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THE MORAL RESPONSIBILITIES OF SCIENTISTS (TENSIONS BETWEEN AUTONOMY AND RESPONSIBILITY)

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I. INTRODUCTION

In the general philosophical literature, the question of moral responsibility evokes issues of general competence (when is a person morally capable of making decisions and thus being responsible for them), coercion (what kind of forces on a person make their choices not their own, but due to someone else, thus shifting moral responsibility), and causation (what conception of causality allows for both enough free will and enough foresight so that we can be considered responsible for the outcomes of our actions). (See Arnold 2001; Fischer and Ravizza 1993; and Paul, Miller, and Paul 1999) The question of the moral responsibility of *scientists*, however, does not hinge on these general issues. Scientists are assumed to be generally capable moral agents; we do not believe that scientific training somehow impairs moral reasoning or moral sentiments. Scientists are not usually under threat of force to not consider certain moral issues; coercion would be considered as pathological in science as it would anywhere else. And the issue of causation applies just as well for scientists as for anyone else; either you believe in a causal structure that allows for moral responsibility in general, or you do not.

Instead of being about these general issues, the moral responsibility of scientists hinges on issues particular to professional boundaries and knowledge production. The question is what we should expect of scientists *qua* scientists in their behavior, in their decisions as scientists engaged in their professional life. As the importance of science in our society has grown over the past half-century, so has the urgency of this question. The standard answer to this question, arising from the Freedom of Science movement in the early 1940s, has been that scientists are not burdened with the same moral responsibilities as the rest of us, i.e., that scientists enjoy "a morally unencumbered freedom from permanent pressure to moral self-reflection." (Lübbe 1986, 82) This essay will challenge the traditional view.[1] First, a basic framework in which to assess the moral responsibilities of scientists will be developed. This framework suggests that the basic tensions concerning the moral responsibilities of scientists arise because of a tension between role responsibilities and general responsibilities

(defined below). Contrary to the traditional view, role responsibilities do not, and cannot, trump the general responsibilities scientists have as human moral agents. Scientists are left with a choice: either accept the burden of general responsibilities themselves, or lose much of their much prized autonomy in allowing others to take on the burden for them.

There are two general bases for moral responsibilities in modern life: there are the general moral responsibilities that each of us holds as humans/full moral agents and there are the role responsibilities that arise from our taking on particular positions in society. Usually, in practice, role responsibilities expand our set of responsibilities. For example, a person who becomes a parent takes on special responsibilities towards their children, but receives no lessening in other responsibilities as a result. Sometimes, responsibilities (arising from both role and general bases) must be weighed against each other. In some cases, however, role responsibilities call for a contraction of general responsibilities. Thus, a defense lawyer is not obligated to report past criminal activity that they learn about from their client (it being protected under lawyer-client confidentiality), whereas the rest of us would have a moral obligation to report such activity. This works only because of the general structure under which our justice system works. Because of the rigid adversarial structure, lawyers have reduced general responsibilities in response to increased role responsibilities. Without the rigid structure, that both defines the defense lawyer's role as client advocate and assigns to other parties the job of properly uncovering crime, such a reduction in general responsibility would not be possible.

It has been argued or assumed that scientists have a similar type of role. Such an argument has generally centered on an absolute need for complete freedom of inquiry by scientists. As Percy Bridgman, Harvard physicist and Nobel Prize recipient, argued in the early years of the atomic age:

> The challenge to the understanding of nature is a challenge to the utmost capacity in us. In accepting the challenge, man can dare to accept no handicaps. That is the reason that scientific freedom is essential and that the artificial limitations of tools or subject matter are unthinkable. (Bridgman 1947, 153)

The knowledge that scientists produce is so valuable to society, Bridgman suggests in his essay, that we must relinquish other claims of social or moral responsibility on scientists so that they can produce this valued end. Scientists, under this view, not only have a need for autonomy (i.e., the ability to be the primary decision-makers in determining the direction of their work), but also have a need to be free from considering the potential consequences of that work beyond the realm of science.

