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Socially Responsible Science: Exploring the Complexities

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Abstract

Philosophers of science, particularly those working on science and values, often talk about the need for science to be socially responsible. However, what this means is not clear. In this paper, we review the contributions of philosophers of science to the debate over socially responsible science and explore the dimensions that a fruitful account of socially responsible science should address. Our review shows that offering a comprehensive account is difficult. We contend that broad calls for socially responsible science that fail to attend to relevant dimensions are not the solution, as they preclude meaningful changes to research institutions and practices. We conclude that narrower, more explicit accounts are more likely to lead to substantive transformation.

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Socially Responsible Science: Exploring the Complexities

1. Introduction

A variety of forces influencing science have made the call for more socially responsible science (SRS) compelling and urgent. First, scientific research has sometimes been utilized to reinforce social inequalities. For instance, research on the biological causes of racial or gender differences has been used to validate negative gender and racial stereotypes and to justify discriminatory public policies (Fine 2010; Richardson 2013; Bluhm 2013). Second, the increasing influence of commercial interests in scientific research has called attention to the negative epistemic and social consequences that such interests can have. Take, for example, the tobacco and oil industry production of biased research and the dissemination of misinformation regarding the safety of their products with the aim of protecting their market share from adverse regulations (Michaels 2008; Oreskes and Conway 2010). Or, consider how the pharmaceutical industry contributed to the current opioid epidemic in the U.S. by promoting the expansion of the opioid market from cancer patients to those with acute or chronic pain, supporting increases in dosage, and downplaying the risks of addiction and abuse (Macy 2018; Marks 2020; Makhinson et al. 2021). Third, the growing recognition of the necessary roles of non-epistemic values in science has raised questions about which and whose values should be influencing research. Feminist work has been crucial in both uncovering problematic values underlying much scientific research and calling attention to the epistemic and social benefits that contextual values can bring to knowledge production (Longino 1990; Martin 1991; Wylie 2001; Richardson, S 2012). Finally, much scientific research fails to benefit communities, particularly those least well off and with some of the most pressing needs (Evans, Shim, and Ioannidis 2014; von Philipsborn et al. 2015; Yegros-Yegros et al. 2020). Much attention has been given, for instance, to the misalignment between disease burden and research funding in general, and the lack of concern among high-income country researchers, who produce the vast majority of global health knowledge, regarding the health needs of those in low-income countries in particular (Evans, Shim, and Ioannidis 2014; von Philipsborn et al. 2015; Yegros-Yegros et al. 2020).

These various concerns have led philosophers of science, especially those working on science and values, to call for science to be more socially responsible (Douglas 2009; Kourany 2010; de Melo-Martin and Intemann 2011; Brown 2013; Bird 2014; Resnik and Elliott 2016). Those making this appeal usually are calling for something more than just epistemically sound science.[1] Policies that govern responsible conduct of research (RCR) in science and engineering

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[1] We assume that there are also responsibilities to ensure the epistemic integrity or soundness of science, but our point here is just that calls for SRS tend to be broader, or involve something in addition to, epistemic integrity. What the relationship is between epistemically sound science and socially responsible science is an open question (and, as we will show, may depend on how SRS is understood). That science is socially responsible may be independent of whether it is epistemically sound, or it could be that these considerations are at least partly interrelated. Whether epistemic or ethical/social considerations are lexically prior is also an open question, one that also depends on how one conceives of SRS. In some contexts, it might make sense to ask whether some science is socially responsible only if it is already epistemically sound, but in other contexts, such as setting research agendas or framing questions, social considerations would be relevant before any methodologies are selected or data is collected or interpreted.

have tended to focus on safeguarding research integrity and proposing ethical rules to protect human and animal subjects (Bird 2006). In general, however, those who argue for SRS are advocating for attention to some *social* aspects of science that are not completely captured by traditional RCR policies or that are usually neglected by scientific communities and research institutions even when RCR policies include some such social responsibilities.

Nonetheless, as we show below, it is not clear what exactly is being called for by those who advocate for SRS, or whether they are really encouraging the same thing. Calls for SRS tend to be general such that they are taken to be uncontroversial. As a result, there has been little interrogation of the concept or what it would require of scientists or institutions in practice. Our goal here is to try to advance discussions on this topic. We first motivate our project by explaining why attaining conceptual clarity regarding SRS is important. We then review the relevant literature exploring the various dimensions that an adequate account of SRS should address. Our review shows that such an account must provide information about *who* has the responsibilities in question, *what* those responsibilities may be*, to whom* they are owed, and the *nature* of the responsibilities. We argue that explicitly calling attention to these needed dimensions is helpful in three ways: i) it provides guidance for those who want to develop meaningful accounts of SRS; ii) it calls attention to the complexity of offering such an account; and iii) it reveals that broad calls for SRS are unlikely to facilitate substantive changes to scientific research agendas or practices. This does not mean that philosophers of science should give up on trying to contribute to the production of socially responsible science. We conclude that they can do so more successfully by providing not general calls for SRS, but targeted ones that specify particular responsibilities that individual scientists or institutions owe to specific groups of stakeholders with respect to certain activities.

