STRATEGIC SCIENCE
RESEARCH INTERMEDIARIES
AND THE GOVERNANCE
OF SCIENCE

'Arm's length'?

Narratives of Impact and Autonomy in UK Research Councils

Working paper: **ESRC Project *Strategic Science: Research Intermediaries and the Governance of Innovation***

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Purpose of the Document

This document is a working paper for the ESRC Project *Strategic Science: Research Intermediaries and the Governance of Innovation* (RES-061-25-0208), outlining the aims and objectives of the project together with forward research plans. It has been prepared for a workshop held on 22 October 2009 at the Royal Geographical Society. Please do not cite or directly quote this paper.

Project Description

Strategic Science is a two-year project funded by the Economic and Social Research Council and hosted by the Institute of Hazard and Risk Research, Department of Geography, Durham University.

The project aims to explore how the development of new technologies is influenced by government policy – principally mechanisms for research funding, knowledge transfer and public deliberation. Comparing recent approaches to nanotechnology with current developments in synthetic biology, the project examines the institutional and governmental dynamics that shape research in these fields.

The project is divided into four phases:

   i.   *Understanding 'Strategic Science'*
        Developing a literature review and conducting archival research on the contemporary history and nature of science policy. Phase one will culminate in a one-day academic seminar to discuss the findings of this review stage and the conceptual framework of the study.

   ii. *Network Analysis*
        Mapping the network of actors involved in science policy and innovation by reviewing policy documents and interviewing UK administrators, science policy and research council representatives and funded scientists in the fields of nanotechnology and synthetic biology.

   iii. *Case Study – Nanotechnology*
        Exploring institutional mechanisms for the support and coordination of nanoscale research by observing decision-making processes at the EPSRC, and by interviewing funded scientists.

   iv. *Case study – Synthetic Biology*
        Conducting a comparative case study of synthetic biology by observing decision-making processes at the EPSRC and by interviewing BBSRC representatives.

Outputs

A final report will be produced for a mixed academic and policy-maker readership together with a range of academic publications and presentations.

For more information about the project please see: www.geography.dur.ac.uk/Projects/science.

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Introduction

Recently Jasanoff and Kim (2009) highlighted a critical absence in both science and technology studies (STS) and broader social science approaches to technological modernity. They suggest that STS scholarship has 'devoted substantially more attention to the products of scientific disciplines, labs, clinics, and other professionally bounded spaces than to the promotion and reception of science and technology (S&T) by non-scientific actors and institutions'. Accordingly they suggest that STS scholarship has broadly neglected the institutional and policy contexts that frame the conditions under which science is practiced. They argue that

> One result is that the relationship of science and technology to political institutions has tended to remain undertheorized. Even in highly political environments, STS research tends to be drawn to scientific and technological innovation as an end in itself, in preference to more complex relationships among knowledge, its applications, and power. … Why states support science rarely gets asked. (p. 120)

In this paper we take a similar starting point in exploring UK research council policy and practice toward nanotechnology and synthetic biology. In concert with Jasanoff and Kim, we suggest that while contemporary STS approaches have usefully articulated the societal challenges posed by new technology, little empirical insight has been developed concerning the ways in which the development of new technologies is shaped and influenced by national science and innovation policies and research support mechanisms. In addition, despite their significant role in mediating between government priority setting and the broader research community, there is little qualitative empirical work that interrogates the role research councils and other intermediary bodies play in both mobilising and translating government science policy priorities.

This absence is striking. Notions of 'national interest' or the 'strategic importance' of science and innovation would be familiar to even the most casual observer of contemporary science and technology policy. New and emerging research programmes – such as nanotechnology and synthetic biology – are cast as having particular strategic significance and as such are the subject of programmatic investment and institutionalised coordination. The relationship between central government policy, science policy intermediaries and the broader scientific community is critical to an understanding of the broader institutional and politico-economic contexts in which research is practiced. However, this is not simply a one-way relationship. Government priorities are not simply translated into funding mechanisms and further into scientific practice. As both Callon and Law (1982) and Latour (1983) have suggested scientific research often has the capacity to transform the context in which it is set, such that broader political and economic drivers are enrolled in scientific practice rather than scientific practice simply being enrolled by broader political and economic drivers. The relationship between national policy and research practice, and the mediating role of intermediary organisations, is therefore both contingent and dynamic. Science policy might therefore be characterised as the circulation of discourse, ideas, imaginaries and arguments at the interface between science and politics that are mobilised differently by a range of intermediary organisations.

The goal of the *Strategic Science* project is to address this absence of critical scholarship through an empirical and ethnographic study of the EPSRC and BBSRC – particularly as they approach

nanotechnology and synthetic biology. This working paper outlines a range of conceptual resources – drawn from interpretive and ethnographic social science traditions – for understanding both contemporary UK science policy and the constitutive role played by research councils.[1] In developing their notion of national socio-technical imaginaries Jasanoff and Kim further suggest that 'national policies for the innovation and regulation of science-based technologies are useful sites for examining imaginaries at work' (p. 121). Again we take a similar starting point. We are focusing here on UK government policies regarding science and technology as a *site* through which to understand the circulation of meaning and discourse at the interface between a national government and a broader research community. In researching UK research councils we are seeking therefore to understand their role as intermediaries in this discursive interplay.

