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THE NEW SOCIAL CONTRACT FOR SCIENCE: ACCOUNTABILITY, RELEVANCE, AND VALUE IN US AND UK SCIENCE AND RESEARCH POLICY

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Introduction

The implicit social contract underwriting public support for science and academic research is changing fast. No longer can geographers expect the kind of blank check promised by Vannevar Bush (1946/1960) in his book *Science, the Endless Frontier*. Bush's report to President Truman provided the blueprint for US postwar policy on science and university research. Scientists working at universities and government laboratories were to be provided with generous federal research funding and complete professional discretion about its allocation in the belief that basic research —research pursued purely for its own sake—both constituted a public good in itself and ultimately paved the way for improvements in national security, human health, and economic performance. By underwriting academic research and establishing the boundary between publicly funded basic science and its commercial and other applications, Bush's report institutionalized the social norms—universalism, disinterestedness, organized skepticism, and communalism—famously identified by Merton (1942/1973) as defining science and guaranteeing its progressive march on truth.

The reality, of course, never quite lived up to the ideal. While recent work in the social studies of science and technology has questioned the linear route from pure science to technical application implied by Bush's model (Bijker, 1995), radical critics have emphasized how heavily the Cold War figured in American science and the spectacular growth of

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American research universities (Kleinman, 1995; Edwards, 1996). Nevertheless, Bush's landmark report articulated the guiding principles of postwar US science policy. Though different in detail, science policies in other western countries were governed by similar attitudes. Professional geographers benefited greatly from this deference to and unquestioned public support of academic inquiry. Though never so well endowed as the "Big Science" projects of physics, research in the social sciences and humanities was also carried along on the coattails of Cold War science policy.[1]

This cozy relationship between university scientists, society, and the state has begun to unravel. Older narratives about scientific knowledge as a public good or as an end in itself no longer hold sway with budget cutters or a public increasingly skeptical about the risks of a Faustian bargain with science and technology. Discretionary government spending has been steadily reduced and the end of the Cold War has deprived science of the unquestioned allegiance and defense funding it once enjoyed. At the same time, economic restructuring and the increasing significance of scientific and technical knowledge to postindustrial production processes have made university research more crucial than ever to both state and corporate economic strategies. These external pressures and internal perception of the opportunities they present are reshaping the way universities relate to government funding bodies and the private sector. Almost without exception, state science policies have moved away from the ideas of academic autonomy championed in the US by Bush and Merton and in Britain by Michael Polanyi (e.g., 1962). Instead, a growing chorus of voices is demanding that science, like other publicly funded services, be made publicly accountable and prove its value for money. Guston and Keniston's recent call for a new social contract is symptomatic of this changing mood: "[T]he changed world of modern science and modern government means that it is imperative to search for and begin to define a new contract, or series of contracts, between the institutions of democracy and the institutions of science. The scientific community needs to reach out to justify its claim on public resources by demonstrating where and how it is relevant in solving public problems" (1994:32).

The broad outlines of this new social contract are rapidly falling into place. These changes in the underlying rationale for public support of academic research have been accompanied by the business-school-speak of mission/vision statements, strategic planning, total quality management, customer satisfaction, and the like, which reflects the advent of managerial practices drawn from the commercial world. Competition and market discipline are widely presented as the means of improving the quality and efficiency of academic research and of guaranteeing its public relevance by making academics more directly responsive to broad public needs. Accordingly, the relationship between public sector funding bodies, academic researchers, and the wider public is being reorganized in terms of customer-contractor relations. This produces accountability of a sort, but

in its articulation of both "publicness" and accountability such a market-based system of *customer* accountability differs markedly from the disciplinary systems it displaces in which the meaning, value, and purposes of academic research were negotiated by relatively autonomous professional communities.

This rationalization of academic research has been widely resisted, and—partly as a consequence—its effects have been decidedly uneven. The call for increased public accountability comprises one major reason why academic inquiry is now increasingly conceptualized in terms of research outputs. Contemplation without publication counts little either in Research Assessment Exercises (RAE) or for hiring and promotion committees. Of course, these are internal disciplinary mechanisms, but they are shot through with the rhetoric of business, both because their decisions carry budgetary implications and so must measure up to the pervasive bottom line and because these values have been internalized by our profession. Members of hiring and review panels are forced to justify their decisions in terms of the all-important values of research productivity, quality, and excellence. These are notoriously ambiguous—and contested—objectives, which, paradoxically, is one reason why they are invoked so frequently.

