

South Dakota State University

Open PRAIRIE: Open Public Research Access Institutional Repository and Information Exchange

School of American and Global Studies Faculty
Publications with a focus on History,
Philosophy, Political Science, and Religion

School of American and Global Studies

2021

Scientific Practice and Democratic Virtues

Gregory R. Peterson

Follow this and additional works at: https://openprairie.sdstate.edu/hppr_pubs



Part of the [Ethics and Political Philosophy Commons](#), and the [Philosophy of Science Commons](#)

[Home](#) [Read](#) [Sign in](#)

CONTENTS

VIRTUE AND THE PRACTICE OF SCIENCE: MULTIDISCIPLINARY PERSPECTIVES

CHAPTER 21.

SCIENTIFIC PRACTICE AND DEMOCRATIC VIRTUES

GREGORY R. PETERSON

Introduction

Democracy and science, it might be thought, go hand in hand. As we commonly think of it, science has its roots in the heritage of Greek thought, and the same is true of democracy. And while Athenian democracy developed at best a complicated relationship with its intellectual luminaries, Athens was nevertheless home to both Plato's Academy and Aristotle's Lyceum. Nearly two centuries later, the scientific revolution most quickly took root in those nations that had come to have some semblance of democratic rule. While the Republic of Florence had passed under Medici control by the time Galileo was active, Newton's home was then the most democratic nation on earth. During the Cold War, the scientific achievements of the democratic West were often put forth as signs of its superiority over its communist foes, and the existence of Soviet scientist-dissidents such as Andrei Sakharov supported the narrative that the scientific enterprise, necessarily committed to the free exchange of ideas and the

[Previous: Justice on the Blockchain? What Might "Smart Contracts" Mean for Virtuous Action?](#)

pursuit of truth even when socially inconvenient, simply cannot thrive in more oppressive contexts.^[1]

The truth is admittedly more complicated: scientists aided and sometimes enthusiastically abetted the Nazi regime, and ongoing nuclear proliferation occurs only because of the many scientists—not all of them coerced—willing to contribute to such efforts. But such cases seem to be the exceptions, and they generally involve not the *pursuit* of science but its technological application. Genuine science plausibly needs, if not democracy, at least adequate freedom of expression in order for ideas to be communicated and critiqued. This was true enough in Galileo’s day that scholars had access not only to the great works of the past but also, with some effort, the works of contemporaries.^[2] On this account, if open, democratic regimes do not actively cause the flourishing of science, they at least do not suppress it, enabling the possibility of cumulative success over time.

But the arrow of causality may also run in the other direction. Democracy may not strictly need science, but it may be the case that the scientific mindset contributes to the quality and integrity of democratic forms of government. Indeed, one of the most persistent correlates to the emergence of democracy is the level of its citizens’ education, a point first noted by Seymour Lipset in 1959 and which continues to have significant support today.^[3] Importantly, education is not the same as *scientific* education, and it is quite possible that other features of education, including relevant components of civic education, account for the relationship. Even so, it is plausible to think that scientific thinking and therefore scientific training contribute to the quality and integrity of democratic regimes, and do so beyond the merely instrumental material benefits that science provides.

This paper briefly explores the case for this proposal. In particular, I argue that what we should think of as *democratic* virtues and *scientific* virtues overlap, and that, whatever other contributions science may bring, encouraging scientific training in a way that contributes to character formation also has positive political effects. First, I lay out a psychologically realistic account of moral and intellectual virtues, one that critically engages contemporary dual-process models of cognition to argue for an account of virtues in terms of integrated harmonic processing that involves both emotion and identity. Second, I introduce the concept of democratic virtues, and I distinguish these from merely civic virtues that support political institutions but not necessarily democratic ones. Although patriotism is a commonly named civic virtue, one can be patriotic with respect to either democratic or undemocratic regimes. But there may also exist specifically democratic virtues, including what we may call democratic trustworthiness, indicating a kind of trustworthiness that is not group-oriented and inversely related to political corruption. Third, I lay out the argument for scientific virtues as central to the conduct of science as a practice. Here I draw on Alasdair MacIntyre’s conception of practices in *After Virtue* to explain why scientific practice requires the development of both moral and intellectual virtues. Crucial to this argument is the understanding that science is a practice and not merely a body of knowledge, requiring the existence of

social institutions that facilitate that practice. To some extent, my argument here parallels that of Daniel Hicks and Thomas Stapleford, although their account is aimed at sociological analysis, not democratic values.^[4] As a practice, science requires the development of both moral and intellectual virtues. That science requires intellectual virtues may seem initially obvious; that science requires the development of moral virtues is perhaps less so. But scientific practice is very much social in character, involving collaboration and mutual trust, and without these qualities present in the community, science cannot advance. Fourth and finally, I bring these threads together. The virtues developed in the practice of science and democratic virtues are intersecting sets, and some of the virtues developed as a consequence of excellence in the practice of science, I argue, can and likely do contribute as well to democratic functioning. While this is to some extent true of moral virtues such as those concerning trustworthiness, the stronger influence likely comes from the intellectual virtues developed in the context of scientific practice that serve to inhibit cognitive biases that can impair the wisdom of the crowd. I conclude by citing some empirical studies that appear to point in this direction and that suggest a differentiation between the impact of science education and education generally.

Although the argument I make is primarily philosophical and conceptual, the overall approach is interdisciplinary. The study of virtue is no longer the province of philosophy alone, and it involves empirical claims that touch on psychology in particular. Any discussion of democratic virtues that claims to have empirical significance must engage other disciplines, notably political science, as well. In this, the argument aims to model an approach that is interdisciplinary in character and that recognizes the connections between philosophical argument and empirical impact.

The Idea of Virtue

When speaking of virtue, I use the term as is roughly typical in philosophical approaches to virtue, which is to treat it as a specific feature or trait of character, and not as a global evaluation of character in general, as it is sometimes used, both historically and in popular discourse. The term ‘trait’ itself is somewhat problematic, as it can suggest a permanent feature that, like a genetic trait, is fixed and automatic in its operation. The translation of the Greek *hexis* into Latin *habitus* to English *habit* is even worse in this regard, suggesting a trait that is not only automatically activated but thoughtlessly so. For Aristotle, virtues were not merely thoughtless habits, but dispositions produced by the “non-rational” part of the soul that nevertheless operated in accord with reason.^[5]

Aristotle’s psychology, while insightful, is in important respects premodern, and while contemporary virtue theorists generally agree in thinking of virtues as dispositions, they can mean very different things by this. Some stress an externalist behaviorist account associating virtue primarily with the action outcomes produced,^[6] while others stress an internalist account closely linked to psychology.^[7] Any

genuine virtue theory must acknowledge a role for both. A purely behaviorist theory would not be a genuine virtue theory at all, but merely a theory of moral behavior, and any such theory would likely need to be construed either in strict terms of deontological action or consequentialist outcome in a way foreign to most virtue theories that recognize the context-sensitivity integral to the concept of virtue. Conversely, any theory that focused only on internal qualities such as emotion or motive would not be able to discriminate between the truly virtuous and the merely well-intentioned. Many individuals mean well and may feel appropriate compassion for the suffering or anger at injustice and yet never genuinely follow through or, worse, become complicit in the acts they abhor. To be virtuous at a high level involves not merely the appropriate motive and emotion, but the capacity to act in the right way at the right time.

