# The Irreducible Complexity of Objectivity

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Abstract

The terms “objectivity” and “objective” are among the most used yet ill-defined terms in the philosophy of science and epistemology. Common to all the various usages is the rhetorical force of “I endorse this and you should too,” or to put it more mildly, that one should trust the outcome of the objectivity-producing process. The persuasive endorsement and call to trust provide some conceptual coherence to objectivity, but the reference to objectivity is hopefully not *merely* an attempt at persuasive endorsement. What, in addition to epistemological endorsement, does objectivity carry with it? Drawing on recent historical and philosophical work, I articulate eight operationally accessible and distinct senses of objectivity. While there are links among these senses, providing cohesion to the concept, I argue that none of the eight senses is strictly reducible to the others, giving objectivity its irreducible complexity.

## 1.0 Introduction[i]

The terms "objectivity" and "objective" are among the most used yet ill-defined terms in the philosophy of science and epistemology. Philosophers discuss such diverse entities as objective knowledge, objective methods, objective observations, objective criteria, objective measures, and objective evaluations, and in some sense, we know what is meant by these terms.[ii] As Daston wrote: "We slide effortlessly from statements about the 'objective truth' of a scientific claim, to those about the 'objective procedures' that guarantee a finding, to those about the 'objective manner' that qualifies a researcher." (Daston 1992, 597) Upon further reflection, it becomes clear that we cannot and do not mean quite the same thing in these different cases. Common to all is the rhetorical force of "I endorse this and you should too," or to put it more mildly, that one should trust the outcome of the objectivity-producing process.[iii] The persuasive endorsement and call to trust provide some conceptual coherence to objectivity, but the reference to objectivity is hopefully not *merely* an attempt at persuasive endorsement. What, in addition to epistemological endorsement, does objectivity carry with it?

In my discussion of objectivity, I will focus on providing a useful answer to this question, one that can be applied to a wide range of epistemic practices and contexts. With my focus on such pragmatic concerns, I will not be addressing objectivity within the usual set of philosophical concerns that arise when discussing the term. I am not concerned here with questions motivated by skepticism or idealism, or by scientism or relativism. Instead, I am concerned with how to make good decisions in a complex world, a world in which we are often called on to both recognize and use "objective" knowledge. If objectivity is a characteristic called upon to elicit our approval or consent in many decision contexts, then we need to be clear about what ascribing objectivity to a claim entails, and how we can decide whether a claim is deserving of the description. Only with such an operationally useful account of objectivity, i.e. one which helps us determine in practice whether a given claim is worthy of the ascription "objective," can we build on objectivity's implicit call to trust. With such an account we can check on what undergirds objectivity's endorsement.

In the past decade, there has been an increased investigation into objectivity *per se*, from both historical and philosophical perspectives. Historians of science have persuasively shown that what has been taken as objective, either in terms of methods or knowledge, has not been constant during the period since the "Scientific Revolution" in the 17th century. (Daston 1992; Daston and Gallison 1992; Porter 1992; Porter 1995) Philosophers, on the other hand, have taken two different approaches to objectivity. Some have argued that objectivity is ultimately reducible to one basic meaning, onto which others have aggregated. (Nozick 1998, Nagel 1986) Others have suggested that objectivity is an inherently complex concept, with no one meaning at its core, but instead several different senses packed together. (Lloyd 1995; Fine 1998; Megill 1994)

In this paper, I will lay out a complex mapping of the senses of objectivity. This mapping will make two contributions to current discussions. First, it will dissect objectivity along operationally distinct modes. The modes are divided along different types of processes we can examine in practice when determining whether to describe the product of that process as "objective."[iv] Thus the mode tells us where to look for the characteristics of objectivity, while the details within the mode tell us what kinds of characteristics to seek there. This is important because objectivity is a term we employ, particularly when discussing knowledge claims; it is an important and useful term in deciding what to accept and what to reject, and so we need to know how we are going to decide whether something is objective or not. If we are going to mean more than brute force endorsement, we should know what we are looking for and how to find it in what we are endorsing. Endorsements or calls to trust are most valuable when it is clear what the basis of trust is. Thus, having operationalized senses of objectivity will provide heft and clarity to the normative force behind the word. For each of the operationally distinct modes, one looks for key characteristics in different types of processes, from human interactions with the world to individual lines of thought to social/group processes. I will describe these further below.

Second, the mapping will allow me to cogently argue that the different meanings of objectivity I explore here are not logically reducible to one core meaning. Within each of

the operationally distinct modes, there are multiple senses of the term. I will argue that neither the modes nor the senses within them reduce to each other. There are conceptual connections across the modes and among the senses, and these provide coherence to the concept of objectivity. No one concept emerges as core, however, and no one mode or sense can serve as the surrogate for the others.[v] Thus, I will argue that there is no single sense that captures the meaning of objectivity. The bases for epistemic endorsement and trust are varied. At the end of the paper, I will discuss the implications of this inherent complexity, for the concept of objectivity, for its use, and for its traditional opposite, subjectivity.

There are meanings that will be left out of this analysis. If there are ideas of objectivity that are not operationally accessible, i.e. we have no way of telling in practice whether or not the term applies in any cases, I have not included them in this analysis. For example, one might consider objective knowledge to be knowledge that is somehow external to all human experience, that is independent of all human thought. I do not think we yet have, however, a way to figure out whether something we know is really independent of all human knowers.[vi] Until we have some effective way of deciding that a piece of knowledge is independent of all human knowers (perhaps encountering some other non-human set of knowers and comparing notes?), this meaning of objectivity reduces in practice to either an inaccessible assumption about the world or to *mere* rhetorical endorsement.[vii] Meanings of objectivity with similar problems are ignored here. They can be added when they are made operationally accessible, i.e. when we have a way to check whether or not a claim is actually objective in that sense. I am interested here only in senses of objectivity that actual human knowers, with their limits, can use in more than a rhetorical way.