To the degree that their ritual invocation makes a show of conforming to the new imperatives governing academic research while at the same time preserving a space for professional academics to decide their meaning in actual practice, such terms serve as what Star and Griesemer call boundary objects: links between "intersecting social worlds" that "satisfy the informational requirements of each of them" by being "both plastic enough to adapt to local needs . . . and robust enough to maintain a common identity across sites" (1989:393). Such a process of translation provides one way to understand the apparent contradiction between the recent report to the US National Research Council (1997) emphasizing the commercial value and policy relevance of geographic research—especially in GIS, remote sensing, and economic geography—and the recent efflorescence of a very different kind of geographic research in cultural studies and critical theory, about which the National Research Council is conspicuously silent. Similar processes are arguably at work in the RAE, where discipline-based panels of experts have been authorized to assess the research quality of academic departments in Britain as basis for distributing government research funds among them.[2]

Important as this resistance has been in subverting the narrow instrumentalism of the new social contract and keeping open space within the discipline for different conceptions of the meaning, value, and purposes of geographic research, it is impossible to ignore the pressures brought by recent policy changes to do research that generates extramural funding. Academic research is more deeply involved than ever before in the production and circulation of economic capital through commercial

research and development arrangements, global media and publishing companies, and private consultancy. The divisions between commercial, educational, and scientific functions are further blurred by the commercialization of universities themselves. Not only is higher education being managed and marketed as a commodity (Mitchell, 1999), but in the new entrepreneurial academy academics and their universities are directly involved in business ventures to capitalize on their research results (Etzkowitz, 1989). Policies to accelerate the commercialization of academic research now play a central role in government strategies for promoting regional economic development and enhancing national competitiveness (Secretary of State for Trade and Industry, 1998; Guston, 1999). Beyond this crucial economic role, states increasingly look for academics to provide "policy-relevant" research to facilitate governmental decisionmaking about complex problems like global environmental change and social exclusion. Real tensions exist between the idea of research as a public service in itself, the pursuit of specifically policy-relevant research questions, and the public value of public funding for research that is potentially of commercial value.

The emerging "triple helix" (Etzkowitz and Leydesorff, 1997) of university-industry-state relations is steadily reshaping each of these intertwined elements. In this essay, I will focus on the implications for geography of the new emphasis on accountability and relevance in government science and research policy in the US and Britain. Insofar as the precise nature of the public needs being served by this new social contract is often unspecified or left so vague as to be unimpeachable, the means of achieving them—the imposition of market discipline—actually displaces these ends themselves. As a result, the campaign to make academic research more socially relevant and more publicly accountable risks becoming something of a Trojan Horse for a set of unexamined political and economic commitments. Beyond the critical questions of to whom such research should be accountable and to what it should be relevant, I will also consider how the new social contract is reorienting certain academic norms and practices.

Accountability and Relevance in Government Research Policy

Concern for the instrumental relevance of research is not a particularly new feature of government science policy. It can be traced back to Francis Bacon and his vision of scientific knowledge as an instrument of state power. What differs now are not the gestures made to the idea of academic research serving the interests of national security, public health, environmental protection, and economic performance but the way governments seek to achieve these objectives through publicly funded research. In this era of global competition and high-tech knowledge economies, no longer (it would seem) can autonomous academic communities be left entirely

to their own devices. Once Vannevar Bush counseled a liberal policy for science, both generous and permissive; now government funding agencies demand bang for the buck, even from so-called "blue skies" science undertaken without any application in mind. They have instituted new managerial regimes of strategic government planning, performance and productivity assessment, and market discipline to "maximize"—as a recent report by the US House Science Committee put it—"success, efficiency, and accountability in the federal research enterprise" (USHSC, 1998:16).

This new approach to science and research policy contains a deep irony. Governments otherwise loath, in this era of economic liberalization, to interfere with the invisible hand of the market are now keen to plan the operational direction and even the conduct of academic research. Under Newt Gingrich's Contract with America, the Republican-led House tried to cancel federal funding for climate change and environmental health research, in the vain hope that, denied the bright light of scientific attention, these problems would simply go away (Gelbspan, 1997). Similarly, under Thatcher, the old British Social Science Research Council received blistering criticism from a government suspicious of the academy in general and hostile not only to the social sciences (except perhaps the dismal one of economics) but even to the very idea of '"Society" itself. The Tories even toyed with the idea of shutting the council down altogether before restructuring it in its present form, the Economic and Social Research Council (ESRC) (Dalyell, 1983). For the most part, such transparently partisan attacks have lacked the necessary political legitimacy to last, but economic pressures have fueled demands to make academic research more economically productive and publicly accountable.

While recent science policy statements in the US and Britain have stressed the need for greater accountability from publicly funded research (HMSO, 1993; NCIHE, 1997:par. 11.3; USHSC, 1998; White House, 1994), the accountability they propose does not begin to approach that so hopefully described by Ulrich Beck:

> the public sphere in cooperation with a kind of "public science" would be charged as a second centre of "discursive checking" of scientific laboratory results . . . Their particular responsibility would comprise all issues that concern the broad outlines and dangers of scientific civilization and are chronically excluded in standard science. The public would have the role of an "open upper chamber." It would be charged to apply the standard, "How do we wish to live?" to scientific plans, results, and hazards. (1992:119)

Despite mounting public anxiety about genetically modified foods and other cutting edge scientific developments, the principal concern of recent science policy has been, not with these broader questions of public

legitimacy, but with increasing the efficiency of and economic returns from scientific research. Playing on the stereotypes of ivory tower indolence and inefficiency, Guston and Keniston (1995) call for publicly funded academic researchers to be made more responsive and relevant to the demands of research customers in government and industry. Likewise, the last British government's White Paper on science and technology policy, *Realising Our Potential*, states that ". . . steps should be taken which, on the basis of other countries' experience, will help harness strength in science and engineering to the creation of wealth in the United Kingdom by bringing it [the publicly funded university science base] into closer and more systematic contact with those responsible for industrial and commercial decisions" (HMSO, 1993:4). In this way, the neoliberal discourse of public accountability has sought to make accountability synonymous with cost-effectiveness, public needs with the demands of paying customers, and public relevance with wealth generation and the research needs of policy making. While these are general themes of government science policy in many industrialized countries, cultural and institutional differences mean that neoliberal reforms of science policy have produced very different outcomes in the US and Britain to which geographers will have to adapt.

