

# Moral Authority in Scientific Research

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Abstract:

This paper addresses the issue of applying moral limitations to modern scientific research and who or what has the authority to do so. It examines two opposing positions on the issue: (1) that moral authority over scientific research should be held by society and (2) that moral authority over scientific research should be held by the scientific community. This argument centers around the nature of societal and scientific morality, and how allowing either to hold authority would affect the progression of research. Overall, it concludes that moral authority over scientific research must come from within the scientific community.

Science. The modern world revolves around it. In the last two-hundred years alone, humanity has experienced change and growth on an unprecedented scale, all due to an explosion of scientific knowledge and application. With science and technology being integrated into the common sphere rather than remaining sequestered in the realm of wealthy academia, modern society and life in general has evolved to be almost unrecognizable from its relatively close ancestors of a couple hundred years ago. Where, just over three hundred years ago, people burned those who practiced science at the stake as witches or heathens, people now rely on the discoveries and technological applications of science in almost every aspect of day-to-day life.

The function of modern society depends on science, and with this dependence comes an increased awareness in the public sphere of the scientific community. More than that, it has led to the recognition of the power and potential, both for good or for ill, of the research done by the scientific community. It is this recognition that stands at the heart of one of the most important philosophical issues of this time: should scientific research be limited by morality, and, if so, what moral guidelines should it follow? Essentially, it is the question of who or what has the authority to impose moral restrictions on the scope of scientific research. In the interest of addressing this issue, I will argue that (a) morality is an inherent limitation of scientific research, and (b) the moral authority to which that research adheres must come from within the scientific community itself.

However, before any arguments can be presented, it is first necessary to provide some definitions of key terms. The idea of a “scientific community” is central to this essay. In the context of this paper, this term refers to those who either actively contribute to the scientific body of knowledge through the practice of the scientific method, or those who are involved in an in-depth study of an area or a range of areas within the scientific body of knowledge. The

purpose of this particular definition is to allow for the inclusion of disciplines that the general population may not consider to be science. In this way, the common perception of the scientific community being limited to those in the fields of chemistry, biology, and physics can be significantly expanded. Additionally, the concept of morality must also be defined. When this essay refers to morality, it is referring to a person, institution, or community's specific conception of what is right, important, or has worth. Morality is considered only in the subjective sense, and the idea of an objective, absolute morality is not addressed here.

Morality and whether or not it has place in the practice of science is a highly debated issue, and centers around the ideas of subjectivity and objectivity in the field. Science, from the Latin *Scientia*, is the study of natural phenomena.<sup>1</sup> It is commonly characterized in one of two ways: (1) a discipline that uses logical inference from empirical observations and (2) an organized and systematic body of knowledge that includes statements of observations, laws and hypotheses that assert regularities, theoretical statements that connect laws, and statements that are confirmable through experimentation and deducible from laws.<sup>2</sup> The first concept focuses on science as a discipline, and highlights the actual practice or method of doing science. It shows the *praxis-oriented* view of science, which, because it focuses on the action and its executor, is inherently subjective. The second concept focuses on the actual information contained within the scientific body of knowledge and highlights its order and cohesiveness. It leaves out any mention of who gathered the information or what actions were performed and focuses on the *cognitive*, objective view of science.

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<sup>1</sup> Jeffrey C. Leon, *Science and Philosophy in the West*. Upper Saddle River, NJ: Prentice Hall, 1999.

<sup>2</sup> Barry Ferst, "A First Look at Philosophy and Science." Lecture, Carroll College, Helena, MT, September 1, 2017.

There are some who argue that morality should be left out of scientific research. This argument comes from the second concept of science mentioned above. It holds that, because the purpose of research is to obtain objective knowledge, the research itself must also be objective. Because morality is a quality of human perception rather than an inherent attribute of what is perceived, it is subjective. Those in favor of this position claim that moral judgements threaten the integrity of scientific research because they affect its objectivity. While this is a logically sound conclusion, the premise upon which it rests is flawed; scientific research in reality cannot be purely objective. As Dr. David Resnik claims in his article *Scientific Autonomy and Public Oversight*, "Science will always be inundated by social values, and attempts to eliminate some values will only succeed in introducing others."<sup>3</sup> What this means is that the moral environment in which research is done has strong influences on how and what is actually done. It shapes what is considered valuable research, what methods are best for each particular project, and what types of technologies should be developed from such information. In fact, methods that are more efficient or effective may be passed up for the sole reason that they are considered morally wrong. This is not to say that research should not endeavor to be objective. Controlling research to prevent environmental or social interference is one of the fundamental doctrines of scientific practice and determines the accuracy and precision of any results gathered. Rather, I am merely pointing out that it is impossible to account for and control every possible variable. Objectivity in research is an unreachable goal; it will always have some level of subjectivity. It is for this reason that I claim that morality is an inherent limitation of scientific research and must not be ignored.