## 2.0 Three Modes of Objectivity and the Senses Within Them

The three operationally distinct modes are as follows: 1) Objectivity$_1$ focuses on processes where humans attempt to interact with the world, such as scientific experimentation or interactions in daily life; in particular, these processes attempt to directly "get at objects" in the world. 2) Objectivity$_2$ focuses on an individual's thought

processes or an individual reasoning process, and particularly focuses on the role of values in that process. 3) Objectivity$_3$ focuses on social processes that structure epistemically important procedures, and examines in particular ways to reach agreement through these processes. In each mode, there are multiple senses of "objectivity." None of the senses below are absolute; in no case is there either objectivity or not. Instead, one can be more or less objective in each sense under each mode.

2.1 Objectivity$_1$: When looking at human interactions with the world, what does it mean to say that such a process leads to something objective? For example, what does it mean to say that a particular experiment produced an objective result, solely in terms of the interaction between the human experimenters, their equipment, and their results? (In the next two modes, I will consider the experimenter's reasoning process and the reception of their results among their colleagues.) In this section I will describe two different processes that are often considered to exemplify the marks of objectivity in this first mode.

Traditionally, an objective result under this mode would be one that gained a grasp of the real objects in the world. However, whether or not it is possible to have good evidence that one has gained such a grasp is precisely at the heart of the realist debates, debates that seem to be solidifying into convictions on each side that their side has won. The view on objectivity$_1$ I articulate here attempts to remain agnostic over the realism issue. This view, I hope, can be drawn on by either side to articulate what is meant by objectivity$_1$, although realists will want to make some additional claims about the implications of having objectivity$_1$ present. In particular, a realist will want to claim that the presence of the process markers I will describe below means that one can make strong claims about the knowledge product. The realist will make the leap from the process markers of objectivity$_1$ to the conclusion that we have gotten at real objects. The anti-realist, on the other hand, can acknowledge the importance of these process markers as indicative of reliable knowledge while denying the realist conclusion (or weakening it in some way). What is important to realize is that while both camps may agree that the processes produce results they would label "objective," one should not then assume that

the objective product (whatever is produced by the proper process) has additional "objective" characteristics. I call the product objective solely because the process of its production has certain markers. Additional (realist) arguments are needed to move from the bare bones objectivity$_1$ arising from an examination of process to the ontological claims about the product, e.g. that the objects described are "really there."

What two types of experimental processes produce objective$_1$ results? The most dramatic experimental process is one in which we can use the results of one experiment in multiple additional experimental contexts reliably. When we can use a new concept or theory like a tool to intervene reliably in the world, ascriptions of the objectivity of those new tools come easily and with strong endorsement. In realist terms, when we can not only bump into the world in reliable and predictable ways, but use the world to accomplish other interventions reliably and predictably, we don't doubt that there is some object there we are using and that it has some set of characteristics we are able to describe. As in Ian Hacking's famous example from *Representing and Intervening*, scientists don't doubt the objective reliability (or existence) of electrons when they can use them to produce images of other things with an electron scanning microscope. (Hacking 1983, 263) I will call this sense of objectivity *manipulable* objectivity$_1$, in recognition of the process of manipulation or tool use central to its meaning. We get degrees of manipulable objectivity$_1$ by considering how reliably and with what precision we can intervene in the world.[viii]

This sense of objectivity is important outside of the laboratory as well as in it. When we can use objects around us, we trust our accounts of their existence and properties as reliable. If I can reach out and drink from the glass of water, and it quenches my thirst, and I can fill it back up again, repeating the whole process reliably, I have good reason to trust the reliability of relevant beliefs about the glass. Note that this way of determining the objectivity of claims is probably just as important as having agreement among competent observers (a sense of objectivity which will be discussed under the third mode). In addition, this method of determining objectivity does not require more than one observer/participant, as long as that observer is able to repeat their interventions. When we can't repeat our interventions (if we can't pick up the glass again, if it dissolves

under our grasp, or, in other contexts, if the experimental process fails to recur after repeated attempts), we rightly doubt the presence of manipulable objectivity$_1$, and thus the reliability of the results. Perhaps it was all an illusion after all.

A second sense of objectivity$_1$ is more passive than manipulable objectivity$_1$ but may be nearly as convincing. Instead of using the initial result for further interventions, we approach the result through multiple avenues, and if the same result continues to appear, we have increasing confidence in the reliability of the result. I will call this sense of objectivity$_1$, *convergent* objectivity$_1$. (Kosso 1989 focuses on this aspect of objectivity.) This sense of objectivity is commonly employed in both scientific research and everyday life. When evidence from disparate areas of research all point towards the same result, our confidence in the reliability of that result increases. Mary Jo Nye (1972) has shown this type of reasoning in the development of atomic theory. Cases in astronomy use similar approaches; when several information gathering techniques provide different but related images, one gains increasing confidence in the general result indicated. In everyday life, when an object continues to appear from a variety of vantage points and using a variety of techniques (e.g. both sight and sound), the possibility of illusion seems remote.[ix] As any birdwatcher will tell you, a convergence of evidence from various sources (e.g. bird coloration and song) assists greatly in the objective identification of the species under observation.

However, one must be aware of the limitations of convergent objectivity$_1$. The strength of the claims concerning the reliability of the result rests on the independence of the techniques used to approach it. (See Kosso 1989 for a detailed examination of epistemic independence.) One must ask whether the techniques employed really are independent ways of gathering evidence or if there is some source of error (or a gremlin in the works) across the methods. Also, it is possible that the convergence is only apparent, and several distinct phenomena are combining to produce the results.