Does the social role that scientists play, the development and presentation of new knowledge, call for a release of scientists from general moral responsibilities to think about the potential consequences of one's actions and choices? As will be argued below, it does not. The social structures that would allow for such a reduction in general moral responsibilities are not in place, and if they did exist, would almost eliminate the autonomy of scientists. Because of the nature of scientists' work, scientists must choose between shouldering the responsibilities themselves and giving up decision-making autonomy to allow others to do so.

II. Negligence, Recklessness, and Responsibility

Before examining the role responsibilities of scientists, an examination of our

general moral responsibilities is needed. What do we mean when we say a person is morally responsible for some action or outcome? The first distinction central to this examination is between causal responsibility and moral responsibility. Moral responsibility involves the attribution of blame or praise. This essay will focus for simplicity on blame, although in general there should be broad symmetries between what warrants praise and what warrants blame. The attribution of blame is not equivalent to the attribution of cause. While some kind of causal connection is necessary, we are not held morally responsible for all the things in which we play a causal role.

Minimally, we are morally responsible for those things we intend to bring about. However, we are not morally responsible merely for those things we intended to bring about. We are also morally responsible to some extent for side effects of our actions. While this is widely accepted, it is a difficult question under what circumstances and to what extent we should be responsible for unintended consequences. Two general categories cover unintended consequences: recklessness and negligence. The definitions used here follow Feinberg 1970 and general legal usage. As Feinberg wrote: "When one knowingly creates an unreasonable risk to self or others, one is reckless; when one unknowingly but faultily creates such a risk, one is negligent" (1970, 193). When one is *reckless*, one is fully aware of the risks one is taking or imposing on others, and those risks are unjustified. What justifies certain risks, particularly when the risks involve other people not given decision-making authority, can be contentious. Nevertheless, there are clear examples of justified risk (speeding on city streets to get a seriously injured person to the hospital) and unjustified risk (speeding on city streets for the fun of it). The key point is that we expect moral agents to carefully weigh such risks and to determine whether they are, in fact, justified.

If, on the other hand, one is not aware that one is risking harm, but one *should* be aware, then one is being *negligent*. When being negligent, one does not bother to evaluate obvious risks of harm, or one does not think about potential consequences of one's actions. As Feinberg noted, there are many ways in which to be negligent:

> One can consciously weigh the risk but misassess it, either because of hasty or otherwise insufficient scrutiny (rashness), or through willful blindness to the magnitude of the risk, or through the conscientious exercise of inherently bad judgment. Or one can unintentionally create an unreasonable risk by failing altogether to attend either to what one is doing (the manner of execution) or to the very possibility that harmful consequences might ensue. (1970, 193–194)

The difficulty with negligence, in addition to determining whether a risk is justified, is to determine what should be expected of the agent. How much foresight and careful deliberation should we expect the individual to have? Often, this question is answered through an examination of community standards, couched in terms of what a *reasonable person* would have done in like circumstances.

Through recklessness and negligence, one can be held responsible for unintended consequences both when things go the way one expects them to and when things go awry. Through negligence, things may go exactly as planned (as far as you planned them), and still harmful and clearly foreseeable consequences would be your fault. You would be responsible because you should have foreseen the problems and planned further. For example, suppose you set fire to a field one dry summer to clear it of brush. You didn't bother to think about how to control the fire, not recognizing the

obvious risk. Because of your negligence, damage caused by the fire raging beyond your property is your moral responsibility. If, on the other hand, you are aware of the risks in setting the fire, decide not to care and proceed anyway, then you are responsible for the damage when the fire escapes, because of recklessness. The distinction between recklessness and negligence thus rests on the thought processes of the agent, on whether they reflect on potential consequences (assuming both that events go as planned and that unexpected "errors" occur) and on whether there was any acknowledgement of possible harms that could arise from the agent's action. Recklessness is the acceptance of unreasonable risk; negligence is the failure to foresee and prevent such risk.