2. The Need for Conceptual Clarity

Insofar as socially responsible science is desirable, achieving greater conceptual clarity about what it involves is important for several reasons. First, while few would doubt that science should be socially responsible, significant disagreements exist regarding what this means. However, even when they might be substantive, these disagreements are obscured by the vagueness and intuitiveness of the term. For example, while some might argue that individual scientists are primarily responsible for ensuring SRS (Douglas 2003; Resnik and Elliott 2016), others might think that such responsibility falls on research funding institutions (Kitcher 2001). Likewise, although some conceptions of SRS might understand it as science that aims to address some pressing needs (Reiss and Kitcher 2009), others might understand it as science that tackles problems of relevance to underserved populations (Harding 2008). Thus, even when philosophers are using the same term, engagement with each other's arguments might be lacking and they may be talking past each other. Conceptual clarification can thus reveal lines of disagreement that need to be uncovered to generate more precise, fruitful, and constructive debates.

Second, elucidating what SRS amounts to is necessary for providing guidance to those trying to do or promote SRS. More clarity is needed for this norm to be action guiding, particularly if individuals or institutions are going to be held accountable for whether they encourage or hinder SRS.

Third, conceptual clarification can help us determine what normative recommendations follow for promoting SRS. For instance, contending that science is socially responsible when it aims to have fair and inclusive processes might call for structuring scientific communities in ways more likely to engage a diversity of views or to address barriers to participation. Similarly, conceptualizing SRS as science that aims to produce knowledge beneficial to certain groups may require strategies for incorporating stakeholder participation in research agenda setting or other stages of research.

Fourth, clarifying what constitutes SRS can allow us to determine whether the normative implications of different accounts are in conflict and thus whether the strategies used to promote a particular view of SRS are likely to work or not for alternative conceptualizations. For example, understanding SRS as requiring that science should benefit groups that are most significantly impacted by – for instance – climate change, may impose obligations to engage with those groups in substantive ways throughout the research process. Yet, if benefiting all or benefiting society in general is the hallmark of SRS, then engaging only some members of the community is unlikely to produce SRS.

Finally, expounding what constitutes SRS allows us to assess various proposals for SRS to determine whether some conceptions are better than others. It also permits a careful defense of on what grounds that might be the case.

3. What Constitutes Socially Responsible Science?

In principle, calls for more socially responsible science do not appear particularly controversial. Science is, after all, a social enterprise and interacts with society in complex ways. The production of scientific and technological knowledge can be harnessed to addresses important social problems, such as mitigating and adapting to climate change, producing more nutritious crops, or treating various diseases. But even when research is epistemically sound, it can also fail to address the needs and interests of many in society, sometimes, even those it is intending to help (Intemann and de Melo-Martin 2010). Science can be practiced in ways that are more or less inclusive of certain social groups, or that facilitate or undermine warranted trust (Grasswick 2010; Scheman 2001; de Melo-Martín and Intemann 2018). Furthermore, the growing recognition that social values play pervasive and crucial roles in scientific decision-making (Douglas 2009; Kourany 2010; de Melo-Martin and Intemann 2011; Resnik and Elliott 2016; Brown 2020), raises difficult questions about which values ought to be endorsed, especially since scientists themselves are not representative of the general population. As with any other social enterprise, scientists, scientific institutions, or the scientific enterprise in general can be held responsible for the choices made and the activities in which they engage. Calls for socially responsible research seem thus consistent with the social nature of science.

But the social nature of science also makes calls for responsible science complex. Various actors e.g., individual scientists, scientific communities, research institutions, or funding agencies are involved in the making of science and thus an appropriate account of SRS must contend with questions about who is responsible for producing, or failing to produce, SRS. Additionally, different entities, can be affected by science, from the planet or society as a whole, to taxpayers, and particular groups. Moreover, various aspects of the research enterprise could generate obligations, from funding decisions, to research practices, questions, methodologies, and interpretations of data, to communication norms, to scientific products. Finally, given the complexity of social responsibility practices, calls for SRS must also contend with what the nature of the obligations is. Obligations may be more aspirational, such as the obligation to help make the world a better place, or more formal and stringent, such as obligations to obtain informed consent.