Making Science Pay in a Pluralistic Environment: Science Policy in the United States

Recent federal policy initiatives in the United States have relied on a mixture of regulatory intervention, public-private partnership, and market discipline to make academic research more accountable and relevant. Before it was itself zeroed out by the Republican Congress, the US Office of Technology Assessment called for Congress to establish research priorities "across fields and subfields" and to oversee more closely the research activities of different federal agencies to insure their science policies fulfill national objectives as cost-effectively as possible (USOTA, 1991:11, quoted in Boesman, 1997:12–13). Given the large number of different federal agencies involved in funding scientific research—often through decentralized allocation systems, as in the case of the US Department of Agriculture's agricultural experiment stations—Congress will have its work cut out for it.

The institutional diversity of the US research system mirrors the pluralism of federal science funding. It boasts a wealth of both government and private laboratories and a heterogeneous higher education system, ranging from small teaching colleges to internationally renowned research universities like Harvard, Stanford, and MIT. Given this success and the diversity of functions served by its constituent parts, there are serious questions about the wisdom of standardizing the allocation of the federal science funding supporting this system. While the USOTA worries that

"criteria used in selecting various areas of research and megaprojects are not made explicit and vary widely," especially in high-level Office of Management and Budget and Congressional decision making, the pluralism of the US research system is widely admired in other countries for fostering a diversity of scientific approaches and insuring against errors of judgement in resource allocation (USOTA, 1991:11, quoted in Boesman, 1997:12–13; Ronayne, 1984).

Nevertheless, the Republican-controlled House Science Committee has taken up the challenge of rationalizing American science funding. Its recent comprehensive review of US science policy calls for sweeping reforms to make American science and industry more productive and thereby "maintain our Nation's strength and international competitiveness" (USHSC, 1998:12). While recognizing the benefits of pluralism and the traditional division of labor between universities (which take the lead in doing federally funded basic research), government agencies and research laboratories (focused on strategic research necessary for specific agency functions), and subsequent commercialization by the private sector, the report seeks to blur these institutional differences so as to develop synergies between different stages of the innovation process. If the House Science Committee has its way, the result will be a science system that is more integrated, both institutionally and functionally, and thus more responsive to the imperatives of international competitiveness and increased economic productivity. In addition to recommending that the "users" of research—both private sector and governmental—be given an equal place alongside academics in technology foresight exercises to plan future priorities for publicly funded research, the House report also calls for tax incentives, regulatory reforms, and other measures to encourage more public-private research partnerships and other involvement by the private sector in university research. In this way the House hopes both to share some of the burden of financing basic research and to encourage more "relevant" kinds of research. Furthermore, it hopes to facilitate the commercialization of that research by involving research users along with researchers themselves in setting priorities for basic research, thereby providing a demand side "pull" alongside the supply side "push" from new scientific discoveries to drive technological innovation and economic growth.

This vision is already coming to fruition. In many fields, the stringency of federal funding and the relative availability of private venture capital have combined to bring academic research into the arms of industry. Internet stocks are the current darlings of the stock market; not long ago it was biotech. Both grew directly out of publicly funded university research, and business is now keen on getting a piece of the action. Within geography, GIS is the best such example. Its success at generating income both from commercial spinoffs and from government grant monies—or, just as important for negotiations with the keepers of university pursestrings, its *promise* of such success—has enabled academic

entrepreneurs to win favor and funds for GIS from deans and venture capitalists alike.

Such partnerships are transforming the way academic research is conducted. The pace of technical and commercial change is now so rapid as to dissolve traditional distinctions between basic and applied research, as well as the institutional divisions of labor these distinctions have heretofore implied. Not only are academics and universities themselves rushing to exploit the lucrative commercial opportunities presented by their research, but business is also investing heavily in basic research in fields like biotechnology, either alone or in partnership with universities. Between 1980 and 1993, the amount of corporate investment in university research in the United States increased in real terms by 265% (Haraway, 1997:91). While industry still provides a minority of university research funding, its significance in university calculations is magnified by the fact that it represents an area of revenue growth at a time of fiscal stringency and that contributions from such private sector "partners" are increasingly a prerequisite for receiving many channels of public research funding. As a result, investment in lucrative research fields like GIS often (though not always) comes at the expense of other apparently less valuable university activities (Etzkowitz and Leydesdorff, 1999).