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<sup>3</sup> David B. Resnik, "Scientific Autonomy and Public Oversight." *Philosophy of Science* 5, no. 2 (June 1, 2008): 220-38.

Given this conclusion, there is an important clarification that I would like to make before I continue to the next section. In his essay in *Ethical Impact of Technological Advancements and Applications in Society*, Evandro Agazzi states the claim that “moral judgements are mandatory because of the social impacts of science and technology, that may be beneficial or harmful to humans.”<sup>4</sup> This represents one of the most common philosophical positions on morality in scientific research. While it is reminiscent of my conclusion, there is a slight difference. When Agazzi states that moral judgements are mandatory, this means that they must be incorporated into the decision processes within the scientific fields. This is unnecessary; moral judgements are already present in these decision processes. Rather, the important issue is to identify who or what should be making those judgements.

Unfortunately, this is a rather thorny issue to tackle. There are countless groups, institutions, or even people that could play the role of a moral authority over scientific research, and to address the specific merits of each is not a feasible task in the space provided. Instead, since it is because of the increased association between society and science that this issue is so important and relevant, I will consider it in that particular context. Therefore, the arguments presented in the following sections of this paper will examine the respective effects of moral authority from within the scientific community and moral authority from without, otherwise known as general society.

Social morality, or rather the moral system that governs society, is, for most people, their default moral system. Because humans are raised in social environments and taught the norms of their society, individual moral systems tend to be, to some extent, reflective of the societal moral system. It is for this reason that many people automatically favor societal moral systems in

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<sup>4</sup> Rocci Luppincini, *Ethical impact of technological advancements and applications in society*. Hershey, PA: Information Science Reference, 2012.

situations such as this, where a system needs to be established. However, despite our natural orientation towards social morality, allowing it to hold authority over scientific research would actually prove a detriment to the field and to society as a whole. Though this is a bold claim, its rationale lies in the very nature of social morality. There are two key components that allow social morality to exist: the foundational principles of the system, and the construction and application of the system. Each of these components, when applied to scientific research, demonstrates distinct and unavoidably harmful effects.

In a society and especially in the context of science, the foundation is largely made up of the principle of utilitarianism. This is the most popular idea of science in the public sphere: that it must produce a practical benefit to society, where the “common good” is served.<sup>5</sup> It is a pragmatic approach in which scientific research is directed in whatever way benefits the most people, and relies on the idea that scientific research is a tool of the people. In a way, this is a viable point of view. Since modern society is so heavily reliant on science and technology, most people are only familiar with those areas in the context of how it benefits them. Members of society who aren't in the scientific community interact with the field in very limited, restricted ways; they only hear about specific research and scientific progress when it is either especially important or unusually dangerous. For the most part, they come in contact with the technological applications of research, not the research itself. With that and the common allocation of tax resources to the sciences, this means that the people are quite literally paying for the progression of science. While this is undeniably self-interested, the vast majority of individuals would naturally expect some form of personal benefit when they give up their hard-earned money to a cause. The result of this is that the majority of people think that the overall goal or purpose of the

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<sup>5</sup> Péter Hartl, “Michael Polanyi on Freedom of Science.” *Synthesis Philosophica* 54, no. 2 (2012): 307-21.

practice of science is to research ways to improve their lives. Essentially, it is a tool for the betterment of humanity. As was stated before, this is a popular idea, and for good reason.

However, it is based on a limited view of how science actually works; it relies on the assumption that the purpose of knowledge is its application, thus meaning that the purpose of science is technology, and the purpose of technology is to help people.

