2018

Respecting Public Investment: The Problems with Democratic Endorsement as a Criterion for Legitimate Value Influence in Science

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RESPECTING PUBLIC INVESTMENT: THE PROBLEMS WITH DEMOCRATIC ENDORSEMENT AS A CRITERION FOR LEGITIMATE VALUE INFLUENCE IN SCIENCE

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Thesis

presented in partial fulfillment of the requirements
for the degree of

Master of Arts
in Environmental Philosophy

The University of Montana
Missoula, MT

May 2018

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Korf, Rebecca, M. A., Spring 2018 Environmental Philosophy

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Criticism of the value-free ideal has motivated attempts to formulate a criterion for the legitimacy of non-epistemic value influence in science. I argue that this search aims to protect two main components of legitimacy, scientific integrity and justice. While integrity is primary, justice remains important, especially in setting scientific goals. One of the main proposals for setting legitimate goals is to rely on democratic endorsement (Intemann 2015). I critically assess four interpretations of this criterion, finding that all are problematic. I then propose and evaluate three alternative models that seek to better balance respect for the public with scientific expertise.

I. Introduction

The results of scientific research inform practices quotidian to political: from what we eat for breakfast to how governments set policies to adapt to climate change. While the results of science are used in a variety of value-laden settings, the practice has often portrayed itself as apolitical, objective, and value-free.

Philosophers of science have heavily criticized the value-free ideal, arguing that non-epistemic value influence is unavoidable, sometimes even desirable, but also sometimes illegitimate. Heather Douglas outlines the history of the value-free ideal and the recent challenges to such ideas (2016, 2-3). While it has long been accepted that values have a role in the selection of which topics to study, such influence was seen as outside of the practice of science. For example, values can obviously influence a geologist's decision to study the bedrock of an area (whether for resource extraction or for safer building practices), but such value-influence was believed to properly end at this decision and not remain through the geologist's practice of her study. Because values were not seen to play a part in the way scientific discoveries were justified—because scientists thought that values could be divorced from the way that evidence was gathered and evaluated—science itself could be legitimately considered value-free.

In 1953, Richard Rudner wrote "The Scientist qua Scientist makes Value Judgements," where he argued that values were essential to the ways scientists interacted with evidence and scientific justification. He contended that values properly play a role in deciding when a claim is justified. Evidence alone is not enough to decide that a hypothesis is valid; values allow us to determine when the evidence is sufficient to say that a hypothesis is confirmed.

In a 1960 response to Rudner, Isaac Levi laid the foundations for the value-free ideal. Levi contended that the decisions about justification could be made without values by relying on "canons of inference" such as simplicity and explanatory power. In 1977, Thomas Kuhn explained a similar view that also argued that societal values were irrelevant to the practice of science, but he termed the canons of inference as "epistemic values." Science could retain objectivity by using agreed-upon epistemic values to make value-laden decisions, avoiding subjective value influence in science.

This value-free ideal has been heavily challenged by philosophers of science. Heather Douglas helpfully groups these challenges into three main categories (2016, 3). First, the descriptive challenge claimed that even science seen as exemplary seemed fraught with value-laden assumptions. Using observations of early primatology and studies of human development, feminist scholars such as Haraway (1989), Longino (1990), and Martin (1996), among others, argued that sexist presuppositions were pervasive in science and influenced the way science—even "good science"—was practiced. When these scholars tried to find ways to remove such values from science, they found that such a task was impossible. Science required value-laden background assumptions and theory choice and could not be done in a "value-free" manner.

Second, other philosophers have argued that the epistemic/non-epistemic distinction made by Kuhn cannot be clearly drawn. Rooney (1992) argued that the way we make this distinction is influenced by non-epistemic values; Longino (1995) in turn, that such a distinction seems arbitrary and that there are good reasons to choose the opposite of several classical empirical values (for example, novelty over consistency).

The third challenge comes from normative grounds: values *should* influence science (Douglas 2016, 6). The inductive risk argument most prominently developed by Douglas is a good example: it makes good sense to use societal values to determine when a hypothesis is sufficiently justified. The normative force of the argument comes from the epistemic priority given to scientists by the public. Such authority comes with a responsibility to be "neither reckless nor negligent" (6). In practice, this means the social implications of a finding should play a role deciding whether or not such a finding should be considered adequately justified and acting on this justification. If a confirmation of a certain hypothesis has societal implications, the evidential standards should respond in a way that minimizes risks. For example, it is rational to have high standards for the safety and efficacy of medicine, but it is also rational to have lower evidential standards for contamination in drinking water. It is thus desirable to have non-epistemic values available to help in "the moment of inference" (Douglas 2016, 8).

While these challenges argue that value influence is inevitable and perhaps desirable, there also are clear cases where such non-epistemic value influence is undesirable. Recent discussion in this area has focused on determining a criterion that delineates the conditions where value influence is legitimate and where it is not.

In this paper, I explain two major approaches towards determining the legitimacy of non-epistemic value influence in science, showing how each requires a criterion for determining the legitimacy of scientific goals. I then discuss the notion of legitimacy, showing how it contains two main concepts: scientific integrity and justice. While I argue that integrity is more important, the question of justice remains. Next, I evaluate a prominent suggestion to determine legitimate goals for science: democratic endorsement. I propose four interpretations of democratic endorsement, showing how each is problematic to a different degree. Finally, I evaluate three alternative criteria that balance public dignity, public well-being, and scientific expertise.

II. Values in Science

Values are priorities, virtues, and preferences that guide the way that we act, think, and feel. For example, a list of values might include classic moral virtues such as humility, courage, and honesty but there are a large variety of possible values; we can value material wealth, our relationships, competition, benevolence, tribalism, and/or tolerance. Values can be as specific as a desire to see one's child succeed in soccer to as general as a desire to minimize overall suffering. A key distinction in this paper is between epistemic values, such as truth and accuracy, from non-epistemic values, such as courage and fairness. As discussed in the introduction, this distinction is not universally accepted (Rooney 1992, Longino 1995). My arguments throughout this paper does not rely on the possibility of such a distinction, but I find that the terms lend conceptual clarity.

Whether epistemic or non-epistemic, values can be informed by one's background, experiences, relationships, and reason, among other factors. For example, personal life experience might convince one person of the need to respect autonomy; another person might hold the same value but learned it instead from an undergraduate ethics lecture on Kant; yet another might have been taught a similar lesson by her mother. Kant himself believed that moral values can come from reason alone; he held that it was rational to promote autonomy and possible to use reason to form and apply the categorical imperative.

