

On the ideal of autonomous science

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**Abstract**

In this paper I first use Alasdair MacIntyre's conception of a practice to develop a version of the common, through increasingly controversial, ideal of value-free, value-neutral, or autonomous science. I then briefly show how this ideal has been used by some philosophers to criticize both governmental and commercial funding of science. I go on to argue that, far from being itself value-neutral, certain elements of this ideal strongly resemble some controversial elements of libertarian political philosophy. I suggest that alternative ideals for science might be developed by drawing on egalitarian liberal and communitarian political philosophy.

## 1 Introduction

Our era is one of fantastic science: science that uses unthinkable quantities of energy to crack open subatomic particles and describe the origins of the universe, science that dedicates thousands of brilliant minds to “deciphering the code of life,” science that in our nightmares is capable of destroying the biosphere of an entire planet, and in our hopes is the only thing capable of saving it. Fantastic science that requires mundane but still amazing amounts of financial support. And this financial support has had an effect on science. Our fantastic science has become polluted, distorted, corrupt, and biased by the very forces that enable its existence.

At least, so we are told, by philosophers, public intellectuals, journalists, and scientists themselves. These voices speak from the political right (Happer, 2003) and the political left (Union of concerned scientists, 2004), and from the “politically neutral” standpoint of “science itself.” In such a politically partisan and divisive time – and our partisanship is even more fanatic than our science is fantastic – such a chorus of warnings ought to be taken seriously.

But what does it mean to say that science is polluted, distorted, corrupt, and biased? Such a question will be answered, implicitly or explicitly, by appeal to a philosophy of science. Not philosophy of science in the narrow sense of (right-wing) logical empiricism or the philosophical program that immediately succeeded it, but in the broader sense of a philosophy of science that describes the way science ought to be, and the way science ought

to relate to society. That is, a philosophy of science in the sense of a regulative ideal of science, what Philip Kitcher (2001) has called an account of “well-ordered science.”

In this paper, I will consider one such ideal. It is a common ideal, though an increasingly controversial one. It is the ideal that science is, or should be, free, independent, and untouched by debates over political and cultural values – what I will call *ethical and political values*. It is the *ideal of autonomous science*. In §2 I will make a distinction between *science as theory* and *science as practice* and state two corresponding versions of the ideal. I will then briefly explain what account the ideal can give of the problem of funding. In §3 I criticize this ideal. It is not independent of ethical and political values in the way that it purports to be. It is, in particular, closely tied to libertarian political philosophy. The ideal of value-free science is not, itself, value-free.

## **2 Autonomous Science**

When we talk about “science,” we mean one of at least two distinct things: the activities of scientists, and the body of knowledge that these activities produce. These two conceptions of science correspond to two different ideals of autonomous science. In §2.1, I will present the two conceptions of science; then, in §2.2, I use these to develop the two ideals.

## 2.1 *Theory and Practice*

There are a variety of ways of defining a scientific theory. A metaphysician might want to talk about a theory as a set of propositions – an abstract collection of abstract objects. Other, more metaphysically adverse philosophers might prefer a slightly more concrete set of sentences. Still others have criticized both of these approaches as inappropriately narrow, and argue that a theory should be understood as a model or set of models, with further disagreement over just what a model is.<sup>1</sup>

While I have a preference for the model approaches, I do not need to choose between these different definitions of theory here. Whatever definition of theory we adopt, we can define *science as theory* as one theory or a collection of several closely related theories. On this definition, to speak very roughly, physics is the theory or collection of theories presented as the content of physics textbooks, chemistry is the theory or collection of theories presented as the content of chemistry textbooks, and so on. There may be difficulties distinguishing one theory from another – is a textbook of quantum chemistry physics or chemistry or both? – but I think these difficulties are best parsed once a definition of theory is in place, and are not important here.

Science as theory is contrasted with *science as practice*. Here I do have a particular definition of the technical term in mind: Alasdair MacIntyre's.

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<sup>1</sup> The inferential conception of representation developed by Suárez (2004) is perhaps the most sophisticated alternative to the classic Hempelian conception of theories. For an overview of the theory/model debate, see Suárez and Cartwright (2008).

By a “practice” I am going to mean any coherent and complex form of socially established cooperative human activity through which goods internal to that form of activity are realized in the course of trying to achieve those standards of excellence which are appropriate to, and partially definitive of, that form of activity, with the result that human powers to achieve excellence, and human conceptions of the ends and goods involved, are systematically extended.