At this point, one might ask his/herself why that assumption is regarded as problematic. After all, many of the people who enter or would like to enter the scientific community do so out of the desire to help people. Actually, the issue with that assumption is rooted in its paralyzing effect on the actual practice of science. In the context of moral authority, scientific utilitarianism means that research goals and technological development would be considered moral if and only if it had prospective benefits towards the public, with its inherent morality proportional to the value of its benefit. Similarly, the immorality of scientific research would be proportional to its prospective harms towards the public. However, what is truly unsettling is that, under that logic, research that had no prospective harms or benefits might still be considered immoral as it constitutes a use of resources without quantifiable return. Given a system where this type of social morality was authoritative, it would cause the masses to tailor the direction of scientific progress according to what is deemed most favorable to the majority of people. However, because these decisions come from outside the scientific community, their application requires that the structure of the community be hierarchical: it requires centralized control and planning.

While, in some cases, a centralized system can work as a functional and efficient method of community organization, its application in the scientific fields would be disastrous. In his essay *Michael Polanyi on Academic Freedom*, Péter Hartl identifies this conclusion as one of the key

points of Michael Polanyi's position.<sup>6</sup> Polanyi argues that the scientific community requires a level of self-direction that is not possible in a system of *centrally directed coordination*. In other words, this is a system or community in which a hierarchical authority directs the actions of individuals within the system. Polanyi's claim is that centralized systems are only effective in situations where one can clearly identify the end result and central direction, such as military operations. However, in situations where there is no central direction or predetermined steps, like tasks involving puzzles or problem-solving, efficiency relies on *self-coordination*. This means that each member of the group must be able to make decisions for themselves as well as keep an eye on their colleagues, thus allowing a level of cooperation in which further steps can be considered in light of other's progress or advancement. Essentially, maximum efficiency is achieved through maximum collaboration within the ranks of the community and, similarly, the progress of the community is halted when the members are unable to adjust and direct themselves in accordance with others. Polanyi writes:

“You can kill or mutilate the advance of science, you cannot shape it. For it 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.”<sup>7</sup>

His point here is that the only effect of attempting to direct scientific progress is to slow it down or halt it. Because the end result is ultimately unknown, it is impossible for an authority to plan science based on what is considered most beneficial. In science, it is not uncommon for promising fields to yield little more than dead ends, and the most unlikely thing to end up being incredibly important. To see this phenomenon, all one need do is consider Alexander Fleming's

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<sup>6</sup> Péter Hartl, “Michael Polanyi on Freedom of Science.” [312-313]

<sup>7</sup> Péter Hartl, “Michael Polanyi on Freedom of Science.” [312]

accidental discovery of penicillin in 1928.<sup>8</sup> This discovery completely transformed medicine and has saved countless lives, but ultimately occurred because Fleming left an uncovered petri dish near an open window, and it happened to get contaminated by a mold of the *Penicillium* genus. What this shows is that, no matter how much preparation or research or money one invests into a project, scientific discovery still has an element of chance to it.

It is this element of chance that makes up the core of my argument against the use of utilitarian morals to direct scientific research. The unpredictable nature of scientific progress means that the application of utilitarian values would be ineffective at best, and destructive at worst. Additionally, social morality designates the ultimate ideal or moral value as the pursuit of the greatest good for the most people. If that ideal held authority, the practice of science would be at the mercy of the whims of the masses. The efficiency and functionality of the field would be significantly decreased, and the incredible advancement that humanity has witnessed in recent past would begin to slow, and maybe even grind to a halt. However, it is the implication of this reduced output that is especially terrifying. Should the benefits of scientific research begin to decrease, utilitarianism would hold that its value as an academic pursuit would decrease as well. Allowing science to be the plaything of the masses could mean the end of science itself, or at least humanity's care for the subject.

However, utilitarianism makes up only one component of societal morality. Other flaws in allocating moral authority to society can be traced back to the second component: the actual construction of the moral system. Whereas the first aspect allows for the formation of moral values, this aspect is what determines which values are incorporated into the overarching moral

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<sup>8</sup> S. Y. Tan, and Y. Tatsumura, "Alexander Fleming (1881–1955): Discoverer of penicillin." *Singapore Medical Journal* 56, no. 7 (July 2015): 366-67.

system. Essentially, it bridges the gap between the moral systems of individuals within the society, and the moral system that governs the society as a whole. In general, the values that are incorporated into the societal systems are those held by the majority of people. In that way, it is reminiscent of a democratic system. While it is worth noting there are some other, non-democratic templates that can be used to create normative moral systems, they are less common and will not be addressed here.