How might recklessness and negligence apply to scientists? Let us assume that scientists bear the full general moral responsibilities to not be reckless or negligent. (Reasons for such a view are presented below.) This would mean that scientists should think about the potential consequences of their knowledge producing activities. If some new piece of knowledge could lead to both good and harm, then scientists should think about those harms and goods, and act in ways to ensure that the good outweighs the harm.[2] If the magnitude or severity of the harm is too great and the probability too high to be compensated for by the potential goods, then the act is reckless, imposing unjustified risks. Scientists should also think about the potential consequences of error, and be sure that they are properly acting to prevent those consequences or to mitigate the possible impacts of error. To not think about how things might go wrong, and to act reasonably to prevent possible harms due to error, would be negligent.

In order to apply negligence to scientists, however, we must decide what level of foresight we might expect from scientists. Happily, the reasonable person standard might actually be easier to apply to scientists than to the average citizen, particularly with respect to the issue of foresight. Scientists have fairly tight-knit epistemic communities and routinely discuss the potential implications of their work. It is rare that a scientist has not thought about some of the potential consequences of their actions as scientists. Reflecting on the proper methodologies and crafting one's papers to elicit certain responses (particularly in arguing for the relevance of one's research) is part of the trade. Discussions concerning risks and implications fill journal pages. Because of this aspect of scientific communities, it is probably easier to ascertain what a scientist should have thought about before performing a risky experiment (or even whether it was perceived as risky by others) than in the broader social context. However, scientists may not be accustomed to full reflection on potential implications of their work. Demanding that scientists shoulder their general responsibilities may require deeper reflection from them. Nevertheless, because of scientific communities, it could be fairly straightforward to ascertain whether a scientist should have perceived certain potential consequences.

Whether scientists *should* even consider broader social implications and other impacts of their work is contested. Under the standard views of negligence, to not consider foreseeable implications opens one to attributions of negligence and blame. If scientists do foresee implications for a particular case where the apparent risks outweigh the apparent benefits, and they then proceed anyway, they can be held responsible for consequences on the basis of recklessness. Thus, to what extent scientists should be held accountable to the general moral requirements imposed by recklessness

and negligence is crucial. And this issue hinges on whether role responsibilities trump these general moral responsibilities to consider unintended consequences.

III. The Role Responsibilities of Scientists

If the primary goal of science is to develop knowledge about the world, then the role responsibilities of scientists should be structured around this goal. Not surprisingly, this is largely the case. Also not surprisingly, these responsibilities are not hotly contested among scientists, but instead are largely accepted as part of, or essential to, being a scientist and the proper functioning of science. For example, scientists expect honest reporting of data, and cases of dishonesty in such reporting are universally condemned as fraud and dealt with harshly in the scientific community (once proven). There is no debate on whether such dishonesty is acceptable or whether it is harmful to science.[3]

Other responsibilities also come with being a scientist. It is expected that scientists will share important results with each other to further the field. (However, this expectation is being directly challenged as more research is being kept secret because of business interests. See, e.g., Maker 1994.) Scientists are also expected to respond in some way to valid criticism. It is unacceptable in science to simply ignore (over a long period of time) evidence that runs contrary to one's views. One must account for it in some way, by finding fault with it or accommodating it, or calling for further investigation with greater accuracy. Simply ignoring other people's works or arguments is not acceptable in science. In addition, when asked, it is expected that scientists will serve as peer reviewers for their fellow scientists' work (either for publication or for funding proposals). This is a time-consuming and thankless job, but one seen as essential to maintaining internal scientific standards, and thus an accepted responsibility. Finally, scientists accept responsibility for training the next generation of scientists properly.

These specific role responsibilities all serve the general goal of the search for truth (or reliable knowledge about the world).[4] It seems clear that this goal defines the role responsibilities of scientists. What is at issue here is whether this responsibility, this goal, obliterates other responsibilities scientists have as human beings and capable moral agents.