As we show below, exploring each of these dimensions is necessary because how they are understood can give rise to diverse conceptions of SRS, which in turn may require very different strategies and practices in order to achieve it. In what follows we review the relevant literature on SRS to examine in detail the various dimensions of responsibility.

3.1 Who Is Responsible?

The notion of responsibility is usually and most clearly associated with individual agents. Indeed, traditional RCR regulations describe the responsibilities of individual scientists. For example, they regulate how researchers should approach research practices such as collection of data, use of animals, engagement with research participants, or determinations of authorship. In general, RCR policies require individuals to refrain from certain behaviors, such as plagiarizing or fabricating data, or mandate specific actions, such establishing best practices for research record keeping.

Yet communities and institutions can also be considered to have responsibilities and can be held accountable for them (Gilbert 2000; French and Wettstein 2006). Arguably, research teams, broader research communities, institutions, and scientific organizations can play significant roles in determining scientific practices, ensuring that such practices are followed, and promoting strategists that cultivate or discourage research integrity, social responsibilities, and ethically sound science. Such groups can also play a role in determining funding priorities and research agendas.

Some calls for SRS seem to primarily focus on individual scientists (Douglas 2003; Bird 2014; Resnik and Elliott 2016). On these accounts, scientists have some responsibilities on two grounds: in virtue of being human beings and in virtue of their role as scientists, and they can be held accountable for meeting or failing to meet their obligations. Scientists, just like the rest of us, have obligations to consider how their actions may harm or affect others (Douglas 2003). Furthermore, as researchers, they also have professional obligations to consider the nature of their work, and its ability to impact society, both epistemically and ethically. Thus, some who discuss the need for SRS emphasize the obligations of individual scientists to consider the foreseeable societal impacts of the research they conduct, reflect on what kinds of science can meet the needs of society, and reflect on the value implications of their work.

Others, however, aware of the importance of collaborations in science, the relational nature of scientific practice, as well as of the complexity of factors in science that might properly be a target of epistemic and ethical obligations have focused on teams, scientific communities, or institutions as those with particular responsibilities to ensure that science is socially responsible (Kitcher 2001; Miller 2011; Rolin 2015; Dang 2019; Fleisher & Šešelja 2022). On these accounts, conducting science involves both social and epistemic collective ends, e.g., generating knowledge or predictions that can avert future large-scale harms or delivering safe and effective treatments against diseases, that require collective action and call for collective responsibilities. Working on large-scale problems, for instance, may give rise to responsibilities to work with researchers from diverse disciplines, ensure that the benefits and burdens of the collective project are distributed fairly, coordinate research efforts, utilize particular methodologies, share data with others or attend to the pressing needs of the diverse populations potentially impacted.

Of course, determining *who* is responsible is important so that those responsible can attempt to meet their duties. It is also important so as to allow relevant stakeholders to engage in accountability practices. Hence, any adequate account of SRS must determine *who* is responsible for producing –or failing to produce—science that is socially responsible.

3.2 To Whom Are Those Responsibilities Owed?

As a complex social activity, science can matter to different people or groups for a variety of reasons. Scientific benefits sometimes are received primarily by some, while the harms or risks are incurred by others. For instance, although the benefits of nuclear power are enjoyed by many, some communities are particularly burdened with the negative effects of nuclear waste (Shrader-Frechette 1993). Some individuals or groups might be more or less invested in ensuring that research in general, or some investigations in particular, advance. For example, advocacy groups, such as the Alzheimer's Association, and patients with the disease were highly influential in the recent, and controversial, approval by the FDA of aducanumab for treatment of Alzheimer's disease (Mullard 2021). Likewise, some indigenous groups have significant concerns regarding genomic research at least in part because of unethical conduct of researchers (Mello and Wolf 2010). Hence, also important to an adequate account of SRS is to determine those to whom scientists, institutions, etc., owe relevant responsibilities.

Calls for SRS have taken different stakeholders as appropriate targets of concern. For some, taxpayers are an appropriate source of authority. A significant amount of science is publicly funded (Moses et al. 2015), and directing public funds towards science is often justified on the basis that research will benefit taxpayers (Sarewitz 2006). At a minimum then, researchers or institutions have some responsibilities to ensure that benefits indeed accrue to taxpayers. Similarly, taxpayers or their representatives can hold relevant parties accountable in this regard. Indeed, that this responsibility exists has raised some concerns about whether they might constrain research autonomy (Cunningham et al. 2014).