We are seeking to complicate current understandings of science policy. We suggest that in current scholarship there is an implicit assumption that the relationship between science and the state is unproblematically embodied in what has become termed 'science policy'. Most prosaically it is assumed that 'science policy' is policy pronouncements written in government documents *about* science. In this model science policy simply acts as an instrument through which priorities are set, targets are framed and programmes initiated and managed. Science policy is cast, eventually, as an unproblematic tool of state bureaucracy. This prosaic reading of science policy is, we suggest, consistent with much current scholarship which tends to rely on positivist understandings of the role of policy in contemporary modes of governing. For example, a range of idealised models – principal-agent-theory or innovation systems theory – populate current research, representing science policy as operating as the formal rules governing relationships between intermediary organisations and central government. Take, for example, the emerging discipline of the 'science of science policy' which has been increasingly incorporated into government thinking and policy planning (National Science and Technology Council and Office of Science and Technology Policy 2008).[2] Broadly, this field attempts to develop scientifically validated 'tools, methods, and data for improving our understanding of the efficacy and impact of science and technology policy decisions'. In this model science policy is regarded as a set of governmental decisions and tools that may be improved through better coordination and management.

We suggest that science policy might be better regarded as an ensemble of discourses, programmes, and institutionally situated practices that circulate at the interface between government and the research community. Here we draw upon Sunder Rajan's (2003) use of the notion of ensemble in defining genomics. He suggests that genomics might be regarded as 'an ensemble of events, technologies, discourses and institutions that spring up around the sequencing of genomes' (p. 89). There are two features of Sunder Rajan's use of the notion of ensemble which are important here. Firstly, in its attention to discourse, practice and institutionally situated agency, the notion of ensemble enables the development of an anthropological and ethnographic sensibility regarding developments in science-state relations. Thinking of science policy as an ensemble reframes our

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[1] Though the field is not fully developed this work can be seen as contributing to qualitative and ethnographic studies of science policy (Cambrosio et al. 1990; Wynne 1992) together with analyses of the institutional contexts of scientific practice (Croissant and Smith-Doerr 2008; Donovan 2005; Irwin 2008; Klein and Kleinman 2002; Knorr-Cetina 2007; Moore 1996; Werle 1998).

[2] The field of the 'science of science policy' now enjoys an explicit position within the US Office of Science and Technology Policy (see for example: http://scienceofsciencepolicy.net/).

project from a positivist conception of what science policy *does* to a post-positivist exploration of what science policy *means* in contemporary settings. By attending to the circulation of discourse amongst intermediary bodies, in the context of institutionally situated practice, we take an interpretive approach toward science policy asking how meaning is both established and maintained at the interface between science and the state (Fischer and Forester 1993; Hajer 1995; Hajer and Wagenaar 2003; Rabinow and Sullivan 1979).

Secondly, the notion of ensemble signals the contingency of science policy. For Sunder Rajan's the genomic ensemble 'spring[s] up' in events around the sequencing of genomes. In this sense the genomic ensemble is dynamic – both contingent on events and requiring work to maintain. We take a similar approach here to UK science policy focusing on the dynamic relationship between intermediary institutions at the interface between central government and the research community. We suggest that, at this interface, science policy takes the form of an ensemble of discourse that speak of the mutual positioning of institutions, relationships of accountability and the influence of broader social and political contexts. We are focused here on the ways in which research councils narrate their roles in a dynamic science policy field. In the situated deployment of such narratives we suggest that we see the deployment of a range of competing meanings associated with the value and purposes of science.

In taking an interpretive of narrative approach, we focus in particular on the performative modes through which such science policy discourse is narrated by UK research councils. In what follows we suggest that as science policy intermediaries research councils narrate their roles and positions in such a way as to mobilise government policy and defend a self-identified mandate as the 'guardians' of basic science. However, their narration of science policy is contingent. It is set amongst a range of competing narratives and a dynamic science policy field. In this context UK research councils have been active in defining modes through which they might be able to demonstrate the ways in which their investment in research funding meets government priorities. As we discuss below this has meant that research councils have been proactive in defining what impacts are and how they can be measured and explicitly contributing to ongoing public policy discussions. In this sense the situated practice of the research councils might be regarded as informed by a different – and at times competing – set of meanings and agendas that seek to reframe science policy debate.

Interpretive Understandings of Science Policy

In developing an ethnographic approach to contemporary UK science policy and the situated practice of research councils we base this project in what scholarship in STS has demonstrated to be a mutually reinforcing relationship between science and the imaginative construction of modern nation states (Jasanoff 2004b; 2005; 2006), the development of contemporary (neo)liberal understandings of democracy and politics (Ezrahi 1990; Kearnes 2009; Mukerji 1989) and broader public knowledge cultures (Irwin and Michael 2003; Wynne 1982; 1995). Jasanoff (2004a) develops what she terms the 'idiom of co-production' to express this interdependence between science and the establishment and maintenance of socio-political orderings. Science and technology might therefore be regarded as elements of contemporary political power that are to be used to both sustain political order and help to establish 'mechanisms of conferring legitimacy on political authority' (Rose 1991, 673). At the same time, a range of synthetic studies have demonstrated the

material linkage between the programmes of national building, contemporary geopolitical struggles for hegemony and the development of what might be termed modern infrastructure and bureaucracy of science (see for example Krige 2006; Krige and Pestre 1997).