(MacIntyre, 1984, 187)

Physics, chemistry, and biology are among the handful of examples MacIntyre gives of practices. For our purposes, a practice has three crucial components:

- (1) a socially organized set of *practitioners*;
- (2) a set of “goods internal to that form of activity,” or *internal goods*; and
- (3) a set of “standards of excellence” for those goods.

For example, biology has all three: the biologists themselves, organized into a network of labs, departments, and institutions; the biological theory (in the open-ended sense we left “theory” above), which they are producing; and the epistemic standards by which that theory is evaluated. More generally, in any practice, the practitioners collectively produce (or at least attempt to produce) the internal goods according to the standards of excellence. A practice is thus one type of collective, goal-oriented activity.

In what follows, I will refer to the standards of excellence as *the internal standards of science as practice*. If the internal goods of science as practice are science as theory, as the example suggests, then the internal standards are the standards by which science as theory is judged. As a first pass, these are the standards given by normative epistemology: one might say, for example, that excellent biological theory is biological theory produced by a reliable process (in the sense of reliabilism). Just as choosing between definitions of theory was not necessary above, choosing between normative epistemologies is not necessary here.

When I refer to science as practice in the remainder of this paper, I will mean either the practitioners – the scientists – or the collective activities by which they produce (excellent) science as theory. For example, when I talk about biology or biology as practice engaging in stem-cell research – thereby treating biology as an agent – I mean either the subcommunity of biologists collectively producing excellent theories concerning the nature and behavior of stem cells or the activities by which these biologists produce these theories.

## 2.2 *Autonomy*

Each of the conceptions of science has its own corresponding ideal of autonomy. While these definitions are formally distinct, the content of the ideal of autonomous science as practice depends on the content of the ideal of autonomous science as theory. And since my ultimate target is the ideal of autonomous science as practice, I present both ideals here and use the terminology of MacIntyre's conception of practice to do so.

The ideal of autonomous science as theory (IAST) is a restriction on the standards for excellent science as theory – a restriction on normative epistemology.

**IAST** The internal standards of science as theory should be independent of all ethical and political values.

If normative epistemology gives the internal standards, this ideal rules out any proposed normative epistemology that incorporates – either implicitly or explicitly – ethical and political values. For example, it would be inappropriate, according to this ideal, to call a piece of science as theory “excellent” simply because it implied that global warming is primarily anthropogenic and hence supported one’s political program. Proponents of this ideal might say that one should adjust one’s political program to fit the best available science as theory, not fit science as theory (by declaring it excellent or not) to one’s political program.<sup>2</sup> To bring in some ethical terminology, we might say that science has its own, “private” conception of the good; it does not share a conception of the good with ethical and political practices.

The ideal of autonomous science as practice (IASP) requires more subtlety. We will begin with a *formal* version:

**IASP-formal** Scientists should engage in science as practice only for the sake of producing internal goods that are excellent according to the internal standards of science as practice.

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<sup>2</sup> For a critical discussion of the value-free ideal in climate science, see Petersen (2000) and Petersen (2008).

Combining this formal version with the ideal of autonomous science as theory gives us what I will call the *first pass* version:

**IASP-first pass** Scientists should engage in science as practice only for the sake of producing science as theory that is excellent according to standards that are independent of any set of ethical and political values.

This ideal helps distinguish legitimate and illegitimate reasons for engaging in science as practice. The ideal counsels the pursuit of research programs only for the sake of knowledge, and not for the sake of any ethical and political values. Hence, taking the example of global warming up again, we should not pursue a research program investigating the causes of global warming for any of the following reasons: because we want to pursue a public policy of reducing net carbon emissions, because we expect to make a lot of money off of trading carbon taxes, because someone will give us a lot of money to pursue this research, because we hate Al Gore, or because we are worried about the social and economic consequences of rising ocean levels. Instead, we should pursue a research program in global warming because, and only because, we anticipate the resulting science as theory to be of high epistemological quality. By acting in this way, science as practice is free and independent of inappropriate outside influence – it is autonomous. In the language of ethics, we can gloss this version of the ideal by saying that *science as practice freely should pursue its own conception of the good*.