Private sector involvement with and investment in American university research activities have been fostered by other public policy changes as well. Most significant in this regard have been patent law reforms. The Stevenson-Wydler and Uniform Federal Patent Policy Acts of 1980 transferred the intellectual property rights stemming from publicly funded research from the federal government to the institutions at which the research was conducted. Universities have responded by establishing various arrangements to profit from publicly funded research through licensing agreements, joint ventures, or other mechanisms that have directly involved them in the commercialization of research results. This has changed the terms of exchange between universities and the private sector. Previously, university expertise and private finance were transferred back and forth through arms-length advisory consultation and philanthropy, which "left control of commercial opportunities of academic research in the hands of industry [and] control over the direction of research and choice of research topics . . . to academic scientists"; now these exchanges are based strictly on commercial calculations (Etzkowitz, 1989:15). As a result, not only are knowledge and money rendered directly interchangeable, but it has also become increasingly difficult to distinguish the functions, motivations, and values of supposedly nonprofit universities from those of businesses organized to produce profits for shareholders. For instance, in common with many US universities, my present employer, King's College London, now requires that all extramural grant proposals and contracts be vetted through its commercial research arm, KCL Enterprises, set up to cash in on the College's lucrative biomedical research.

The effort to make universities and academic research more "relevant" by involving them more directly in producing wealth has created a number of other conflicting interests and obligations. Many of *Antipode*'s readers will have firsthand experience of the tensions between general undergraduate education and specialized graduate education and between teaching and research. At institutional and administrative levels, other difficulties arise. The model of professor and graduate student apprentice, common in the social sciences and humanities, is being displaced in the sciences by large, hierarchically organized research groups, often managed separately from the university's traditional departmental structures. This organizational form is necessary to compete for research grants and capitalize on expertise. "Possessing many of the same characteristics of a small business, apart from the profit motive, some of the research groups or 'quasi-firms' are only a short step away from turning into [private] companies when the opportunity arises" (Etzkowitz, 1996:276; cf. Etzkowitz, 1998). Consequently, they present university administrators, academics, and research group members with difficult challenges, including how to balance traditional academic priorities against the new commercial ones and how to manage the competing intellectual property rights of researchers against university administrators. For state and federal governments, meanwhile, the goal of using publicly funded research as an engine of local or regional economic development can come into conflict with the university's interest in maximizing its commercial income in a global market. In turn, local business often resents the competition presented by the commercial ventures stemming from publicly funded university research activities.

Top-down Triage: Research Policy in the United Kingdom

The trend towards direct government involvement in and economic discipline of academic research is even more pronounced in Britain. Science and technology form the keystones of the government's strategy for "building the knowledge-driven economy" (Secretary of State for Trade and Industry, 1998). Along with the infrastructure payments of the Higher Education Funding Councils, several major charitable foundations and the seven government research councils account for 73% of all research funding at British universities (House of Commons Science and Technology Committee, 1998:para. 43). As a result, research funding in Britain —like the government itself—is much more centralized than in the United States. Furthermore, British policymakers defer much less to the principle of scientific autonomy, so sacred in the United States where the institutions of judicial review and legislative oversight provide less scope for the exercise of administrative discretion (Vogel, 1986). Before his ascension to the government front bench changed his views on state power over public freedom of information, MP Jack Straw, onetime opposition education critic and now Home Secretary, complained that the Education Reform

Act of 1988 gave the Minister for Education 415 new powers of central control over universities (Pritchard, 1998:109). These differences in the structure and culture of government make it much easier in Britain to direct science funding centrally in pursuit of certain state objectives.

Thus, in consultation with civil servants, business leaders, and other so-called "stakeholders," the ESRC recently identified nine thematic priorities to which it now directs 65% of all its research funding. These themes include such topics near to the heart of the present government as "economic performance and development," "governance, regulation, and accountability," "innovation," and "social inclusion and exclusion" (ESRC, 1999b). This blatant appeal to government priorities is a self-conscious strategy by ESRC directors and advisors, who are mostly academics on secondment, to protect funding for the social sciences, which historically in Britain have neither been well regarded nor well provided for by government science policy. With more of the prestige of "hard" science behind them, other British research councils have been much less concerned with demonstrating their immediate relevance to government paymasters. Nevertheless, in the wake of the last government White Paper, they too were forced to reformulate their missions "to make explicit their commitment to wealth creation" (HMSO, 1993:6).

Since peer review remains the conduit through which research council funds in Britain are distributed, the commitment of academic research to the project of wealth creation is perhaps more rhetorical than real. Nevertheless, the UK government is beginning to make institutional reforms necessary to enforce this commitment. As in the United States, it has begun to experiment with technology foresight exercises to involve business leaders, policy makers, and other so-called stakeholders in the allocation of research funds so as to insure their relevance (Martin and Irvine, 1989). This instrumental conception of university research was perfectly reflected in the recent reorganization of the Office of Science and Technology (OST), which oversees the UK research councils. Once part of the cabinet-level Department for Education and Employment, it has been moved into the Department of Trade and Industry in hopes of joining up the government's science and research policy with its trade and commercial strategy. According to its official website, the OST devotes itself to "maintain[ing] and develop[ing] excellence in UK science, engineering, and technology and to maximis[ing] their contribution to sustainable wealth creation and quality of life" (1999).