Both manipulable and convergent objectivity$_1$ require examination of the experimental process (or more generally, human-world interactions) to find the process markers that support ascription of objectivity to (i.e. endorsement for trust in) the results. Whether

one would then want to ascribe additional properties to the results depends on one's position in the realist debate; the analysis here remains agnostic. As with both convergent and manipulable objectivity$_1$, we have varying degrees of confidence that we have gotten objective$_1$ results depending on our confidence in the independence of the methods and their specificity, or depending on the reliability of the results as a tool and the variability of contexts in which it is reliable. Thus, both senses of objectivity$_1$ are operationalizable and are matters of degree.

2.2 Objectivity$_2$: When looking at individual thought processes, what does it mean to say that the end result of that process is objective? For example, if we say that someone has written an objective overview of a problem, or produced an objective analysis of a situation, or developed an objective approach to a question, what do we mean? Instead of focusing on the interaction between the experimenter and the world, this mode of objectivity focuses on the nature of the thought process under scrutiny, and in particular on the role of values in the individual's thought processes. I will discuss three different senses of objectivity under this mode. They are often conflated in practice, with deeply problematic results.

The least controversial sense of objectivity$_2$ is the prohibition against using values in place of evidence. Simply because one wants something to be true does not make it so, and one's personal values should not blind one to the existence of unpleasant evidence. As Lisa Lloyd wrote: "[I]f one is personally invested in a particular belief or attached to a point of view, such inflexibilities could impede the free acquisition of knowledge and the correct representation of (independent) reality." (1995, 354) It is precisely for this reason that some metaphorical "distance" or detachment between the knower and their subject is recommended. Such detachment, it is hoped, will keep one from wanting a particular outcome of inquiry too much, or from fearing another outcome to such an extent that one cannot see it. Let us call this sense *detached* objectivity$_2$.

Unfortunately, detached objectivity$_2$ is often rapidly expanded to *value-free* objectivity$_2$, the second sense under this mode. In value-free objectivity$_2$ , all values (or all subjective

or "biasing" influences) are banned from the reasoning process. This meaning of objectivity derives support from the idea that values are inherently subjective things, and thus their role in a process contaminates it, making it unobjective. In an effort to prevent this, philosophers and scientists have argued that we need to exclude values from science, particularly ethical and societal values. Note how much broader this prohibition is from prohibiting values from supplanting evidence. Values can play many roles in the reasoning process aside from displacing evidence, from focusing interests and questions to determining which errors are more tolerable. However, we remain under the grip of a post-positivist hangover that all (non-epistemic) values in the (internal stages of the) scientific reasoning process are bad. We fear that any role for values (which some positivists defined as inherently meaningless) in epistemic processes will "distort" knowledge. We train scientists to believe that values are not allowed in science and they must ward off any appearance of personal values or personal judgments playing a role in their doing of science. Thus, scientific papers have a very formulaic structure in which the role of the scientist as active decision-maker in the scientific process is deftly hidden.

I have argued elsewhere that this is a mistake. (Douglas 2000) Hiding the decisions that scientists make, and the important role values should play in those decisions, does not exclude values. It merely masks them, making them unexaminable by others. The difference between detached objectivity$_2$ and value-free objectivity$_2$ is thus a crucial one. It is irrational to simply ignore evidence but it is not irrational, for example, to consider some errors more serious than others (and thus to be more assiduously avoided) or to choose a particular avenue of investigation because of one's interests. Scientists need to acknowledge the important role values must play in scientific reasoning, while not allowing values to supplant good reasoning. The personal vigilance scientists have so long directed towards keeping values out of science needs to be redirected towards keeping values from directly supplanting evidence and towards openly acknowledging value judgments that are needed to do science. In other words, scientists must learn to negotiate the fine but important line between allowing values to damage one's reasoning (e.g. blotting out important evidence, focusing only on desired evidence, etc.) and using values to appropriately make important decisions (e.g. to weigh the importance of

uncertainties). It is that fine line that defines the first sense of objectivity$_2$ (detached), and is obliterated by the second (value-free).

There is a third sense of objectivity$_2$ that is also often conflated with value-free objectivity$_2$, but plays an important and distinct role in modern discourse. This sense, *value-neutral*, should not be taken to mean free from all value influence. Instead of complete freedom from values, one instead focuses on taking a position that is balanced or neutral with respect to a spectrum of values. In situations where values play important roles in making judgments, but there is no clearly "better" value position, taking a value-neutral position allows one to make the necessary judgments without taking a controversial value position, without committing oneself to values that may ignore other important aspects of a problem or that are more extreme than they are supportable. It is in this sense that one can call a written overview of current literature "objective."[x] It takes no sides, not making commitments to any one value position, but takes a "balanced" position. While the overview may in fact incorporate values in how it presents and views its topic, it does not allow extremes in those values.

Thus, under value-neutral objectivity$_2$, objective can mean reflectively centrist. One needs to be aware of the range of possible values at play in the situation, aware of the arguments for various sides, and to take a reflectively balanced position. Such value-neutrality is not ideal in all contexts. Sometimes a value-neutral position is unacceptable. For example, if racist or sexist values are at one end of the value continuum, value-neutrality would not be a good idea. We have good moral reasons for not accepting racist or sexist values, and thus other values should not be balanced against them. But many value conflicts reflect ongoing and legitimate debates. One might think, for example, of debates between those placing primary value on robust local economies based on industrial jobs and those placing primary value on preventing health/environmental harms potentially caused by those industries. Another example would be the conflict between the needs of current generations around the globe, and the potential needs of future generations. In these and similar cases, value-neutral objectivity$_2$ would be a clear asset.