To say that virtues are traits is to imply that they are more than a matter of consciously willing the right thing, and built into the concept of virtue is the idea that, as traits or dispositions, they are standing features of character that are in certain respects automatic. In modern psychological parlance, virtues can to some extent be explained in terms of contemporary dual-processing models that distinguish between explicit cognitive processes accessible to conscious reflection and implicit cognitive processes that, while possessing content, are in most instances consciously accessible in the form of intuitions or emotion.^[8] Dual-process models have limitations, and psychology tends to emphasize those cases where processes conflict, what may be called “oppositional processing.”^[9] Such oppositional processing certainly occurs, and it provides a possibly satisfying explanation for the well-known philosophical problems of weakness of will and conflict of will, perhaps best documented in early form by Augustine.^[10] In contrast, fully formed virtues are best characterized in terms of ‘harmonic processing,’ where implicitly formed intuition and emotion works in concert with our explicit decision-making. Such harmonic processing appears characteristic of other forms of expertise, and a now substantial body of evidence supports this claim.^[11] On this account, the implicit processes constitute not mindless reflexes but winnowed wisdom, formed by experience, narrative, and example. Such wisdom is both emotionally embodied and deeply connected to the individual’s sense of moral identity. Thus, possessing the virtue of moral courage involves more than the episodic flash of emotion and action that rises in defense of an oppressed colleague, since such flashes may occur unreliably and, more importantly, not be deeply connected in any way to character and long-term dispositions. True moral courage emerges precisely because the being of one’s character is so aligned that in many cases, the proper expression of moral courage is a regular feature of who one is. Such expressions are not wooden or inflexible, and part of being truly courageous involves knowing when and how courage should best be expressed in a given context.

Not all virtues are moral virtues, and both Aristotle and Aquinas distinguish between moral and

^[12]

intellectual virtues. Strictly speaking, intellectual virtues such as practical wisdom and understanding are not moral virtues, although their proper functioning is important for the proper execution of moral virtue. The distinction between moral and intellectual virtues is primarily one of domain; intellectual virtues also involve integration with both emotion and identity. This may seem initially counterintuitive, especially since we tend to see the operations of reason and emotion as not only distinct but even diametrically opposed. We now know this claim to be largely incorrect, and a number of studies indicate that severing the neural circuits integrating reasoning and emotional processes leads to severe deficits in judgment, moral or otherwise.^[13] Deeper reflection suggests how this is true. Although we tend to stereotype rational reflection and activity—including scientific reflection and activity—as occurring best in the absence of emotion, this is far from true.

Certainly, some emotions and mood states, such as anxiety, interfere with clear thinking. Most instances of strong emotion are genuinely incompatible with deep explicit reflection on a problem, but scientific reflection and rational reflection more generally are consistent with and supported by a range of emotions, including the joy and pleasure one feels when solving a difficult mathematical or scientific problem and the initial frustration one feels when results don't turn out as planned. Frustration is a negative emotion, and while it may impel the novice to abandon further rational reflection, the expert will often find frustration itself a motivator. While it may not be strictly an emotion, the experience of *flow* first diagnosed by Mihaly Csikszentmihalyi^[14] also serves as a subtle positive reinforcement of intellectual activity. Likewise, identity plays a crucial role, a fact borne out by the now numerous studies on how self-perceptions and stereotypes of race and gender imposed by dominant groups can inhibit mathematical and scientific performance. To do science requires being able to see oneself as a scientist, and those who are unable to do so face internal barriers to achievement that can be difficult to overcome.^[15] Such achievement is particularly difficult in the absence of good mentoring and role models.

Keith Stanovich has recently argued that while it is standard to divide cognition into dual-processes, what we commonly think of as explicit processing can be further subdivided into algorithmic processing and reflective processing.^[16] While the former is characterized by the explicit rule-following characteristic of simple arithmetic or the step-by-step development of a proof or argument, the latter is characterized by more global assessments. While algorithmic processing consists in the kind of rationality captured by IQ tests, reflective processing is characterized by “cognitive styles” that protect against issues such as confirmation bias or my-side bias. Although Stanovich treats reflective processing as explicit, it would seem to have a clear implicit component as well, and much of what Stanovich describes as reflective processing bears more than a family resemblance to intellectual virtues.

The Idea of Democratic Virtues

Although Aristotle spoke only in terms of moral and intellectual virtues, it has been common, especially in recent decades, to speak also of civic virtues.^[17] For the ancients, the distinction between moral and civic virtue was not clear cut, and for Aristotle in particular moral virtues simply *were* civic virtues, since a life of virtue for Aristotle was a life lived in the context of a Greek polis committed to the flourishing of its citizens. This civic dimension of virtue revived with the rise of the Italian republics in the Middle Ages, most notably Florence and Venice.^[18] Although these republics defined themselves by their opposition to tyranny and their commitment to citizen flourishing, they typically lacked many of the ingredients we would now think essential to democratic governance. The point is an important one, for while their legacy is frequently pointed to as an important source for the concept of civic virtue, influencing later reflection and debate on the topic in England and North America, the specifics of their histories also highlight the fact that civic virtues are not necessarily synonymous with democratic virtues, and it is conceivable to be, for instance, deeply patriotically committed to a regime that is anything but democratic.

This raises an important issue regarding what should in fact count as a civic virtue. It might be thought that civic virtues are simply moral virtues and that, for instance, patriotism in support of autocratic regimes cannot be genuine patriotism because its aim is one contrary to proper human flourishing. In this context, it is probably better to think of civic virtues more like the way intellectual virtues are frequently conceived. Just as intellectual virtues are commonly thought of as qualities of character distinct from moral virtues, so too should we think of many civic virtues as distinct from moral virtues, and just as some intellectual virtues can be employed for bad ends, so too can civic virtues. But there may also be virtues which either directly or indirectly support democratic institutions, and I will refer to these as “democratic virtues.” Such virtues may also be intellectual, civic, or moral virtues, and while some civic virtues such as generic patriotism may also serve to support democratic institutions, some may also be distinctive in their support of democratic institutions and opposition to non-democratic ones. These democratic virtues may not be present on traditional virtue lists, with one obvious reason for this being that fully democratic institutions are a relatively modern invention. That a virtue is not named does not mean it does not exist, only that it has not yet been identified.^[19]