Recent scholarship has diagnosed the emergence of new forms of multilevel of governance in an increasingly network-oriented social and political context. For example, recent studies in science policy studies suggest that models of scientific governance based on hierarchal, top down government have given way to more distributed forms of governance (Féron and Crowley 2003; Hackmann 2001).[3] In the context of the increasingly strategic approach taken by national governments to the support of scientific research, governance itself has become more complex. Féron and Crowley (2003) develop a model of distributed governance which highlights the critical significance of the levers and incentives through which national science priorities are mediated, and the role played by non-State actors and intermediary bodies. Féron and Crowley's model of distributed governance focuses on the *range* of organisations at the interface between governance and science. Such intermediary bodies include, for example research funding agencies, knowledge transfer networks and public engagement programme – together with a range of other bodies that also operate at this interface, including regulatory authorities, standardisation bodies, expert advisory groups, scientific institutions and learned societies, foresight procedures and NGOs, and civil society organisations.

So, while the state patronage of scientific research, through the post-WWII inauguration of research councils and funding agencies, was initially based on broadly held notions of the socially progressive nature of science (Bernal 1939; Bush 1945), overtly strategic approaches to the funding and coordination of research have emerged since the 1970s (Geuna 1999; Jamison 1989; Senker 1991). In current policy discussions public investment in scientific research and innovation is increasingly presented as a strategic response to the challenges of globalisation and the rise of new industrial powers (Brown 2006; HM Treasury 2003; Lord Sainsbury of Turville 2007). Here recent government policy has begun to articulate notions of a distributed innovation system – in which intermediaries such as the research councils are cast as an element of the bureaucratic conditions under which innovation will occur.

Typically, therefore, state support for science is justified by an appeal to the cultural worth of science, to its capacity to effect socially progressive development and to strategic national interests. The movement between scales is significant here. Science is represented as having universal *cultural* value while also being critical to the *national* interest. The mechanisms through which research funding is organised – the research councils, science budgets, government priorities and science policies – are therefore contested discursive sites through which scientific and technological progress are both mobilised and debated. In developing a research programme for understanding the role of UK research councils we suggest that approaches developed in STS, and in interpretive and ethnographic social science more broadly, might therefore be usefully applied to nationally oriented science policies. As such we view the interface between science and politics as a discursive institution that appears as 'temporarily stabilised outcomes of processes of enrolment' (Callon and

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[3] This is of course a diagnosis that has been applied to public policy more broadly (Rhodes 1996), particularly in the context of network-definitions of society (Castells 1996).

Law 1982, 622). Our orientation is then toward the practices through which discourses and meanings circulate. We draw here on interpretive and argumentative traditions of policy analysis. Fischer and Forester (1993) define this mode of policy analysis in the following terms:

> To see policy analysis as argumentative practices is to attend closely to the day-to-day work analysts do as they construct accounts of problems and possibilities. Recognizing these accounts as constrained, organisational accomplishments in the face of little time and poor data. We can evaluate the analysts' arguments not only for their truth or falsity but also for their partiality, their selective framing of the issues at hand, their elegance or crudeness of presentation, their political timeliness, their symbolic significance, and more. Policy and planning arguments are practical productions. (p. 2-3)

In viewing governance as a 'practical production' Fischer and Forester focus on policy work as the institutionally situated construction of both 'problems and possibilities'. In this sense there is an intertwining of the practical and the discursive in Fischer and Forester's account of governance in which policy is understood as a site of argumentation in which competing meanings are debated.

Thinking of science policy as an ensemble helps to focus our analysis on the range of policy objects that circulate at this interface. These include: policy statements, budgets, reports, priorities, frameworks, metrics, and actors – that form the currency of science policy. What is common to each of these policy objects is that they embody (often competing) agendas, goals and meanings. For example, the articulation of government priorities in the science budget (see for example Department for innovation Universities and Skills 2007) might therefore be viewed as operating argumentatively by attempting to shape research findings allocations in particular ways. The science budget is one element of what we might think of as a form of distributed science policy. Formally the science budget sets relationships and objectives between a range of institutions – including the research councils, government departments and Treasury together with other intermediaries and parliamentary committees. However, beyond this formal role the budget might be seen as an embodiment of a set of meanings regarding the strategic importance of particular forms of scientific practice. The institutionally situated responses of intermediary organisations, such as research councils, might therefore be read as a negotiation of these meanings.

Therefore in approaching UK research councils ethnographically, conceptualising them as active intermediaries in the circulation of discourse and meaning, we are orientated toward three particular dynamics. Firstly, in conceptualising science policy as a distributed, and discursive, institution we focus on the deployment and argumentative contestation of discourse, language and meaning. Such meanings include competing notions of the cultural, economic and strategic value of science and the national interest. Secondly, in viewing the interface between science and governance as populated by a range of intermediary organisations, our approach seeks to explore the situated practices through which science policy discourse is made meaningful in institutional settings. Thirdly, in developing an ethnographic sensibility toward the work of the research councils, our approach examines the constitution of actors and agency in these institutional settings (Shore and Wright 1997).