However, the British government has been conspicuously reluctant to back up this kind of rhetoric with the funding necessary to have much hope of achieving it. Recent reviews of British science policy unanimously conclude that university research is chronically underfunded. As the Dearing Report of the government's recent blue ribbon review of British higher education starkly put it, "Without a major injection of funds to improve the infrastructure of the UK's top quality research departments,

we do not believe the future competitiveness of the UK research base can be secured" (NCIHE, 1997:para. 11.37). Furthermore, real wages for British academics and university research personnel have barely kept up with inflation and have fallen some 30% behind those of comparable non-manual workers in the UK economy (IRHEPC, 1999; NCIHE, 1997: para 14.42–45). While the government has forced universities to compete through the Joint Infrastructure Fund for shrinking basic resources, its higher education funding policy has imposed "efficiency gains"—a curious Thatcherite euphemism for freezing or even reducing public sector resource allocations while simultaneously ratcheting up performance targets—to squeeze more students through British universities while at the same time reducing the per student allocation by more than 40% since 1976 (NCIHE, 1997:para. 3.59).

The government's commitment to monetarist fiscal policy means its pledges to improve the "knowledge base" ring hollow. Indeed, so hegemonic is neoliberal fiscal austerity that the Dearing Report (NCIHE, 1997: para 11.39) recommended addressing the crisis in university infrastructure funding with a revolving loan scheme whose principal advantage appears to be that investment in publicly funded universities would not count against the Public Sector Borrowing Requirement figures with which the Treasury seems so obsessed. The government has based its approach to "promoting the commercialisation of university research" on programs of "incentives for researchers to work with business," which serve to redistribute more of the existing public research funding towards the needs of business, rather than increasing the total volume of publicly funded research—and if the rising tide lifts all boats, the total becomes relevant (Secretary of State for Trade and Industry, 1998:6). Despite this objective, the Dearing Report noted ruefully that the RAE—another government-sponsored, competitive, and quasi-market mechanism for improving research productivity and accountability—rates Research Council grants more highly than commercial contracts and consultancy research.

The British government is pinning its hopes for increased economic productivity on technology foresight exercises, university-industry research partnerships, and other programs designed to promote the transfer and commercial exploitation of skills and technology from UK universities. (The UK's economic productivity currently lies in the bottom half of those of all European Union countries.) Where these measures have failed to produce anything like the record of commercial spinoffs from MIT or Stanford so envied by British policy makers, the tendency has been to blame universities and deploy still more sticks, along with the odd carrot, in hopes of whipping the lazy dons into shape. If the hightech industrial parks around Cambridge—the so-called Silicon Fen—make a pale reflection of the Silicon Valley that has grown up in the shadow of international research powerhouses like Stanford, Cal Tech, and UC Berkeley, much of

the blame must be laid at the door of British industry and British government policy. "Apart from pharmaceuticals, UK businesses invest much less than their foreign competitors" on research and development (Secretary of State for Trade and Industry, 1998:22). Lacking the venture capital culture present in the United States, British industry has been much slower both to invest in research and development and to forge partnerships with UK universities, as the government's own statistics bear out. However, the government is little better. As the Dearing Report noted, "The UK government makes one of the smallest contributions [as a percent of GDP] of the G7 countries" to basic research and development (NCIHE, 1997:para. 3.74). These comparatively meager levels of government infrastructure support encourage British companies seeking to milk the sacred research cow to look overseas and do business with better funded and equipped American universities, rather than their somewhat decrepit British equivalents. A number of British firms testified to the Dearing Commission that they were "relocating their collaborative projects with universities outside the UK as a direct result of decay in the research infrastructure" (NCIHE, 1997:para 11.33). A recent study found that an extraordinary 45% of the research and development conducted by large British firms is actually done overseas, mostly in the United States (Martin and Salter, 1996:51).

Investment and the Reorientation of Research Norms and Values

As these policy documents suggest, scientific research is increasingly regarded both as an economic asset and a strategic investment. Indeed, the British Treasury even commissioned a study of *The Relationship Between Publicly Funded Basic Research and Economic Performance* (Martin and Salter, 1996). This concern stems directly from the new "social contract" and the "specific expectation that basic research should generate economic and social benefits in return for the substantial public funds it receives" (Martin and Salter, 1996:ix).[3] Once reified, the investment metaphor demands that science pay monetary dividends, and this imperative imposes a very different form of accountability on academic research communities governed by disciplinary norms of universalism, disinterestedness, organized skepticism, and communalism. In the UK, "the combination of low expenditure on basic science . . . compared with other western European countries and the priority funding status given to those fields that encourage links with between the public and the private sector places strong pressure on researchers to make their work appear relevant to UK industries" (Rappert, 1995:384). The promise of tangible payoffs has also become an almost obligatory part of individual research proposals and of the negotiation of university and government funding schemes. For instance, the director of the US National Science Foundation, Erich Bloch, successfully linked his Congressional budget requests to the idea of improving

economic competitiveness through greater research investment in critical fields that were likely to underpin emerging technologies, such as engineering, computer science, and materials research (Irvine, Martin, and Isard, 1990: 139–40).

