The traditional understanding of science is that of a value-free process of knowledge-acquisition which guarantees objectivity in its results—this is usually called the value-free ideal of science or, for short, the value free ideal. According to this view, science is not really influenced by values in the content of the knowledge it produces. It produces, rather, an objective representation of the world as it stands, independent of human beings and the social, political, and personal values we hold and play out in our lives. So while science is of course done by human beings, that fact is somewhat irrelevant to the content of knowledge scientific inquiry produces—that content is value-free. At least, that's what the value free ideal says.

Understanding this position is an important first step in studying feminist perspectives on science, firstly because this view of science is often held by those who raise objections to feminist critiques of science, and it is the value-free ideal which feminist critics of science often object to. Without a good understanding of the value-free ideal, it might be difficult for us to have a good sense of exactly what's being argued by many feminist theorists.

Another reason it's important to understand this view is that people on opposite sides of this debate can often talk past each other, failing to understand what the objections are to their arguments or points of view. Since we will be reading mostly feminist literature which actively opposes the value-free ideal, I want to make sure we have a good understanding of the value-free ideal it is reacting to, so we can think carefully and precisely about the sorts of claims feminist theorists on science are making. Any study about science—even social or historical studies—are inevitably dealing with claims about truth, nature, and reality, so there's inevitably going to be a bit of philosophy involved in working through these ideas. Don't be put off if you find this week's readings a little complicated or dense. This is the theoretical foundation, and we are moving onto practical examples in our session next week. For those of you who prefer less philosophy and more social science or history, there is plenty of that coming up.

A final reason I want to mention as to why it's important to really get a good grasp of theories of the value-free ideal of science and the dialectic it has with feminist perspectives on science, is that given the fact that these debates take as their central concern the objectivity and reliability of scientific knowledge, it's important to understand the political tightrope we're walking here. It's easy to characterize those who say that science is pure fact and doesn't have any sexist or racist values involved in it, as ignorant or bigoted or just not caring about the realities of oppression facing women, people of color, and queer communities. But it's not always accurate to take this view, and we might be guilty of drawing up a straw man opponent. The truth is, that the objectivity and authority of scientific knowledge is important for everyone. Just think of climate science deniers and the trouble we've had mobilizing a serious response to the climate crisis. Honestly, that problem has just as much to do with capitalist interests in sustaining the fossil fuel industry as it does with any intrinsic public distrust of science, but the propaganda campaign against climate science has at least highlighted the importance of sustaining public trust in scientific knowledge. When we do feminist critique of science, we must therefore be responsible and careful not to throw the baby out with the bathwater, so to speak. Science, with all its political problems and historical connections with

patriarchy and industrial capitalism, is still one of humanity's greatest instruments for uncovering information and techniques that can help us survive and thrive. So please, let's be radical, but let's not be clumsy.

So this week, we are going to look at some of the arguments and rationale for the value-free ideal of science, and we'll consider what is at stake for people who argue for or against this position.

Let's start by looking at our reading from Reichenbach's book, Experience and Prediction, before moving onto Lacey's and Douglas' books to look at more recent debates in the value-free ideal. To tell you a little bit about Reichenbach, and the logical positivist school he was part of, he was a very prominent philosopher and physicist in Germany in the 1920s. He was a close associate of Albert Einstein, who helped him get a position as professor of physics at the University of Berlin. Because he was Jewish, Reichenbach had to flee to the United States in the 1930s, after which he took up a position as professor of philosophy at UCLA.

Now, it may seem a little strange that a physics professor ended up working in a philosophy department, but this was quite common among a popular philosophical movement called Logical Positivism or Logical Empiricism. The first half of the twentieth century was a period in which science as a form of activity saw a radical increase in its epistemic authority—meaning that it started to develop a kind of monopoly on the authority to create knowledge. This meant that it started to replace other ways of determining legitimate claims about what reality was like, including philosophy. And in Germany during this period, this trend brought an influx of philosopher-physicists into philosophy departments and seminars who started to reconceptualize what kinds of knowledge claims philosophy was and was not capable of making, what philosophy's relationship was to be with the sciences, and how philosophy should now be done.

The view proposed by the logical empiricists was that science is an all-encompassing source of knowledge which consists of two categories of statements: "tautologies" which included mathematical and logical formulae; and "protocol sentences" which included observation-based statements that could, in principle, be verified by the methods of empirical science (Carnap, 1959, p. 76).

This had two major consequences. While they're related, the second consequence is more important for our purposes.