The Traditions and Dilemmas of UK Research Councils

Our starting point is to explore the contingent and contested *terms* or narratives through which UK research councils construct their own identities.[4] By Narrative we mean a particular form of discursive circulation defined by the articulation of roles and responsibility (Davies and Harré 1990; Harré and Moghaddam 2003). In seeking to understand science policy as an ensemble of discourse and meaning we focus on the ways in which research councils narrate their own identities and roles. For example, a senior executive at one research council represents defines the role of research councils in the following way:

> [T]hen there's a sort of interface discussion about what the proper role of the research councils [is] to help in [research for innovation, higher education and skills]. It's not a direct requirement because the Haldane principle is one where there is a broad policy set within government, then the research councils observe that policy and look to see how they can, within their proper remits, contribute to it. [...] The long arm of Haldane slightly shrinks and then expands and shrinks and expands but is never actually gone away. So where we have, for example now articulations of big national challenges … in those policies in central government there is beginning to be a research element drawn up alongside it. (executive level manager, research council)[5]

There are two ways in which this extract is indicative of broader processes of institutional identity construction in UK science policy. Firstly, though not fully developed, the extract indicates the terms through which these identities are posed. In particular the interviewee refers an understanding of the research councils as operating at 'arms length' from government – embodied in what has become known as the 'Haldane Principle' of research council autonomy. The Haldane principle therefore serves as a narrative analogy with immense meaning and connotation – referring to the mandate through which research councils have understood their roles and identities. This principle ties research councils to wider discourses about the cultural value of science, research councils as the guardians of 'basic research' and the notion that scientific excellence is necessarily defined within the research community. Secondly, the extract indicates the ways in which these terms are both mobilised by research councils and contested in the context of recent policy shifts. The terms through which research councils construct their own identity become more visible when they are challenged by new and different policy imperatives, when research councils are forced to confront their own institutional traditions. It is this interplay between tradition and challenge that Bevir and Rhodes (2006) suggest as the analytical focal point for interpretive or decentred accounts of contemporary governance:

> A decentred account of governance represents a shift of topos from institutions to meaning in action. ... A decentred approach implies that governance arises from the bottom up. Governance is a product of diverse practices composed of multiple individuals acting on all sorts of conflicting beliefs that they have reached against the backdrop of several traditions and in response to varied dilemmas. A decentred approach leads us, then, to replace

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[4] Here we are drawing in Connolly's (1983) notion of the '*terms* of political discourse' – the 'institutionalised structures of meaning that channel political thought and action in certain directions' (p. 1).

[5] This, and subsequent extracts, are taken from set of ongoing research interviews conducted with UK administrators, science policy and research council representatives. They are presented here in the manner of indicative findings from this ongoing research.

aggregate concepts that refer to objectified social laws or institutions with ones that we craft to explain particular beliefs and actions of interest to us. It inspires narratives of traditions and dilemmas. (p. 99)

For UK research councils, tradition – and the dilemmas associated with those traditions – are wrapped up with concerns regarding both their relationship with central government and their distinctive identities amongst a range of other intermediary bodies and funding bodies. In particular in recent policy discourse, and in interviews, research councils have sought to recover, and indeed seek defences for, the Haldane Principle. This principle operates as a 'creation narrative' detailing the historic purpose and mandates of the research councils as non-departmental government bodies, operating at arm's length from central government based on a broadly understood dualism between 'scientific autonomy' and 'government priority setting'.

The roots of the Haldane principle lie in the strategic concerns of the First World War which created the impetus for the modernisation of the 'machinery of government' related to science and research. After outbreak of the First World War a number of inadequacies in the research and education infrastructure were recognised – principally that science in Germany had 'been more thoroughly and effectively applied to the solution of scientific problems bearing on trade and industry and to the elaboration of economical and improved processes of manufacture' (Board of Education 1915, 352). It was this strategic concern for the geopolitical security of the nation that forced policy changes within higher education and in industrial research more generally that would eventually lead to establishment of the contemporary UK research system. The overwhelming policy ambition at the time was for a new *machinery* of state assistance and coordination of research. Accordingly, the white paper called for the establishment of a new governmental unit – the *Department of Scientific and Industrial Research* (DSIR) (p. 352). Initially, the DSIR had three main functions – the operation of its own research laboratories; the administration of industrial research laboratories; and the award of research grants to postgraduate students and university staff. Though initially rooted in the political and economic needs of war-time Britain this research focus 'gave way in the 1920s and 1930s to programmes on such problems as more efficient use of fuel, the development of home-grown timber, industrial fatigue, and building research' (Gummett 1991, 16). As such the DSIR exceeded its initial constitution and grew in importance as the premier vehicle for state support of scientific research, providing the model of 'what came to be known as the research council system in Britain and, indeed, throughout the Empire' (Gummett 1980, 24).

It is significant then that it was in this context that *Haldane Report of Machinery of Government Committee* (Ministry of Reconstruction 1918) sought to provide a mechanism for state support for, and coordination of, research while reinforcing notions of the social, political and economic autonomy of science. As such the Haldane report relied on a distinction between:

> research that was needed for the specific purposes of a particular department, and research which was for the general use of all departments. The former it said should continue to be done under the supervision of the department in question … the latter, however, was best not supervised by an administrative department, precisely because it was of value to more than one department and needed somehow to be related to all potential beneficiaries in a flexible way. (Gummett 1980, 25)

Though not explicitly used in the report, the distinction between specific and general use research later became known as the Haldane principle. However, Edgerton (2009) suggests that the Haldane principle is an 'invented tradition' – by virtue of the simple fact that the contemporary formulation of the principle does not occur within Haldane report itself, but developed later through a rediscovery of the Haldane distinction between research of general and applied applicability. Importantly the recovery of this distinction, and indeed the development of what become the Haldane principle, was made in the context of concerns about government intervention in science and its potential to compromise the cultural integrity of scientific practice.[6] The Haldane principle was cast as articulating the autonomy of research councils from direct government direction.