Thus, patriotism as such may only incidentally provide support for democratic polities, but there may also be a specific form of democratic patriotism, defined in terms of its commitment to not only one’s own democratic institutions but also those of others. MacIntyre’s analysis of patriotism argues that we should be skeptical of this.^[20] On his account, patriotism is rooted in the values of a particular community of which one is a part, and it is precisely because one is so rooted that one is willing to sacrifice and to militarily defend one’s country. Liberalism, committed as it is to forms of autonomy and

freedom unconstrained by prior commitments, is unable to generate such communal commitment, and as such can never truly serve as the basis of a political system. But it would be a mistake to think that these are the only two options, and a further mistake to think that participating in community and committing oneself to democratic institutions, both at home and abroad, are mutually exclusive. A *democratic* patriotism is one that distinguishes itself not by a nativist commitment to a national community but by a commitment to the very principles and institutions of which one's community is a part. Crucial here is the kind of community with which one identifies, as well as how that identity is expressed. When the community of Le Chambon-sur-Lignon risked its very existence to rescue Jews from the Nazis, for example, they were not betraying their own community for the sake of others but precisely living out the principles upon which their community was founded.^[21]

Such democratic patriotism would be but one instance of a democratic virtue, but others would be important as well. A substantial body of literature points to the importance of trust and trustworthiness for the success of democratic institutions, and surveys consistently show a significant correlation of generalized trust and democracy.^[22] But trust is at best only part of the equation, since it makes little sense to trust individuals who are not in fact trustworthy. Whether or not we think of willingness to trust as a virtue, gullibility—the disposition to trust excessively—is certainly a vice and a trait to be avoided. But trustworthiness is a virtue and a democratic trustworthiness, committed both to the democratic institutions of one's country and to reliable exchange and relation with all of one's fellow citizens and not just those of one's favored group based on class, sex, or race is arguably central to the persistence and success of a democratic polity. It may be democratic trustworthiness that is measured by Transparency International's Corruption Perceptions Index, which correlates inversely with levels of democratization.^[23] Individuals with the virtue of democratic trustworthiness holding positions in public institutions can find their character tested when those around them are corrupt, or when leaders who come to power aim to corrupt public institutions to their own benefit. At such times, democratically trustworthy individuals are forced to decide between their own short-term self-interest and their commitment to the public good, and in particular cases they may feel required to act as whistleblowers for the sake of the public interest.

Virtues of Scientific Practice

It is commonplace to think of science first and foremost in terms of its products, whether they be new scientific theories or the capacity for technological achievements. But technological advancement predates what we think of as modern science, as does the idea that science is a received body of knowledge. Indeed, a central feature of the break between modern science and the received science (natural philosophy) of Aristotle and Ptolemy widely recognized in the Middle Ages was the willingness

to abandon the notion that science simply is such a received body of knowledge. What makes science *science* is not the body of knowledge that it produces, but the way that such knowledge is produced. This knowledge production requires certain kinds of practices that are sometimes both demanding and difficult to learn. Training is thus essential, and training in turn requires the persistence of communities of scientists committed both to maintaining the norms of practice and to passing the practices and their norms to succeeding generations.

It is commonplace to render scientific practice into the conception of the scientific method, and then to package the scientific method in such a way that it can be easily taught to students in science classes learning both the content and practice of science for the first time. In this narrow view of scientific practice, scientific practice just is a formulaic application of the scientific method, and in such contexts the scientific method is often reduced to a simple script consisting of literature review, hypothesis formation, hypothesis testing, and interpretation of tests in terms of confirmation and/or falsification. The problems with this approach as an actual description of scientific practice are well-known, for it at best significantly underdetermines what is involved in scientific practice and at worst significantly misconstrues how scientific knowledge is generated. These points were first highlighted in a significant way by Thomas Kuhn,^[24] and subsequent generations of philosophers of science have sought with varying degrees of success to resolve these issues.

A broader conception of scientific practice is thus needed. The idea that science is an enterprise constituted by a set of practices will seem not at all strange to virtue ethicists. In his influential *After Virtue*, Alasdair MacIntyre lays out an account of practices in relation to the virtues, and he even briefly alludes to science as a practice within which virtues are developed.^[25] For MacIntyre, a practice just is a cooperative human activity that is able to produce goods internal to the activity and in which there can be demonstrated forms of excellence.^[26] A simplistic game or activity like tic-tac-toe cannot be a practice because it is not sufficiently complex to enable excellence or the production of internal goods. Chess, however, is such a practice, and MacIntyre makes a point of emphasizing that, while the novice chess player may initially play only to seek goods external to the game of chess itself (esteem of one's friends, prize in a competition), the experienced chess player is one who typically learns to internalize the goods of playing chess and to value them in their own right. Certain virtues are required in the playing of chess, and these must be developed through time, experience, and example in order to achieve excellence at the game.

As a game, chess provides a very limited example, but MacIntyre's analysis applies well to scientific practice. While science may be pursued for goods purely outside of the practice of science, there also exist goods internal to the practice of science, and the best scientists are often those who are motivated by the internal goods even in the absence of external ones. As a complex practice, science requires the

development of certain moral and intellectual virtues. That the practice of quality science requires the development of intellectual virtues is not surprising, given that we conceive of science primarily as a rational activity—indeed, many would regard the practice of science as the practice of rational activity par excellence. Plausible candidates for intellectual virtues important for the practice of science include curiosity, perseverance, conscientiousness, and creativity.^[27] Perseverance may not at first seem like an intellectual virtue, but perseverance in intellectual activity can be an especially important quality for scientists given that research projects often span years or even decades before promising results emerge. Likewise, creativity is often underestimated as an important quality, in part because we often think skill in science to consist largely of mathematical ability combined with in-depth knowledge of the subject material. But the problems that science poses are often quite vexing, and finding a good scientific model requires much more than simple Baconian induction. When we do recognize the importance of creativity, we often then ascribe it primarily to creative geniuses such as Einstein, implying that creativity is simply something one is born with: some people have it and some don't. But in most instances, creativity can to some extent be learned, and scientific creativity is made possible by both deep training and deep knowledge of the material.

