Cognitive Attitudes and Values in Science

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We argue that the analysis of cognitive attitudes should play a central role in developing more sophisticated accounts of the proper roles for values in science. First, we show that the major recent efforts to delineate appropriate roles for values in science would be strengthened by making clearer distinctions among cognitive attitudes. Next, we turn to a specific example and argue that a more careful account of the distinction between the attitudes of belief and acceptance can contribute to a better understanding of the proper roles for values in a case study from paleoanthropology.

1. Introduction. The notion of a cognitive attitude remains somewhat unclear in the existing literature (see McKaughan 2007), but we will characterize it as an evaluative response to some content, such as a proposition, a model, a theory, or a hypothesis.[1] For example, consider the hypothesis "hominid bipedalism evolved because it was selectively advantageous for male hominids to be able to carry food back to their offspring with their hands." One might believe this claim, one might think that it is more likely than not to be true, one might accept it as a fruitful hypothesis, or one might entertain it for the purposes of identifying its weaknesses. Philosophers working in many different subfields have recently emphasized the importance of clarifying these different cognitive attitudes (see, e.g., Stalnaker 1984; Cohen 1992; Bratman 1999; Audi 2008). Philosophers of science in particular have begun to explore the differences between believing that a hypothesis is empirically adequate or true versus accepting it as pragmati-

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1. Many epistemologists focus more narrowly on "propositional attitudes" (see McKaughan 2007), but we think it is important not to presume that scientists' attitudes are directed only toward propositions. For the sake of simplicity we will use the term "hypothesis" and the placeholder "*h*."

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cally justified or as pursuit worthy or as an appropriate basis for action (van Fraassen 1980; Laudan 1981; McKaughan 2007; Elliott 2011a).

In this article, we argue that more careful attention to cognitive attitudes could advance contemporary work on science and values. Section 2 will motivate our claim by showing that the major recent efforts to delineate appropriate roles for values in science would be strengthened by making clearer distinctions among cognitive attitudes. In order to illustrate the benefits of analyzing cognitive attitudes in greater detail, section 3 develops a careful distinction between the attitudes of belief and acceptance, and section 4 shows how this analysis can help to elucidate the proper roles for values in recent high-profile paleoanthropology research.

2. Values in Science: Why Cognitive Attitudes Are Needed. The literature on values and science is replete with efforts to draw distinctions between the appropriate and inappropriate roles that various sorts of values can play. This section shows that three of the most important previous accounts of values in science could be strengthened by clarifying how they appeal to distinctions between particular cognitive attitudes. These three accounts employ (1) a distinction between epistemic and nonepistemic values, (2) a distinction between direct and indirect roles for values, and (3) a distinction between cases in which hypotheses are underdetermined by available evidence and those in which they are not.

Consider first the distinction between epistemic and nonepistemic values. Ernan McMullin (1983) is particularly well known for defending a distinction between epistemic values (e.g., predictive accuracy, explanatory power, and fertility), which provide reasons to think a hypothesis is true, as opposed to nonepistemic values (e.g., ethical, religious, or political considerations), which do not reliably support the truth of a hypothesis. Daniel Steel (2010) has recently clarified this distinction. A potential problem for this approach, however, is that scientists sometimes have good reasons for drawing conclusions (e.g., because policy makers are calling on them for advice) even though the available evidence and epistemic values do not provide decisive reasons for thinking that a particular hypothesis is true (Elliott 2011b). In a well-known interchange with Janet Kourany, Ronald Giere (2003) acknowledged this point and emphasized that even if nonepistemic values are irrelevant to epistemic decisions about what claims to believe as true, they are nonetheless relevant to practical decisions about what claims to adopt as a basis for action. Similarly, in response to Douglas (2000), Sandra Mitchell (2004) argued that nonepistemic values can appropriately generate action but not belief. Therefore, thinkers like Giere and Mitchell would apparently benefit by clarifying the difference between the cognitive attitude of believing a claim versus the attitude of accepting a

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claim as a basis for action, but their work does not currently elaborate on this distinction.[2]

A second approach to delineating the roles of values in science comes from Heather Douglas. Building on previous work by figures such as Richard Rudner (1953) and C. West Churchman (1948), Douglas argues in both an influential paper (2000) and a recent book (2009) that nonepistemic values can appropriately influence all aspects of scientific reasoning, including the assessment of hypotheses, as long as they play only an indirect role. Kevin Elliott (2011a) has recently argued that the distinction between direct and indirect roles has been formulated in importantly different ways by various thinkers. Nevertheless, the basic idea is that scientists can appropriately appeal to nonepistemic values when setting the standards of evidence for accepting a hypothesis, but they should not appeal to nonepistemic values when determining whether those standards of evidence are met.