The first consequence is that, according to the logical empiricists, "there is no question whose answer is in principle unattainable by science," dismissing immediately any notion of areas of

knowledge that are not conducive to factual scientific investigation and analysis (1969, p. 290). Any "philosophy of norms, or philosophy of value, on any ethics or esthetics as a normative discipline" is incapable of producing knowledge, since claims concerning norms and values are "not empirically verifiable nor deducible from empirical statements," and are therefore "pseudo-statements" (Carnap, 1959, p. 77; Carnap, 1969, p. 291). This left their idea of genuine philosophy--"scientific philosophy"--with a significantly reduced role: "to clarify meaningful concepts and propositions, to lay logical foundations for factual science and for mathematics" (Carnap, 1959, p. 77); in Reichenbach's words, "to analyze the results of science, to construe their meaning and stake out their validity" (Reichenbach, 1949, p. 310).

The second consequence is that science—the only way of accessing reliable, authoritative knowledge—is completely set apart from values. For the logical empiricists, it was a different kind of thing which did not come into contact with or become influenced by the messy world of actual human behavior and social relationships. Scientific inquiry was structured and determined by logic—either by tautological statements, statements that are true by definition, or by observational statements, statements directly observed and verified by experiment. This philosophy of science, then, established a strict and clear boundary between facts and values that has carried over into much theorizing about science ever since.

In Reichenbach's book, Experience and Nature, we find a classic statement of the value-free ideal of science. Reichenbach makes a number of distinctions relevant to the value-free ideal of science.

Firstly, he draws a distinction between the epistemologist (who researches knowledge) and the sociologist. He says the sociologist of knowledge takes into consideration the external relations of science, whereas the epistemologist, or the logician of science, takes into account only the internal relations of science. What does that mean?

Knowledge is a concrete thing, he says. It involves speeches and human actions, and books. But these aspects of science are of a fundamentally different nature than the internal structure of knowledge.

The sociologist—who studies external relations of science—is interested in things like whether all astronomers are bourgeois men or play instruments. But the epistemologist is only concerned with questions about the meaning of concepts, the presuppositions of methods, how we know sentences are true, the logical connection between statements. The sociological and the logical come apart in the processes of science, and you can study the actual core of scientific knowledge without any consideration or concern for the social context in which the research is done.

This is connected to the second distinction he makes. Reichenbach distinguishes between the epistemologist and the psychologist. Science, as he said, is a human practice, so it involves human thought processes and behaviors. Actual scientists might make leaps of faith or decisions based on their character—for example, are they risk averse? Or they might be great scientists, but nevertheless take certain things for granted as obvious rather than insisting on an exact proof. Or they might use a lot of intuition in deciding on their research projects or in designing their experiments. But the epistemologist is not interested in how the scientist actually thinks or researches or comes to conclusions. That's the job of the psychologist. The epistemologist is interested only in the rational reconstruction of science. How thought processes would occur or ought to occur if they are consistently arranged according to the rules of logic.

This is where he derives his very famous distinction which is still widely discussed in philosophy of science today—between the context of discovery and the context of justification. The critical task of the epistemologist is to construct an understanding of scientific processes of knowledge in which actual processes of thought are replaced by justifiable operations conducted according to the dictates of logic. This, he claims, is where the real power of scientific knowledge comes from—in the fact that its justification really doesn't have anything to do with what people accept or whether people like it or find it plausible or intuitive. It's to do with a separable domain or sphere of, well, reality I suppose, which is logic and logical rules and inferences.

We'll see more details later in the quarter, when we discuss feminist challenges to the notion of impartiality, on how this kind of conceptual separation between the logic of scientific inquiry and the practice of scientific inquiry—very much a social phenomenon—has provided a foundation throughout the 20th century and into the 21st for making claims that science is value free, that is objective and not infected with political interests. The point is in the claim that these things can in principle be separated from each other.

This has evolved over the decades since R's book, which was written in 1938, but these debates are still going on today. Our readings of the books by Hugh Lacey and Heather Douglas give us a sense of how debates on the value-free ideal of science have been taking place in recent decades. So let's turn to that now.