But as much as the practice of science requires intellectual virtues, it requires certain moral virtues as well. Paramount to the practice of science is a commitment to truth, which requires both honesty and integrity. Scientists who willfully fabricate data or results do significant damage to science as a practice, since undetected fraud can lead to much wasted effort by other scientists and significantly damage not only the careers of the scientists who rely on the fraudulent work but also the standing of science with the public. Integrity—understood here as a form of moral courage in the face of adversity—comes into play both with respect to fellow scientists and with respect to a sometimes hostile public that feels threatened by the implications of a scientific theory. Not only may politicians exert pressure on scientists to avoid areas of research that are controversial, corporations may seek to bribe or co-opt scientists to hinder the spread of truths they find inconvenient.^[28]

Since science is often if not typically a collective endeavor, the development of a sense of fair play and interpersonal justice can be crucial. The collaborator who brazenly insists that she be first author even when she has only contributed modestly to a project will soon find herself involved in no projects at all. Crucially, scientific fair play involves a commitment to treating scientific collaborators as equals regardless of race or gender and regardless of personal attitudes towards politics and religion. In addition to whatever moral injury is caused by failing to act fairly, successful scientific collaboration requires both mutual respect and a sense of obligation to carry one's own weight. When these are lacking, collaborations break down or become ineffective. This social character of science is in some respects distinctively modern, but it is important to note that science has always involved some level of collaboration. The Royal Society was established in 1660, and it was founded precisely due to the

perceived need for scientists to interact and productively disseminate and critique each other's work.

Other relevant intellectual and moral virtues could be listed. While some of these virtues may already be possessed to some degree by individuals who choose to pursue science as a passion or career, it is important to note the central role that scientific exemplars and mentors can play in the development of these virtues. This is perhaps most true of intellectual virtues, but it holds for moral virtues as well. Lead scientists who run a lab poorly not only harm the careers of those who work there, they provide a poor model of scientific leadership for those under them. It must also be noted that, while scientists sometimes meet these ideals, many do so only partially, and some act contrary to the norms of science, resulting in all too frequent cases of fraud and misrepresentation of data. As a robust and self-correcting practice, science can often manage such cases. But as with any practice, excessive violation of standards can erode the institution, even enough to cause collapse.

Democratic and Scientific Virtues as Intersecting Sets

It is perhaps obvious that, however we think of scientific virtues and democratic virtues, their relation is not one of identity. Democratic patriotism may be a democratic virtue, but there is little reason to think that it does or should play a role in the practice of science. Somewhat less likely, it may also be the case that the practice of science in particular disciplines requires a damping down of particular emotional reactions that are important to virtuous behavior outside the scientific realm. A number of studies, for instance, show that medical doctors demonstrate lower levels of emotional empathy than average individuals, a process that appears to develop during medical school as students find that continual empathizing with patients is emotionally exhausting.^[29] This can be problematic for effective communication with patients, and a number of programs now exist to correct the problem.^[30]

But there are a number of cases where potentially interesting overlap exists for both moral and intellectual virtues. As already noted, democratic trustworthiness is one potentially important virtue for democratic societies. It is typically not enough to have well-structured institutions and laws that promote trustworthiness, and it is not even enough to rely on a division of powers based on mutual self-interest as a protection against untrustworthy individuals.^[31] When democratic institutions are imposed on countries by foreign powers, they often fail, and a central reason for such failure is that even well-designed institutions can collapse when there exists insufficient commitment to the public good. How is such commitment developed? Science as a practice does not directly aim at the production of democratic trustworthiness, but, as mentioned earlier, the practice of science requires the development of honesty and integrity. A scientific community that had an insufficient number of members committed to honesty and integrity would simply die in confusion. In the scientific context, honesty and integrity are strongly

complementary virtues, since an honest scientist who lacks the moral courage embodied in integrity will be able to practice science effectively only as long as such science is uncontroversial and lacking the significance to garner significant critical attention. The practice of science thus needs individuals who will stand by their results even when it is unpopular to do so, whether the criticism comes from within the scientific community or outside of it. In this context, it is important to note how such honesty and integrity can conflict with the scientist's own self-interest as normally conceived. In the short run it can be advantageous to yield to criticism, pretend that the results were other than they were, and even in the long run it may be prudent to simply shift focus to topics that are less controversial and possibly more lucrative.

Nonscientists should regard science as a practice to be epistemically trustworthy in part because individual scientists are morally trustworthy. And we might expect that once a scientist has internalized the virtue of trustworthiness within the domain of science, the scientist will carry that norm into areas outside of the practice of science. It would simply be embarrassing and provoke cognitive dissonance for someone who is scientifically trained and who internalizes the norms of science to produce a business report or the minutes of a meeting that were inaccurate, not simply because doing so might lead to bad outcomes and not only because it would reflect badly on her if the mistakes were discovered, but because doing so would be contrary to her understanding of who she is. Good scientists don't falsify or misrepresent data, and this is true whether operating within the context of scientific practice or outside of it. More importantly, individuals who have had sufficient scientific training and have internalized the values of science, whether they go on to a career in science or not, will share these values, and such values, when integrated into a person's identity, will impact the other domains of life.

We begin to see, then, how scientific trustworthiness begins to translate into democratic trustworthiness. Very few professional scientists enter politics directly, but many who receive scientific training go on to careers other than in science, including careers in the public sector or careers that disproportionately influence those who are in the public sector. The institution of science contributes to the formation of individuals who possess the virtue of trustworthiness, and these individuals then go on to participate in other institutions, thereby affecting their trustworthiness as well. It is important to note that scientific trustworthiness, much like democratic trustworthiness, involves a commitment to the principles of the institution that transcend the interests of the group. This can produce painful dilemmas for scientists who sometimes have to choose between their commitment to scientific principles and the commitments of, for instance, co-religionists or political community.

Such a model is plausible, but we might also expect the results to be modest: not all professional scientists internalize trustworthiness adequately, and those who receive lesser degrees of scientific training will internalize trustworthiness to a lesser degree as well. It is plausible, therefore, that the

intellectual virtues formed as result of participation in scientific practice play a larger role in the functioning of democracy. One standard line of argument in favor of democracy as a form of government is the claim that democracy benefits from the “wisdom of the crowd,” the idea that in some contexts groups of individuals make better decisions than an individual does alone. First formalized by Condorcet, modern scientists have observed a number of instances where group estimation of events reliably predict future outcomes.^[32] But, as Condorcet noted, the reliability of prediction depends on whether members of the crowd have accurate information, and in some cases individuals make poorer decisions when acting as part of a group than when acting independently.^[33]

At least some of this difference in performance is explained by the existence of cognitive biases. Cognitive scientists have diagnosed a substantial number of such biases. Confirmation bias and variations thereof are perhaps the most discussed, but other biases include the anchoring effect and hindsight bias.^[34] Biases are not inherently bad, and many such biases operate effectively as heuristics in the proper environment.^[35] Take, for example, confirmation bias. If the great majority of one’s judgments are well-formed, it will in most cases make sense to rely on such previously formed judgments when encountering new information. If I am sleeping on a train traveling in Europe and wake up to see Greek signs out the window, it is reasonable to infer that I am in Greece rather than that I am passing through a movie set with Greek street signs. Biases become problematic, however, when they activate improperly and contribute to faulty inferences. Confirmation bias can and often does go wrong, and can in this sense be an intellectual vice.