Douglas briefly acknowledges in her book, however, that her argument for incorporating nonepistemic values in science depends on a particular view about the cognitive attitudes of scientists. In particular, she insists that scientists are performing a specific sort of action when making socially relevant claims as voices of authority (2009, 16). She acknowledges that nonepistemic values are not relevant to the very narrow question of what one should believe to be true (2009, 16), but she argues that science involves much more than believing particular claims. Much of science involves making claims that decision makers can act on, and Douglas insists that nonepistemic values are relevant to setting the standards of evidence for making these sorts of claims. However, she does not clarify the precise cognitive attitudes involved in propounding claims as voices of authority. Thus, defenders of the distinction between direct and indirect roles for values in science could strengthen their account by clarifying the precise cognitive attitudes employed by scientists when they propound claims for public policy purposes.

Finally, a third approach to distinguishing appropriate and inappropriate roles for values in science is to argue that nonepistemic values are appropriate as long as scientists are faced with a situation of underdetermination, that is, if there are two or more incompatible but empirically equivalent hypotheses available. For example, Kourany claims that "the feminist project encourages . . . the provision of epistemic values supportive of egalitarian goals as well as a choice procedure that favors egalitarian options in cases of underdetermination" (Kourany 2003a, 10). To our knowledge, neither Kourany nor other prominent philosophers of science who appeal to underdetermination emphasize cognitive attitudes other than belief. On fur-

2. Mitchell even uses 'belief' and 'acceptance' synonymously (Mitchell 2004, 251).

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ther scrutiny, however, it appears that their accounts would be much stronger if they did so. A common criticism of Kourany's perspective is that scientists should merely suspend their judgment if they are faced with underdetermination (see, e.g., Haack 1993; Giere 2003). Kourany has responded that "withholding judgment is frequently not feasible in real scientific practice" because of "the need to act" (Kourany 2003b, 24). However, as we have already seen, scientists could indeed accept a particular hypothesis as an appropriate basis for action (or as pursuit worthy or as worthy of endorsement) without believing that it is true. Moreover, given that some of the philosophers of science who appeal to underdetermination are suspicious of the very attempt to distinguish epistemic values from nonepistemic values (see, e.g., Longino 1996), it would seem very promising for them to explore whether scientists should respond to underdetermination by adopting cognitive attitudes other than the belief that particular hypotheses are true.

3. Distinguishing Belief and Acceptance. In order to strengthen our claim that more detailed attention to cognitive attitudes would facilitate better accounts of the roles for values in science, this section develops a careful distinction between the attitudes of belief and acceptance, and section 4 shows how this account can help in analyzing a specific case study. A cognitive attitude is an evaluative response to some content of the form "*S A* that *h*," where *A* stands for the attitude of an agent, *S*, about a hypothesis, *h* (Schwitzgebel 2010). The cognitive attitude of belief is commonly defined as follows: *S* believes that *h*, iff *S* regards *h* as true.[3] The cognitive attitude of acceptance is more difficult to define. Some epistemologists and philosophers of science use 'acceptance' as a generic concept that includes the cognitive attitude of belief, but is broader than belief (see, e.g., van Fraassen 1980; Stalnaker 1984). Others, such as Jonathan Cohen and Michael Bratman, clearly distinguish between the concept of belief and the concept of acceptance. For Cohen, accepting a hypothesis means "including that [hypothesis] among one's premises for deciding what to do or think in a particular context" (Cohen 1992, 4). Similarly, Bratman claims that in accepting that *h* I am "taking it for granted that [*h*] in the background of my deliberation" (Bratman 1999, 20). Hugh Lacey (2005) and Daniel Steel (2011) provide a more normative account of acceptance, arguing that epistemic values should be satisfied (or at least should not be distorted) in order for a hypothesis to be worthy of acceptance. Yet, in the science and values debate, these normative accounts could be criticized as question begging because

3. We acknowledge that behind this rather rough definition there "lies a sea of complex psychological and conceptual questions" (McKaughan 2007, 183; see also Schwitzgebel 2010), but our focus here is on paving the way for another cognitive attitude, namely, acceptance.