In many societies and especially ones in which science plays a significant role, decision by majority or democratic decision-making is highly valued. This means that many people, when first encountering the idea of democratic science, might think it a positive thing. When morality in science is ruled by the social majority, every member of society would have a say in what is valued or considered important research, thus influencing the direction of science itself. On the one hand, this seems just. Fairness would seem to dictate that, if someone were to be affected by the results of scientific research, they ought to have some level of influence over what that research might be. In developed societies, people place a great deal of importance in the idea of fairness and making sure everyone has a say in what happens to them; the democratic aspect of social morality embodies this. However, as attractive as the idea might appear, democratic morality in science is just as dangerous as utilitarianism. It is a threat to the entire field. The reason for this centers around the central concept of democracy: that everyone, no matter their social, economic, or educational situation, would have equal influence. In the context of scientific research, the result is that people who have no knowledge of the area would have some level of moral authority over it and be able to make decisions regarding its future. In a democratic moral system, the input of people with no level of scientific expertise is equally as influential as the input of actual members of the scientific community with expertise in the field.

This is the dilemma addressed by Madjick and Keith (2011): how the authority accorded by expertise can be reconciled with the authority of a democratic system when they are in direct opposition.<sup>9</sup> Essentially, because expertise is a form of authority and the function of a democratic polity is to provide a check on authority, the two concepts are in contrast. To solve this dilemma, Madjick and Keith define expertise as a type of argument, or method of argumentation, rather than a level of knowledge. They write that:

“The argumentation that constitutes expertise does not reside in the knowledge or experience of the arguer (thus argumentation is not simply a tool for asserting expertise), but relative to a problem; expertise invokes not a relationship to specialized knowledge but to the ability to respond appropriately to problems.”<sup>10</sup>

What this means is that the level of expertise on a subject is what determines the extent to which an individual can effectively respond to a problem; a solution to a problem proposed by an “expert” would have a greater likelihood of success than one proposed by an amateur. In the context of this paper, the responses to moral dilemmas relating to scientific research that come from within the scientific community would be more effective than those that originated outside the community.

The other implication of this argument is that, in addition to its role as the “exercise of well-informed reason,” expertise also functions as the “justification of a judgement.”<sup>11</sup> Using this idea, we can conclude that a moral judgement that is grounded in expertise is more likely to be a *better* judgement (in that it is more accurate or has better results) than one based solely on

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<sup>9</sup> Zoltan P. Majdik and William M. Keith, "Expertise as Argument: Authority, Democracy, and Problem-Solving." *Argumentation: An International Journal on Reasoning* 25, no. 3 (July 26, 2011): 371-84.

<sup>10</sup> Madjick and Keith, "Expertise as Argument," [372-373]

<sup>11</sup> Madjick and Keith, "Expertise as Argument," [374]

morals. This is an important conclusion regarding the idea of democratically regulated research. In a scientific system that answered to a democratic moral authority, a large part of the moral judgements would be unjustified in that they would not come from members of the scientific community and, therefore, would not have a significant level of expertise to back them up. Since they are not based on a knowledge of the area, many of the unjustified judgements could be flawed or entirely erroneous. After all, a moral judgement based on misinformation or lacking key information is hardly more than a guess. If such judgments were held by the majority of the population, a democratic moral authority would allow them to be enacted. The possible consequences of this could be severe, especially when one considers the massive effects that scientific advancement has on society and the world as a whole.

One of the most dramatic examples of this is the controversy begun by Andrew Wakefield and colleagues in 1998, when they published a paper linking the diagnosis of autism in children to the MMR (measles, mumps, and rubella) vaccine.<sup>12, 13</sup> Though the design of the experiment detailed in the paper was poor and the conclusions were speculative at best, the paper received a large amount of publicity, thus causing many parents to refuse to vaccinate their children. As a result, several measles outbreaks (most notably in 2008-2009) occurred in the United Kingdom, Canada, and the United States that were attributed to the lower vaccination rates. However, almost immediately after the appearance of Wakefield's paper, several epidemiological studies were conducted and published results refuting the proposed link between autism and the MMR vaccine. Eventually, it was revealed that the results presented in the article were fraudulent, causing Wakefield to lose his medical license. The key point to this issue and the reason that it is

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<sup>12</sup> Stanley Plotkin, Jeffrey S. Gerber, and Paul A. Offit, "Vaccines and Autism: A Tale of Shifting Hypotheses." *Clinical Infectious Diseases* 48, no. 4 (February 15, 2009): 456-61.