Samuelson and Church have recently argued for an interpretation of the failures of cognitive biases in terms of a lack of the virtue of intellectual humility.^[36] They note that in the cognitive bias literature most biases are understood to be failure of implicit processing, often referred to as Type 1 processing. Further, they note that many of these biases are egocentric in nature: the failure of confirmation bias thus gives improper weight to one’s own prior commitments. As a result, they argue, overreliance on such automatic, implicit processing can be understood as a form of intellectual arrogance. Such individuals lack intellectual humility, which requires an openness to the other as other and the willingness to consider other sources of information as important as one’s own.^[37]

Samuelson and Church employ a default-interventionist model of interaction between implicit and explicit processing that is slightly different than the harmonic processing account of virtue I have proposed, but their argument supports the case I am making here: implicit processes are not simply automatic but subject both to training and learning processes and to dynamic interaction with explicit forms of processing. We all may have cognitive biases and we may all be susceptible to them to varying degrees, but we are not all equally susceptible. If we are careful, we can learn to identify and to correct them, internalizing epistemic norms associated with virtues such as intellectual humility which help us

to better process information and make good judgments.

Scientific training and participation in scientific practice is one likely source, though not the only one, for the development of intellectual virtues that protect against faulty cognitive biases. Scientific training requires precision in reasoning and causal reasoning in particular, and good scientific training involves recognition of cognitive biases that lead to errors both in interpretation of data and application of theory. Heuristic rules such as “correlation does not necessarily imply causation” and “absence of evidence does not necessarily imply evidence of absence,” or even “the simplest explanation is the best,” embody principles important to the practice of science that are also context-sensitive and thus associated with the cultivation of intellectual virtues. Good hypothesis testing involves principles of logical inference and falsification, and the practice of science in general requires the development of a healthy skepticism requiring skillful discrimination between reliable and unreliable sources of information.

It is relatively easy to see how the intellectual virtues inculcated in scientific practice benefit democratic institutions, serving not merely as scientific virtues but as democratic virtues as well. If democracy is dependent on the wisdom of the crowds, democracy can only function well if a sufficient proportion of the crowd is able to interpret evidence appropriately. Much recent evidence supports the conclusion that our political decision-making is subject to the same biases found elsewhere and that political decision-making is further influenced by group identity and norms of judgment and, increasingly, by forms of technology and social media that encourage forms of “enclave deliberation” reinforcing these effects. [\[38\]](#)

Recent evidence suggests that college education in and of itself does not protect against these effects, and the highly educated can be even more prone to partisan polarization about subjects such as climate change in ways that suggest, at least sometimes, greater bias than the less-well informed. [\[39\]](#) There seems to be a particular reason for this: many highly educated individuals have the same biases as less educated individuals, but because they are typically better at explicit (Type 2) reasoning, they are also better able to manufacture reasons justifying their already biased position. Such individuals would appear to lack the intellectual humility championed by Samuelson and Church, although in these cases the vice is located much more in the interaction between the forms of processing.

The fact that the highly-educated may be more biased and polarized in their handling of information may seem surprising at first, especially given the extensive research showing a strongly positive relationship between education and democratization. There are a number of possibilities here, but one possibility is that the *kind* of education citizens receive is important, and the fact that most college students go into fields other than science may be important. Students usually receive some science education in primary and secondary education, and in many cases whatever additional science education they receive in college only adds minimally to what they have already received. In addition, many of those who do

receive science training do so in the context of professional training in such areas as engineering and medicine, where the goal is not so much to learn how to be a scientist but to apply the results of scientific knowledge to a particular professional field. Although such individuals would receive considerably more exposure to science than individuals who pursue degrees in marketing or English, their engagement with science as a practice may not be sufficiently different to distinguish the values they internalize from those internalized by people with only a high school education.

More recent research by Kahan, et al, supports this general point,^[40] providing evidence that possession of a specific trait, science curiosity, counters biased reception of information and instead encourages open engagement, even when the information received is contrary to a subject's existing views. Further research will be needed to support the empirical claim that scientific virtues positively impact political decision-making, but my point here is primarily conceptual: if we understand what scientific virtues are, we should realize that they are the kind of virtues which, when employed in the political sphere, support democratic institutions and thus may be counted as democratic virtues. In particular, science as a practice encourages and even requires the development of intellectual virtues that are also important for the sustenance of democratic institutions. Given the small percentage of the population that is active in scientific professions or that holds advanced degrees in the natural or social sciences, it might be thought that even if there is such a positive impact, it must be quite small. But a couple of things could be said here. First, a constituency does not have to constitute a majority to have a significant political impact, and influential minorities can sometimes have substantial influence on the course of political deliberation.^[41] Second, we need not think of scientific virtues as being the sole possession of practicing scientists; students who receive some modicum of training in primary and secondary education may develop virtues such as scientific curiosity, even if only in attenuated form. But if this analysis is correct, it suggests an added value to science education beyond its clearly economic value and the value of the knowledge it produces. If done right, science education contributes to the development of scientific virtues, and so also to democratic virtues. Science education is thus also civic education, providing an additional reason to improve science education not only locally but also globally.

Conclusion

The argument developed in this paper is admittedly but a sketch, and more work needs to be done to make it conceptually compelling. Particularly needed are philosophically useful phenomenologies of scientific practice, which among other things would aid in our ability to identify relevant scientific virtues and their potential impact outside their immediately relevant context. It is important to note in this context that, while genuinely internalized scientific virtues may in fact contribute to the stability of democratic institutions, this is very different from claiming that scientists are all intellectual or moral

paragons. Quite the opposite: the history of science is replete with stories of scientists behaving badly. Many practicing scientists are able to produce good science while never fully internalizing the virtues of their scientific discipline, and many scientists are able to bracket their values while supporting morally troubling or even clearly evil practices in other domains of their lives.

Further, we should understand the present impact of scientific virtues on democratic institutions to be quite modest, given the relatively weak status of scientific education as a whole in the United States if not in Europe. Stronger scientific education would undoubtedly improve the situation, but it is also important to remember that the presence of scientific virtues is but one of many factors that can contribute to strong democratic institutions, and likely not the most significant. Nevertheless, democracies rely on an educated citizenry, and the wisdom of crowds can only be tapped if such wisdom is in fact present.

GREGORY R. PETERSON is Professor of Philosophy and Religion and Director of the Ethics Lab at South Dakota State University. In addition to numerous journal articles, he is author of *Minding God: Theology and the Cognitive Sciences* (2003) and the co-editor of several volumes, most recently *Property Rights in Contemporary Governance* (2019). Current research interests include virtue theory, political philosophy, applied ethics, experimental ethics, and democratization. Dr. Peterson is the recipient of numerous grants and fellowships from the National Science Foundation, the National Endowment for the Humanities, and the John Templeton Foundation.