As Hugh Lacey explained his book, there are three ways in which science may be claimed to be free of personal, social, political, moral, and religious values:

1. Impartiality, or the claim that the internal reasoning of science is free of social values such that scientific theories are accepted or rejected purely on the basis of their relation to available material evidence according to the highest available standards,

2. Neutrality, or the claim that scientific theories as a whole (derived in a manner consistent with impartiality) do not presuppose or imply any particular social or political judgments, or serve any particular social or political purposes,

3. Autonomy, or the claim that science is driven by purely epistemic concerns (in accordance with impartiality and neutrality), detached from society's values in the form of interference from government, political or religious institutions, or the military.

Scholarship on the interaction of science and social values have, at various instances, contradicted claims to each of these forms of value-objectivity as descriptive statements of scientific inquiry. Historical accounts have demonstrated the existence of government and military interference in the conduct of institutional physics, contradicting science's autonomy (Kevles, 1987); psychological research has demonstrated the detrimental political effects of the publication of cognitive differences research, challenging science's neutrality (Steele, 1997; Spencer, Steele, and Quinn, 1999; Dar-Nimrod and Heine, 2006); and feminist epistemology has highlighted the influence of social and political values in the methodological assumptions of sociobiology research programs, challenging science's impartiality (Longino, 1987; Longino, 1990; Rooney, 1992). We will explore challenges to each of these versions or subclaims of the value-free ideal in the coming weeks.

Some of these forms of objectivity or value-freedom have also been employed prescriptively, as ideals to which science should or should not strive, or be permitted, to conform. In many cases, we see a combination of both descriptive and prescriptive employments, mixing different types of value-freedom. For example, autonomy is claimed to be prescriptively appropriate for science, since science is descriptively an impartial activity; or it is claimed that science is not actually producing neutral knowledge, so scientific research should not be autonomous.

Perhaps the most famous debates concerning objectivity and values in science were those occurring in the context of nuclear physics research into the atomic and hydrogen bombs in the 1940s and 1950s. In reaction to the nuclear physics research that had enabled the development of nuclear weaponry, a growing number of concerned citizens and scientists put pressure on scientific institutions to put structures in place to make physics more accountable to broader social values. This included \the formation of societies of scientists dedicated to controlling as far as possible some of the aspects of scientific discoveries" (Bridgman, 1947, p. 148). These societies sought to restrict nuclear physics' autonomy by making it accountable to broader social institutions, attempts which were justified by pointing to the lack of neutrality of the knowledge produced by nuclear physics. These critiques were met with responses that science should not be denied autonomy from the interference of society and its concerned citizens because it is not, essentially, a political enterprise. Such rejections of demands to constrict or forbid elements of scientific research for the social good relied upon a narrative of science's value-freedom in terms of its impartiality of method.

Edward Teller, the physicist responsible for the technical design of the hydrogen bomb still used in most of the world's nuclear weapons, employed notions of the neutrality and impartiality of science to defend its right to autonomy in his message urging atomic physicists to get "back to the laboratories." He argued that "[t]he scientist is not responsible for the laws of nature. It is his job to find out how these laws operate" (Teller, 1950, p. 71). His contemporary, the Nobel Prize winning physicist Percy Bridgman, also defended nuclear science's right to autonomy on the basis of the impartiality of its method, saying that science simply invokes evidence to face "the challenge of an external world not understood" (1947, p. 153). "[S]cientific freedom is essential," he claimed, if the scientist is to "understand nature" (ibid., p. 153). The gist of this argument, forms of which are still made today, is that, since science is oriented towards extracting objective knowledge about an external nature from the use of an impartial method it is distinguishable from any representation or utilization of that knowledge in the service of a particular end or ideology, and bears no responsibility for the latter practices.

It's important to understand that many of those defending science's right to autonomy, and its status as neutral and impartial, do not deny the existence of social and political consequences of scientific research programs, nor the undesirable nature of these consequences. They often recognize and dislike "as much as anyone" the role of science in "military hardware, surveillance of dissidents, destructive and environmentally unsound industrial practices, and the manipulation of mass consciousness through the technologies of popular culture" (Gross and Levitt, 1994, p. 2). They typically acknowledge the historical reality of Nazi eugenics, the oppression of women, racial and ethnic minorities, and LGBTQ people, as well as the role science has played in facilitating them (cf. Sokal, 1996; Wilson, 1976; Gross and Levitt, 1994; Wolpert, 1993). Often, what they defend in terms of science's objectivity is the impartiality of `the scientific method': The scientific method, when properly adhered to, is such that it produces objective truths absent of the value judgments that plague other forms of knowledge and practice. This point will be very important for us as we get into feminist debates concerning impartiality later in the quarter.