Another factor that can lead to value formation is expertise. Expertise is specialized skills or knowledge that can come from a variety of sources, most commonly education or experience.[1] Experience in a field can help one understand what should be prioritized, valued, or protected. While there are many forms of expertise, such as the expertise of a parent raising her fourth child

[1] A more full discussion of expertise can be found in Collins and Evans (2007).

or the expertise gained from traditional ecological knowledge, this paper focuses on scientific expertise. Scientific expertise is only one of the factors that inform values, but it is relevant in this paper because only a subset of the population has such expertise. Thus, the values of many working scientists are informed by an extra factor unavailable to nonscientists. Scientific expertise can also be seen as an epistemic privilege unavailable to members of the general public.[2]

While the values of scientists can be affected by their expertise, we still need a method to determine if and when these values can legitimately impact their scientific work. In response to criticism of the value-free ideal, two approaches have been proposed to determine the legitimacy of non-epistemic value influence in science. The roles approach, developed most prominently by Douglas, protects an epistemic core from influence by non-epistemic values. Non-epistemic value influence may be legitimate only if it does not corrupt this core, sparingly defined as logical consistency and empirical adequacy. In this conception it is the ways in which values influence science, rather than the type of values, that determine legitimacy.

Douglas's framework makes three key distinctions. First, value influence may be direct or indirect (2016, 10). This distinction acknowledges that values can play different kinds of roles in scientific decision-making. Direct value influence occurs when values serve as "reasons in themselves" for making decisions (10). For example, a scientist could be motivated by a value of

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[2] It should be emphasized that the public may have other types of expertise unavailable to scientists. For example, the public is the expert of their own experience and desires. Nonscientists might also lack formal scientific training but might possess astonishingly nuanced and valuable traditional ecological knowledge that comes from living in a place for an extended period of time. Such highly place-based knowledge is often unavailable to scientists who study general systems. This expertise, and the values that may come from it, can also constitute epistemic priority and should be taken seriously. While this paper focuses on scientific expertise, many of the arguments can also be applied to other forms of expertise such as traditional ecological knowledge.

respect for animal suffering and choose not to test experimental drugs on lab rats because of this value alone. In contrast, indirect value influence can help in the decision of whether the evidence for a hypothesis is sufficient, but the value does not serve as a reason in and of itself. An example of this kind of value influence is a scientist who decides to delay submitting a paper for publication that might add fuel to a racist's ideological fire until she is abundantly sure her data is sufficient. While her value of the equal dignity of all members of humanity influenced her decision, it cannot and does not substitute as evidence.

The second distinction is between the two areas in which such influence may occur. External decisions occur outside of scientific study itself but may be about what to study or the method of study. The scientist above who chooses not to use lab rats as experiments is making an external value judgment. Internal value influence can affect decisions about the evidence characterization and interpretation, such as which models to use or variables to measure.

These distinctions are the basis of Douglas's criteria for legitimacy (2016, 10). Direct value influence is only acceptable when external, for example, when deciding which subjects to study. In contrast, indirect value influence is acceptable and sometimes desirable internally as well as externally. Indirect, internal, legitimate influence includes cases such as inductive risk reasoning (such as the scientist above being extremely careful about the evidential standards of her study). Thus in the roles approach, it is the ways in which non-epistemic value influence occurs that serves as the prime determiner of legitimacy.

In contrast to the roles approach, the aims approach argues that value influence is legitimate if and only if it successfully serves legitimate goals. It is the kind of goals that determines the legitimacy of non-epistemic value influence, rather than the ways that such values may impact science. If a scientist's goal of helping the poor impacts her practice, the aims approach evaluates the appropriateness of that goal rather than the ways her goal might impact the way she performs her study. Kevin Elliott's 2017 book *A Tapestry of Values* defines legitimate goals as ones that are transparent, representative, and inclusive of input of stakeholders (2017, 10). Kristen Intemann defines legitimate goals as ones that are "democratically endorsed" (2015, 217). I will address the problem of how to clarify the concept of 'democratically endorsed' or 'representative' in section IV.

Both approaches balance the roles of epistemic integrity and legitimate goals for science in different ways. In the aims approach, the primary consideration is the legitimacy of goals, with the assumption that for value influence to successfully serve those goals it must protect epistemic integrity (Intemann 2015, 227). There are two ways this might occur: the protection of epistemic integrity may be a democratically endorsed goal, or epistemic integrity may be needed to achieve democratically endorsed goals. Either way, such protection is contingent on conditions that may not always be present. The roles approach, in contrast, explicitly protects epistemic integrity from non-epistemic value influence. However, external or indirect value influence is acceptable because it does not affect the epistemic core.

Douglas's framework allows for direct influence in external settings such as the setting of scientific goals, but she does not explicitly discuss the legitimacy of the types of values that may influence this process. However, the question of value influence in the selection of scientific goals is still extremely relevant. Just as evidential standards have societal implications that should be considered through inductive risk reasoning, decisions about what to study also have public impacts that should be considered when determining scientific goals. Thus, there is ample room (and a need for further discussion) within Douglas's framework to for questions of legitimacy of scientific goals, because those scientific goals have societal impacts.

In the next section, I argue that one way to conceive of the difference between two approaches is to conceive of their approaches to what "legitimacy" means, one focusing on protecting epistemic integrity, the other focusing on just goals for science. Within this framework, both approaches still need a way to articulate whether a scientific goal is acceptable.

III. Legitimacy as Justice and Integrity

One can understand the difference between the two approaches as a difference in their conception of "legitimacy."

Douglas describes legitimate value influence in science as that which retains the trustworthy nature of science—a practice whose findings retain the epistemic integrity normally expected of science. The definition is intuitively appealing because it attempts to protect the integrity of science as a practice. Without epistemic integrity, science fails to further the project of gathering reliable knowledge about the world.

The aims approach takes a different perspective on the notion of legitimacy, seeing it primarily as a question of justice. If legitimate value influence is that which successfully pursues legitimate goals, it is the goals of research that determine the legitimacy of such value influence. The goal of research cannot be simply to preserve epistemic integrity; it needs to serve some kind of justice.[3] This definition is appealing because it recognizes the societal power of science and the need to respect public investment in science. In addition, justice is an intrinsic good, arguably a characteristic to which all societal endeavors should aspire.