As with objectivity$_1$, objectivity$_2$ admits of degrees. One can be more or less detached from one's subject and thus more or less successful at keeping personal values from directly interfering with one's reasoning. One can be more or less neutral with respect to various values, more or less reflective on the spectrum of values and positioned in the middle of extremes. And, if one still holds to the ideal of value-free objectivity$_2$, one can be more or less free from values in total. One determines the degree of objectivity$_2$ by examining the reasoning process and looking at the role of values, or, for value-neutrality, by ensuring that one has considered the range of values and has taken a middle position considerate of that range. Thus objectivity$_2$ is operationalized by internal retrospection or by external examination of an individual's reasoning process.

2.3 Objectivity$_3$: When examining the social processes involved in knowledge production, what does it mean to claim that the end result is objective? Instead of examining an individual line of thought, what one examines for objectivity$_3$ is the process used among groups of people working to develop knowledge, and in particular, the process used to reach an agreement. Again, there are three distinct senses of objectivity$_3$, with different epistemological strengths and weaknesses.

Social processes can be considered "objective" if the same outcome is always produced, regardless of who is performing the process. I will borrow from Megill (1994) and label this sense *procedural* objectivity$_3$.[xi] Procedural objectivity$_3$ allows society to impose uniformity on processes, allowing for individual interchangeability and excluding individual idiosyncrasies or judgments from processes. If there is a very clear and rigid quantitative form with which to process information, regardless of who processes that information, the same outcome should result. For example, in the grading of procedurally objective$_3$ tests, no individual judgment is required to determine whether an answer is correct or not (e.g. multiple choice tests, once the key is made). The tests are designed so that there is one definitively correct answer for each question. Thus, there is no need for individual judgment on the correctness of a given answer. It is either correct

or not, and the final score is the sum of correct answers. Regardless of who grades the tests, the same score should result for each test.

Theodore Porter's historical work traces the development of this sense of objectivity in the past two centuries.[xii] (Porter 1992; Porter 1995) In his examination of objectivity in accounting, he shows how the focus on rules, particularly inflexible and even-handed rules, lends credence to the field of accounting. (Porter 1992, 635-6) In his 1995 work, *Trust in Numbers*, Porter expands the areas of examination, looking at the role of rule-bound quantification techniques across engineering, accounting, and other bureaucratic functions. Quantification through rules (as opposed to expert judgment) allows for both an extension of power across traditional boundaries and a basis for trust in those with power. Procedural objectivity$_3$ thus serves a crucial function in the management of modern public life.

The key to procedural objectivity$_3$ is that regardless of who engages in a procedurally objective$_3$ process, they would do it in the same way, producing the same result. The elimination of idiosyncrasies, while enabling public trust, does not ensure the elimination of values, however. Instead of individual values, the values are encoded in the processes themselves. A rigid quantitative process that eliminates the need for personal judgment forces one to examine the situation in a fairly narrow way. Inflexible rules mean that some nuances, which might be important to particular cases, will be left out. As Porter wrote: "Quantification is a powerful agency of standardization because it imposes some order on hazy thinking, but this depends on the license it provides to leave out much of what is difficult or obscure." (1992, 645) Which inputs are emphasized as important for the decision process reflects whatever values are built into the process. Thus rules can force one to disregard evidence that one might otherwise consider relevant. The way that outcomes are determined in the process can also reflect values. Such processes generally have set thresholds for when one outcome as opposed to another will be warranted. Whether those are the appropriate thresholds for the outcomes reflects a value judgment. Thus procedural objectivity$_3$, while eliminative of individual judgment, in no way eliminates values.[xiii]

Procedural objectivity$_3$ is not the only way in which we look to social processes for an objective outcome. Two additional senses of objectivity$_3$ are often subsumed under the heading of "intersubjectivity." The first, which I will call *concordant* objectivity$_3$, reflects a similar concern with unanimity of outcomes across groups of people. Instead of seeking to eliminate individual judgment, however, this sense checks to see whether the individual judgments of people in fact do agree. When we say that if some set of competent observers all concur on a particular observation then it is objective, it is this sense which we are using. While procedural objectivity$_3$ may be useful for achieving concordant objectivity$_3$, it is not necessary for it.[xiv] The processes leading up to the agreement may be socially sanctioned and fairly rigid, forcing individual judgment from the arena, or they may be looser. Individuals relying primarily on their individual judgment coming to an agreement without procedural constraints would provide a stronger sense of concordant objectivity3 than with procedural constraints. Presumably there would be greater potential sources for disagreement without procedural constraints. Thus to reach agreement without them would seem to increase the reliability of the group's judgment.

For Quine, this sense of objectivity was essential: "The requirement of intersubjectivity is what makes science objective." (1992, 5) As Quine and others have used it, concordant objectivity$_3$ is applied in cases where the individuals are simply polled to see how they would describe a situation or context, or whether they would agree with a particular description. There is no discussion or debate here, no interactive discourse which might bring about agreement. If the agreement is not there, there is no concordant objectivity$_3$. If the observers agree, then the observation is objective$_3$. If not, then it is not.