Bibliography

- Alemán, Eduardo, and Yeaji Kim. “The Democratizing Effect of Education.” *Research & Politics* 2.4 (2015): 1–7.
- Aristotle. *Nicomachean Ethics*. Edited by Roger Crisp. Cambridge: Cambridge University Press, 2000.
- Aquinas, Thomas. *The Summa Theologica*. Translated by the Fathers of the English Dominican Province. New York: Benziger Bros., 1947.
- Augustine. *The Confessions*. Translated by Maria Boulding. Hyde Park, NY: New City Press, 2001.
- Banakou, Domna, Sameer Kishore, and Mel Slater. “Virtually Being Einstein Results in an Improvement in Cognitive Task Performance and a Decrease in Age Bias.” *Frontiers in Psychology* 9 (2018). <https://doi.org/10.3389/fpsyg.2018.00917>.
- Bargh, John A., Peter M. Gollwitzer, Annette Lee-Chai, Kimberly Barndollar, and Roman Trötschel. “The Automated Will: Nonconscious Activation and Pursuit of Behavioral Goals.” *Journal of Personality and Social Psychology* 81.6 (2001): 1014–27.
- Barro, Robert J. “Determinants of Democracy.” *Journal of Political Economy* 107.S6 (December

1999): S158–83.

- Bilalić, Merim, Andrea Kiesel, Carsten Pohl, Michael Erb, and Wolfgang Grodd. “It Takes Two: Skilled Recognition of Objects Engages Lateral Areas in Both Hemispheres.” *PLoS ONE* 6.1 (2011): e16202. <https://doi.org/10.1371/journal.pone.0016202>.
- Breda, Thomas, Elyès Jouini, and Clotilde Napp. “Societal Inequalities Amplify Gender Gaps in Math.” *Science* 359.6381 (March 16, 2018): 1219–20.
- Centola, Damon, Joshua Becker, Devon Brackbill, and Andrea Baronchelli. “Experimental Evidence for Tipping Points in Social Convention.” *Science* 360.6393 (June 8, 2018): 1116–19.
- Csikszentmihalyi, Mihaly. *Creativity: Flow & the Psychology of Discovery & Invention*. London: Harper & Row, 1997.
- Damasio, Antonio. *Descartes’ Error: Emotion, Reason, and the Human Brain*. New York: Penguin, 1994.
- Doris, John M. *Lack of Character: Personality and Moral Behavior*. Cambridge: Cambridge University Press, 2002.
- Driver, Julia. *Uneasy Virtue*. Cambridge: Cambridge University Press, 2001.
- Evans, Jonathan St.B.T., and Keith Frankish, eds. *In Two Minds: Dual Processes and Beyond*. New York: Oxford University Press, 2009.
- Frankish, Keith. “Dual-Processing and Dual-System Theories of Reasoning.” *Philosophy Compass* 5.10 (2010): 914–26.
- Gigerenzer, Gerd. *Gut Feelings: The Intelligence of the Unconscious*. London: Viking Penguin, 2007.
- Gingerich, Owen. *The Book Nobody Read: Chasing the Revolutions of Nicolaus Copernicus*. New York: Walker & Company, 2004.
- Glaeser, Edward L., Rafael La Porta, Florencio Lopez-De-Silanes, and Andrei Shleifer. “Do Institutions Cause Growth?” *Journal of Economic Growth* 9.3 (2004): 271–303.
- Haidt, Jonathan, and Fredrik Bjorklund. “Social Intuitionists Answer Six Questions about Moral Psychology.” In *The Cognitive Science of Morality: Intuition and Diversity*, edited by Walter Sinnott-Armstrong, 181–218. *Moral Psychology*, Volume 2. Cambridge, MA: MIT Press, 2008.
- Hallie, Philip Paul. *Lest Innocent Blood Be Shed: The Story of Le Chambon and How Goodness Happened There*. New York: Harper & Row, 1979.
- Hertwig, Ralph, and Gerd Gigerenzer. “The ‘Conjunction Fallacy’ Revisited: How Intelligent Inferences Look Like Reasoning Errors.” *Journal of Behavioral Decision Making* 12 (1999): 275–305.
- Hicks, Daniel J., and Thomas A. Stapleford. “The Virtues of Scientific Practice: MacIntyre, Virtue Ethics, and the Historiography of Science.” *Isis* 107.3 (2016): 449–72.
- Hursthouse, Rosalind. *On Virtue Ethics*. New York: Oxford University Press, 1999.

- Kahan, Dan M., Asheley Landrum, Katie Carpenter, Laura Helft, and Kathleen Hall Jamieson. “Science Curiosity and Political Information Processing: Curiosity and Information Processing.” *Political Psychology* 38 (February 2017): 179–99.
- Kahan, Dan M., Ellen Peters, Maggie Wittlin, Paul Slovic, Lisa Larrimore Ouellette, Donald Braman, and Gregory Mandel. “The Polarizing Impact of Science Literacy and Numeracy on Perceived Climate Change Risks.” *Nature Climate Change* 2 (May 2012): 732.
- Kahneman, Daniel. *Thinking, Fast and Slow*. New York: Farrar, Straus and Giroux, 2011.
- Klein, Gary. *Sources of Power: How People Make Decisions*. Cambridge, MA: MIT Press, 1998.
- Kuhn, Thomas. *The Structures of Scientific Revolutions*. Chicago: University of Chicago Press, 1962.
- Lipset, Seymour Martin. “Some Social Requisites of Democracy: Economic Development and Political Legitimacy.” *American Political Science Review* 53.1 (1959): 69–105.
- Lorenz, J., H. Rauhut, F. Schweitzer, and D. Helbing. “How Social Influence Can Undermine the Wisdom of Crowd Effect.” *Proceedings of the National Academy of Sciences* 108.22 (2011): 9020–25.
- MacIntyre, Alasdair. *After Virtue*. Notre Dame, IN: University of Notre Dame Press, 1981.
- ———. *Is Patriotism a Virtue?* Lawrence: University of Kansas Press, 1984.
- Miller, Christian B. *Character & Moral Psychology*. New York: Oxford University Press, 2014.
- Montesquieu. *The Spirit of the Laws*. Edited by Anne M. Cohler, Basia C. Miller, and Harold S. Stone. Cambridge: Cambridge University Press, 1989.
- Narvaez, Darcia. “Moral Complexity: The Fatal Attraction of Truthiness and the Importance of Mature Moral Functioning.” *Perspectives on Psychological Science* 5.2 (2010): 163–81.
- Oreskes, Naomi, and Erik M. Conway. *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming*. New York: Bloomsbury Press, 2011.
- Pocock, J.G.A. *The Machiavellian Moment: Florentine Political Thought and the Atlantic Republican Tradition*. Princeton, NJ: Princeton University Press, 1975.
- Putnam, Robert D. *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon & Schuster, 2000.
- Riess, Helen, John M. Kelley, Robert W. Bailey, Emily J. Dunn, and Margot Phillips. “Empathy Training for Resident Physicians: A Randomized Controlled Trial of a Neuroscience-Informed Curriculum.” *Journal of General Internal Medicine* 27.10 (2012): 1280–86.
- Russell, Daniel C. *Practical Intelligence and the Virtues*. Oxford: Oxford University Press, 2009.
- Samuelson, Peter L., and Ian M. Church. “When Cognition Turns Vicious: Heuristics and Biases in Light of Virtue Epistemology.” *Philosophical Psychology* 28.8 (2015): 1095–1113.
- Shapiro, Johana, Elizabeth H. Morrison, and John R. Boker. “Teaching Empathy to First-Year Medical Students: Evaluation of an Elective Literature and Medicine Course.” *Education for Health*

17 (2004): 73–84.