To some extent the economistic rhetoric of competition, investment, and value-added is just froth atop fairly traditional disciplinary practices for establishing research priorities, allocating resources, and validating knowledge claims. Peer review, for instance, remains largely unchallenged as the principal mechanism for deciding such matters. Clearly, disciplinary standards still matter a great deal. Despite government efforts to encourage academics to do more policy relevant research, the gray literature of consultancy reports and government policy analysis is, as Peck (1999) notes, not well rewarded in the professional circuits of academic capital.

In other ways, however, the investment metaphor marks the beginning of a fundamental shift in the social norms and values of academic research. Market discipline has exposed university research to the terminal short-termism of market calculation. University infrastructure spending is distorted by a tragedy of the commons in which libraries and other general research support facilities—public goods in the technical sense—are chronically underfunded as resources flow into administrative units whose activities are likely to pay more immediate, tangible, and excludable returns on investment. As Hill and Turpin observe, university research "funding is being moved from supporting the research that exists to providing a kind of venture-capital 'stake,' which is invested in seed capital and in support of research grant-chasing activities" (1994:340). With individual salary, promotion, and prestige—as well as, in Britain, departmental RAE rankings tied to success in the highly competitive grants-getting game—there is growing recognition, even among policymakers, that the present system tends to encourage "safe" research at the expense of critical "research that challenges the status quo or pushes the boundaries of conventional wisdom" (USHSC, 1998:13).

Academic researchers are increasingly subject to the demands of paying customers in government and industry. Recent science policy reforms have opened university-based research to private sector investment and commercial influence. They have also created a competitive "market" for basic research by separating its purchasing by research councils and other public sector funding agencies from its provision by academic researchers, according to the neoclassical dogma of Baumol et al.'s (1982) influential contestable markets theory. Such forms of market-based accountability are restructuring the context of academic research and discovery. Through the intertwined public sector and commercial markets for research, the purchasers of academic research exercise more control over the determination of research priorities, problems, and even the approaches pursued by their academic clients. Webster's (1994) empirical study shows that this is more than just a theoretical possibility. The interpenetratation of university

research with corporate capital is already beginning to influence the construction of research agendas in fields like molecular biology and engineering, where such partnerships are particularly common. In concert with chronic budgetary crises and the associated cultural capital to be gained within the academy through grantsmanship, systems of market-based accountability and performance assessment put the squeeze on research activities and outcomes for which outside partners are unwilling or unable to pay.

Reflecting on my own experience, I feel such pressures impinging on my career path. While academic employment depends on a generalized "excellence" in research, some research clearly pays better than does other research. Having trained as a historical geographer, I have found success in the academic labor market only by emphasizing my environmental expertise, which promises the kind of relevance valued by funding agencies and other potential paying customers. Research income has become necessary both as a sign of academic "excellence" and—in an age of short-term contracts and soft money positions—as a pursuit in itself. Deans and department heads have no choice but to favor those individuals and administrative units with the potential for delivering the top-sliceable research grants necessary for keeping their institutions in the black. In many departments, if you want a new computer on your desk, a trip to a conference, or even paper for the photocopier, you need to win the extramural funding to pay for it. Of course some places are considerably leaner and meaner than others. Hill and Turpin note that at many Australian universities "the criterion *sine non qua* for promotion ha[s] become dollars attracted" (1994:345). This is becoming increasingly common in the US and Britain as well. In this way monetary signs of academic excellence are displacing substantive judgements about the qualities that gave meaning to academic knowledge production in the first place.

Like the money, most of the attention in recent science policy debates has been concentrated on the physical and biological sciences. However, as my anecdote suggests, recent reforms have perhaps had their greatest impact on research in the social sciences and humanities. Lacking the prestige conferred by the hard sciences, people in these fields have had to work even harder to prove the instrumental value of the relatively meager public sector resources devoted to support them. The behavioral and social science program of the US National Science Foundation has been repeatedly threatened with elimination, and as a consequence it has adopted a very defensive posture, emphasizing both its commercial potential and its value for policymaking purposes. Thus, GIS research, useful for geodemographics, environmental management, and steering cruise missiles away from Chinese embassies, has become the centerpiece of its research program in geography. Similar imperatives drive government policy in the UK. Britain, of course, never even had state-funded equivalents of the perpetually endangered US National Endowment

for the Humanities and the National Endowments for the Arts, though an Arts and Humanities Research Board was recently proposed by the Dearing Report (NCIHE, 1997). Unique among the seven UK research funding councils, the ESRC has dispensed entirely with the idea of expanding human knowledge as an end in itself. Instead, it promotes its mission in narrowly instrumental terms: "contribut[ing] to economic competitiveness, the quality of life, and the effectiveness of public services and policy" (ESRC 1999a).