In this way the 'Haldane Principle' has come to stand for two distinct meanings. Firstly the invention and recovery of the Haldane Principle embodies a fundamental distinction between applied research and research of more general applicability – variously termed 'curiosity driven', 'basic science' or 'blue skies research'. By consolidating a distributed system for direct government funding of applied research and the administratively independent funding and coordination of university-based and basic research the Haldane reforms initiated the notion that what would later become the research councils would operate as 'guardians' of basic research against overt political or administrative interference. The Haldane principle also stands for a range of associated meanings – an opposition between scientific excellence and administrative oversight and notions that research quality and priorities must be generated spontaneously by the research community themselves. Secondly, the Haldane principle is cast as giving organisational expression to this model of science, in which research councils are positioned as enabling the research community to pursue its own priorities, without direct interference by government.

The Haldane principle, therefore, encapsulates both a discursive tradition through which research councils have constructed their own institutional self identity, and a set of challenges or dilemmas that they face in the contemporary science policy landscape. This has particularly been the case after the publication of the *Rothschild Report* (1971) which proposed the introduction of the customer-contractor principle in the relationship between government departments and research organisations. Criticising the historic autonomy of the Research Councils in regard to applied research, the report suggested re-channelling funding from the Councils to individual government departments with particular interests in specific applied research. Seemingly challenging the cultural norm of 'basic science' – around which the research councils have defined their institutional position and identity – this notion of the customer-contractor relation between government and scientific practice was explicitly maintained in the establishment of the modern research councils in the early

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[6] For example, Edgerton (2009) reports that the earliest record in Hansard of a contemporary understanding of the Haldane principle occurred in 1964 in a parliamentary comment by the Conservative Lord Hailsham attacking the introduction of a Ministry of Technology. Lord Hailsham is said to have claim that the Ministry:

> is a totally new departure from recent practice and in my opinion at least, is a most retrograde step. Ever since 1915 it has been considered axiomatic that responsibility for industrial research and development is better exercised in conjunction with research in the medical, agricultural and other fields on what I have called the Haldane principle through an independent council of industrialists, scientists and other eminent persons and not directly by a Government Department itself. (Lord Hailsham quoted in Edgerton 2009)

As such Lord Hailsham articulates the Haldane principle as meaning the independence of research institutions and research councils.

1990s. Indeed, building on the Rothschild Report, this reorganisation of the research council system into six (and latterly seven) subject and discipline specific councils was also orchestrated through a renewed emphasis of the purposes of research funding for 'wealth creation and quality of life' (Department of Trade and Industry 1993).

More recently, UK governmental approaches to research have increasingly been framed in the context of *innovation* – associated with new definitions of the national interest. In place of strategic technologies for the defence of the nation, or to secure the national manufacturing base, innovation is itself now taken as a defining national interest *par excellence*. As such recent policy has begun to speak of *streamlining* the research system by clarifying the relationships between interlinked actors (Department of Trade and Industry 2003, 52). In this model the Research Councils are represented as one element of a system of diverse specialised institutions, particularly as collaborating with actors such as the Technology Strategy Board in funding applied and innovation research whilst helping to set priorities for innovative research that links to governmental policies of wealth creation and quality of life. As such, science policy has been cast as part of a 'clear economic policy' – 'to make choices about the balance of investment in science and innovation to favour areas in which the UK has a clear competitive advantage' (Lord Drayson 2009).

What is striking about recent policy rhetoric is the degree to which current discourse seeks to both challenge and reinforce the invented tradition of the Haldane principle. Having been cast as establishing a model of research council autonomy, the 'Haldane Principle' is used as a defence against change and in propositions for new modes of research funding. For example, a recent report by the House of Commons Innovation Universities Science and Skills Committee (2009) both reaffirmed key Haldane principles of the independence of researchers from central government, and the role of government as setting the over-arching strategic policy directions whilst questioning the research council identity as the guardians of science, placing this role instead with the learned societies. As indicated in the interview quotation above – the Haldane principle is case as a constant that 'shrinks and expands' in different policy settings 'but never actually goes away'. Therefore the Haldane principle operates as a part of a narrative of tradition through which a range of associated cultural meanings about science are framed and debated.

Narrating the Interface
The mobilisation of the Haldane principle in recent science policy debate therefore embodies a range of competing meanings regarding the nature and value of science. The Haldane principle is articulated here as part of a longer narrative of how the historic autonomy of the research councils is vital to the protection of the 'science base'. The ways in which current government policy has challenged the traditional role of the research councils has required the recovery of the Haldane principle as a defence and the proactive narration of these discursive meanings by the research councils. In developing an interpretive understanding of research councils as science policy intermediaries, we suggest that in this interplay research councils receive and mobilise policy discourse whilst also seeking to reframe it. Interpretive traditions in policy analysis have tended to focus on the circulation of metaphors, analogies and storylines in policy discourse together with the development of discourse coalitions and institutionally situated practices amongst policy actors (Fischer and Forester 1993; Hajer 1995). In developing this approach we explore the situated modes

through which research councils operates as intermediaries. The ongoing research of the Strategic Science project will, through ethnographic research, focus the ways in which research councils narrate their roles and positions within a distributed science policy system. Therefore, in what follows we briefly explore three key ways in which research councils narrate their traditions and their dilemmas.