According to these defenders of science's autonomy, Scientific method isolates the phenomena of nature from their social and political settings and impartially derives knowledge of them from the evidence, paying no heed to the personal, practical, political, or social significance of the knowledge or its phenomena. There are no particular values in scientific knowledge, precisely because it is impartially derived from the evidence. Science's indifference to our politics renders it "liable at any moment to produce results that demolish one or another cherished preconception of ideology" (Gross and Levitt, 1994, p. 147). We might not like the evidence or knowledge, it may contradict what we hope to be true--for example, it may be "unacceptable by feminist lights" (ibid., p. 146)--but the evidence and knowledge are indifferent to and independent of our values, as long as proper "empiricist procedure" is followed (ibid., p. 135).

Accompanying such claims of the impartiality-induced neutrality of science is the claim that any non-neutral social or political consequences of scientific knowledge must belong to conditions

outside the bounds of science. The external uses of objective scientific knowledge may be politically and socially value-laden, but the internal workings of scientific inquiry are insulated from social and political effects by virtue of a method governed strictly and exclusively according to epistemic standards for obtaining objective knowledge about an external reality. Society and its values are halted at the laboratory door, where objective science, insulated by its value-proof method, takes over. Under this view, `science per se' can be clearly demarcated from society, and from "the uses to which science is put" (ibid., p. 2).

While `science per se' is responsible for the production of knowledge, "the implementation, the application, of that knowledge is a social and political decision" (Wolpert, 1993, p. 159) and may therefore be considered the proper responsibility of "the political and economic forces controlling our society" (Gross and Levitt, 1994, p. 2). It is on this basis that objects of political concern, like nuclear weaponry and industrial pollution, are clearly demarcated from purely "scientific understanding" (Wolpert, 1993, p. 173).

Now, you might be tempted to justify the arguments for the autonomy and impartiality of nuclear physics research on the basis of a difference between `science' and `technology'--nuclear physicists research nuclei; governments and militaries build and utilize bombs. However, more recent debates on scientific research programs into cognitive differences between genders, sexual orientations, and races slip into similar patterns. We'll look at this debate in more detail next week, when we have a live session to discuss some readings which employ the value-free ideal to defend cognitive differences research, but it's worth considering it briefly in the context of this lecture.

In response to political effects of the publication of scientific research on gender- and race-related cognitive differences in the form of documented harm and risk to women and racial minorities, some scholars of science urge limitations on science's autonomy in the form of restrictions on cognitive differences research (Kourany, 2016; Kitcher, 2001, Chap. 8). Many critics circumvent the issue of scientific method's impartiality by arguing that the right of scientific research programs to strong autonomy should be denied simply on the basis of the evidently non-neutral interactions of scientific knowledge with other aspects of society (Kourany, 2016; Kitcher, 2001; Douglas, 2009; Shrader-Frechette, 1996), but researchers still respond with a case for science's autonomy based on a picture of science as a purely intellectual process that is fundamentally insulated from society and its values. "`What is problematic about cognitive differences research,' they claim, `is not the questions asked or even the results sometimes obtained, but the prejudiced--the racist and sexist--context in which the research takes place' " (Kourany, 2016). Psychologists Ceci and Williams defend the right of cognitive differences research to autonomy--"the scientific truth must be pursued" (Ceci and Williams, 2009)--by making a leap from impartiality of method to neutrality of results.

They assert that political or social consequences "do not result from allowing scientists to publish their findings" on correlations between race and IQ scores, and that the demonstrated harm to

identity groups results rather from the context in which the findings are received (ibid.). Some scientists appear incredulous that knowledge derived using impartial scientific methods could possibly give rise to negative political consequences. Sociobiologist E. O. Wilson has claimed that "social progress can only be enhanced, not impeded, by the deeper investigation of the genetic constraints of human nature" (1976, p. 190), and biologist Lewis Wolpert has claimed that the more we pursue objective knowledge through science, "the better the chance we have to make a just society" (1993, p. 164). Physicist Alan Sokal has also claimed that "rational thought and the fearless analysis of objective reality (both natural and social)" will necessarily lead to improvements in society (1996). Moreover, the kind of impartially-derived knowledge of nature and reality that science is believed to provide has been described as "intrinsically good" (Wolpert, 1993, p. 159), "one of the chief glories of man" (Bridgman, 1947, p. 154), and "desirable human ends in their own right" (1996). The common assumption running through these claims is that the impartiality of method--the derivation of knowledge through the use of logic and high standards of evidence--guarantees either the value-neutrality of scientific knowledge, or the uncontroversial positivity of its consequences, thereby validating its requests for autonomy from socially or politically imposed restrictions.