This ideal can also be used to reject the work of some (purported) scientists. For example, epidemiologist David Michaels has criticized oil industry-sponsored research into

the toxicology of benzene, which purports to show that benzene is much less dangerous than indicated by research done by NIOSH (the National Institute for Occupational Safety and Health). To an extent, Michaels' criticisms are straightforwardly epistemological:

The oil studies were both diluted and underpowered. They did not have large enough study populations to find statistically significant differences for any but the most prevalent health effects . . . . Specifically, in this case, putting together numerous diluted cohorts yielded only a much larger but still very diluted cohort – lots of people, but few with significant exposure. The guaranteed result: no excess leukemia. (Michaels, 2008, 73)

However, in the next paragraph, he adds a further, and very different, criticism:

Why spend the money [on such statistically weak studies]? The industry needed some “evidence” to wave in the face of OSHA . . . . It's a game, and everyone knows it, but OSHA must, by law, analyze the proffered studies, file answers, analyze the answers to the answers, and so on ad infinitum. The studies served *their purpose* for the oil industry – *they bought some time*, if nothing else – but no one in the regulatory sciences was impressed . . . . The industry knew this, too . . . . (Michaels, 2008, 73, my emphasis)

Here the problem is not with a failure to meet the standards of normative epistemology, nor that these standards are not independent of ethical and political values (a violation of IAST).

Rather, the problem is that this research is *being done for the sake of* ethical and political values – a violation of the first pass version of IASP.

A classic statement of IASP is Michael Polanyi's "The republic of science" (1962). Polanyi argues that science "can advance only by essentially unpredictable steps, pursuing problems of its own, and the practical benefits of these advances will be incidental and hence doubly unpredictable" (62); scientists must therefore be free to "assess[] the depth of a problem and the importance of its prospective solution primarily *by the standards of scientific merit accepted by the scientific community*" (57, my emphasis). That is, science as practice must be free to pursue its own internal goods. On the other hand, any effort to force scientists to choose research programs based on ethical or political values is an external imposition on science and is likely to backfire, producing low-quality and useless results.

More recently, James Robert Brown (2008) has attacked the commercial funding of science. Brown argues that, since commercial interests only fund research that is likely to be profitable (and profitable for those who are already wealthy), the science as theory that results is not adequately tested against rival science as theory. (197-99) For example, patentable and highly profitable pharmaceutical treatments for high cholesterol are not compared to unpatentable, less profitable, and potentially more effective diet and lifestyle-based treatments. While this problem has ethical aspects, Brown presents it primarily as an epistemological issue: "I consider the whole business a question of good methodology, not morals" (288). But his solution is to create and increase forms of funding that "guarantee the *independence* of the

researchers” (281, my emphasis) and make sure that the agencies responsible for funding research and guiding public policy are “*free* of any sort of governmental or industry influence” (283, my emphasis). As with Polanyi, science must be free to pursue its own ends.

The first pass version of IASP might be problematic; I show this with two examples.<sup>3</sup> Consider, first, the Tuskegee Syphilis Study. Suppose that, in this case, the understanding of syphilis that the researchers anticipate from the study is of the highest quality. The first pass version of the ideal of autonomous science as practice, since it rules out considerations of ethical and political values, might be taken to imply that the researchers should pursue this study. But clearly it is morally abhorrent, and should not be pursued. Moral considerations constrain how research programs may be pursued, and the ideal ought to reflect this clearly.

Next, consider a group of particle physicists interested in investigating certain kinds of high-energy collisions between subatomic particles. They anticipate that the resulting science as theory will be excellent according to the internal standards of the practice of particle physics. However, this research program requires an enormous investment of resources – everything and everyone needed to construct, power, and run a superconducting supercollider. The particle physicists are unable to legally procure these resources, and decide that the best way to do so is to kidnap and hold for ransom the five wealthiest people in the world. Again, the first pass version of the ideal might be taken to imply that they should follow through with this morally abhorrent plan: ethical and political values play no role in science as practice, at

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<sup>3</sup> Philip Kitcher presents – and goes on to criticize – a similar view with similar qualifications in (2001, ch. 1).

least ideally.

What's gone wrong in these two cases? In both, moral restrictions have been violated. It is reasonable, I think, to construe these violations in terms of rights: the rights of the subjects in the Tuskegee Syphilis Study and the rights of the owners of the stolen resources in the second case. For the ideal of autonomous science as practice to be acceptable, it must recognize and respect the difference between acceptable and unacceptable means to the ends of science as theory. More generally, we can say that the means scientists use to produce science as theory must be morally permissible.