Research Councils as 'Guardians of Science'

The importance of the invented tradition of the Haldane Principle, for the research councils, is that it links notions of research council autonomy to their perceived role as the guardians of the 'science base' or of 'curiosity driven' research. This position is not uncontested. Other intermediary organisations – particularly other research funding bodies and learned societies – also claim this role.[7] Intermediary organisations therefore engage in forms of mutual positioning – deploying discursive strategies that construct their identity in relation to others. A range of scholars (for example Brown and Rappert 2000; Hajer 2003; van Lente and Rip 1998) have demonstrated the ways in which policy agendas are developed through the ways in which actors attribute the roles the of roles and responsibilities of both themselves and others. The positioning of different intermediary actors towards each other and towards government policy therefore forms one element of the circulation of different meanings in science policy.

In this form of narration roles and responsibilities – particularly regarding the governance of science – governance are attributed diversely to research councils and other intermediaries, and that these attributions might have an impact on positioning and activities of other actors. This can be observed and explored in actors reflecting on their own positions and by projecting roles and responsibilities onto other actors. Take for example the following extract from an interview with a representative of the Wellcome Trust, who positions the Trust in relation to research councils:

> Well obviously a huge breadth of research that gets funded – a lot of what we fund – is basic science. So that would be research where the scientists are heavily involved in identifying the research questions. … We see other funders, like the research councils – because they sit closer to government – [as being] more responsive to government and are becoming more responsive to government priorities. And we have had a healthy debate within the science community, as to the extent that the research councils should be doing that. (Interview with Wellcome Trust Representatives)

On a hypothetical continuum that might extend from 'basic, curiosity driven research' on one side to 'applied, and directed research' on the other this extract demonstrates the positioning of Wellcome Trust activities are on the more basic side of this continuum. The research councils, however, are positioned rather differently as inherently responsive to government priorities. This is not an uncontested positioning rhetoric. Interviews with research council representatives reveal a reverse positioning, aimed at demonstrating the distinctive position of the research councils in relation to other intermediaries. For example:

> We are arms length, non-departmental public bodies, funded by what is now BIS, the Business and Innovation and Skills Department of government. We are tasked to

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[7] It is precisely this notion of guardianship that has been critiqued in recent policy (House of Commons Innovation Universities Science and Skills Committee 2009).

support a healthy research base which people can draw upon, whether that's other academics, industry or other stakeholders, and secondly to ensure we get good pull-through of the research and training we're supporting, recognising that at the end of the day, research councils support research at the basic end of the spectrum … (mid-level manager, research council)

This form of positioning discourse is a way of narrating relations between science policy intermediaries and establishing and maintaining a distinctive identity in a dynamic policy environment. We are interested here in these claims not as factual assertions, but as forms of meaning making – that although different affirm a set of common understandings. For example, these accounts share common features around the roles and responsibilities of intermediaries in regard to science and its governance. For example, (1) the use of analogies to the historic, but contested, mandate of the research councils, of funding excellent research to keep up and develop a broad and 'healthy' research base fairly independently from government but in the context of broad government policies regarding education and skills, and broader areas of research; (2) rooting research council activities in contested claims to the cultural worth of science, and the idea that excellent science should, or could only, be lead by scientists; and more broadly to (3) an *a priori* opposition between scientific excellence and external priorities. These narratives affirm a set of meanings about the cultural value of science, the necessity of 'protecting' the science base, and the autonomy of science from overt direction. These meanings therefore operate as cultural tropes that help to shape the broader relationship between science and contemporary politics.

Research Councils 'Demonstrating their Impact'

The second site at which the practices of science policy negotiation become visible is in recent calls for the research councils to both measure and demonstrate the *impact* of their research funding. Tied to notions of streamlining the role of the research councils within a distributed innovation system, recent policy specifically calls for research councils to account for the economic impact of their research funding. The most obvious effect of the 'impact debate' on research council practice has been changes in the formal requirements in research proposals. In place of single statements regarding the beneficiaries or potential 'users' of research, current research council application forms require applicants to disaggregate between the 'impact' and 'beneficiaries' of proposed programmes of research. Though research councils have attempted to widen the frame through which impacts might be both measured and demonstrated, in government policy this renewed interest in the impacts of research funding is tied to two imperatives. Firstly, government policy increasingly suggests that research funding should be linked to economic impacts and wealth creation, and as such research councils need to demonstrate the impact of their research funding. Secondly, government policy also speaks of a new role for the research councils as *influencing* the behaviour of universities and the broader research community. A recent review of the economic impact of research council funding – known as the *Warry Report* (Research Council Economic Impact Group 2006) – outlines these twin imperatives:

The Research Councils should influence the behaviour of universities, research institutes and Funding Councils in ways that will increase the economic impact of Research Council funding. … Research Councils should make strenuous efforts to demonstrate more clearly the impact they already achieve from their investments. It is difficult to measure the

economic impact of innovations which may be delayed in time and indirect in consequence. It is important to measure outcomes, however difficult, rather than outputs. (pgs. 3-5)

Here we see a subtle challenge to the traditional self-identity of the research councils as guardians of the 'science base' in which notions of excellence and worth are developed within the research community. Significantly this review did not suggest changes in research councils funding mechanisms – a wholesale shift from responsive mode funding to more programmatic funding directed to externally set targets, for example. However the review places an onus on the research councils to engage more proactively with the research community, influencing research practice and demonstrating the impact of this influence.