Unsurprisingly, scholars of science have taken to questioning the impartiality of scientific methods, and whether such methods can guarantee the neutrality of its knowledge. Richard Lewontin has argued that it is "not at all obvious that the methods and problematic of natural science produce an `objective' picture of the world untainted by ideology and by the social and political predispositions of scientists" (1996, p. 294). Andrew Ross has argued that there is "nothing distinctive to differentiate science from any other social activity," and that the very notion of science's methodological impartiality is a "dogma" which is "used to fend off social criticism and to protect professional contracts with the corporate-military state" (1996, pp. 6, 13). Stephen Gould (1996), Helen Longino (1987; 1990), and Phyllis Rooney (1992) have each challenged the impartiality of research programs in sociobiology and intelligence testing, by demonstrating that the posing of certain questions and the derivation of their conclusions have depended partly on pre-existing social and political values—we'll cover that in more depth in later weeks. Some theorists have gone so far as to suggest that impartiality of method (in the sense of freedom from the influence of personal, social, moral, religious, or political values) is impossible to guarantee, and that scientific method should be intentionally altered and adapted to suit our proclaimed political values.

Critiques of science's impartiality of method, while achieving a significant degree of success and acceptance in scholarly circles, have left a great number of scientists and scholars dissatisfied. Although some have argued that the links between scholarly literature and the rise of populism are tenuous (Rosenfeld, 2019, Chap. 4, Kitcher, 2011, pp. 15-16), other scholars and public commentators have attributed responsibility for the recent growth of populism to academic fields like social studies of science. They suggest that their challenges to the impartiality of scientific methods have undermined public confidence in science, and in expertise more generally (cf. Rosenfeld, 2019, Chap. 4 n. 6).

The importance of public and government confidence in science was recently highlighted in the controversial rejection of the overwhelming scientific evidence for human-induced climate change by the President of the United States. In a tweet in 2012, Donald Trump claimed that, "The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive." In a campaign speech in 2015, he said of global warming, "A lot of it's a hoax. I mean, it's a money-making industry." In 2016, he appointed Myron Ebell--who had accused climate scientists of being a "gang" who had been "manipulating and falsifying the data"--as head of his transition team for the Environmental Protection Agency. Trump questioned the neutrality of climate science research by suggesting that specific political and economic interests were served by the acceptance and proliferation of its findings--a claim that is arguably true, since it indicated a need to reduce specific manufacturing processes and American reliance on fossil fuels, all of which disproportionately affect specifically situated citizens and industries. But ultimately, his challenges to the authority of climate science relied not just on the political inconvenience of climate science research findings, but fell back on challenges to the impartiality of the method of producing scientific results--impartiality that science studies scholars, who occupy very different worlds and usually hold very different politics, have also devoted significant effort to challenging. Regardless of the causal connection between populism and scholarly challenges to scientific impartiality (which are hypothetical at best), this example of scientific evidence being unduly disregarded for the political purposes of justifying the repeal of the Clean Water Rule and the Clean Power Plan, and the withdrawal of the United States from the international Paris Agreement on climate change, illustrates the importance of sustaining a popular narrative of at least some form and degree of scientific authority based on the reliability and trustworthiness (if not the absolute impartiality) of scientific methods.

From the consistent appeals and challenges to scientific impartiality in debates concerning politically contentious science, it seems that impartiality is a tricky notion to navigate. On the one hand, we do not want to encourage a belief in science as a process completely insulated from wider social concerns, which would justify requests for the autonomy of research programs that cause serious risk or harm to individuals or groups. But while we seek to make science accountable for its social and political consequences, we cannot comfortably deny that scientific research is capable of some form of impartiality that, if manifested, is deserving of our trust and respect when arriving at consensus on received opinion and when deciding on public policy. The suggestion that scientific method can, and even ought, to be doctored to better manifest predetermined social and political values does not seem consistent with the much-needed trust in the impartiality of scientific methods.

These are some of the issues we'll be considering over the coming weeks as we explore feminist critiques of science, considering how science has been used as an instrument of domination, and culminating in our discussion of impartiality later in the quarter. Next week, we will look at a specific example of the value free ideal being used in context, through readings in recent debates over

cognitive differences research, to get a clearer and more concrete sense of how the value free ideal plays into feminist perspectives on science.