IV. General Responsibility vs. Role Responsibility for Scientists

It has been argued above that we have a general responsibility to consider both intended and unintended consequences of our actions. Whether we are negligent in considering potential consequences or reckless in our disregard for potential harms, we are held responsible for consequences if our actions are unjustifiable or unreasonable. Whether scientists are subject to such general moral reflection is not clear. As mentioned in the introductory section, the standard view of the past half-century has been that they are not. In this section, it will be argued that this view is mistaken.

One way to protect scientists from having to think about the potential impact of their work is to argue that scientists pursue new knowledge (or truth), and that this pursuit is so important, nothing should get between scientists and their pursuit. This argument has seen many forms, from arguments concerning free inquiry to the freedom in science movement of the 1940s. Under these views, what scientists do is so important, they should not be hampered by social, moral, or political considerations. The pursuit of knowledge/truth trumps all

other values, and allows scientists to shed their general responsibilities in favor of their role responsibilities. Someone else, politicians or ethicists or society outside of science, should worry about the implications, but without interfering with the activity of scientists.

This picture fails for two reasons. First, knowledge (or the pursuit of truth) does not trump all other values. If it did, we would happily submit our children to scientists who wished to use them for biochemical testing and no moral limits on methodologies would be in play. But truth is not so valuable to us that we are willing to do this, despite the fact that controlled human testing would be the best and perhaps only way to fully understand the full biological impacts of chemical substances, for example. That there are prices we are not willing to pay for knowledge, or the search for truth, means it is not an ultimate value existing on a plane above all others. The categorical pursuit of truth is unacceptable. This does not mean that the pursuit of truth is not valuable, or that it is not one of preeminent values of our society. It simply means that, in general, other values deserve to be considered as well.

Second, the potential implications of science go well beyond the applications of scientific knowledge. While it may be possible that those outside of science can control the uses of applied science in the form of technology, the impact of knowledge *per se* is far less controllable. As many have pointed out, knowledge is not passive. It can, by its very existence, change our self-conception, our options and responsibilities, and our view of the world (Sinsheimer 1979, Wachbroit 1994, Johnson 1996). Outsiders to science cannot control a piece of research's epistemic and ethical impact after the research is complete. Only scientists (or other insiders) can exert such control, by choosing to pursue particular research programs, or by framing the presentation of the results, emphasizing some implications over others.

In addition, some of the choices scientists make in pursuing knowledge occur deep in scientific practice, in the fine tuning of methodologies, the characterization of data, or the interpretation of data. That the scientist makes these choices, with potentially important implications and potential consequences of error, may not even be apparent in the published final report (Douglas 2000). The places of choice and control by scientists with important social and ethical implications go far beyond the ostensibly publicly controllable application of science in new technologies. Someone must be responsible for thinking about the potential consequences at these decision points, or the general responsibilities go completely neglected.

An abandonment of these general responsibilities in science is neither warranted nor desirable. Indeed, the consequences could well be catastrophic. One striking example of scientists seriously and successfully paying attention to their general responsibilities arose during the development of atomic weapons. Whatever one may think of the morality of building such weapons, the test of the first plutonium bomb was not just a test of a new technology. It was also a decisive test of some of the physical principles that went into the development of the bomb, from the fissionability of plutonium to the calculations behind the implosion device developed by Kistiakowsky. It was also an experiment about what happens when you produce an explosive chain reaction in the atmosphere. No one had done this before, and there were some worries. One worry that was thought up well before the test, and worked on by Hans Bethe, was that the energy in the explosion might produce an explosive chain reaction in the earth's atmosphere, thus

obliterating human life on earth. Happily, the scientists had not only thought of this potential outcome, Bethe pursued the possibility and determined it was scientifically impossible (Rhodes 1986, 419). Who else but the scientists immersed in the project could have foreseen this and determined it was nothing to worry about?[5]

Another standard example of scientists taking on their general responsibilities is the concern scientists raised over recombinant DNA techniques and the resulting Asilomar conference. (See Culliton 1979.) In both these cases, scientists, while doing science, reflected on the potential unintended consequences and found the risks unacceptable. Before proceeding with the development of science, they paused, and made sure that the harmful consequences either were nearly impossible, or figured out ways to make them so.