These calls might be seen in the context of what a number of authors have termed the emergence of an 'audit society' that is embodied in the use of techniques drawn from accounting across a range of social and political domains (Porter 1995; Power 1997; Strathern 2000). For example, Power (1997) demonstrates how both the 'idea' and 'practice' of audit have, since the 1980s, been used in a variety of new contexts, producing what he terms an 'audit society'. The increasing ubiquity of such techniques across social life is based on their presumed objectivity, producing a kind of expert-led knowledge in the construction of forms of 'government without politics'. In one sense calls for a renewed emphasis on the impacts of research funding, and developing techniques and metrics for demonstrating this impact, might therefore be seen as consistent with the overarching role that techniques of accounting, measurement and calculation play in contemporary governmentality. However, there is an ambiguity in the ways in which the research councils have been called to account for, and demonstrate, the impact of their research funding. While current scholarship on the emergence of 'audit cultures' has tended to focus on the deployment of specific accounting techniques – and broader understandings of accountability and transparency – in recent science policy discourse both the means and ends of this accounting remain ambiguous. For example *The Allocations of the Science Budget 2008/09 to 2010/11* (Department for innovation Universities and Skills 2007) makes clear that whilst resources are made available to research councils to 'drive forward the economic impact agenda in the face of global challenges' this impact is to be measured through 'performance management data' that will underpin the demonstration of impact with 'rigour and quantitative evidence'. However, in meeting the requirements of this performance management system the research councils have responded by seeking to reframe this expectation precisely through the deployment of new and advanced techniques of accounting, measurement and calculation. For example, responding to recent policy discourse Research Councils UK issued the following statement:

> The Research Councils have been challenged to 'make strenuous efforts to demonstrate more clearly the impact they already achieve from their investments.'… That said, it is also widely accepted that 'it is difficult to measure the economic impact of innovations which may be delayed in time and indirect in consequence'. Indeed the consensus in the economics literature is that measuring the economic impacts of science, innovation and research funding is highly problematic. (RCUK 2007, 5)

The report goes on to detail a study undertaken to develop 'baseline economic assessment of the UK Research Councils' and a subsequent reframing of impacts in four main categories:

- Development of human capital (primarily through the acquisition of skills through the research process)
- Business and commercial (dealing with the commercial exploitation of research)
- Policy (the impact that research has on the creation and application of, primarily, government policy)
- Quality of life (diverse impacts such as improved environment, social cohesion, health and cultural advances). (p. 5)

In this sense the research councils might be said to have exploited an implicit ambiguity in both the means and ends through which they have been called to demonstrate the impact of research funding. As the statement implies, the approach here is to use accounting techniques and economic research not simply to demonstrate the impact of research funding, but also to demonstrate the difficulty of this form of demonstration and to argue for a widening of the notion of impacts. Accordingly, on the basis of these techniques the research councils have provided metrics demonstrating their impact in these wider frames (Office of Science and Innovation 2006). Following Callon (1998) we see here that techniques for what he terms the 'measurement of properties' become sites at which the politics of science policy discourse are played out. Again, to emphasise our central argument, in these debates about the technicalities of measuring and demonstrating the impact of research funding we see the circulation of competing meanings regarding the cultural value of science. Barry (2002) highlights both 'the fragility of "metrological regimes" and the "inventiveness of measurement" [such that] measurement and calculation can have the effect of disrupting the frame of politics, and creating a conduit for the cross-contamination of the economic and the political' (p. 268). Here we suggest that the fragility of the metrological regimes for accounting for the impact of research funding – their internal ambiguity – has enabled the development of a range of different understandings of both impact and the importance of science in contemporary social, economic and political life.

Research Council Contributions to Public Policy

Lastly we suggest that the research councils' explicit involvement in public policy debate is an evolving mechanism through which they have begun to actively contribute to and shape broader discussion. For example, research councils have begun to respond in a more outward-focused way to concerns about the social and ethical dimensions of emerging research programmes, such as nanotechnology and synthetic biology. The approach here has been twofold. Firstly, research councils have commissioned and published a number of reports – largely written by social scientists and ethicists – on the social and ethical dimensions of new technologies (see for example Balmer and Martin 2008; Wood et al. 2003; 2007). Secondly, research councils have also increasingly engaged techniques drawn from science communication and public engagement on subjects including nanotechnology, synthetic biology and stem cell research (Bhattachary 2008; Bhattachary et al. 2008; Stilgoe 2007) in actively contributing to wider policy discussion.

Some research councils have a longer track record in using techniques of public engagement, deliberation and consensus conferences (Joss and Durant 1995) and undoubtedly a renewed enthusiasm for public engagement within the research councils is one element of what a number of authors have characterised as the 'new governance of science' in which public participation is increasingly cast as playing a critical role in the development of research agendas (Hagendijk and

Irwin 2006; Irwin 2001; 2006; Macnaghten et al. 2005). However, what is significant here is the way in which the research councils have begun to see their role as active contributors to unfolding public policy considerations of the social dimensions of new and emerging technologies. For example, the EPSRC recently sponsored a major public engagement project in conjunction with a call for proposals on 'Nanotechnology for Healthcare'. Similarly, the BBSRC has through its Bioscience for Society Strategy Panel has recently initiated a working group to consider issues raised by the emerging area of synthetic biology. This working group published an independent review of social and ethical challenges associated with synthetic biology research into in June 2008. Commissioned by the BBSRC's Bioscience for Society Strategy Panel, this report is part of its programme to ensure that BBSRC 'adequately addresses issues raised by this emerging area of science and technology'.[8]

We suggest that this move towards an explicit contribution to unfolding public policy debate is motivated by the notion that research programmes such synthetic biology may become an issue of broader public concern. Here then we see the cultivation of a more overt role in the proactive development of public policy in relation to new and emerging technologies as an emerging mode through which research councils narrate their role in the science policy interface.