- Simonton, Dean Keith. *Creativity in Science: Chance, Logic, Genius, and Zeitgeist*. Cambridge: Cambridge University Press, 2004.
- Spezio, Michael, Gregory Peterson, and Robert C. Roberts. “Humility as Openness to Others: Interactive Humility in the Context of L’Arche.” *Journal of Moral Education* (April 2018): 1–20.
- Stanovich, Keith E. *Rationality and the Reflective Mind*. New York: Oxford University Press, 2011.
- Sunstein, Cass R. *#Republic: Divided Democracy in the Age of Social Media*. Princeton, NJ: Princeton University Press, 2017.
- Surowiecki, James. *The Wisdom of Crowds*. New York, NY: Anchor Books, 2005.
- Welzel, Christian. *Freedom Rising: Human Empowerment and the Quest for Emancipation*. Cambridge: Cambridge University Press, 2013.
- Williams, Carol A. “Empathy and Burnout in Male and Female Helping Professionals.” *Research in Nursing & Health* 12.3 (June 1989): 169–78.
- Wolfe, Audra J. *Freedom’s Laboratory: The Cold War Struggle for the Soul of Science*. Baltimore, MD: Johns Hopkins University Press, 2018.
- Zagzebski, Linda. *Divine Motivation Theory*. Cambridge: Cambridge University Press, 2004.

1. Audra J. Wolfe, *Freedom’s Laboratory: The Cold War Struggle for the Soul of Science* (Baltimore, MD: Johns Hopkins University Press, 2018). [↵](#)
2. Owen Gingerich, *The Book Nobody Read: Chasing the Revolutions of Nicolaus Copernicus* (New York: Walker & Company, 2004). [↵](#)
3. Robert J. Barro, “Determinants of Democracy,” *Journal of Political Economy* 107.S6 (December 1999): S158–83; Edward L. Glaeser et al., “Do Institutions Cause Growth?,” *Journal of Economic Growth* 9.3 (2004): 271–303; Eduardo Alemán and Yeaji Kim, “The Democratizing Effect of Education,” *Research & Politics* 2.4 (October 2015): 1–7. [↵](#)
4. Daniel J. Hicks and Thomas A. Stapleford, “The Virtues of Scientific Practice: MacIntyre, Virtue Ethics, and the Historiography of Science,” *Isis* 107.3 (2016): 449–72. [↵](#)
5. Aristotle, *Nicomachean Ethics*, edited by Roger Crisp (Cambridge: Cambridge University Press, 2000). [↵](#)
6. Julia Driver, *Uneasy Virtue* (Cambridge: Cambridge University Press, 2001); John M. Doris, *Lack of Character: Personality and Moral Behavior* (Cambridge: Cambridge University Press, 2002); Christian B. Miller, *Character & Moral Psychology* (New York: Oxford University Press, 2014). [↵](#)
7. Linda Zagzebski, *Divine Motivation Theory* (Cambridge: Cambridge University Press, 2004); Rosalind Hursthouse, *On Virtue Ethics* (New York: Oxford University Press, 1999). [↵](#)
8. Jonathan St.B.T. Evans and Keith Frankish, eds., *In Two Minds: Dual Processes and Beyond* (New

- York: Oxford University Press, 2009); Keith Frankish, “Dual-Processing and Dual-System Theories of Reasoning,” *Philosophy Compass* 5.10 (2010): 914–26; Keith E. Stanovich, *Rationality and the Reflective Mind* (New York: Oxford University Press, 2011). [↵](#)
9. Jonathan Haidt and Fredrik Bjorklund, “Social Intuitionists Answer Six Questions about Moral Psychology,” in *The Cognitive Science of Morality: Intuition and Diversity*, edited by Walter Sinnott-Armstrong (Cambridge, MA: MIT Press, 2008), 181–218; John A. Bargh et al., “The Automated Will: Nonconscious Activation and Pursuit of Behavioral Goals,” *Journal of Personality and Social Psychology* 81.6 (2001): 1014–27. [↵](#)
 10. Augustine, *The Confessions*, translated by Maria Boulding (Hyde Park, NY: New City Press, 2001). [↵](#)
 11. Darcia Narvaez, “Moral Complexity: The Fatal Attraction of Truthiness and the Importance of Mature Moral Functioning,” *Perspectives on Psychological Science* 5.2 (2010): 163–81; Merim Bilalić, et al., “It Takes Two –Skilled Recognition of Objects Engages Lateral Areas in Both Hemispheres,” *PLoS ONE* 6.1 (January 24, 2011): e16202, <https://doi.org/10.1371/journal.pone.0016202>; Gary Klein, *Sources of Power: How People Make Decisions* (Cambridge, MA: MIT Press, 1998); Gerd Gigerenzer, *Gut Feelings: The Intelligence of the Unconscious* (London: Viking Penguin, 2007). [↵](#)
 12. Aristotle, *Nicomachean Ethics*, edited by Roger Crisp (Cambridge: Cambridge University Press, 2000); Thomas Aquinas, *The Summa Theologica*, translated by the Fathers of the English Dominican Province (New York: Benziger Bros., 1947). [↵](#)
 13. Antonio Damasio, *Descartes’ Error: Emotion, Reason, and the Human Brain* (New York: Penguin, 1994). [↵](#)
 14. Mihaly Csikszentmihalyi, *Creativity: Flow & the Psychology of Discovery & Invention* (London: Harper & Row, 1997). [↵](#)
 15. Thomas Breda, Elyès Jouini, and Clotilde Napp, “Societal Inequalities Amplify Gender Gaps in Math,” *Science* 359.6381 (March 16, 2018): 1219–20; Domna Banakou, Sameer Kishore, and Mel Slater, “Virtually Being Einstein Results in an Improvement in Cognitive Task Performance and a Decrease in Age Bias,” *Frontiers in Psychology* 9 (June 11, 2018), <https://doi.org/10.3389/fpsyg.2018.00917>. [↵](#)
 16. Stanovich, *Rationality and the Reflective Mind*. [↵](#)
 17. Google’s ngram viewer reveals a gradual though uneven gain of usage for “civic virtue” over the past two hundreds years, with a sharp increase in the 1980s, perhaps due to the renewed interest in virtues more generally (https://books.google.com/ngrams/graph?content=civic_virtue&year_start=1800&year_end=2000&corpus=15&smoothing=3, accessed December 12, 2018). [↵](#)
 18. J.G.A. Pocock, *The Machiavellian Moment: Florentine Political Thought and the Atlantic*