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they presuppose that nonepistemic values cannot legitimately influence the acceptance of scientific claims.[4] This is why we prefer a nonnormative, descriptive account of acceptance, and we propose the following definition: *S* accepts that *h*, iff *S* presupposes *h* for specific reasons in her deliberation.

On our account, then, there are two main differences between belief and acceptance. First, many epistemologists insist that one cannot believe at will, whereas the acceptance of a proposition can be controlled voluntarily (see, e.g., Williams 1973).[5] Second, whether a proposition is worthy of belief varies only on the amount of evidence available and is not based on other contextual factors because belief is always focused on arriving at truth (Williams 1973; Bratman 1999). In contrast, what a person accepts varies with context. Our definition of acceptance integrates this contextual variation by virtue of the phrase "for specific reasons." Moreover, we refer to specific reasons because one often has many concurrent reasons, which sometimes need to be weighed, giving priority to a particular set of them in the end.

For example, one could accept a hypothesis because it appears to be a promising subject for further investigation in a particular context (Laudan 1981), or because it provides the best approach for simplifying particular reasoning tasks (Steel 2011), or because it serves as the best basis for formulating a particular regulatory policy (Elliott 2011b).[6] One can even accept a hypothesis or theory for particular reasons in one context (e.g., accepting it as pursuit worthy because it could help achieve the aim of collecting a valuable body of new scientific data) while refusing to accept it in another context because of other reasons (e.g., not accepting it as a basis for policy making because it is unlikely to contribute to policies that achieve an appropriate balance of benefits and risks to citizens).

Given this account of the cognitive attitudes of belief and acceptance, one can see how it becomes possible to evaluate the sorts of values that are appropriate to these attitudes. Namely, one must consider whether particular values are relevant to the specific reasons for which one is adopting a particular cognitive attitude.[7] If, for example, scientists are deciding whether

4. Daniel Steel (2011) allows for the influence of one pragmatic value on acceptance, namely, simplification.

5. See Bennett (1990) for a useful discussion of Williams's argument.

6. Of course, one could also express these evaluations in terms of belief; for example, *S* believes that a hypothesis is pursuit worthy. However, and this is crucial, one cannot believe a hypothesis because it is pursuit worthy, but one can accept it because it is pursuit worthy. Furthermore, one can accept a hypothesis without believing it, whereas when an agent believes a certain hypothesis she will probably also accept it in at least some contexts.

7. A complete approach to regulating values in science would need to address two further issues. First, even when values are logically relevant to the reasons for adopting a cog-

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to accept a particular hypothesis (say, that a chemical is toxic to humans at a particular dose level) as a basis for public policy making, then ethical values are clearly relevant to deciding whether or not the hypothesis should be accepted. If, in contrast, scientists are considering whether or not to believe that the hypothesis is true, ethical values are logically irrelevant and have no legitimate role to play because belief is directed only toward achieving truth.

4. A Case Study from Paleoanthropology: Lovejoy's Male Provisioning Hypothesis. Let us now make our distinction between belief and acceptance more concrete by showing how it could assist in analyzing the role of values in a specific case study from paleoanthropology. The evolution of bipedalism is one of the most fundamental and interesting elements of the phylogenetic process of becoming human. There are a plethora of hypotheses that attempt to explain the evolution of this first step to humanity (see Niemitz 2010). In our case study, we will concentrate on the widely discussed "male provisioning hypothesis" (Lovejoy 1981, 2009). We contend that careful attention to the cognitive attitudes of belief and acceptance highlight two lessons. First, acceptance is a much more appropriate cognitive attitude to adopt than belief because paleoanthropologists are confronted with a situation of prevailing underdetermination in this case. Therefore pragmatic and ethical values have a legitimate role to play alongside epistemic values in evaluating the male provisioning hypothesis. Second, this case illustrates that a dialectical relationship holds between values and cognitive attitudes; once a wide range of values are taken into account, many scientists may conclude that they should adopt an even weaker attitude toward the male provisioning hypothesis than acceptance.