Integrity and justice, while both important, can come into conflict. I contend that integrity should take priority in these cases. Consider the four possibilities for non-epistemic value

[3]A thorough discussion of what counts as justice falls beyond the scope of this paper. We will consider two main components of 'justice': promoting public well-being and respecting public autonomy.

influence in science created by the two criteria: science that retains integrity and pursues just goals (J ∧ I), science that does not retain integrity but does pursue just goals (J ∧ ~I), science that retains integrity but pursues unjust goals (~J ∧ I), and science that neither retains integrity nor pursues just goals (~J ∧ ~I).[4]

1. J ∧ I. Science that pursues just goals and retains epistemic integrity is obviously desirable. For example, a psychologist might be motivated by a desire to help people to be especially careful in her assessments of refugee children. Fisheries biologists might conduct careful study of the effects of hatchery salmon in order to ensure that local tribes are able to continue their traditional lifestyle. Physicists, motivated by a desire to raise the standard of living in developing countries without contributing to climate change, might research greener energy methods, being careful to avoid bias. J Λ I is the ideal situation, the category into which we hope all science might fall.

2. J ∧ ~I. Science that pursues just goals but does not retain epistemic integrity is problematic. One could imagine an aquatic toxicologist who wanted to shut down a factory well-known for exploiting its under-age workers. She could choose methods of research and areas of observation that make the pollution of the factory seem worse than it is--for example, testing water directly next to the wastewater pipes from the factory and finding the concentration of lead higher than that allowed for river water. In this case, just goals are pursued—the factory is shut down—without the retention of scientific integrity. Her work does not provide fertile ground for future study or reveal anything about the world. It also risks undermining public trust in the

[4] Here, just goals are either just or neutral, such as basic research, in contrast to unjust goals. The purpose of J is to exclude unjust goals.

scientific enterprise. Justice as a goal only makes sense when coupled with the pursuit of reliable knowledge.

3. ~J ∧ I. This form of science does not serve just goals, but does retain scientific integrity. For example, a scientist might be determined to show racial differences in intelligence. While her goals are deeply problematic, she does not allow bias to affect the epistemic integrity of her enterprise. This is also problematic: even if she continually fails to confirm her hypothesis, she uses resources on an endeavor that does not serve society's goals. At best, her failure lends support to the opposite view. At worst, the endeavor brings publicity to harmful viewpoints. Still, the scientist is producing useable (if not useful) data. Both are valuable, but useful data serves important goals; usable data does not do so presently but is still valuable.

4. ~J ∧ ~I. The final category is science that serves unjust goals and does not retain epistemic integrity. For example, the racist scientist from the example above could manipulate her sample size until it "proves" her hypothesis. This is deeply problematic because, at worst, it promotes injustice and undermines public trust in science, and, at best, it is a complete waste of resources and fails to produce any kind of usable data.

We thus have four categories: J ∧ I (ideal), J ∧ ~I (well-meaning but problematic), ~J ∧ I (wasteful but producing useable data), and ~J ∧ ~I (highly problematic). It results from this analysis that integrity is more important. We should attempt to maximize both justice and integrity, but when in conflict, integrity should take priority. Consider ~J ∧ I and J ∧ ~I. Both use resources such as time, money, and public attention. ~J ∧ I uses these in pursuit of unjust goals, but produces usable data. J ∧ ~I, in contrast, may serve just goals, but in doing so produces non-useable data. Focusing solely on justice risks wasting resources *and* creating unusable data. Moreover, such science risks damaging the public trust that gives it privileged position in society.

Science is, basically, the building of a large self-correcting tower. J $\wedge$ ~I introduces faulty bricks. Some bricks may be obviously flawed and easily discarded. But others may blend in with the rest, surreptitiously providing an inadequate foundation for other J $\wedge$ I science. Integrity of construction should come first.

Ideally, science should remain in the J $\wedge$ I category. But when the two goals come in conflict, it is important to make the integrity distinction first because this enables science to preserve its integrity, which is essential to its project.

The aims approach fails to give sufficient priority to epistemic integrity because it focuses only on the goals of research. There are cases in which non-epistemic value influence can help science serve those goals successfully without retaining epistemic integrity. As discussed above, I and J are not coextensive; the assumption that successful science is science that retains its integrity is not well-founded. In this way, the roles approach better protects scientific integrity than the aims approach.

In response to the aims approach, Daniel Steel (2017) proposes Ibsen problems that show the problems of this kind of science. Named after a situation in one of Ibsen's plays, such problems occur when a society might desire a certain goal—perhaps even a just goal—and risk corrupting scientific data in order to do so. For example, most environmentalists in Washington wanted to remove the Elwha dam in order to restore traditional salmon runs that were essential to the ecosystem and native culture. This was a just goal that could have been successfully served through scientific inquiry that failed to protect an epistemic core, perhaps through an overinflation of the harms of the dam to communities downstream in an effort to gain more popular support.

We will hear more on the Elwha in section IV, but let us examine another case study that illustrates how reliance on a criterion of democratic endorsement may fail to sufficiently safeguard scientific integrity.

Brian Wansink, a food behaviorist and the director of the Food and Brand laboratory at Cornell University, certainly seemed to conduct science that served democratically endorsed just goals. His work focused on food psychology and examined the subtle impacts of the ways that food is presented on our appetite and consumption. A publicity photo shows him surrounded by several of his experiments: the same volume of juice in glasses of different diameters, a bowl of orange candies next to a bowl of the same candy in mixed colors, and a bowl of movie theatre popcorn larger than his head (Rosner 2018). One of Wansink's more famous experiments include the "bottomless soup bowl," a bowl that was rigged to refill itself at a constant level. His 2005 paper cited data that people would eat at much higher rates from this never-ending bowl (Wansink et al. 2005).

Wansink's work was popular with the press and policy makers. His headlines seemed tailor-made for evening news broadcasts—"This One Trick Could Curb Your Snacking Habit"—and he was the executive director of the USDA Center for Nutrition Policy and promotion from 2007 to 2009 (Cornell faculty page). His website boasts that more than 30,000 US schools have joined his "Smarter Lunchroom Movement."