Such rhetoric was carefully designed for the consumption of skeptical policy makers, and there are real questions about the degree to which it influences actual practice. It is important not to discount the real autonomy still enjoyed by academic researchers, at least those fortunate enough to hold permanent positions, to decide for themselves what kind of research to do. However, with the public value of academic research defined in such instrumental terms, policy relevance has become the principal rationale for funding social science research. Having hollowed out much of their own internal research capacity through swingeing budget cuts, governments rely more than ever on outside advice from private consultants and academics (Hiebert, 1999). Subcontracting this work out to academic researchers not only offers a cost-effective and more flexible alternative to hiring more civil servants but also holds out the seductive promise of greater public legitimacy, insofar as it trades on the reputation of university researchers for greater objectivity and political independence than government authorities. In turn, the market created by government demand for policy relevant research provides an attractive source of research income for cash strapped universities. Since the general questions are driven by the needs of policymaking "customers," research of this kind is more likely to be system-supporting than critical in any deep diagnostic-utopian sense (Benhabib, 1986). Of course, academic interests and practices remain different from those of policymakers, to the point that the kind of policy research done by academics is often not very useful for making actual policy decisions. This frustration causes governments to reevaluate their reliance on academic policy advice (Hiebert, 1999; Peck, 1999).

Nevertheless, the need to satisfy—or appear to satisfy—the demands of customers for policy relevant research has had palpable effects on human geography. The recent US National Research Council's *Rediscovering Geography: New Relevance for Science and Society* begins by emphasizing how geographical information and "tools are being used by educators, business people, researchers, and policy makers to address a wide range of scientific and societal needs" (1997:vii). With its overwhelmingly instrumental emphasis, the report gives short shift to critical traditions of human geography, and the Council's call for the discipline's "supply capacity" to be brought into balance with the "demand" for relevant expertise effectively airbrushes them out of the future of the discipline as well (National

Research Council, 1997:171). Again, it is important not to read too much into promotional documents prepared for the benefit of outside sponsors or to exaggerate the degree to which the instrumentalism they espouse has colonized actual practice. Geographers, at least those with the security of fulltime university employment, still enjoy considerable autonomy over their research and teaching work. Equally, however, it would be naive to ignore the great influence that the perceived willingness of outside partners to pay for certain kinds of geographical knowledge (and knowers!) now exerts in university calculations. Public policy changes, budget cuts, and new managerial practices have put these financial considerations front and center in university hiring, promotion, and resource allocation decisions. If geography is what geographers do, these gatekeeping decisions about who gets to become a geographer and what they can legitimately do will determine the future of the discipline. It will probably mean more research in GIS and such apparently policy relevant fields as global environmental change and economic geography, at the expense of "useless" cultural and historical geography.

The new system of market-based customer accountability is very different from the way sociologists and philosophers of science have traditionally understood the ways in which scientific knowledge is made publicly accountable and legitimate. Peer review and the idea of expert autonomy celebrated by Bush and Merton are founded on the communicative rationality of scientific debate that is free, disinterested, reasoned, open to public scrutiny, and therefore publicly credible. In contrast, the new public accountability promulgated by public sector reformers appeals to the rationality of the market in pursuit of public interests in efficiency and cost-effectiveness. It transforms academic debate from a metaphorical market of ideas, in which competing theories battle it out for epistemic validation on the basis of rational debate, to an actual market system in which the value of knowledge and its pursuit is determined solely by its exchange value and thus upon the power of interested parties to pay for it. Like all markets, the market for research grants is structured to favor well financed government and private sector customers over those without the economic power to express their "demands" in the marketplace. The ability of industry funded scientists to cast public doubt on the otherwise overwhelming scientific consensus about the health risks of smoking suggests something of the influence over the contexts of scientific discovery and of validation that money can buy.

Of course skepticism is the stuff of science, but so too is disinterestedness, and the growing sway of market forces undermines this and other social norms heralded by Merton (1942/1973) as the secret of science's epistemic success. Hill and Turpin (1994) contend that it has shifted the "steering mechanisms" of academic research away from truth-seeking and reoriented them around profit-seeking. A number of other critics have complained that these new market values threaten the academic values

of communalism, disinterestedness, and organized skepticism. Pharmaceutical and biotech companies like Du Pont and Monsanto have carved out exclusive contracts with major international research universities. Such arrangements often include confidentiality and intellectual property agreements that limit the free dissemination of research findings within the academic community (Webster, 1994). In geography, Curry (1998) suggests that proprietary pressures stemming from academic involvement in GIS ventures, as well as industry sponsorship of university GIS research and teaching laboratories, tend to undermine the autonomy of academics and to inhibit searching criticisms of this emerging technology.

Conclusion: Reflexivity Beyond the Relevance of Interests

The institutional structures and broad social contract sustaining academic research are undergoing rapid transformation. Government policy has emphasized the importance of competitiveness and economic productivity and used a variety of mechanisms to make academic research relevant to these instrumental purposes. New forms of accountability in research funding and the development of new partnerships between business, government, and universities provide powerful market incentives—and discipline—to make academic research more responsive to the demands of customers in government and the private sector. Although the results have been decidedly uneven, I hope I have shown that the effects of this new social contract are potentially far-reaching and may reshape the social norms of academic practice.

If our critiques of the emerging triple helix of intertwined university-state-industry relations are not to sound like special pleading for the old days of ivory-tower elitism, we need to find a way to make what we treasure publicly meaningful. As I see it, the problem with the new social contract is not so much with the idea of making academic research publicly relevant and accountable, but with the narrowness with which public relevance, accountability, and value have been defined. Fetishizing the outcomes of research, in terms of new findings and results, the new social contract for science favors those ways of practicing science most likely to generate immediate commercial and economic benefits and discounts other reasons for engaging in academic inquiry and conversation.