While concordance among a set observers can be a powerful statement, the limitations of concordant objectivity$_3$ must be recognized. It cannot guarantee that one has gotten at something real; there is always the chance of a group illusion. It cannot guarantee that values are not influencing or supplanting reasoning; the observers may have shared values that cause them to all disregard important aspects of an event. Nevertheless,

idiosyncratic values that influence observation will not be allowed to determine a statement of fact. Idiosyncrasies may prevent concordance, but only widely shared idiosyncrasies, an oxymoron, can help create it. If agreement is attained, the testimony of the group will help bolster claims for the actuality of the observation. There is a second limitation: how one decides on the composition of the group. Because this weakness is shared with the third sense of objectivity$_3$, I will discuss this problem further below.

The third sense of objectivity$_3$, *interactive* objectivity$_3$, involves a more complex process than concordant objectivity$_3$. Instead of simple agreement, this sense of objectivity$_3$ requires discussion among the participants. Instead of simple assent to an observation account, the participants are required to argue with each other, to ferret out the sources of their disagreements. It is in the spirit of this sense that we require that scientific data be shared, theories discussed, models open to examination, and, if possible, experiments replicated. The open community of discussion has long been considered crucial for science. The hope is that by keeping scientific discourse open to scrutiny, the most idiosyncratic biases and blinders can be eliminated. In this way, you can have other people help make sure you are not seeing something just because you want to.

The social character of science and its relationship to objectivity has been an increasingly important topic among philosophers of science. (Kitcher 1993; Longino 1990; Hull 1988) As Longino argued in chapter 4 of *Science as Social Knowledge*: "[T]he objectivity of science is secured by the social character of inquiry." (1990, 62) In that chapter, she goes on to discuss conditions of social interaction which increase the interactive objectivity$_3$ of a process of inquiry. Among these are recognized avenues for criticism, shared standards for arguments on which criticisms are based, general responsiveness to criticism, and equal distribution of intellectual authority. (Longino 1990, 76-79) A detailed discussion of these conditions is beyond the scope of this paper, but the key point here is that the quality of interaction among investigators and the conditions for those interactions are crucial for interactive objectivity$_3$.

Among the difficult details of interactive objectivity$_3$, including precisely how the discussion is to be structured and how it is to proceed, one of the most difficult issues remains defining who gets to participate in the discussion. Having some communal standards for discussion will require that some boundaries be set up, between those who agree to the shared standards and those who do not. In addition, some discussions will require a degree of competence or skill. For both concordant and interactive objectivity$_3$, defining competence becomes a problematic issue. Some level of competence is essential (minimally that there are shared language skills), but very high and uniform standards for competence would reduce participant diversity. Some diversity among participants is crucial for interactive objectivity$_3$; getting agreement among a group of very like-minded people increases the possibility that a shared bias or delusion has produced an unwarranted result. All the observers in agreement may share the same problematic bias, particularly in a low diversity group, and it would go unnoticed. Thus, a deep tension remains under both interactive and concordant objectivity$_3$– between shared standards that provide a basis for discussion/agreement and the diversity of participants. Because of this tension, neither interactive nor concordant objectivity$_3$ guarantee that all ideological bias has been removed from science.

This tension, and the other complications in applying interactive objectivity$_3$, allow for degrees of objectivity. As Longino wrote: "A method of inquiry is objective to the degree that it permits *transformative* criticism." (1990, 76, italics hers) Depending on how strong the requirements are for a diverse group of people to sit at the table of discussion, how the process of discussion is structured (e.g. is intellectual authority equally distributed among participants) and how stringent the requirements are for agreement (what is going to count as consensus), the end result will be more or less objective$_3$. Similarly, the greater the diversity of participants for concordant objectivity$_3$, one again gets greater degrees of objectivity$_3$. Once again objectivity is a matter of degree.

With eight distinct senses of objectivity in three different modes, one might wonder whether we could simplify the complexity of objectivity. I will argue in the next section that such simplifications cannot be accomplished for the sake of simplicity alone– that the senses are not logically reducible to each other. The structure I have described here, with three different modes, bolsters this claim. In each mode, we look at different kinds of processes in order to establish objectivity. (Recall that, for objectivity$_1$, one examines the particular laboratory or human-world interactive processes. For objectivity$_2$, one examines individual reasoning processes. For objectivity$_3$, one examines the structure of group dynamics and social processes.) The operational focus of this mapping should assist us in clearer, more explicable use of objectivity; it provides us with a better sense of what to look for when labeling something objective. In actual examples, we may want more than one sense of objectivity across different modes to be present, but, as I will argue below, that does not mean that if one sense is present, the other will be too. We can have more than one sense of objectivity at play in a given context, but there is no necessity that if one is, others will follow.

## 3.0 The Irreducibility of Objectivity

In the previous section, I described three different modes containing eight different senses of objectivity. Historians have begun the very interesting work of accounting for how such a complex accretion of meanings have attached themselves to the word objectivity. Philosophers might wonder, however, whether it is possible to simplify the situation. Perhaps some of these meanings might be reduced to others, or perhaps we could decide that some of the meanings did not belong to the word. In this section I will argue that neither of those simplifications is satisfying. None of these meanings is logically reducible to other meanings (unless one is willing to make rather strong metaphysical or epistemological presumptions). While there are no reducible meanings here, neither are the senses unconnected. There is coherence to objectivity. While I do not agree that all the meanings are desirable, pulling apart objectivity must be done on normative grounds other than lack of fit.

First, note that I have already made clear the distinctions among the different senses within modes. Thus, within the different modes, the divergence of meanings and contexts of applicability make it implausible that the different senses are reducible to each other. For objectivity$_2$, the important differences between detached, value-free, and value-neutral objectivity$_2$ are discussed in the section above; similarly for procedural, concordant, and interactive objectivity$_3$. For manipulable and convergent objectivity$_1$, the fact that one uses the result to do something *else* in manipulable objectivity$_1$, as opposed to gathering information relevant to the result using different methods in convergent objectivity$_1$, seems an obvious and important distinction.