Concluding Remarks

In this paper, and for the *Strategic Science* project more generally, we are seeking to address the absence that Jasanoff and Kim's (2009) highlight in the relative lack of empirical research regarding the institutional contexts in which governments support science. In developing conceptual resources to explore the ways in which the development of new technologies is influenced by national science and innovation policies and research support mechanisms, we aim to critically rethink contemporary understandings of science policy, and in particular to examine the role of intermediaries, such as the UK research councils, within science policy, as such to examine the constitution of actors and agency in the institutional settings (Shore and Wright 1997) of science policy. Taking an interpretive approach to science policy, focusing on discourse and practice we have focused here on narratives that articulate both of traditions and dilemmas of UK research councils. Analogous ethnographic analyses (for example Cambrosio et al. 1990) has demonstrated the intertextual and discursive character of science policy. That is, we might regard science policy as site in which a range of meanings – regarding both value and purposes of science and the nature of contemporary politics – circulate. Accordingly in the institutionally situated contexts in which science policy is both mobilised and translated we have suggested that we see both the reaffirmation ad active contestation of these meanings.

One characteristic of this interplay is the recovery, deployment and debate about historic mandate of the research councils. In this context the Haldane Principle represents an analogy to the historic mandate of the research councils, embodying their meaning and self-perception, despite being an invented tradition (Edgerton 2009). This tradition has been challenged and reinforced in science policy discourse, becoming a space for the renegotiation of cultural meanings around the nature and value of science. Diverse actors recur to the Haldane principle, but for the research councils it represents a medium of positioning themselves between the notions of working 'at arm's length' to

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[8] www.bbsrc.ac.uk/society/dialogue/activities/synthetic_biology.html.

government, helping to develop a 'healthy research base' and contributing to national wealth creation and quality of life through strategic research funding. Such narratives represent a dynamic between traditions of research council autonomy and dilemmas associated with the ways in which the research councils have been positioned in recent science policy.

In moving into an ethnographic research phase, which will focus specifically on research council practices associated with both nanotechnology and synthetic biology, our working hypothesis is that in these fields this dynamic interplay between narratives of autonomy and narratives of impact will become both more palpable and more pointed. Significantly, nanotechnology and synthetic biology are the subject of strategic investment and institutionalised coordination mechanisms. Nanotechnology in particular has been targeted as a strategic cross-council priority area through the *NanoScience through Engineering to Application* programme of the most recent science budget (Department for innovation Universities and Skills 2007). In this programme the interplay between the historic autonomy of the research councils and calls for the targeted demonstration of the impact of research funding becomes clear. For example the programme outline suggests that:

> To focus the UK research effort we will work through a series of Grand Challenges developed in conjunction with researchers and users in areas of societal importance such as energy, environmental remediation, the digital economy, and healthcare. An interdisciplinary, stage-gate approach spanning basic research through to application will be used including studies on risk governance, economics, and social implications. The challenges will be addressed via interdisciplinary consortia supported jointly by the Research Councils and the Technology Strategy Board. The Councils will also work with the cross-Government Nanotechnology Research Coordination Group to respond to the Royal Society/Royal Academy of Engineering report on Nanoscience and Nanotechnologies. (p. 23)

Here we see evidence of the three discursive sites, discussed above, mobilised in constructing a nanotechnology research programme. In this context research council activity is focused on issues of 'societal importance' and will be addressed collaboratively with other intermediary bodies with inbuilt mechanisms for demonstrating impact. As such nanotechnology offers a particularly pertinent case study for the interplay between these contemporary science policy dynamics, and the ways in which research councils respond to them.

So, what is new here in our approach? We suggest that the novelty of this approach is in its capacity to produce new understandings of science policy particularly by attending to the institutional contexts in which science is practiced, particularly at the interface between the broader scientific community and the state. Rather than simply focus on science policy as a set of policy tools – or indeed the formal roles of the research councils – we argue that science policy should be regarded as a dynamic ensemble of discourse (cf. Hajer 1995; Sunder Rajan 2003), reflecting the mutual positioning of institutions, relationships of accountability and the influence of broader social and political contexts.

These dynamics play out at different discursive sites: in the self-narration of research councils as 'guardians of science'; in their demonstration of (economic and wider social) impact; and in their contribution to wider public policy. These three sites will be the focus of our ongoing research into the nature of UK science policy broadly, and the role of the research councils as intermediaries within this discursive site specifically. We aim to continue the ethnographic research in a threefold way: (1) by conducting further interviews with policy makers and administrators at the EPSRC and

BBSRC as well as at other intermediary bodies, and with scientists and government-based policy-makers to develop a comprehensive understanding of science policy and the role of intermediaries; (2) by conducting several ethnographic stays at the EPSRC during peak-times of decision-making processes in regard to nanotechnology and synthetic biology in the end of 2009 and the beginning of 2010, thus embedding the researcher into the daily work of the research council to explore the practices and lived storylines from within; and (3) by continuously examining intermediaries' and government science policy documents as they are being developed and published during the next months as representation of policy and political narratives contributing to science policy discourses.

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