We are considering the male provisioning hypothesis because it has been widely discussed in both the scientific and popular literature and because it illustrates many of the ways in which attention to cognitive attitudes can help to clarify the proper roles for values in scientific practice. This hypothesis, which C. Owen Lovejoy proposed in his *Science* article "The Origin of Man" (1981), attempts to explain the origin of bipedalism by a change of hominid sexual and reproductive behavior. Based on observations of mother-infant relationships among chimpanzees, Lovejoy assumes that the mortality rate of hominid infants increases with a higher mobility of their mothers. Conversely, lowered mobility of mothers would decrease the mortality rate of their infants. As Lovejoy makes clear, "lowered mo-

nitive attitude, it is necessary to distinguish between values that support or help to advance those reasons and values that do not. Second, a complete account would need to provide criteria for deciding which reasons and cognitive attitudes are appropriate for scientists to adopt in particular contexts. For further discussion of these issues, see Willmes (2012), sec. 3.5.

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bility of females would reduce accident rate during travel, maximize familiarity with the core area, reduce exposure to predators, and allow intensification of parenting behavior, thus elevating survivorship" (Lovejoy 1981, 345).

Moreover, Lovejoy reasons, the ecological conditions of the Miocene (23–5.5 million years ago), which resulted in large seasonal differences in food availability, would favor a division of feeding sites between male and female hominids. In food-sparse times there would simply not have been enough food for all hominids if they foraged in the same area. So it would have been advantageous (increasing birth rate and survivorship) if hominid males went to distant areas to forage. However, Lovejoy stresses that this strategy does not work for polygynous mating because, on the one hand, "the advantage of feeding divergence is reduced as the number of males is reduced," and, on the other hand, male hominids would compete with their own offspring for food and mates (Lovejoy 1981, 345). Assuming monogamous pair bonding, Lovejoy further claims that it was selectively advantageous for male hominids to provide their mates and offspring with collected food items. And this is where the evolution of bipedalism comes into the picture. According to Lovejoy, there was a further positive selection for those male hominids who could bring back many food items to their mates and offspring: "a strong selection for bipedality, which would allow provisions to be carried 'by hand,' would thus accompany provisioning behavior" (Lovejoy 1981, 345).

There are at least two important motivations for thinking carefully about the proper role for various sorts of values—especially ethical ones—in evaluating Lovejoy's hypothesis. First, paleoanthropological theories in general have the potential to receive a great deal of popular press and to influence contemporary conceptions of human beings and their social organization.[8] Second, the male provisioning hypothesis in particular has the potential to encourage traditional androcentric attitudes and gender roles, which have had seriously detrimental effects on women throughout human history (see, e.g., Harding 2006; Kourany 2010). For example, Discovery Channel broadcast two special documentaries devoted to the discovery of *Ardipithecus ramidus* after *Science* had devoted a whole issue of 11 articles to these findings in 2009. Lovejoy wrote one of these articles alone, coauthored many others, and worked together with Discovery Channel. Assuming that many people outside of the scientific community are informed about (and interested in) paleoanthropological hypotheses, one should not rule out the possibility that paleoanthropological claims—enjoying scientific authority—

8. We do not claim that the influences of paleoanthropological theories on societal conceptions of gender roles are legitimate; we merely argue that these influences are often present, even if they are sometimes subtle.

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can have an effect on our views of humankind and on our thinking about the correct social organization of our lives.

Despite the social significance of the male provisioning hypothesis, one might worry that these sorts of considerations have no legitimate role to play in a scientific evaluation of the hypothesis. However, the first lesson to draw from our clarification of the cognitive attitudes of belief and acceptance is that ethical and pragmatic considerations are appropriate in this case. Traditionally, the attitude of belief has dominated discussions of scientific practice. Because the specific aim of those adopting the cognitive attitude of belief is to arrive at the truth, nonepistemic considerations such as the social consequences of adopting the male provisioning hypothesis would seem to be irrelevant for scientists. However, we contend that the attitude of acceptance is far more appropriate for scientists to adopt in this context. Therefore, nonepistemic values are important to consider.