Wansink and his students studied whether obese people tended to sit closer to buffet tables and whether putting Elmo stickers on oranges persuaded children to choose them over cookies (Lee 2018). Lansink wrote a blog post praising the work ethic of one of his graduate students, Ozge Sigirci, who wrote five papers in six months based off of a single set of data about pizza consumption (Singal 2018).

The aims of Wansink and the Food and Brand Lab's work certainly seem to be ones that are democratically endorsed and just. Helping people identify and eliminate temptations that lead to unhealthy eating is an obviously good goal.

But just as his lab found the method of slicing pizza has certain impacts, they also had an ability to slice data in impactful ways. Wansink and his team were known to gather data first and form hypotheses later, "massaging" the data until the p-values went below the accepted baseline of p=0.05 (Lee 2018). In other cases, they would fiddle with which subjects were included in their sample until it supported their desired hypothesis. The Cornell Sun quotes six former students who reported that Wansink pressured students to "use unethical research methods to produce findings that would bring publicity to the lab" (Newburger 2018). One student, Arianna Ulloa, remembered him instructing her to "just keep messing with the data until you find something." The graduate student who wrote five papers in six months, Sigirci, completed her impressive output based on a single set of data from a "failed study which had null results," according to Wansink's blog post. He praised her for creatively finding results through what others have called very questionable data analysis methods (Singal 2018). Since these practices have come to light, Wansink has retracted eight papers and issued corrections on fifteen others (Newburger 2018).

Intemann's criterion defines non-epistemic value influence as legitimate when it "successfully serves democratically endorsed goals." Wansink's aims of discovering easy, painless ways to eat healthier easily fit into the democratically endorsed category. What American wouldn't love knowing a way to magically trick oneself into eating better? Wansink's practical recommendations—eat from smaller bowls, make fruit more attractive to children, etc.—used science to justify common sense principles to help people eat better without feeling like they were sacrificing.

But while Wansink's work certainly served democratically endorsed goals, it is not clear whether it served them successfully. Cathleen O'Grady writes in *Ars Technica*,

> "*All of Wansink's ideas might be correct*, despite the scrutiny. Doing the things Wansink recommends could, perhaps, make you healthier and help you lose weight. There's currently no evidence that they *won't*, and much of the advice is in the neighborhood of common sense. But the evidence that his recommendations *will* help is under fire" (emphasis from original).

We have good reasons to think that Wansink's recommendations could still successfully serve democratically endorsed goals. The problem is that the evidence upon which his recommendations were based is the product of work that did not retain scientific integrity, so we are now forced to justify those recommendations through "common sense" rather than empirical data.

Under Intemann's criterion of democratic endorsement, then, the non-epistemic value interference in Wansink's work appears to be legitimate. While his discredited work certainly could still prove to be successful in helping people be more healthy, until his harmful practices were uncovered we had no reason to doubt them. Wider awareness of the impacts of the way we eat our food are still a commendable achievement. It's reasonable to say that his work still has successfully served a democratically endorsed goal, though perhaps not to the same extent as originally thought.

The criterion of democratic endorsement is unable to protect scientific integrity, and so it does not exclude cases of value influence that should be excluded. While Wansink's advice could still be true, many of his scientific findings are no longer able to serve as evidence for further research. It might still be a good idea to start eating soup out of smaller bowls, but it is not a good idea to use Wansink's data as a basis for further research on whether the same is true of ice cream.

This case study shows the dangers of using criteria that do not protect scientific integrity. Without ensuring that scientific integrity is protected, the aims approach risks accepting science that no longer retains its integrity. If we focus solely on the types of goals that non-epistemic value influence serves, even if we add in a clause that such science should serve those goals successfully, we are still left without resources to exclude paradigmatically problematic cases.

Notice that these problems are true not only of Intemann's criterion specifically, but also of the aims approach in general. Without the theoretical tools to ensure the retention of scientific integrity, the aims approach is forced to accept cases of non-epistemic value influence where such influence compromises the trustworthiness of science.

While the integrity distinction should be primary, the justice distinction is also important. $I \wedge J$ science is far preferable to $I \wedge \sim J$, and so any approach towards determining the legitimacy of non-epistemic value influence in science should attempt to make both distinctions. Protection of an epistemic core, while important, does not provide sufficient guidance to exclude science that pursues unjust goals.

The necessity of both distinctions can be seen when it is applied to the Wansink case. We might use Douglas's definition of protection of an epistemic core as a potential way to protect scientific integrity. Because Wansink and his students did not retain empirical adequacy when collecting and analyzing their data, the non-epistemic value influence in such case could not be characterized as legitimate. (At least one grad student admitted to being motivated by a desire to prove herself to her mentor, a non-epistemic value influence that caused her to accept shaky data strategies that she might not have otherwise) (Lee 2018). Others were motivated by trust that Wansink knew what he was doing (Newburger 2018).

Let us imagine an alternate universe where Wansink and his students did retain empirical adequacy in their work, but aimed to help fast food chains find ways to influence customer's behavior so that they would buy more unhealthy food, especially for their children. While such work passes the first test, it does not serve just goals. We need another criterion to make such a distinction. Intemann's democratically endorsed criterion could potentially be helpful here, though the previous section explores several problems with it. Regardless, even if integrity is protected a criterion should also have a way to determine whether non-epistemic value influence serves desirable goals.

A good criterion for legitimacy of non-epistemic value influence should be able to exclude both cases of unjust resource use and failure to retain scientific integrity. Once the I/~I distinction can be made, the J/~J distinction remains extremely important. ~J ∧ I is still very undesirable because there are limited resources. J ∧ I is far preferable to ~J ∧ I. Even if integrity takes priority, we need a criterion for just goals in science. Both approaches to non-epistemic value influence in science, not only the aims approach, ought to articulate one. The setting of scientific goals has societal impacts and should aim toward justice (or at least, away from injustice). Within Douglas's framework, scientific goal setting is an external practice where direct value influence is acceptable. This certainly accomplishes Douglas's goal of protecting an epistemic core, but does not provide sufficient guidance on how value influence can help the practice of science be more just. Thus, the question of the influence of values in the setting of scientific goals is important for both approaches.

With this understanding of what a criterion should accomplish, let us turn to a critical evaluation of the main proposal in the literature.

IV. Democratic Endorsement

Elliott (2017) and Intemann (2016) propose the following: science should serve democratically endorsed (or democratically representative) goals. We will first examine why this criterion is appealing before critically assessing four interpretations of the concept.