It is doubtful that anyone could fully take over this function for scientists. Because science's primary goal is to develop knowledge, this goal invariably takes scientists into uncharted territory. While the science is being done, presumably only the scientist can *fully* appreciate the potential implications of the work, and, equally important, the potential errors and uncertainties in the work. And it is precisely these potential sources of error, and the consequences that could result from them, that someone must think about. The scientists are usually the most qualified to do so. Partial sharing of general responsibilities is possible, as is now done with ethical review boards and clear standards for dealing with human subjects. But the more that scientists relinquish their general responsibilities, the more they must relinquish their autonomy.

In order to see why, consider what would be required if we implemented a system that provided ethical oversight of all scientific decisions, in order to remove the burden of general responsibilities from scientists. The consideration of non-epistemic consequences could be neither an afterthought to the research project nor a process merely at the start of the project if the general responsibilities are to properly fulfilled. Instead it would have to be an integral part of it, being involved throughout the research project. Those shouldering the general responsibilities to consider social and ethical consequences of research (or of errors in research) would have to have decision-making authority with the scientists, in the same way that research review boards now have the authority to shape methodological approaches of the scientists when they are dealing with human subjects. However, unlike these review boards, whose review takes place at one stage in the research project, those considering all of the non-epistemic consequences of scientific choices would have to be kept abreast with the research program at every stage (where choices are being made), and would have to have the authority to alter those choices when necessary. Otherwise the responsibility would not be properly fulfilled, and would not be able to keep pace with the developments accompanying discovery. Such intensive oversight, however, would devastate any remaining autonomy in science.

In sum, the structure of science cannot shield scientists from their general responsibilities without sacrificing their autonomy. Currently, there are no adequate social structures that could fully take over this function from scientists, if we thought it desirable to do so. And to fully develop such a structure would involve a very high level of oversight and possible intervention in science, at every decision point scientists have. Such oversight would obliterate scientific autonomy. This does not mean scientists should be fully on their own when grappling with these difficult issues

raised by general responsibilities. When research programs are well-mapped out ahead of time, general public discussion of the potential impacts can help scientists shoulder the burden. But precisely because they are in the forefront of an ever-changing field, they cannot fully relinquish their general responsibilities without fully losing autonomy.

Because of the awesome power of science to change both our world, our lives, and our conception of ourselves, the actual implementation of scientists' general responsibilities will fall heavily on them. With full awareness of science's efficacy and power, scientists must think carefully about the possible impacts and potential implications of their work. Although there is no qualitative difference between this responsibility and the responsibility of automobile drivers to proceed with due care and caution, the quantitative burden is much greater. The ability to do harm (and good) is much greater for a scientist, and the terrain almost always unfamiliar. The level of reflection such responsibility requires may slow down science, but such is the price we all pay for responsible behavior. The driver may need to take more time getting to his destination; similarly the scientist may need to take more time in developing her research and determining how to present the results.

However, it must be emphasized that the responsibility to reflect on potential consequences of one's work does not arise *because* science has such power. The basis for this responsibility is one all humans share as moral agents. Scientists are not excused from this responsibility because they are scientists searching for truth. Truth is not such a transcendent good that only truth matters. And the social structure that could relieve scientists of their general responsibilities is neither in place (as it would need to be before scientists could give up such responsibilities) nor could it ever fully be in place, without a complete loss of scientific autonomy. Scientists must shoulder at least some of this general responsibility. The power of science simply makes the fulfillment of the responsibility more urgent. Thus, scientists, with the power they wield through their endeavors, must show due care with the execution of the general responsibility not to be reckless or negligent. Contrary to the tendencies of the past century, scientists should place *more* thought into the consequences of their actions as scientists because they are scientists, particularly social consequences, not less.

V. Conclusion: Difficult Weighings Ahead

While the search for truth is not a transcendent good, it still is a good. When considering both intended and unintended consequences of one's work, the development of knowledge is an important and worthy goal for scientists—but it must be weighed against other goods, including basic human rights, quality of life, and environmental health.

