrence Jr. (1999) 'A Place at the Table: Policy Analysis, its Postpositiv Critics, and the Future of Practice,' *Journal of Policy Analysis and Management*, 18(3): 411-424.
- Merleau-Ponty, M. (1962) *The Phenomenology of Perception*, London: Routledge and Kegan Paul.
- Mouffe, Chantal (1996) 'Deconstruction, Pragmatism and the Politics of Democracy,' in Chantal Mouffe (ed), *Deconstruction and Pragmatism*, New York: Routledge, pp. 1-12.

- Murdoch, Jonathan (2001) 'Ecologising Sociology: Actor-Network Theory, Co-construction and the Problem of Human Exceptionalism,' *Sociology*, 35(1): 111-133.
- Nowotny, H.; Scott, P. and Gibbons, M. (2001) *Re-thinking Science: Knowledge and the Public in an Age of Uncertainty*, Cambridge: Polity Press.
- Oreskes, N. (2004) 'Science and public policy: what's proof got to do with it?' *Environmental Science and Policy*, 7: 369–383.
- Patomäki, Heikki and Wight, Colin (2000) 'After Positivism? The Promises of Critical Realism,' *International Studies Quarterly*, 44: 213-237.
- Petersen, Imme; Heinrichs, Harald and Hans Peter, Peters (2010) 'Mass-Mediated Expertise as Informal Policy Advice,' *Science, Technology and Human Values*, 35(6) 865-887.
- Pickering, Andrew (1984) *Constructing Quarks: A Sociological History of Particle Physics*, Edinburgh: Edinburgh University Press.
- Pickering, Andrew (1995) *The Mangle of Practice*, Chicago: Chicago University Press.
- Pielke, R. (2004) 'When scientists politicize science: making sense of controversy over the sceptical environmentalist,' *Environmental Science and Policy*, 7: 405–417.
- Popper, Karl (1959) *The Logic of Scientific Discovery*, New York: Basic Books.
- Rorty, Richard (1989) *Contingency, Irony and Solidarity*, Cambridge: Cambridge University Press.
- Sarewitz, Daniel (2004) 'How science makes environmental controversies worse,' *Environmental Science and Policy*, 7: 385–403.
- Saussure, Ferdinand de (1974) *Course in general linguistics*, edited by Charles Bally and Albert Sechehaye in collaboration with Albert Reidlinger; translated from the French by Wade Baskin. Revised edition, London: Fontana.
- Shapiro, M. (1981) *Language and Political Understanding: The Politics of Discursive Practice*, New Haven, CT: Yale University Press.
- Steinmetz, George (1998) 'Critical Realism and Historical Sociology. A Review Article,' *Comparative Studies in Society and History* 40(1): 170-186.
- Stern (2010) 'Fraktionen wollen Energiekonzept abschwächen,' *Stern*, 18 September, 2010. Available at: <http://www.stern.de/wirtschaft/news/sz-fraktionen-wollen-energiekonzept-abschwaechen-1604835.html> Accessed 16 October, 2010.

- Torfinn, Jacob (1999) *New Theories of Discourse: Laclau, Mouffe and Žižek*, Oxford: Blackwell Publishers.
- Torfinn, Jacob (2005) 'Discourse Theory: Achievements, Arguments, and Challenges,' in David Howarth and Jacob Torfinn (eds) *Discourse Theory in European Politics: Identity, Policy, Governance*, Basingstoke: Palgrave, pp 1-32.
- Torgerson, Douglas (1986) 'Between Knowledge and Politics: The Three faces of Policy Analysis,' *Policy Sciences* 19:33-59.
- Toulmin, S. (1990) *Cosmopolis: The Hidden Agenda of Modernity*, Chicago: University of Chicago Press.
- Varela, Charles (2002) 'The Impossibility of Naturalism? A Response and a Reply,' *Journal for the Theory of Social Behaviour*, 32(1): 105-111.
- Voloshinov, V. (1973) *Marxism and the Philosophy of Language*, Cambridge, Mass: Harvard University Press.
- Vygotsky, Lev (1986 [1934]) *Thought and Language*. Translation newly revised and edited by Alex Kozulin, Cambridge, Mass: MIT Press.
- Wittgenstein, Ludwig (1967 [1953]) *Philosophical Investigations*, Translated by G.E.M. Anscombe. Oxford: Blackwell.