The criterion of democratic endorsement is attractive because the public has a large stake in the selection of scientific goals. The American public invests in scientific funding. The fiscal year 2017 federal budget includes $155.8 billion for overall scientific research and development, equal to 0.81% of the country's GDP (Reardon & Ross 2017). This money is divided among several different federal agencies and programs, including the NIH, NASA, NOAA, DOE, DOD, NSF, and EPA. Excluding research funded by the Department of the Defense, spending on science comprises about 2.67% of the federal government's discretionary spending. If the public is funding science, it is reasonable to ask that science be accountable to the public—they are the ones paying for it, after all. (Other sources of scientific funding include research universities, many of which are publicly funded, and grants from private foundations.)

Additionally, the public shares in both the spoils and failures of science. Scientific innovations like the polio vaccine, genetics, and antibiotics have saved countless lives. Research on the effects of pollution changed the legal system, the way we deal with waste, and the standards of car emissions. Other innovations, like the atomic bomb, have changed the course of history. The failure of science to create new ways to reduce the carbon footprint of our energy consumption will also change our lives. Every day, people are saved by newly developed medical treatments; every day, people die from diseases without any available treatments. Science will be especially important as we enter an age of climate change that will be characterized by novel and unpredictable climatic and ecological conditions. The public bears the consequences of what science decides to study and not to study. In this way, the public also pays the price for the selection of scientific goals, even if the study is privately funded.

This background forms the basis for an argument for why the criterion of democratic endorsement is attractive:

1. The public is invested in the outcomes of science.
2. When the public is invested in outcomes of an enterprise, their good should be considered in decision-making of that enterprise.
3. Therefore, the good of the public should be considered in scientific decision-making.
4. The best way to accomplish 3 is to ensure the goals of science are democratically endorsed.

Premises 1-3 are relatively uncontroversial. Premise 4 is the primary assertion of Intemann and Elliott. It asserts that the good of the public is best served by democracy.

Democratic endorsement has an additional benefit of lending authority to science. The Declaration of Independence describes government as "deriving their just powers solely from the *consent of the governed*." Democratic endorsement might be rephrased as "consent of the affected," thus giving scientific institutions increased justification for their selection of goals.

Democratic endorsement as a criterion acknowledges public investment in science and lends science authority. However, it is unclear how democratic endorsement should be interpreted in practice. Below, I propose four possible interpretations of the criterion. Though some of these models are preferable to others, all are problematic.

The first interpretation is the simplest view of the term: “democratically endorsed” values are held by the majority of the polis. For example, a poll might show that 68% of the public values clean waterways, but only 45% value space exploration. On this interpretation, studying ways to restore riparian ecosystems would be legitimate, but space exploration would not be.

This simple view is both unacceptably permissive and unacceptably exclusive. First, the majority of the population might hold values that are problematic. For example, in the 1800’s much of the population believed that women were less intelligent than men. This view and the value-laden assumptions that flowed from it motivated a large amount of research on craniology. Historically, the majority of the American population might have believed that black people were less deserving of rights than whites. This is the kind of value judgment that led to deeply problematic scientific practice like the Tuskegee syphilis study.

Second, the majority of the population might not hold a value that should influence science. Thus, this conception excludes values that are legitimate and important. For example, most scientists value environmental sustainability. However, public opinion might not reflect this value, whether today or a few decades ago. Research on how climate change affects ecosystems and restoration projects is essential, and environmental sustainability seems to be an obviously legitimate value to drive that research. The exclusion of values such as environmental sustainability under this interpretation is problematic.

It is also not clear that the majority of the population would necessarily support the epistemic values that are essential to science. In a “post-truth” political environment that is normalizing “alternative facts,” even truth does not reach the level of democratic representation needed to be deemed legitimate in this conception. While Intemann and Elliot's work is focused on non-epistemic values, it is problematic when this conception could, when applied to epistemic values, rule out values such as empirical adequacy, a basic characteristic of scientific theories.

This interpretation illustrates a larger problem with democratic endorsement or representation: they give the public a responsibility to make decisions, even when it is not equipped to do so. Scientists possess expertise that shapes their values. Scientists have increased education, experience, and access to knowledge. This expertise informs their values as well as their practice. While one might worry about "undemocratically privileging" the values of scientists (Intemann 2015, 218), expertise should still be taken into account.

Let us turn to narrower interpretation of this model that sees democratically endorsed goals as ones that are commonly held: the consensus model. This model defines democratically endorsed goals as ones that are commonly held by almost all of the population, and is less over-permissive than the simple-majority conception.

The main advantage of this "Venn-diagram" conception is that it can ameliorate the over-permissiveness of the simple majority conception. Even if the majority of the populace holds unjust or prejudiced values, as long as at least some of the populace does not hold these values, this conception prevents such harmful values from being said to legitimately influence scientific practice.

However, the advantage of the consensus model is also a disadvantage: it is unclear that there exists sufficient common ground to provide an adequate pool of legitimate values. Even if the requirement is only that the vast majority agrees, very few non-epistemic values will meet such a standard. Several important non-epistemic values would most likely be disqualified, including environmental sustainability. Just as the majority of the population might not value environmental sustainability, there is even less likelihood that environmental sustainability would reach the threshold to be legitimate under the consensus model. Other non-epistemic values that could potentially pass the simple model would be excluded: perhaps a value of the equality of people of different sexual orientations or of the value of the suffering of animals.

This model illustrates another general problem with democratic endorsement: the values of the populace are not temporally static. Recent paradigm shifts on opinions about LGBTQ issues illustrate the dangers of basing scientific practice on values that shift in popularity. Under this model, values might come in and out of consensus. The time scale of scientific research makes this problematic: early climate change research was not reflective of public consensus, but trends suggest that it already is or will be in the near future. If scientists waited for consensus to obtain, a wealth of scientific data on the climate would be missed. The consensus model improves over the simple majority model, but shares the problem of excessive exclusivity.

Values exist on different levels of specificity. A different version of the consensus model that focuses on underlying values could be more successful.