The more interesting avenues for reduction lie between modes. Can particular social processes provide objectivity$_2$ in individual reasoning? Can objectivity$_2$ in individual reasoning provide for certain kinds of interaction with and knowledge about the world? Does objectivity$_1$ reduce to meaning that objectivity$_3$ is present? It is here that we find objectivity's conceptual coherence but irreducible complexity. Instead of addressing all 42 possible reductions across modes, for brevity's sake, I will discuss only several of the most plausible avenues.

Some of these avenues have already been mentioned. I noted in the previous section that procedural objectivity$_3$ does not eliminate values (value-free objectivity$_2$); nor does it assure that neutral values will be reflected in the procedure (value-neutral objectivity$_2$). However, it might make the values embodied more apparent, hopefully in the process of setting up the procedures. In this way, it may assist in the achievement of value-neutral objectivity$_2$, even if it does not guarantee it. Similarly, such procedures reduce the opportunity for idiosyncratic individual values to alter the process, as discussed above. Thus, in some contexts, procedural objectivity$_3$ may assist in the achievement of detached objectivity$_2$. While there is no guarantee of achieving any of the senses of objectivity$_2$ with procedural objectivity$_3$, there are conceptual links between the two for some contexts. When Daston and Gallison describe the rise of "mechanical" objectivity in the nineteenth century, they are calling on several senses of objectivity that were seen as connected: procedural objectivity$_3$ (the following of rules to eliminate personal

interpretation), detached objectivity$_2$ (the need for personal restraint), and convergent objectivity$_1$ (the belief that personal interpretation would interfere with getting reliable results). (Daston and Gallison 1992) It is loose connections such as these that provide the coherence in objectivity without allowing for simple reductions.

Another common avenue for attempts at reduction involves arguments concerning individual reasoning processes and experimental (human-world interactive) processes. One might claim that if one's reasoning processes embody detached objectivity$_2$, then one will achieve either manipulable objectivity$_1$ or convergent objectivity$_1$ (or both).[xv] Upon reflection, it should be clear that no such guarantee exits. There are plenty of errors one might make, aside from values supplanting or masking evidence, from simple errors in recording information to the more subtle sources of errors arising from unwitting trust in the capabilities of instrumentation. One can go as far back as Francis Bacon's Idols of the Tribe, Market Place, and Theater to find general sources of error that have nothing to do with an individual imposing his values on the world (which would fall under Idols of the Cave). These errors would be sufficient to prevent one from gaining experimental success in either of the two senses (manipulable or convergent). And even if one makes no obvious errors, one may still not have the right puzzle pieces to provide one with convergent objectivity$_1$ or manipulable objectivity$_1$. A good deal of luck goes into such success. Thus, while detached objectivity$_2$ would likely help in many contexts, it is not reducible to the senses in objectivity$_1$.[xvi]

Before moving on, let us consider one more avenue for reduction. One might argue that convergent objectivity$_1$ really amounts to concordant objectivity$_3$ or interactive objectivity$_3$, i.e. that getting multiple avenues of evidence for a result is equivalent to having groups of people agree that something is the case, either through simple agreement or interactive debate. However, it must be noted that one person can accomplish convergent objectivity$_1$. It is usually more difficult to go it alone, but there is nothing in convergent objectivity$_1$ that requires group activity. Despite the lack of necessary connection, there are contexts in which both convergent objectivity$_1$ and interactive objectivity$_3$ would be at play and would bolster each other. With multiple

people working on different but related problems and debating the results, we are more likely to trust the results, and there is less chance that a mass deception is being perpetrated.[xvii] The social activity of science, of many people working together to cover each other's blind spots and to put together the most comprehensive picture possible, greatly enhances our confidence in its accuracy and reliability. But objectivity$_1$ *need* not rely on such social activity.[xviii]

Although I have not discussed all of the possible avenues for reduction,[xix] I hope it is clear that such attempts at reduction would merely eliminate aspects of objectivity for the sake of simplicity alone. Such an impoverishment of meaning is not warranted on those grounds. Even with eight senses, objectivity is conceptually coherent. As I have attempted to show, there are conceptual links across the senses, but no one sense fully captures the meaning of objectivity. This does not mean that we must accept all the meanings I have laid out here, either as desirable or as being finished. I doubt that the final chapter in the history of objectivity has been written. But we should be fully aware of the complexity of the concept with which we deal when we invoke the term. By drawing on several senses of objectivity simultaneously, and using them to evoke each other, we already work within this network of meanings. The mapping provided here should help clarify where and how we are drawing links between the different senses and across the various modes.

## 4.0 Objectivity and Subjectivity

Although there are eight distinct senses to objectivity, it is rare that we invoke just one when we use it in practice. By focusing on how we might operationalize the term, I have articulated a set of things we look for when deciding whether or not to invoke the term. Usually, when we call something objective, we mean to say that some cluster of those things is present. For example, a piece of scientific research is objective because it provides convergent sources of evidence for some result (convergent objectivity$_1$), it is agreed among members of that field that the research is well done and provides adequate

support for its claims (concordant objectivity$_3$), and the researchers were very careful not to read too much into their data as they felt themselves drawing closer to a particular result (detached objectivity$_2$). A review report might be objective because the reviewer took pains to consider all the disparate research and perspectives on a contentious topic (value-neutral objectivity$_2$), and in a debate over the topic that followed, a group of experts came to similar conclusions and found, when they met as a review panel, they had nothing to add (interactive objectivity$_3$). The complexity of objectivity provides for both its flexibility in usage and the strength of its normative force. There are multiple grounds from which to call for trust of a claim, from which to endorse that claim to others.