From the responsibility to weigh and find the right balance of goods, it does not follow automatically that some research should be forbidden. Scientists (and nonscientists) need to weigh carefully the goods of developing knowledge with the risks that might be involved. Sometimes scientists will decide that the good of the knowledge to be gained will outweigh the necessary risks; other times they will not. And sometimes scientists will figure out ways to mitigate the potential risks so that unacceptable risks become acceptable (e.g., recombinant DNA). Because developing knowledge is a good, the vast majority of research programs should be continued, but the behavior of scientists in

performing their work may need to be modified.

In addition, the picture of the moral responsibilities of scientists painted here makes no direct claim on whether pursuing a particular piece of knowledge should be forbidden. What should be clear from the analysis above is that it is theoretically possible for some areas of research to be forbidden because the risks of harm are judged to outweigh the potential benefits. Whether or not it makes sense to forbid scientists (and others) from pursuing some piece of knowledge has been addressed by others recently (Johnson 1996; Kitcher 2001, 93–108). In the examples put forth by Johnson and Kitcher, it becomes apparent how difficult it is to make a case that the pursuit of some knowledge should be forbidden. Only very particular social circumstances in which the basis of free inquiry itself is threatened by a research program (as in Kitcher's example) or some other similarly threatening possibility (such as knowledge that can *only* be used to produce egregious harms) seems to rise to the occasion of justifying a prohibition. This is because we cannot be sure what might be discovered in a research program, knowledge is a value, and there are so many other ways of mitigating the harmful effects of knowledge. Despite this complexity, there is too much at stake for the general responsibilities of scientists to be neglected. Careful reflection and justification of scientific decisions is needed.

Nor does this essay imply that scientists must give up their autonomy. It is doubtful an oversight system that would adequately address the general responsibilities could be effectively implemented. It does mean however, that scientists cannot run their profession on the basis of isolation from society; they must accept their general responsibilities that are an inescapable part of their work and meet them fully. Only by meeting their responsibilities will scientists be able to maintain the autonomous decision-making so hard fought for after the Second World War.

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NOTES

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1. This view is also expressed in Merton 1938, 261, and Wueste 1994, 2, to be challenged by both.

2. However one weighs those harms. While utilitarian frameworks for negligence have been standard, Simons 1999 argues for deontological frameworks in evaluating unjustified risk.

3. The issue has been raised whether fraud in science is encouraged by institutional arrangements that place too much emphasis on the pursuit of credit. There is also debate on the extent of fraud in science. See Callahan 1994.

4. Some generally accepted responsibilities do not serve the goal of knowledge, but instead act to protect the boundaries and autonomy of science. For example, scientists are expected to maintain the ethical standards of proper research, particularly when dealing with living subjects, and scientists have agreed to come under systematic regulatory review in order to protect those ethical standards. Such review keeps scientists from having to shoulder this heavy burden themselves, and also keeps unwanted scrutiny and interference out of science. While this arrangement forces scientists to give up some autonomy, in the long run, it protects scientific autonomy.

5. If one is desperate to shield scientists from their general moral responsibilities, one could argue that the scientists should only think about the potential consequences of their work when developing methodologies. Such methodological considerations would prevent scientists from using unethical methodologies, and would perhaps keep scientists from inadvertently bringing catastrophe upon the world (as in the bomb case). Under this view, once the methodology is set up, scientists should cease to think about the potential consequences of their work and of its possible errors. Such a move requires that one can make a clean distinction between a methodology selected at the beginning of a study (when one would be required to think of consequences) and choices made later in the study (when one would not). Such a clean distinction seems to me untenable. Studies rarely go perfectly as planned, and judgments must be made along the way on whether to keep intact or modify original methodological choices. In addition, events may occur that are unexpected and for which no methodological protocols are in place. Why should only expected events receive full considerations and unexpected ones not? Science in practice is too fluid for such clean distinctions.

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