Nonetheless, private industry is also a significant source of funding for research and development (R&D) worldwide. Industry funding in the US, for instance, accounted for 65% of total R&D spending in 2013 (NSB2016). Similarly, industry’s global biomedical research expenditures were approximately $162 billion in 2011 (Moses et al. 2015). Thus, we might ask to whom such researchers and companies are accountable and whether they have social responsibilities that extend beyond stockholders.

Furthermore, publicly funded science might affect non-taxpayers directly or indirectly. Consider, for instance, NIH funded research on gain-of-function experiments involving influenza, SARS, and MERS viruses, which though publicly funded by USA taxpayers could have impacts on people in other countries (Selgelid 2016; Evans, Lipsitch, and Levinson 2015). Thus, some might argue that there are responsibilities to those who are impacted by research, regardless of whether those groups also helped fund the research.

Calls for SRS usually have this broader group of stakeholders in mind. For some, researchers or institutions have responsibilities to all of those impacted by science in general (Brown 2020). Lacey (2016) argues that scientific research should be conducted so as to ensure respect for nature, in addition to promoting the well-being of everyone everywhere, suggesting that there are obligations that extend to entities beyond humans. Some have argued more specifically that researchers have responsibilities to those impacted by a particular research area, such as climate change (Intemann 2015; van Ginkel et al. 2020).

For some, however, considerations of social justice suggest that researchers and institutions do not have the same responsibilities to all of those who are impacted by the research at stake. On these accounts, researchers and institutions have special obligations to particular groups rather than to human beings in general. Many have argued that researchers have specific obligations when engaging or interacting with patients or subjects who have well-founded distrust of (white) researchers or their institutions (Warren et al. 2020). Standpoint feminists, for example, have argued that researchers have special obligations to marginalized groups when identifying research priorities, formulating questions, and utilizing particular methodologies (Harding 2008). Decolonial theorists have argued that because of the history of colonization, climate change researchers have special responsibilities to Indigenous peoples who are disproportionately impacted by changes to climate systems (Whyte 2017).

3.3 *What Are Their Responsibilities?*

Any adequate account of SRS must also indicate what exactly are the responsibilities that individual scientists or scientific institutions have. Arguably, any SRS account will take scientists and institutions to be responsible for the epistemic integrity of the research conducted. Obligations to be honest, share relevant information, ensure accuracy in data collection, or develop policies to prevent misconduct would contribute to ensuring epistemic integrity.

As mentioned earlier though, calls for SRS aim to propose additional social responsibilities that scientists or research institutions have. However, there are multiple social dimensions of research for which scientists or research institutions could conceivably be held accountable. First, several have argued that there are responsibilities regarding what is studied, which questions are prioritized, or what is funded (Kitcher 2001; Reiss and Kitcher 2009; Pogge 2012; Kourany 2010). For some advocates of SRS this means that scientists and institutions have responsibilities to conduct research that advances particular ethical and political ends such as justice, egalitarianism, or minimization of oppression (Fruchterman 2004; Kourany 2010). In some cases advancing such goals obligates scientists and institutions to not conduct certain type of research, such as research on racial or gender cognitive differences because such research has produced very little significant knowledge but has resulted in significant harms by reinforcing unfounded racial and gender stereotypes that are used to justify inequalities (Kourany 2016; Leuschner and Fernandez Pinto 2021). In others, promoting justice or other ethical goals, can actually impose obligations to prioritize certain types of research, such as those in neglected diseases (Reiss and Kitcher 2009)

More often, calls for SRS, contend that scientists –and/or institutions-- have responsibilities for the products or impacts of their research (Shrader-Frechette 2007; Douglas 2009; Resnik and Elliott 2016). At a minimum, this might be understood as a responsibility to avoid imposing unnecessary or unfair risks on those who may be affected. For example, the increasing number of high-containment biological laboratories allow for more research on new and re-emerging dangerous pathogens, but it also raises the possibility of accidents or thefts with potentially disastrous consequences (Vennis et al. 2021). From this perspective, where potential negative consequences of scientific innovations are foreseeable, scientists and institutions have responsibilities to minimize or, where possible, eliminate potential harms. In some cases, such responsibility might lead to prohibiting certain research because of the disastrous potential consequences (Lipsitch and Galvani 2014). Most science and engineering codes of ethics at least urge researchers to pay attention to the health, safety, and welfare of the public and the environment (NAS 1992; ASCE 2020; IEEE 2020).