Republican Tradition (Princeton, NJ: Princeton University Press, 1975). [↵](#)

19. Debates exist over the enumeration of virtues; these include whether a full list of virtues can be given, whether such virtues are cross-culturally universal, and whether such a list must even be finite. For instance, Daniel C. Russell, in *Practical Intelligence and the Virtues* (Oxford: Oxford University Press, 2009), argues that there cannot be an infinite number of virtues without the concept becoming vacuous, and, further, that if there are not cross-culturally universal virtues this also raises important issues of moral relativism which would be of particular importance to the political domain. I would suggest that the answer to this question follows a similar line of argument to that concerning the universality of emotions: while there exist emotions that appear to be culturally distinct (e.g., Japanese *ijirashi*—the emotion of admiring of another who has overcome an obstacle—or Ifaluk *song*—a sort of righteous indignation), the specificity of emotions is grounded in features of human biology that are universal or nearly so. Thus, Ifaluk *song* may not be quite the same as “anger” in the American context, but there are significant overlaps, and English speakers can recognize most if not all of the features of *song* if it is adequately explained to them. Similarly, there may be particularity of virtue expression across cultures, but since virtues are deeply connected to human well-being, and since human well-being *is* in significant respects universal by definition of being *human* well-being, there exists a common core of value which virtues must also tap (for more on this argument, see Gregory R. Peterson, *Just Virtues*, in preparation). [↵](#)
20. Alasdair MacIntyre, *Is Patriotism a Virtue?* (Lawrence: University of Kansas Press, 1984). [↵](#)
21. Philip Paul Hallie, *Lest Innocent Blood Be Shed: The Story of Le Chambon and How Goodness Happened There* (New York: Harper & Row, 1979). [↵](#)
22. Christian Welzel, *Freedom Rising: Human Empowerment and the Quest for Emancipation* (Cambridge: Cambridge University Press, 2013); Robert D. Putnam, *Bowling Alone: The Collapse and Revival of American Community* (New York: Simon & Schuster, 2000). [↵](#)
23. <https://www.transparency.org/research/cpi/overview>. [↵](#)
24. Thomas Kuhn, *The Structures of Scientific Revolutions* (Chicago: University of Chicago Press, 1962). [↵](#)
25. Alasdair MacIntyre, *After Virtue* (Notre Dame, IN: University of Notre Dame Press, 1981), 188. [↵](#)
26. *Ibid.*, 187. [↵](#)
27. The list is meant to be illustrative. The Scientific Virtues Project, led by Robert T. Pennock, has examined several virtues and their relation to scientific practice, including humility, scientific objectivity, and curiosity (see <https://msu.edu/~pennock5/research/SVP.html>). Much work has also been done on scientific creativity, although not from the perspective of virtue theory. See, for example, Dean Keith Simonton, *Creativity in Science: Chance, Logic, Genius, and Zeitgeist* (Cambridge: Cambridge University Press, 2004); Csikszentmihalyi, *Creativity*. [↵](#)

28. Naomi Oreskes and Erik M. Conway, *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming* (New York: Bloomsbury Press, 2011). [↵](#)
29. Johana Shapiro, Elizabeth H. Morrison, and John R. Boker, “Teaching Empathy to First-Year Medical Students: Evaluation of an Elective Literature and Medicine Course,” *Education for Health* 17 (2004): 73–84; Carol A. Williams, “Empathy and Burnout in Male and Female Helping Professionals,” *Research in Nursing & Health* 12.3 (June 1989): 169–78. [↵](#)
30. Helen Riess, et al., “Empathy Training for Resident Physicians: A Randomized Controlled Trial of a Neuroscience-Informed Curriculum,” *Journal of General Internal Medicine* 27.10 (2012): 1280–86. [↵](#)
31. Montesquieu, *The Spirit of the Laws*, edited by Anne M. Cohler, Basia C. Miller, and Harold S. Stone (Cambridge: Cambridge University Press, 1989). [↵](#)
32. James Surowiecki, *The Wisdom of Crowds* (New York: Anchor Books, 2005). [↵](#)
33. J. Lorenz et al., “How Social Influence Can Undermine the Wisdom of Crowd Effect,” *Proceedings of the National Academy of Sciences* 108.22 (2011): 9020–25. [↵](#)
34. Daniel Kahneman, *Thinking, Fast and Slow* (New York: Farrar, Straus and Giroux, 2011). [↵](#)
35. Gigerenzer, *Gut Feelings*; Ralph Hertwig and Gerd Gigerenzer, “The ‘Conjunction Fallacy’ Revisited: How Intelligent Inferences Look Like Reasoning Errors,” *Journal of Behavioral Decision Making* 12 (1999): 275–305. [↵](#)
36. Peter L. Samuelson and Ian M. Church, “When Cognition Turns Vicious: Heuristics and Biases in Light of Virtue Epistemology,” *Philosophical Psychology* 28.8 (2015): 1095–1113. [↵](#)
37. Michael Spezio, Gregory Peterson, and Robert C. Roberts, “Humility as Openness to Others: Interactive Humility in the Context of L’Arche,” *Journal of Moral Education* (April 11, 2018): 1–20. [↵](#)
38. Cass R. Sunstein, *#Republic: Divided Democracy in the Age of Social Media* (Princeton, NJ: Princeton University Press, 2017). [↵](#)
39. Dan M. Kahan, et al., “The Polarizing Impact of Science Literacy and Numeracy on Perceived Climate Change Risks,” *Nature Climate Change* 2 (2012): 732. In what follows I assume that polarization is bad, but it is important to note that polarization is a complex phenomenon. Polarization may occur when both parties are improperly influenced to move to extremes and the position of neither party is either epistemically or morally sound. But in some cases polarization can occur when one party is right and the other is wrong. The period of greatest polarization in American politics—the American Civil War—would be such an instance. [↵](#)
40. Dan M. Kahan, et al., “Science Curiosity and Political Information Processing: Curiosity and Information Processing,” *Political Psychology* 38 (February 2017): 179–99. [↵](#)
41. Damon Centola, et al., “Experimental Evidence for Tipping Points in Social Convention,” *Science*

360.6393 (2018): 1116–19. [↵](#)

LICENSE



[Virtue and the Practice of Science: Multidisciplinary Perspectives](#) by Gregory R. Peterson is licensed under a [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License](#), except where otherwise noted.

SHARE THIS BOOK

[Share on Twitter](#)

Powered by Pressbooks

[Guides and Tutorials](#)

[Contact](#)