It should also be clear that the complexity allows room for change. We might decide that some meanings should be dropped (as I think value-free objectivity should be). And we might find that new meanings will be added as our practices change over time. There is no ahistorical fixedness to objectivity to date; there is little reason to think we are finished developing the term.

Finally, any discussion of objectivity would not be complete without considering its perennial opposite-- subjectivity. If objectivity is such a complex term, what are we to make of subjectivity? I will sketch an answer to that question here; a fuller treatment will have to await future work.

Not surprisingly, a close look at subjectivity reveals a similarly complex conceptual stew. One can mean subjective in terms of something which only the individual can experience. In this sense, subjective things are things that cannot be directly shared among individuals. I cannot simply open my mind to someone else; it must be a mediated exchange through language and gesture. Subjective can also be used to describe experiences for which only personal, individual experience is relevant. Thus, how I felt about a movie, for example, is a subjective question in this sense. It may be that others shared my feelings, but if not, my feelings are not wrong (although they may be ill-founded, e.g. I missed the first half of the movie). External monitoring of feelings (using biological measures such as pulse rate and pupil dilation) may contradict the initial

personal report of feelings, but if the individual, upon reflection, says "No, I really felt this way," there is something primary about that report. Subjectivity here defends that primacy.

Another meaning of subjectivity is more derogatory, relating to the interference of subjective elements in reasoning process or knowledge production. There are a range of ways in which subjective elements might interfere with knowledge production. For example, one might impose one's personal beliefs on the world, ignoring relevant evidence to the contrary. It is precisely this form of subjectivity that detached objectivity$_2$ attempts to avoid: the construction of the fallacious argument "I want X to be true, therefore X is true." Subjectivity in this sense ignores evidence to the detriment of good reasoning. There is an element of idiosyncratic arbitrariness in this sense of subjectivity, one that is in clear opposition to the aspects of objectivity that build trust.

Not all subjective elements in reasoning processes need be considered detrimental, however. For example, it might be for subjective reasons that a researcher takes a particular methodological path (e.g. a hunch or a feeling), but such subjective influences can still be highly productive. Other subjective elements can also be beneficial. Under the view that non-epistemic values introduce a subjective element into science, all such values are subjective. Thus, ethical judgments or decisions based on social values are often labeled subjective. However, in many of these cases, there is little debate that such values play an important and necessary role in the reasoning process. For example, the ethical values that constrain the use of human subject in medical research are not seen as detrimental subjective influence. Nevertheless, we often label value judgments in general "subjective." Perhaps this blanket label needs to be discarded in conjunction with the value-free meaning of objectivity.

In addition, whether or not values *per se* are subjective remains ambiguous. Perhaps in some cases, where values are openly debated and reasons for holding them explored, the values transcend the localization of subjectivity into the shared space of intersubjectivity. If there is agreement on a set of values, does that mean the values are concordantly objective$_3$? If the values are agreed upon after much debate among a diverse group, does

the interactive objectivity$_3$ of the values become apparent? If my analysis of objectivity is on target, this would be the case. That the idea of objective values can both be made conceptually coherent and still seem so dissonant indicates the complex terrain that "subjectivity" covers, some of which may well overlap with "objectivity," not just oppose it.[xx]

What should be clear from this brief discussion is that subjectivity is not just the lack of objectivity, and objectivity is not just the overcoming of subjectivity.[xxi] Both are rich concepts, elements of which may be placed in stark opposition to each other. When we invoke either objectivity or subjectivity, we draw on several of these elements at once, although rarely are all aspects invoked. We need to be clear, with ourselves and with others, on which elements of objectivity we are invoking and how we are using them. Only then can we decide whether to accept an "objective" claim, whether to trust its endorsement.

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[i] This paper developed over several years, with the work beginning in talks given at the University California Berkeley's Center for Toxic and Nuclear Waste Management (November 1999), Taking Nature Seriously Conference (February 2001), International Society for the History, Philosophy, and Social Studies of Biology Meeting (July 2001), and the Eastern Division APA (December 2001). However, the ideas presented here developed most with feedback from Ted Richards and Doug Cannon. I would also like to thank the anonymous reviewer for providing very helpful and thought-provoking comments. Finally, my thanks to the National Science Foundation (SDEST grant # 0115258) and the University of Puget Sound's Martin Nelson Junior Sabbatical Fellowship for their generous support which made this work possible

[ii] See, for example, the uses of "objectivity" and "objective" in Giere 1999, 41-44.

[iii] The relationship between trust and objectivity has been emphasized by both Porter (1995, see esp. chaps. 8 & 9) and Fine (1998).

[iv] The process itself is not properly described as objective, although we often call a process "objective" when what we really mean is that the outcome of the process, if performed properly, is objective. Conflating the process (the producer of objectivity) with the product (the objective outcome) must be avoided.

[v] This is not surprising given that philosophers who have argued for a core meaning have focused on different aspects of objectivity. While Nozick focuses on human-world interactions in his account of invariance as objectivity, Nagel focuses on individual thought processes in his account of aperspectivalism as objectivity. See Lloyd 1995, 365-373, for more examples of divergent philosophical accounts.

[vi] Perhaps one could check to see if some new piece of information surprised all human knowers. One could then argue that this universal surprise was an indication that the knowledge was independent of human knowers. Note, however, that even universal human surprise would not be conclusive here; general self-deception can lead to such surprise even for human-dependent beliefs. In addition, I can think of no cases in the history of science when *everyone* was surprised by some result.

[vii] I do think that the world exists independently of human knowers. But this is not equivalent to our *knowledge* of the world being so independent.