Some philosophers of science have gone further and argued that scientists or institutions not only have obligations to consider the possible harms of the research they produce, but that they have responsibilities to ensure that the research actually provides benefits (Brown 2020). This view is also reflected in the broader-impacts criterion for funding agencies, such as the National Science Foundation. In some cases, it is foreseeable that the end products of research, even if successful, are not likely to have wide benefits. Research on recyclable plastics, for example, may predictably yield limited social benefits if such materials are cost-prohibitive, or cannot be adopted by many communities because of an existing lack of recycling infrastructure (Sicotte and Seamon 2021). Research that focuses on lifestyle changes to address chronic diseases can have significant benefits but it is nonetheless often neglected (Vodovotz et al. 2020). Thus, conceptions of SRS that call for science to attend to benefits impose duties on researchers, funding agencies, or research institutions to support, pursue, and conduct research that is at more likely to yield social benefits.

Yet what constitutes a social benefit is contested. Some construe social benefits as primarily economic ones (Leff 1984), while others take them to involve addressing particularly pressing social needs such as food insecurity or life threatening diseases (e.g., Reiss and Kitcher 2009; de Melo-Martin and Intemann 2011) or factors that most deeply impact human flourishing (Kourany 2010).

Some advocates of SRS have focused less on the results or direction of research and more on ensuring responsible decision-making or appropriate processes. Kitcher (2001, 2011), for example, is concerned with how to make fair or responsible decisions about research priorities or agendas, and Longino (2002) has emphasized the need to ensure that the processes, methodologies, or norms that govern participation in science are fair, promote objectivity, and are socially just. What might be required in this case is adherence to responsible processes, rather than a responsibility to study (or not study) particular topics or achieve specific benefits.

For others, SRS involves responsibilities regarding how research is pursued or what kinds of methodologies are employed. For example, in biomedical research, there might be distinct responsibilities to engage in certain practices when conducting clinical trials. Some groups are at high-risk of severe COVID because of complex social factors, such as underlying health conditions that are deeply intertwined with a history of systemic racism, lack of access to healthcare, and distrust of medical institutions and health care professionals (Warren et al. 2020; Egede and Walker 2020). To the extent that participating in clinical trials could be of potential benefit, biomedical researchers might be thought in such cases to have responsibilities to ensure that such groups have access to clinical trials for certain interventions. They might also be thought to have responsibilities to develop and implement strategies that promote trustworthiness and foster credibility so that this minimizes obstacles to participation (Egede and Walker 2020).[2] Similarly, some have argued that those doing research related to particular communities have obligations to abide by certain ethical principles for doing community-based participatory research, including building respectful relationships, allowing the co-production of research questions and methodologies, sharing data, and ensuring that the research is mutually beneficial (Koskinen 2014; Wallerstein et al. 2017).

In other cases, methodological decisions may depend on value judgments, such as whether it is preferable to have a higher rate of false positives or false negatives when designing a test (Surkova, Nikolayevskyy, and Drobniewski 2020), characterizing evidence (Douglas 2009), making modeling decisions (Winsberg 2012) or calculating other epistemic risks (Biddle 2020). In such cases, judgments made about which sort of risks are more acceptable can result in conflicting policy recommendations (de Melo-Martin and Intemann 2016; John 2015).

Yet making value judgments goes beyond the expertise of individual researchers. This might impose obligations on scientists to be transparent about the value judgements they make so that such judgments can be critically evaluated, or to involve others in analyses of risks (Douglas 2009; Intemann and de Melo-Martin 2010; Resnik and Elliott 2016). For instance, while there have been improvements to climate models that reduce uncertainties about cloud formation, aerosols, and water vapor feedback, significant uncertainties remain (IPCC 2021). These uncertainties carry risk of errors. Models might contain parameterizations for clouds that overestimate (or underestimate) the extent to which clouds will contribute to warming effects (Intemann 2015). In the face of such uncertainties, climate scientists may decide that it is better to run the risk of overestimating warming feedbacks than to underestimate them, so as to enable policymakers to protect against the worst-case scenario. This, however, is a value judgment. Scientists could be required to make uncertainties and their value judgments about which risks are acceptable transparent (Elliott and McKaughan 2014). Policy makers could then evaluate how different value judgments might have produced different scientific results.

Some have argued that scientists have responsibilities not only for what they study and how they study it, but also for how they communicate results and engage with various publics (Resnik and Elliott 2016; John 2019). Such accounts impose obligations about what information or data should be publicly shared, and how results should be responsibly communicated to other experts, non-experts, and policymakers. Communication responsibilities might be particularly

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[2] Note that there may also be epistemic obligations for having an adequately diverse pool of human subjects in a clinical trial. Doing so may be necessary for achieving generalizable knowledge. Our point here is that ethical considerations can also give rise to responsibilities to increase diversity or foster participation of certain groups. As mentioned earlier, whether epistemic or ethical/social considerations come first or have lexical priority is an open question. Indeed, it might well be a misguided question insofar as these issues are often interconnected.

important when contested value judgments are involved in the research (Resnik and Elliott 2016; John 2019), when the results of science reinforce widespread social norms or biases (Havstad 2021), or insofar as there are risks or uncertainties involved that vary depending on the values at play (Intemann 2020).