As an illustration, consider two groups. One might value the continued existence of mountain ecosystems in West Virginia for a multitude of reasons— for example, ecosystem services or the ability of their children to have similar recreational experiences. Another group might value the continued existence of coal mining jobs, similarly for a variety of reasons: to preserve the economic benefits provided by such jobs or the heritage they represent. Under the simple model, whichever value is supported by a larger portion of the population could be legitimately integrated into scientific practice. Under the consensus model, neither value would likely be legitimate as neither would be likely to be supported by a large enough consensus of the population.

Now consider the underlying values. Those who value mountains probably do so because of a more fundamental value of environmental sustainability. Likewise, those that value coal jobs probably do so because of a more fundamental value of economic sustainability. Looking one step deeper, we find that environmental sustainability and economic sustainability both focus on sustainability tout court: the ability to continue our existence. Sustainability might flow from values like prudence or a hope to provide for future generations. Interests that conflict at the surface level may share common underlying values.

The foundational-consensus model improves over the simple or consensus model by looking at the shared values that inform more specific ones, thus expanding common ground. The consensus model would exclude both environmental and economic sustainability, but the foundational-consensus model would allow the underlying value of prudence.

This model addresses the first general problem because it provides scientists with foundational values to interpret with expertise. It allows some public influence as well as room for scientific discernment.

While foundational values are likely more stable, change is still possible. The emphasis on certain values may shift. For example, in the 1950's, technological progress and economic growth probably qualified as foundational values. The same might not be true in 2040.

But there is another problem unique to this model: by looking beyond the specific, the model might have become too vague. If very different specific values can be supported by the same foundational ones, it follows that these foundational values provide little guidance to set specific goals. For example, scientists may decide to interpret the foundational value of prudence as environmental sustainability and work on climate change. That decision might contradict the specific values of a population who views prudence differently. It becomes unclear whether the scientists' goal is democratically representative. If considering foundational values can lead to drastically different goals, the model seems unhelpful.

The foundational-consensus model might be improved if we look at fundamental values through a different lens, possibly in a way similar to John Rawls's veil of ignorance (1971/1999, 118). In the thought experiment, Rawls asks us to imagine ourselves as rational individuals planning a society from a standpoint where we do not know anything about our position in society. Rawls argues a society thus planned would be based on his well-known principles of justice. The veil of ignorance is meant to make us think outside of privilege, making justice a part of rational self-interest.

Could we set appropriate, democratically endorsed, goals for science from behind the veil of ignorance? On the one hand, some appropriate epistemic goals would likely be endorsed: rational individuals in the original position would likely want science to retain its epistemic integrity, as it is essential to the scientific project that has been so successful in improving quality of life. Such individuals would probably also desire to see the spoils justly distributed through scientific goals that aim towards improving the lives of all. On the other hand, problems arise when we try to interpret the idea that scientists ought to "check values" at the door. The entire motivation behind the pursuit of our criterion is the recognition that we cannot separate ourselves from our values; a thought experiment that relies upon that ability is unlikely to help.

The intuitive appeal of Rawls's veil of ignorance points to the idea that science ought to serve just goals. No one person's values should be privileged without sufficiently compelling reason.

Are there compelling reasons to privilege the values of scientists? In some situations, yes. Scientists have epistemic privilege from their expertise that informs their values. While democratic endorsement is initially attractive, it is problematic because not enough room is left for the importance of scientific expertise.

The case of the Elwha dam removals in Washington's Olympic National Park illuminates the problems of democratic endorsement in balancing scientific expertise and giving sufficient guidance to scientists. The Elwha River, once home to legendary salmon runs that boasted enormous fish, was dammed in two places in the 1910's to provide power for the area's growing lumber industry ("Elwha River Restoration"). The thousands of fish that once made their way up the river to spawn were suddenly stopped by the dams, and the Klallam people were left without the economically and culturally essential salmon runs (Wray 1997). One dam created a lake over the tribe's most sacred place, where the Klallam believed their people had been created.

The Elwha River begins high in the Olympic Mountains and carried glacially carved silt to the Strait of Juan de Fuca ("Elwha River Restoration"). The two dams created two lakes that stopped 27 million cubic yards of nutrient poor sediment (Howard 2016). In valleys where salmon carcasses once fed flourishing coniferous forests, these lakes were beautiful but lifeless. The river downstream of the dams, now carrying far less sediment, began to change paths, and the delta slowly started to disappear.

As the forest industry declined and the area began to use new sources of power, calls came for removal of the dams. The decision was made to remove the dams in 1992, but Washington state senator Slade Gorton blocked funding until he left office in 2000 (Howard 2016). The dams were finally removed in 2011 and in 2015 the first salmon appeared above the where the dams had once stood (Mapes 2016).

Policies always rest on values, and non-epistemic value influence infused every step of this process. Where our interest lies, however, is on the legitimacy of non-epistemic value influence in the science that surrounded this case. What I hope to show is that each proposed conception of democratic endorsement fails one two fronts. First, they do not provide helpful guidance in this case, and second, they do not provide adequate room for the influence of scientific expertise on values.

Science was heavily involved in the dam removal project. Before the removals were planned, fisheries biologists investigated the possibility of salmon runs returning to the Elwha. Social scientists researched the importance of the river to the culture of the lower Klallam tribe and the history of the dams. Hydrologists and geologists used LIDAR and simulations to estimate the amount of sediment in the lake beds and the effects of dam removal on the landscape.

There was much uncertainty about what would happen once the dams were removed. The silt trapped behind the dams—enough to fill the Century Link Stadium in Seattle nine times—threatened to cause problems downstream (Duda et al. 2008). Not only was the excess sediment dangerous, it also would make the water very turbid. Would the life that depended on the river downstream be able to survive the change? How long would it be until the silt load would decrease? Would the river change course? Would water-treatment plants be able to keep the water drinkable for the local communities that depended upon it?

When I visited in 2012 as a park service assistant for the Elwha Science Symposium, the area above the Elwha Dam looked like a moonscape. Stumps from trees harvested right before the dams were constructed had been preserved by the lake and covered in feet of light gray silt. Park staff had planted hundreds of young trees in an attempt to revegetate; most were dying in the nutrient-poor silt. Since then, revegetation has proven more successful, but before the dams were removed it was uncertain how long it would take before anything would grow in the former lakebeds.

Science is still an essential part of the restoration project, from observing changes in the river's shape, temperature, and turbidity, to catching and examining the fish that swim above it, to determining the best way to revegetate the former lake beds. If non-epistemic values influence these scientific practices (as they almost certainly do), is such influence legitimate under Intemann's criterion?