This leads us to the following revised version:

**IASP-revised** Scientists should engage in science as practice

- only for the sake of producing internal goods that are excellent according to the internal standards of science as practice, and
- only so long as the proposed means of producing those internal goods are morally permissible.

Combining this with the ideal of autonomous science as theory gives us the *final version*:

**IASP-final** Scientists should engage in science as practice

- only for the sake of producing science as theory that is excellent according to standards that are independent of any set of ethical and political values, and

- only so long as the proposed means for producing that science as theory are morally permissible.

The final version of the ideal recognizes that scientists do not automatically have access to all the resources needed to pursue their research programs. They will need, for example, to petition governmental and commercial sponsors for the resources needed to build large and expensive pieces of equipment – their governments will not just spontaneously decide to build a superconducting supercollider and then look around for a physicist interested in using it. Similarly, the final version of the ideal recognizes clear limits on how far scientists can go in their pursuit of science as theory. Ethical and political values have a legitimate, though extremely limited, role to play in setting external constraints on what scientific research should be done. It is, in particular, not permissible for science as practice to violate the rights of others in its pursuit of its own ends. Just as the first pass version of the ideal was glossed as the claim that *science as practice freely should pursue its own conception of the good*, this version can be glossed as the claim that *science as practice freely should pursue its own conception of the good, compatible with the same freedom for others*.

While ethical and political values constrain the choice of research program, they do not determine this choice. Society is not – or at least should not be – dictating to science as practice just what science as theory should be pursued. Instead, society and its ethical and political values impose some limited, external constraints on science as practice. Since these constraints are external, science as practice itself can still be said to be value-free or

value-neutral.

### **3 A politically neutral ideal?**

Now that I have defined the ideal of autonomous science as practice, I turn to criticism of it. In particular, I will argue that the ideal makes certain assumptions about the relationship between science as practice and society that are the same as assumptions about the relationship between individuals and society made by libertarianism (of the political, not mental, sort). These assumptions are much less plausible – and, thus, IASP is much less plausible – if one starts with alternate assumptions about individuals and society. Rather than being itself neutral with respect to ethical and political values, the ideal actually involves controversial ethical and political values. I will first identify two features of the ideal in §3.1, then relate these features to libertarianism in §3.2.

#### *3.1 Two Features of the Ideal*

The first feature of the ideal is that *scientists need not make decisions about which research programs to pursue with any regard to the consequences of those actions except the excellence of the theories produced*. Consider a research program into innate differences in mathematical ability between men and women and between various racial and ethnic groups. The science as theory produced by any such research program, whatever its actual content, is quite likely to have a pernicious effect on the education and careers of female and non-Anglo-American

mathematicians and scientists.<sup>4</sup> But suppose, in addition, that the *means* for producing this science as theory are morally permissible: no women or minorities were harmed in the making of this study. IASP implies that science as practice should observe the appropriate ethical restrictions on the treatment of human research subjects, but does not counsel against the research program on the grounds that it is liable to have pernicious *effects*. Indeed, it prohibits any consideration of such effects, in exactly the same way it requires scientists to ignore positive effects – e.g., technological innovation – in deciding whether to pursue a research program in pure science. Anticipated consequences, whether ethically positive or ethically negative, are specifically ruled out as grounds for pursuing a certain research program.

This point is not new. Indeed, proponents of the ideal have made the connection. The Nobel laureate physicist and philosopher of science Percy Bridgman, for example, “believed that any restriction, any external imposition of an agenda, would corrode the purity of the scientific enterprise” and “challenge[d] any social philosophy that required the *individual* scientist to be responsible for the use of his [*sic*] creations or the consequences of his discoveries” (quoted in Schweber (2000, 6), emphasis in Schweber). The historian Silvan Schweber has argued that this was actually the appeal of the ideal of autonomous science in the wake of the development of the atomic bomb – Bridgman made these remarks at a meeting of the American Association for the Advancement of Science in December 1946,

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<sup>4</sup> See Caplan and Caplan (2005) and Kitcher (2001, ch. 8) for criticisms that start in much the same place. Note that, while Kitcher’s own view does not have this first feature, it still exemplifies the second. Since Kitcher does not pretend his view is value-neutral, having this second feature is not an immediate problem for him.

responding to Oppenheimer's argument in November 1945 that the Los Alamos physicists must take responsibility for the consequences of their actions.