3.4 What Is the Nature of the Responsibilities?

Given the wide range of decisions and practices for which scientists or scientific institutions might conceivably be responsible, it is also important for an adequate account of SRS to describe what the nature of those responsibilities is. That is, it needs to clarify whether the obligations imposed in order to produce SRS are legally enforceable or whether they simply have moral force (Douglas 2014). For instance, the obligation to obtain informed consent from most research subjects is legally binding and a variety of institutional mechanisms exist to ensure that researchers fulfill this duty and that they are sanctioned in various ways if they do not. On the other hand, although some consider them to be moral in nature (Richardson, H 2012), whether researchers' ancillary-care responsibilities (e.g., providing care for a disease that is unrelated to the study in question) should be enforceable is contested.

If the responsibilities in question are meant to be moral ones, an appropriate account of SRS also needs to explain what their moral force is. That is, it needs to indicate whether the responsibilities are morally binding and thus call for appropriate reactive responses such as blaming and judgments of culpability or whether they are meant as aspirational. For instance, one might conceive of the responsibilities involved in producing SRS as a normative ideal of *good science,* rather than biding moral obligations. Kitcher (2001, 2011), for example, gives an account of well-ordered science where ideally-informed decision makers determine priorities for research agendas. While he intends his account to be action guiding, that is, to provide a basis for making judgments about whether science is well-ordered given the needs and interests of a democratic society, it is not clear that scientists or even scientific funding institutions should be sanctioned for failing to produce well-ordered science. This way of understanding SSR can still allow relevant stakeholders to hold scientists or institutions accountable in some sense, as they might offer criticism of those who blatantly disregard the ideal or might ask for justification of decisions or actions in relation to the ideal. It also provides scientists and institutions with action-guiding rules and principles that they should strive to follow.

On the other hand, one might conceive of the relevant obligations as morally binding ones that call for blame and praise and for moral emotions such as resentment and guilt. Scientists that fail to meet their duties regarding SRS could thus be blamed for not living up to their responsibilities. Their reputation could suffer as a result.

Determining the nature of the responsibilities aimed at producing SRS is important for various interrelated reasons. First, whether one thinks that the obligations are legally enforceable or only morally binding should have an influence on what obligations are proposed. For example, generally, enforceable obligations impose burdens on institutions to develop mechanisms for compliance, e.g., reporting processes, committees to investigate cases of suspected non-compliance, procedures to impose sanctions, or strategies to promote compliance. Enforceable obligations also usually involve some punishment –from minor to very serious--for those who fail to fulfill their obligations regardless of whether such failure is unintentional or willful. Similarly, it is hard to see how some obligations could be enforceable. For instance, the obligation to incorporate input from stakeholders depends in part on the voluntary participation of others and thus enforcing such responsibility would be inappropriate.

Second, the nature of the obligations at stake might also influence how specific the obligations can be. Obligations that are merely aspirational might be more general than those intended as morally or legally binding. For example, arguably a duty to benefit all is aspirational given that it is beyond researchers' or even institutions' control to ensure that science benefits all. Sometimes research fails, unforeseeable harmful consequences result, and social, cultural, geographical, or environmental forces make it impossible for the benefits of particular interventions to be realized. Furthermore, different groups, communities, or individuals may disagree about what constitutes a benefit. On the other hand, a more specific obligation to ensure that clinical trial participants receive information about actionable incidental findings can be legally and morally enforceable.

4. Moving Forward

What is the upshot of the present exploration on what a successful account of SRS should involve? A few things seem particularly important. First, at a minimum, a robust, account of what constitutes SRS is unlikely to involve individual scientists alone as the subjects of responsibilities. Although individual scientists have a certain degree of power over relevant aspects of the research enterprise, as individuals they have little control over decisions and actions involving funding priorities, direction of the research agenda, or use of research products.