<sup>13</sup> T. S. Sathyanarayana Rao, and Chittaranjan Andrade, "The MMR vaccine and autism: Sensation, refutation, retraction, and fraud." *Indian Journal of Psychiatry* 53, no. 2 (2011): 95-96. doi: 10.4103/0019-5545.82529

highlighted here is that, despite the rock-solid scientific proof that vaccines are not connected to autism, there still exists a community of people who continue to back Wakefield.<sup>14</sup> While this example does not highlight the moral aspect of my argument, it is important in that it demonstrates the sort of damage that a single erroneous idea can cause when that idea is allowed to be acted upon. It is an example of a scientific/medical situation where public opinion and social values actually have power and effect, and the disastrous consequences that can occur. Parents who deny the MMR vaccination to their children out of fear of autism expose them to potentially fatal diseases over an imagined risk, needlessly endangering both the children in question and the community as a whole. This is because lower vaccination levels mean increased chances of someone getting infected as well as increased chances of them spreading the illness to another person. All of this damage comes from the fact that the parents do not have the appropriate level of knowledge on the subject to choose the most effective option for their children (i.e. the option with the least risk and most benefit). In other words, they don't have the level of expertise required to respond to the problem.

At this time, it is worth noting a possible objection to the argument above. One could claim that this example does not support my point that democratic morals are harmful to science by pointing out that opponents of vaccinations are a small minority of the population. Since democracy depends on majorities to make decisions, one could argue that the vaccine controversy cannot be used to model democracy. However, this objection depends on a misunderstanding of the purpose of the example. The vaccine controversy merely models the effects of having the power to act on erroneous judgements. The danger of democracy comes

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<sup>14</sup> Laura Eggertson, "Lancet retracts 12-year-old article linking autism to MMR vaccines" [<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2831678/>]. *CMAJ: Canadian Medical Association Journal* 182, no. 4 (March 9, 2010): E199-E200. doi:10.1503/cmaj.109-3179.

from the possibility that a majority might hold an erroneous judgement and thus have the power to act in accordance with it. There is some scientific research that, through either its promotion or inhibition, has a much greater potential for harm than one vaccine, and democracy puts that entire potential at the hands of a public that, for the most part, does not have the expertise to effectively handle it.

This concept of expertise is what sets the application of moral authority in scientific research apart from basic moral norms or moral authority. The level of expertise and relevant knowledge required to function in the sciences is far above that needed in general society and a moral authority that does not have that level of expertise is inadequate in passing meaningful and valid judgements. Since societal morality is determined by a majority that, for the most part, is unlearned in the sciences, allowing it to have authority over research could have far-reaching and dramatic consequences.

Coupled with the inadequacies of the first component of societal morality, the foundational principle of utilitarianism, it is clear that societal morality as a whole must not hold authority over research. This conclusion leaves one option remaining: the moral authority that regulates scientific research must come from within the scientific community. In a way, the morality of the scientific community is similar in structure to that of the general masses; as they are both groups of people, the authority to which they answer is the set of moral norms within the group.

However, there is a definite difference between the values recognized between scientists and those held by the general public. This is because, in addition to their individual moral code, scientists also recognize certain scientific values that are distinct from social values. Dr. David Resnik provides valuable insight on this concept with his definition of scientific values as the

goals and norms that govern scientific conduct.<sup>15</sup> He states that the goal of a scientist is dependent on his/her respective profession. By stating this, he rejects the idea of science having one overarching goal, like finding the truth or helping people. Additionally, he identifies both ethical (honesty, fairness, accountability, etc.) and epistemological (objectivity, precision, consistency, etc.) norms for scientific conduct. The importance of these concepts comes from the fact that they help reveal the nature of the moral authority that a scientific community constructs for itself. By rejecting the idea of a single purpose for science, he rejects the utilitarian moral foundations held by most of the masses. Additionally, the inclusion of both epistemic and ethical norms into scientific values helps to provide a standard of morality that upholds the common ideals of moral conduct while also not compromising the quality or integrity of the work. Ultimately, what this demonstrates is that, in order to construct a moral system that protects science in addition to other people, it must be done from a position of familiarity with scientific practice. In other words, the source of moral authority over scientific research must be the values of those within the scientific community, since they make up the only population with a verifiable working knowledge of the field.