Under the first conception of simple majority, it seems like the Elwha is not a case of legitimate value influence. The dam removal was met with controversy, and public opinion on the effort is still mixed. The removal was publicly funded, performed on public national park land, and was one of the most expensive dam removals to that date. The public was invested in the success of the removal, but under this conception did not endorse such action. Under the simple majority conception, such value influence would be illegitimate. Under the second conception, such value influence would also be illegitimate as a functional consensus for support would not be possible either.

One problem with these two conceptions is that they do not give adequate voice to the minority and marginalized. The lower Klallam tribe had opposed the dams since they had been proposed, but their voices were definitely in the minority and would not be heard under these conceptions (Wray 1997).

The next two conceptions attempt to ameliorate these problems. The foundational consensus model looks for shared values underlying different values held by different groups. In this case, one group valued restoration of the river to its original state, possibly based on a desire for social justice, ecological health, and other values. Another group valued keeping the dams, possibly based on desires to retain the recreational value of the lakes and avoid spending public money on what seemed like an unnecessary and costly project. Looking deeper, these values might be in turn based on a desire for good stewardship and management. But that doesn't provide much help to scientists—how can scientists determine which group had the correct interpretation? This seems to "undemocratically privilege" the values of the scientists, unacceptable under Intemann's criterion.

The fourth conception, looking from within the veil of ignorance, might support dam removal. Rawls's principles of justice favor the good of the marginalized, and so might give precedence to the good of the Klallam tribe. But because the thought experiment depends on the ability to separate oneself from personal values, it seems unhelpful in this case. It does not give specific enough guidance to scientists, and does not allow them to use their expertise in other to interpret it further.

Each conception also fails to take into account the expertise of scientists, which informed their values and influenced their practice. These values were often different from the general public, but expertise provided important insight on what should be valued. For example, park restorationists had increased perspective on what the goals for revegetation should be: it might be more important to the success of the ecosystem and the health of the river to quickly provide shade and prevent erosion than it was to promote biodiversity. Fisheries biologists had increased knowledge of the impact of hatchery fish on native populations and thus had a different values on the importance of successful dam removal to allow native populations to return without the help of hatcheries

Thus, under the proposed conceptions of democratic endorsement, we are left with two options that cannot account for the good of a marginalized minority group and two options that fail to provide sufficient guidance. Neither adequately address the importance of scientific expertise. We need a criterion that can better handle cases like the Elwha, precisely because it is in these more difficult cases that we need a criterion. Cases where non-epistemic value influence supports just, democratically endorsed goals while retaining scientific integrity are easy to approve as legitimate. It is in cases where these three categories do not overlap that we most need guidance, and where the criterion of democratically endorsement falls short.

The case also illustrates the problem of the temporal fluctuations in democratic endorsement for different goals. When the dams were installed, the public generally was in full favor (except for the Klallam tribe); non-epistemic value influence in science would be legitimate if it served to successfully fulfill the democratically endorsed goal of gaining a reliable source of power. But by the time of removal, such a goal was no longer relevant, and non-epistemic value influence now could only be relevant if it served over democratically endorsed goals. If the scientists who initially researched and designed the dams were influenced by non-epistemic values (as they almost certainly were), was such value influence legitimate in 1910 but not in 2010? This lack of temporal stability is another problem for the criterion of democratic endorsement.

Non-epistemic values that were formed both by scientific expertise and by a desire for social justice supported study of the impacts of dam removal as a valid scientific goal, but it is not clear that the criterion of democratic endorsement would support this study as legitimate. In this way, the case of the Elwha dam removals displays the multiple problems of democratic endorsement. First, the criterion is unclear and the proposed conceptions either fail to provide sufficient guidance to scientists or fail to protect the good of a marginalized minority group. If we return to the discussion of legitimacy as promoting scientific integrity and just goals, it is also problematic that democratic endorsement would not accept a just goal such as the removal of the dams.

Finally, the criterion does not adequately account for the importance of scientific expertise in the formation of non-epistemic values, and the reasons why we might want to privilege these values. Expertise acts as a sort of epistemic privilege unavailable to the public as a whole.[5] A good criterion for the legitimacy of non-epistemic value influence in science should have sufficient room for scientific expertise as well as respect for the public.

V. Other Possible Criteria

We can now move onto our next project of investigating whether there is a better criterion to determine the legitimacy of non-epistemic value influence on scientific goals.

In order to do so, we need to ask what we want in such a criterion. If we return to the syllogism presented in Section III, premises 1-3 stand. It is premise 4—that democratic endorsement is the best way to respond to public investment in science—that is problematic. Our task is to better fulfill premise 3–that public interest be considered.

One important reason why democratic endorsement does not successfully fulfill premise 3 is that it fails to take scientific expertise seriously.[6] Expertise informs values and goals; scientists have epistemic privilege not available to the public that should be considered.

[5] This case study is especially illuminating on this point because scientific expertise is not the only relevant type of expertise that should be considered in the dam removals. The traditional ecological knowledge of the Klallam tribe is another sort of legitimate expertise that informed their values. Democratic endorsement fails to adequately consider both scientific and traditional local expertise, a major problem for the criterion because both have important perspectives that can lead to desirable consequences.

[6] Another reason, illuminated by the Elwha case study, is that democratic endorsement fails to adequately consider minority voices. I attempt to tackle the problem of consideration of scientific expertise here, but whole-heartedly acknowledge the need for a criterion to also consider the voices of minorities. My hope is that the three proposed models provide fertile ground for further work on this issue.

Thus, one important desideratum is that scientific expertise is taken seriously. Another, taken from the syllogism, is that the public investment be respected. Such respect can manifest in two ways: through the respect of public dignity and the respect of public well-being, depending on whether one focuses on deontology or utility.

We then have the foundations for three desiderata. First, the public is invested in science, and so a criterion for justice should be respectful of this investment and promote their good. Second, scientific expertise provides an epistemic advantage, and so should be respected. Third, the public should be treated with dignity, and so a criterion for justice should empower them. Thus, a criterion should take the following things seriously: public wellbeing, scientific expertise, and public dignity. I propose three models to be assessed: paternalism, professionalism, and the trustee model. The models differ on the issues of the presence and justification of authority.