Much of the critical response to government science policy and the restructuring of academic research has focused on the powerful social and economic interests served by this instrumentalism. For instance, Vavakova complains that the emphasis on accountability and research relevance conflates "private economic interests with the broad interests of society" and thereby conceals "transfers from the public sector to private industry" (1998:209). Others (Curry, 1998; Haraway, 1997; Pritchard, 1998) have focused their ire on the commodification and privatization of knowledge

achieved through the commercialization of university research, while Bassett (1996) follows a long line of concern about the loss of academic autonomy and subversion of independent social critique. These are real dangers and should be resisted, but it is also important to be reflexive about the interests and identities involved. While corporate capital may have benefited from these new arrangements, so too have parties within the university sector. For example, once the darlings of the military, university physics departments are imploding, while the reorientation of public science policy and research spending around the new imperatives of economic competitiveness and global environmental change has fostered substantial growth in molecular biology and earth science departments. Clearly, the changing winds of science policy present both problems and potential opportunities for university research.

On the one hand, government policy here in Britain favors individuals from larger and better-established departments in the competition for scarce research grants and postgraduate studentships. Such a triage approach may well make some sense in a few particularly capital-intensive research fields where, for example, access to particular laboratory apparatus may be an important limiting factor in research. However, this Big Science model does not apply to all disciplines and all fields of inquiry. In human geography it is certainly debatable whether the interests of postgraduate training are best served by concentrating the lion's share of the studentships at a few large and well-connected departments whose success in monopolizing them is then used as an indicator of research quality for the RAE, thereby legitimating and further reinforcing the very inequality created by government policy in the first place.[4] As Ron Johnston (1993, 1995) has noted, the government's research and teaching policy has served to increase the resources differential between new and old universities and thereby to entrench still further the older schools' influence and power.

That said, one of the most important effects of the emerging triple helix is the calling into question of the easy distinctions between academics and outsiders upon which simple interest-based critiques of the new social contract for science depend. Not-for-profit universities are being run like businesses, with academics encouraged to be entrepreneurial and to exploit commercial opportunities. At the same time businesses have gotten more involved in academic research, forging partnerships with universities or even setting up their own research facilities. The same is true for many nongovernmental organizations and political action committees, which freely mix advocacy with research and so find themselves working closely with both academics and policymakers. This blurring of traditional roles and identities clearly poses certain problems, some of which I have tried to explore here, but it also holds out some exciting possibilities. For instance, recent feminist work has emphasized the ideal of research as a dialogue in which research subjects are partners, not simply passive objects of study to be represented and spoken for.

There are, of course, telling differences between the power relations involved in an interview and those involved in a multimillion dollar research contract between a university laboratory and a drugs company. One important function of academic autonomy and freedom is to provide the space necessary to excavate these differences, diagnose the problems, and discuss solutions to them. Ironically, this traditional role so cherished by critical intellectuals shares with neoliberal science policy reforms a narrowly instrumental conception of academic research. As Bassett suggests, the recent agonizing among critical geographers about "activism and the academy" is partly a symptom of the way in which we as academics identify ourselves "through a defense of some notion of the intellectual as a socially privileged knowledge producer" (1996:507). However, even if the linguistic turn has dulled the epistemic and emancipatory confidence of critical theory, the ideals of speaking truth to power and of unmasking oppressive social relations continue to organize much academic discourse. Indeed, this is precisely what I am trying to achieve by writing this essay: to diagnose the tacit social and political commitments behind the reform of government research policy and thereby help correct them.

This instrumental conception of critique, however, tends to discount other reasons to engage in research. It takes the identities of and relations between researchers, their partners, and publics as fixed and disregards the intersubjective processes though which these identities emerge. If academic roles and identities are shifting through the reorientation of university-industry-government relations, then so too must the ways that academic research becomes relevant and valuable for its customers. Often the intersubjective processes of trust building, mutual understanding, and social learning involved in doing research can be as important for participants as the substantive results. However, the narrow focus on outcomes and results, a focus common to both neoliberal accountability discourse and critical theory, tends to ignore and thus devalue these intangible effects. For critical geographers, the challenge is to find ways of making what we do and who we thereby become publicly meaningful in ways that go beyond the instrumental relevance of application and do not reify our own identities or those of our publics and partners.

Notes

1. An example of this would be Murphy's classic studies of American Central Business Districts, which Ron Johnston told me in a personal communication were funded by the Office of Naval Research.
2. In response to a previous draft of this essay, both Ron Johnston and Keith Hoggart made the important point that the RAE was originally proposed by university vice chancellors, largely in the belief that if the universities did not come up with some research assessment mechanism, the government would impose one on them over which academics would have much less control.

3. The US government has commissioned several similar studies. See, for example, USOTA (1986).
4. At a recent public consultation meeting, Professor Bob Burgess, chair of ESRC's Postgraduate Training Board, explained that 90% of all the Board's postgraduate studentships go to just 10 universities. Although I have been unable to obtain the precise breakdown, it is probable that that distribution would be even more concentrated in human geography.

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