Thus, according to IASP, scientists *qua* scientists are not completely ethically responsible for their actions – they can only be judged epistemologically, by the quality of the science as theory they produce, and for the permissibility of the means used to produce it. But, far from being value-neutral and uncontroversial, exempting someone from ethical responsibility clearly *is* a matter of ethics, and *does* reflect certain values.

The second feature of the ideal is that *society is sharply distinguished from and external to science*. Society provides restraints on science, preventing it from harming others in pursuit of its good, and provides funding and other resources. As per the second clause of the final statement of the ideal, science cannot use absolutely any means in pursuit of its ends. But these limitations are minimal, and negative – they tell science only what it *cannot* do, not what it *should* do.

Society – in particular, the state – also prevents others from harming science, at least when things are working properly. As with both Brown and Polanyi, the ideal is best respected when external influence on science is minimal. The role of the state and other social institutions is to protect science from outside influence. In return for this, science owes society nothing, or almost nothing. Science produces goods for society only accidentally (technological innovations) or insofar as society has embraced the internal goods of science as its own, i.e., as society has learned from science to value pure scientific knowledge as a good

in itself. Society cannot expect, much less require, science to make social contributions.

Science has its own conception of the good, and society should not challenge or change that conception, merely enable science to autonomously pursue that good. Bridgman, for example, argues that society does not have “the right to exact ‘disproportionate service from special ability’” (quoted in Schweber (2000, 7)).

The two features are closely related. Among the consequences not to be taken into account when choosing between research programs is the anticipated positive social value and applicability of the resulting science as theory – the importance of the outcomes according to ethical and political values. Again, the scientist *qua* scientist is responsible for neither the positive or negative “side effects” of her research.<sup>5</sup>

### 3.2 *The Libertarian Connection*

In libertarian political philosophy, society is sharply distinguished from and external to individuals. The state’s sole legitimate function is to maintain the order needed for individuals to have and pursue freely their own conceptions of the good. The requirements that the state and other citizens can make of an individual are minimal – typically nothing more than restraint from performing actions that would interfere with the autonomy of others. In particular, neither the state nor other citizens are ever justified in appropriating the goods produced by the individual’s free labor, much less directing an individual’s labor for the

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<sup>5</sup> One wonders whether Bridgman would be equally rigorous about not taking responsibility – that is, credit and acclaim – for positive side effects of his research.

benefit of others. To do either – in the form, for example, of imposing an involuntary tax – would be (tantamount to) slavery. (Nozick, 1974, 169)

This is precisely the second feature of the ideal of autonomous science that I identified above. Just as others cannot expect the individual to produce any goods for the sake of others or the public good, society cannot expect science as practice to produce any science as theory for others or the public good. Society respects the individual's autonomy by allowing her to pursue his own conception of the good without requiring anything from her and with minimal interference – just enough to keep her from directly or actively harming others; and society respects science's autonomy by allowing it to pursue its own conception of the good without requiring anything of it and with minimal interference – just enough to keep it from directly or actively harming others. Society cannot require significant sacrifices of the individual/science, even for the sake of others' basic needs. To paraphrase Kitcher – who apparently failed to realize that there are libertarians who explicitly argue for the parallel point – one must believe that the duty to respect property rights is so strong that it is binding, even in situations that will adversely affect the underprivileged (2001, 103).

By contrast, egalitarian liberal and communitarian political philosophies generally require individuals to make some contribution to the public good or the good of others, even involuntarily. Typically, arguments for these claims appeal to interdependence – the deep need for human beings to live with others in society. John Rawls' original argument for his conception of justice as fairness – an egalitarian liberal conception – relies on a conception of

society as the “social union of social unions” and an argument that, for all human beings, a good life requires being part of such a union. (Rawls, 1999, §79) Similarly, Martha Nussbaum, another egalitarian liberal, has argued that the agency individuals gain by forming a state together is an important part of their freedom:

The ability to join with others to give one another laws is a fundamental aspect of human freedom. Being autonomous in this sense is no trivial matter: it is part of having the chance to live a fully human life. In our day . . . the fundamental unit through which people exercise this fundamental aspect of human freedom is the nation-state: it is the largest and most foundational unit that still has a chance of being decently accountable to the people who live there . . . . [T]he nation-state and its basic structure are . . . a key locus for persons’ exercise of their freedom. (Nussbaum, 2006, 257)