Second, contrary to what might appear by the presence of multiple calls for SRS, it seems clear that developing a rigorous, action-guiding account of SRS would not be an easy task. As we have argued, various considerations -- relevant to different activities or decisions, by scientists and institutions, with manifold impacts, on diverse stakeholders-- are at stake in producing science that is socially responsible. The interrelations among the different dimensions discussed above contribute to the complexities of a sound account of SRS. For instance, *who* is responsible affects –and is impacted by-- *what* their responsibilities can be and how those responsibilities can be enforced or encouraged. For example, while individual scientists, can discharge obligations to share data with relevant parties, obtain the consent of research subjects, reflect on the possible consequences of their research, or advocate for certain lines of research, they cannot individually be held accountable for ensuring that some types of research receive funding priority or for determining how research results will be used. Similarly, questions about *to whom* responsibilities are owed cannot be separated from considerations about *who* owes the obligations in question. For instance, an account of SRS that takes primarily individual scientists to be those responsible is likely to have difficulties providing a plausible account that the responsibilities are owed to all. And as mentioned, how one conceives of the nature of scientists or institutions' responsibilities has direct implications for what responsibilities one can reasonably propose. Insofar as one conceptualizes responsibilities as legally enforceable, it would be implausible to argue that individual scientists have obligations to ensure that particular research projects are conducted given their limited power over funding priorities.

A further upshot of this exploration is that broad calls for SRS are unhelpful. This is so first because, even when cognizant of the various dimensions of responsibility discussed above, broad calls neglect the relevance of these various dimensions as well as of their interrelatedness. Furthermore, broad calls are too vague to be genuinely action-guiding. This is so for two reasons. First, they cannot aid in determining whether particular research practices, institutional policies, or funding priorities might be promoting research that fails to be socially responsible. For example, without clarity regarding what types of benefits are relevant for SRS, any scientific project could be judged as socially responsible. After all, most, if not all, research can be described as benefiting at least some publics in some way. Indeed, researchers and institutions commonly claim that their research brings benefits such as knowledge-acquisition, economic gains, innovative technological developments, tools, evidence to guide policy, or improvements for human health. When the goal of SRS is vague, it becomes easy to show that some benefits will be produced, at least for someone. Broad calls are also unlikely to be of help in making decisions about which specific research strategies, methodological approaches, or funding schemes, might be more or less socially responsible. For instance, if one understands SRS as science that is more likely to promote justice, how would one determine between research directed at addressing some pressing health needs, one aimed at mitigating environmental harms, or one pursuing clean energy?

Second, broad calls for SRS cannot be genuinely action-guiding because they are unable to provide conditions for holding scientists or research institutions accountable for producing or failing to produce SRS. For example, unless one can identify *who* is responsible and *to whom* researchers and institutions owe responsibilities, it is hard to determine when members of the public have a claim, or which particular groups can hold scientists or research institutions accountable.

Given the complexities of offering a robust, action-guiding account of SRS, i.e., various actors, considerations, conflicting interests, and uncertainties and the problems that broad accounts face, it may be more useful to narrow the focus. Philosophers of science could propose explicit responsibilities that specific agents owe to particular groups of stakeholders with respect to certain activities, as well as the nature of those responsibilities. Indeed, some of these more specific accounts already exist. For example, there is a significant body of literature proposing detailed responsibilities that researchers have to the communities that are directly impacted by their research, including responsibilities and best practices for community-based participatory research (Koskinen 2014; Wallerstein et al. 2017). Other work has focused on the responsibilities that scientific institutions have in promoting fair and equitable research agendas and what that might look like (Kitcher 2011; Reiss and Kitcher 2009). More focused calls for SRS could also investigate whether anyone has special obligations to those least well-off or to historically oppressed groups, and what those obligations could be.

One might object that we are dismissing too swiftly the value that a broad call for SRS can have. After all, ethical guidelines followed by Research Ethics Committees (RECs), for instance, can include broad ethical rules such as “minimize risks to participants” “ensure that the burdens of research are fairly distributed,” or “maximize potential benefits of the research.” RECs review and make judgment about clinical research every day. Likewise, the –very broad-- medical precept “first do no harm,” is often used by healthcare professionals to make determinations about treatment for their patients.

Of course, we are not arguing that broad calls for SRS have no value whatsoever. It is true that RECs and healthcare professionals use broad ethical rules to make judgments about what research is ethical or what treatments might be appropriate. Broad ethical rules such as “scientific actors should do research that benefits the public in some way” present several advantages. They are likely to gain support from a diversity of relevant stakeholders and they can be used in ways that allow for consensus among different parties. Given that questions about funding priorities, research agendas, production of benefits, etc., are controversial, proposing guidelines that can achieve consensus is no small task. Broad calls can thus serve an important rhetorical purpose, allowing various stakeholders to command science that is more socially responsible. Furthermore, broad calls for SRS can be helpful in directing attention to some aspects of knowledge production that are often neglected by scientists and research institutions –e.g., ensure that research benefits marginalized populations, get input from communities that will be most affected by the research. They can also be helpful for directing funding decisions at the institutional level. For example, the portion of the NSF’s broader impact criterion that calls for research to benefit society is quite vague but nonetheless requires researchers to make the case as to how their work does so and, to some extent, enables individual reviewers and review panels to compare the strength of different proposals regarding the likelihood that such potential benefits would come to be.