[viii] Even if one is a realist, one must be careful not to inflate the claims made in the name of this aspect of objectivity. Even if one has the strongest sense possible that one has gotten at an object, that some object really is there and that one can manipulate it in some reliable way, this does not mean that all of the theories about that object are true, or that we know everything there is to know about it. All we know is that there is something really *there* to work with. Biologists that can reliably manipulate a cellular receptor don't doubt that it exists, even if they do not fully understand its function (e.g. the Ah receptor), and chemists don't doubt that chemicals commonly used to perform reactions exist, even if all of the mysteries of the chemical are not fully plumbed. This lack of doubt among scientists does not exclude the possibility of surprise (e.g. that the object will fracture into something more complex) or error (e.g. that two different objects will come to be seen as the same entity under different circumstances). Broad claims of realism (or closeness to truth) for scientific theories *as a whole* are not supportable by manipulable objectivity$_1$.

[ix] This is also the primary sense of objectivity focused on by those concerned with "invariance" in experience (although in some cases manipulable objectivity$_1$ may also be

in play). (See Nozick 1998) Unfortunately, Nozick's argument that invariance captures all of objectivity falls short. First, the additional aspects of objectivity I discuss below are hand-waved through as assisting with the gaining of invariance (even though this is not always the case). Second, invariance depends on comparisons across approaches, but which approaches are acceptable is to be decided by asking scientists. This may simply reduce to scientists telling us what is objective and what is not. Finally, it is not clear whether invariance captures objectivity or theoretical sophistication. Invariance may just mean that theoretical development has advanced to the point that one can convert an outcome from one system or perspective to another, not that measurements actually taken capture something of the world. For example, one can have invariance between Celsius and Fahrenheit temperature measurements (because there is a set way to convert from one scale to the other), but that does not show that thermometers are capturing something reliably. To show that, it would be better to use a more independent check on temperature, such as an infrared scan. If that produces a temperature that is close to the thermometer's measure (i.e. is convergent with it), one gets the sense that the measurements are reliable and objective. The match between the two measures need not be exact, as invariance suggests.

[x] As in the recent SAB review of EPA's dioxin health assessment revisions, where the SAB panel found that "the Agency document contains and thorough and generally objective summarization of that [peer-reviewed dioxin] literature." (SAB 2001, 16)

[xi] See Megill 1994, 10-11. Note that Megill's definition of procedural objectivity has far more in common with Porter's (1995, 4) and Daston & Gallison's (1992, 82-83) use of "mechanical" objectivity than with Arthur Fine's more recent use of the label. (Fine 1998, 11) Fine's definition of "procedural" objectivity seems to include all three senses of objectivity$_3$ I discuss here.

[xii] Porter labels this sense of objectivity "mechanical" instead of "procedural." (Porter 1995) I use the latter term because it seems to capture better this sense of objectivity$_3$.

[xiii] As Fine wrote: "Bias and the impersonal are quite happy companions." (1998, 14)

[xiv] In practice, there can be strong ties between the three senses of objectivity$_3$. Agreed upon procedures for making observations (procedural objectivity$_3$) can greatly promote the achieving of concordant objectivity$_3$. The final sense of objectivity to be introduced below, interactive objectivity$_3$, can help define the disciplinary boundaries in which such agreements on procedures (and then observations) take place. However, while such interdependence can occur, it need not. The senses are still conceptually distinct and can be independent of each other.

[xv] That we would use the term objective both for getting at objects in the world and for being free of values raises an interesting question: Why would one think that values are bad for science? The answer, as is well known, lies in the idea that personal values distort or interfere with our understanding of the world. The simple reduction is often made that if we eliminate values and/or subjective influences, then we will get at the objects of the world. Note the complex relationship between free of subjective influences and free of values in general. While these categories overlap, neither fully encompasses the other. Some values are intersubjective and some subjective influences may be epistemic beliefs not clearly tied to values.

[xvi] In some uncommon contexts, detached objectivity$_2$ may hurt. Sometimes blinders to some evidence may help one see something important in other evidence more clearly,

furthering science in the process. Historians and philosophers are beginning to discuss such cases in greater depth, and there is much consternation over whether they are pathological. But only if one believes that detached objectivity$_2$ must be reducible to convergent objectivity$_1$ are those cases truly problematic. Otherwise, one can acknowledge those cases, and still argue that in general, detached objectivity$_2$ is the best policy(because it is so rare that the world is the way we desire it to be).

[xvii] As noted in the introduction, the importance of trust for objectivity has been emphasized by Fine (1998, 17-18).

[xviii] Similarly for manipulable objectivity$_1$—it does not need intersubjectivity for reliability, merely individual repeatability.

[xix] Fine (1998, 16) argues against logical reduction between nonperspectival objectivity and absolute objectivity (which relates best to the senses of objectivity discussed here). I do not have a non-perspectival sense of objectivity here because of its *prima facia* lack of operationalizability. By combining aspects of objectivity$_2$ and objectivity$_3$, one may be able to build some loosely operationalizable sense of aperspectival objectivity. For example, one might argue that aperspectival objectivity is detached objectivity$_2$ combined with concordant objectivity$_3$. However, it must be remembered that multiple perspectives do not negate perspective altogether.

[xx] Having objective values is different from objectifying values. Recall that none of my senses of objectivity means independent of human knowers. Thus, saying that values can be objective does not mean that values are independent of humans, although "objective values" may carry that connotation for some. Values can be as dependent on humans as color is on light, and objective in several senses.

[xxi] There are additional elements to subjectivity: elements of emotion, the heavy weight placed on personal judgment, the localization of a claim to one person at one time, the sense of isolation that comes when being told a particular view is "subjective."