And Charles Taylor contrasts the “individualism” or “atomism” of Locke and Nozick (Taylor, 1985, 188) with his own communitarianism:

What has been argued in the different theories of the social nature of man [sic] is . . . that they only develop their characteristically human capacities in society. The claim is that living in society is a necessary condition of the development of rationality, in some sense of this property, or of becoming a moral agent in the full sense of the term, or of becoming a fully responsible, autonomous being. (190-1)

On none of these three views is society treated as something sharply distinguished from or external to the individual – an alien force, liable to be oppressive and distorting if its role is not severely restrained. Instead, the individual flourishes by contributing to the collective project of building and maintaining a just society. For both libertarianism and IASP, by contrast, society – and especially the state – is just such an alien force, and its influence must be restricted. This contrast suggests that a rival to IASP could describe a more positive, mutually enabling, relationship between society and science, one modeled on the conception of the enabling relationship between the individual and society in egalitarian liberalism and communitarianism.

Is the first feature of the ideal – that scientists need not make decisions about which research programs to pursue with any regard to the consequences of those actions except the quality of the theories produced – also libertarian? Insofar as libertarians hold that individuals need not take the full consequences of her actions into account, the answer is “yes.” Consider Nozick’s account of rights as “side constraints,” which he uses to contrast his political philosophy with utilitarianism:

In contrast to incorporating rights into the end state to be achieved, one might place them as side constraints upon the actions to be done: don’t violate constraints  $C$ . The rights of others determine the constraints upon your actions . . . . This view differs from one that tries to build the side constraints  $C$  into the goal  $G$ . The side-constraint view forbids you to violate these moral constraints in

the pursuit of your goals; whereas the view whose objective is to minimize the violation of these rights allows you to violate the rights (the constraints) in order to lessen their total violation in the society. (Nozick, 1974, 29)

On this view, I need only take (a) my individual ends and (b) the rights of everyone else involved into account when I deliberate over which course of action to take. And rights (and violations of rights) are not, strictly speaking, consequences or effects. It is more accurate to say they make some *means* of achieving my ends morally impermissible. Thus, I need not take either (c) anyone else's ends nor (d) the effects of my actions on others into account. As Analytic Marxist G.A. Cohen puts it, "For Nozick there is no more justice in a millionaire's giving a five dollar bill to a starving child than in his using it to light his cigar while the child dies in front of him." (Cohen, 1995, 31) But this is exactly what IASP says: scientists should only take into account (a) the internal goods of science as practice and (b) the moral permissibility of the means of producing those goods. They need not take either (c) or (d) into account. With respect to this feature, IASP *just is* a libertarian conception of rights as side-constraints on scientific research.

Again, there is a sharp contrast here with egalitarian liberal and communitarian views. An alternative to IASP that drew on these rival political philosophies would require scientists to take (c) and (d) into account when choosing a research program.

## 4 Conclusion

My claim in this paper is not that libertarianism and the ideal are wrong; this is not the place to argue points of political philosophy. I am arguing only that, since libertarianism is not value-neutral and the ideal has libertarian features, the latter is not value-neutral either. Because it depends on controversial ethical and political assumptions, it cannot be considered free of ethical and political values.

I also am not claiming that the autonomous pursuit of excellent science as theory is necessarily incompatible with the public good, or that the interests of science as practice are essentially opposed to the interests of other sectors of society. I do not deny that our lives are shot through with electronics that would not exist if research into mathematical logic and quantum mechanics had not been pursued. On the political side, libertarians have long and famously argued, following Adam Smith, that a free market, in which each individual freely pursues her or his self-interest with only minimal regard for the interests of others, tends to produce an optimal distribution of goods.

But libertarians and proponents of the ideal must admit the existence of cases in which the interests of various individuals conflict. To return to an earlier example, the interest neuroscientists have in pursuing their research into innate differences in mathematical ability conflicts with the interest female mathematicians and scientists have in not being stereotyped and marginalized. Any attempt to resolve this conflict must involve some ethical and political values – some way of weighing the two interests against each other. Perhaps the ideal is right

to give absolute weight to the interest of neuroscientists and give none to the female mathematicians and scientists; perhaps not. But, however we resolve this conflict, we must make at least an implicit appeal to some ethical and political values.

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