Nonetheless, we do not believe that the possible advantages of broad calls for SRS make them more desirable than narrower, more specific accounts. This is so for several reasons. Although broad ethical rules of the type “scientists should conduct research that benefits the public,” can gain support and consensus more easily than more specific ones, such as “when conducting research with groups that have been mistreated by researchers in the pass, ensure that you develop strategies to engage the community and obtain their input, and do not proceed without the agreement from the relevant community authority,” this consensus will be at the cost of substantive changes to scientific research agendas or practices. This is so precisely because actors with conflicting views about what the relevant benefits are, or who the pertinent public is, will be able to more easily justify their actions in relation to a principle that is broad or vague. As mentioned earlier, most research can be described as offering some type of benefit to the public. Similarly, although few would reject scientists’ responsibility “to consider the harmful effects of their work,” how to proceed after such consideration, e.g., inform about potentially harmful effects and continue with the research; ensure that strategies are put in place to minimize harms before continuing with the research; change the direction of research to avoid the potential harms, is left open to each individual scientist or team.

Broad calls for SRS simply disguise the complexity of what a robust, action-guiding account of SRS involves. They also conceal the relevance of legitimate disagreements in the conceptualization of the different dimensions discussed. For example, we might broadly agree that researchers or institutions should avoid research that threatens human dignity, but there may be significant disagreement about what constitutes human dignity and which kinds of activities threaten it (de Melo-Martin 2011). Witness, for instance, the substantive disagreements that exist in relation to conducting research involving human embryos (de Melo-Martin 2008, 2011). Furthermore, insofar as general calls do not involve legal or moral enforcement, scientists or institutions less inclined to be attentive to the social dimensions and impacts of the research they conduct and fund would have little incentive to change course.

In fact, RECs ethical guidelines can have just these problems. Criticisms of the variability of RECs decisions regarding their research evaluations are common (Helfand et al. 2009; Abbott and Grady 2011; Polito et al. 2014; Michelson et al. 2018). It is not, or not necessarily, that some RECs are making incorrect decisions. On the contrary, the point is precisely that those inconsistent decisions can often be justified by referring to the ethical principles used to evaluate clinical research.

Furthermore, although RECs decisions about research are guided by some general ethical principles, regulations regarding the approval of clinical research are very detailed in many respects, e.g., what things cannot be considered benefits in assessments of risks and benefits, requirements for informed consent, confidentiality protections, and so on. RECs also have the authority to disapprove research that the Committees believe does not meet the ethical guidelines. Such guidelines are legally enforceable, and severe consequences can follow for researchers or institutions that fail to meet them.

Accounts of SRS that provide clear and specific responsibilities, e.g., "when conducting community-based participatory research, researchers must share data with their community partners in an agreed-upon form and timely manner," and impose explicit sanctions for failing to meet them might generate more disagreements about whether such responsibilities are grounded or feasible and can meet with challenges to enforcement. Nonetheless, they have more chances to bring about the changes that many of those calling for science to be more socially responsible seek.

5. Conclusions

While few would dispute that SRS is desirable, calls in philosophy of science for SRS make it difficult to determine what that involves. We have offered here a review of the relevant literature and showed that a robust account of SRS needs to attend to various dimensions of responsibility: who has the responsibilities called for, what those amount to, to whom they are owed, and what the nature of those responsibilities is. Although those calling for SRS can be quite aware of these different dimensions, we contend that they often neglect the complexity of attending to such dimensions and the consequences of doing so. We have shown that each of these elements can be interpreted in different ways and that they relate to each other in complex ways. This has led us to conclude that offering such an account is difficult. Moreover, given the relevance of these dimensions and the complexity of their relationships, we have also argued that broad, unspecific calls for SRS are ill-suited for bringing about the types of changes to either scientific practices or research agendas that motivate such calls.

Although one might take our claims to undermine efforts to promote more socially responsible science, we offer a more optimist reading of our conclusion: philosophers of science can be more effective in furthering substantive changes in science production by providing more clear and specific accounts of particular responsibilities. We hope that this exploration into what successful accounts of SRS must consider will help with that task.

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