Further support for the idea of allowing scientific values to function as moral authority comes from the concept of expertise that was introduced earlier in the paper. As stated before, Madjick and Klein defined expertise as an argumentative technique that depends on one's ability to respond effectively to a problem.<sup>16</sup> In situations involving moral issues relating to research, those in the scientific community would be best equipped to effectively solve the problem. They can maintain the morality of scientific practice without sacrificing the integrity of the information

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<sup>15</sup> David B. Resnik, "Scientific Autonomy and Public Oversight." *Philosophy of Science* 5, no. 2 (June 1, 2008): 220-38.

<sup>16</sup> Madjick and Klein, "Expertise as Argument," [372-373]

gained. The scientific community's knowledge of their practices means that they are able to construct a moral system in which research may be productive, effective, and moral.

Additionally, though this is a fairly obvious point, it stands to reason that the scientific community would have significantly more viable justification or "well-informed reason" behind their moral system than any candidate without their level of involvement in the field. Given these points, I must conclude that the scientific community is significantly more qualified to make the moral judgement calls that affect itself.

Now that I have presented my position in full, I would like to take some time to address some possible objections. The first is centered around the idea of accountability and points out that, in the sort of moral system described here, its presence appears to be lacking. This counterargument holds that scientific community is so similar in thought and values that there would be no diversity of opinion over decisions. When the whole community agrees on the choices or direction of science, there would be no one to hold them accountable should those choices turn sour. While this represents a real issue often seen in homogenous groups, it actually does not apply to this situation. This objection is based on the assumption that members of the scientific community are similar in their thoughts and values, and this is fairly true when one's idea of the scientific community is one of white-coated, test-tube-carrying lab scientists. However, as was defined above, this theory operates based on a far wider definition of the scientific community. Its members are defined in their careers by their use of the scientific method, or formulating hypotheses based on empirical data and observations. In this way, softer sciences like sociology and psychology are included in the community, as well as more unconventional fields like economics and statistics. This allows for a much wider range of discourse within the community, as each type of career field emphasizes different values and perspectives on issues. In this way,

diversity is maintained within the community, thus allowing members to be held accountable for their actions.

The second objection that I would like to highlight regards the presence of corruption and dishonesty within the scientific community. It points out that, in giving the scientific community the authority to self-regulate, the moral system that I propose would open the door to unchecked corruption and crony politics. If the community was no longer subject to the constant scrutiny of the outside world, it might encourage sketchy activity and bias, especially in the peer review process. Ivor Catt details his ongoing battle with the peer review process in his article, *The Decline of Science*, which has occurred even with all the current regulations on publishing scientific research.<sup>17</sup> In a self-regulating system such as the one I propose, this sort of underhanded behavior could worsen significantly. This objection highlights a valid point, but it can be countered in much the same way as the first one. Since there is a high level of diversity present in the community, in order for that level of diversity to be achieved, the community would need to have a significant population. With a relatively large population and distribution of disciplines, the self-regulation conducted by the community would not be dramatically less thorough than regulation conducted from the outside. Though there would, inevitably, be a slightly higher amount of dishonesty, it is not high enough to pose a significant threat to my position.

This essay was written with the goal of addressing of one of the most pivotal moral issues of the modern age: who has the authority to impose moral limitations on the practice of science? Throughout the course of this article, I have presented an argument to show that, morality an inherent part of the scientific research and that the moral authority followed by that research

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<sup>17</sup> Ivor Catt, "The Decline of Science." *Journal of Information Ethics* 24, no. 2 (2015): 113-20.

must come from within the scientific community. There are several flaws to this argument, stemming mostly from the increased risk of corruption and lack of accountability, but it is my view that, as a whole, the benefits of the theory outweigh the risks. This theory is more than just an answer to a question; it provides a template for how moral issues in the sciences can be addressed, and who has the ability to address them. Ultimately, it lays the foundation for a new dynamic between society and science that is tailored to the modern world and its unique issues.

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