Before we evaluate these models, it is important to discuss how the three elements above relate to one another. It is inaccurate and unhelpful to see them as ends of one-dimensional spectra with high respect for public on one end opposed to high respect for scientific expertise on the other. I propose to see them as different axes on a three dimensional space. One axis represents degrees of respect for the public, the second represents degrees of respect for scientific expertise, and the last represents degrees of respect for the public well-being. Thus, it is a priori possible to maximize all elements.

With this in mind, let us turn to our assessment of our three potential models. The first is paternalism, where the values and decisions of those with epistemic privilege are favored and imposed on those viewed as less capable or incapable of making those decisions, without consent (Dworkin 2013). Paternalism is justified (if ever) only if it is motivated by the well-being of its target. The classic example of paternalism is of a parent and child; it is not just for a parent to treat her toddler's wishes about the best way to cross the street equally to her own. A paternalistic model allows scientists to set goals for science on the basis of their expertise and with the public's well-being in view.

Paternalism exhibits high respect for scientific expertise, but low respect for public dignity. This model could promote well-being if we agree to the premise that the epistemic privilege of scientists gives them an advantage of knowing what is best for the public (an admittedly controversial claim). Paternalism is justified only in specific conditions where it is acceptable that the public is deemed incapable of making appropriately informed decisions. That such conditions be ever satisfied is disputable.

In view of our assessment of paternalism, let us look for a model grounded in public consent: the professional model (Freidson 2001, 180). In a market economy, the proper role of businesses is not to tell customers what they should want. It is not the place of the car dealer to tell a customer who comes to buy a two-door sports car as her family's main vehicle that a minivan would serve her four children better. This contrasts with the role of professionals. Educators are accountable to society as a greater whole and tell the students what they should want, even if that prescription is a long term paper. Professionals serve a higher good than the immediate preferences of the person they are serving.

This model diverges from paternalism in that one is free to take or leave the advice offered by professionals. Doctors provide professional advice, but their patients are not forced to follow suit. The professional model, applied to scientific goal-setting, construes scientists as providing advice that the public may or may not follow. Thus there is high respect for public dignity, but lower emphasis on scientific expertise. There is a potential that the public will choose against the informed opinion of scientists, and so potentially negatively affect their own well-being. Professionalism overly privileges public dignity at the expense of the other desiderata.

Is there a middle option? Political philosophy provides a distinction between the trustee and representative models (McCrone & Kuklinski 1979). In the trustee model, the expert has increased access to relevant knowledge and is entrusted with decision-making powers by a group. The trustee serves the group's best interest, even if her decision does not reflect those of the group. A classic example is an investment banker who acts in the fiduciary benefit of her clients. The investors do not pay the banker to make the decisions they themselves might make; rather, they pay her to use her privileged knowledge to make decisions that best serve their interest. In contrast, the representative model sees the decision maker as a proxy for the will of the people. Her job is primarily to represent the decisions that they might have made, sometimes despite their best interest. Scientists seem to fit better in the trustee model than they do in the representative model. Like investment bankers who know the market better than their clients, scientists know the scientific landscape better than the public.

This trustee model respects scientific expertise. It also respects public well-being, under the premise that scientific expertise is a good guide to determine it. Finally, it respects public dignity, as it is grounded on consent and trust. The trustee model thus fulfills our desiderata. That said, two difficulties arise. First, while the best interest of the investment bankers' clients is clear, the public interest in science is less so. Second, while many people choose to sign contracts with bankers, it is not clear that the current public would willingly entrust scientists with decision-making power over the goals of science

The trustee model best maximizes our three desiderata, but it is unclear whether the conditions under which it is justified currently exist. In its absence, the choice of which model is preferable between paternalism and professionalism is unclear. Paternalism sacrifices public dignity for well-being; professionalism lowers the ability of scientists to promote well-being of the public, but gives the public greater autonomy. We are left with a classic moral dilemma: when in conflict, do we more value public well-being or respect for public dignity? Kant says we should promote autonomy above all; he would prefer the professional model. Mill, in valuing well-being, would likely be more sympathetic to the paternalism model. Among the three models, we are left with an, appropriately value-laden, choice. Of course, an obviously desirable fourth option is a different model than those proposed in this paper that better maximizes our three desiderata.

VI. Conclusion

If we accept that non-epistemic value influence in science is inevitable, we need a way to determine when such value influence is legitimate. Legitimacy has two components: retention of epistemic integrity and promotion of justice. Though both components are important, protection of epistemic integrity should be primary if the elements are in conflict. Even if democratic endorsement is asked to do only the work of promoting justice, it fails to do so because it fails to take scientific expertise seriously. We need a new model in which public dignity, public well-being, and scientific expertise are respected. We assessed three candidates: paternalism, professionalism, and the trustee model. While the trustee model seems ideal, its conditions of realization may not be satisfied in our society. If so, we are currently bound to choose between professionalism, a more deontological approach, and paternalism, a more utilitarian approach, for goal-setting in the sciences.

Acknowledgements:

While this thesis bears my name, it is the result of the hard work, investment, and generosity of many. First and foremost, I cannot thank my chair Soazig Le Bihan enough for her help and encouragement on this project. Her insightful conversation, kind words, and expert editing were essential for its completion--anywhere I sound particularly intelligent most likely comes from her hard work on the project (any mistakes, of course, are entirely mine). My goal is to become even half as skilled and generous as the example she provides.

I am very privileged to also have Albert Borgmann and Dan Spencer on my thesis committee. Both have inspired me to be a better thinker and a more intentional philosopher. I so appreciate their comments on this work and their role as examples of excellence and kindness.

I am thankful to Kelsey Johnson for including me in some of her work on the Elwha (and being the first “real person” I knew with a master’s degree) and to my undergraduate ethics advisor Keith Wyma for steadfastly nurturing my philosophical abilities even when I thought I should just be a pharmacist.

Finally, I so appreciate the community of philosophers—whether they self-identify as one or not--who shared their time and insights with me. Travis and Ben patiently listened to very early versions and provided helpful comments. My mom, a dental hygienist, had me explain this work in an easily digestible way so that she could share it with her patients. From park service friends who listened on long hikes, to members of the Whitworth debate team who listened on long van rides, to my roommates’ long suffering listening in general: thank you for engaging in this conversation. It is my hope that this thesis, as imperfect and technical as it may be, can be a small step towards making sense of our world and the right way for us to live in it.

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