One of the crucial problems with the attitude of belief in this case is that paleoanthropologists are faced with a state of prevailing underdetermination. When constructing hypotheses about the evolution of bipedalism, they have to rely on various sorts of ecological data, primatological studies, and archaeological findings (e.g., fossil bones), which all offer ample scope for varying interpretations. As Alison Wylie puts it, "there is no critical mass of archaeological material that will, in itself, bring anthropological goals within reach" (1996, 341). Moreover, there are additional epistemic problems with Lovejoy's proposal. Dean Falk contends, "although it is well known that severe predator pressure is associated with such habitats [i.e., the habitats considered by Lovejoy], it is never explained how an absence of males from core areas results in reduced exposure to predators in helpless females rather than increasing it" (Falk 1997, 114–15). Adrienne Zihlman adds, "Lovejoy's picture of the hominid female—to whom everything comes and who goes nowhere—is completely inconsistent with the mobility and activity of all known primate females, even when pregnant or carrying their offspring" (Zihlman 1985, 374).

Taking account of this state of prevailing underdetermination in paleoanthropology, as well as the problems highlighted by Falk and Zihlman, it is arguably inappropriate for scientists to adopt the attitude that the male provisioning hypothesis is true or even highly probable. This runs counter to the confident claims that Lovejoy made in his initial article: "The sequential evolution of behavior proposed in this article has a high probability of mirroring actual behavioral events during the Miocene" (1981, 346). In response to the difficulties that we have raised, one might argue that Lovejoy should merely drop his degree of belief in the hypothesis. However, given the plethora of other plausible paleoanthropological hypotheses on the market, the short lifespan of most hypotheses in this field, and

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the empirical problems with his hypothesis, we suggest that it is more appropriate to adopt other cognitive attitudes.[9]

Instead of believing the male provisioning hypothesis, a promising alternative attitude might be to accept the hypothesis because it merits further investigation. This attitude might do justice both to the intriguing evidence that Lovejoy has marshaled as well as the strong cautionary considerations that we have highlighted. If scientists accept the hypothesis as worthy of further investigation or pursuit, however, what range of values are relevant to further assessments of the hypothesis? We suggest that epistemic, pragmatic, and ethical values are all relevant. From an epistemic perspective, there is more reason to pursue the hypothesis if there is enough evidence in its favor to suggest that it might possibly be true or that it will spawn another hypothesis that is true. Pragmatic considerations seem particularly important. Even if the hypothesis eventually turns out to be false, paleoanthropologists need to evaluate whether investigating the hypothesis will uncover fertile data or suggest other promising hypotheses or simplify their thinking in ways that can advance their inquiries. Finally, ethical considerations are also relevant when deciding how aggressively to pursue the hypothesis, although commentators disagree about the precise extent of scientists' ethical responsibilities. At a minimum, however, if the male provisioning hypothesis is indeed likely to contribute to social attitudes that cause harm to women, that may provide reasons (though perhaps not decisive reasons) not to investigate it as aggressively as one otherwise would (Kitcher 2001).

A second lesson in this case is that a dialectical relationship appears to hold between values and cognitive attitudes. As scientists begin to assess whether they should accept the hypothesis for further investigation (and, if so, how aggressively to pursue it), they are likely to arrive at differing evaluations of the extent to which each sort of value (e.g., epistemic, pragmatic, and ethical) is achieved. They will also presumably arrive at differing views about how to weight these values. For example, suppose that a number of prominent scientists were to conclude that they should accept the hypothesis. Under these circumstances, those who weight the regressive social ramifications of the hypothesis particularly heavily in their deliberations might conclude that they have good reasons to adopt a dif-

9. Lovejoy himself seemed to recognize this point in his later work. Whereas he initially claimed that the reduction and loss of male hominid canines "served as primary evidence" in favor of his model (1981, 346), Lovejoy stresses in a later article that we can "only hypothesize" an answer to the question why such an elimination of canines occurred (Lovejoy 2009, 74e1). Moreover, Lovejoy emphasizes that the kind of modeling he is using (i.e., adaptive suites) is "obviously speculative even for living organisms" (Lovejoy 2009, 74e2).

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ferent cognitive attitude toward it. They might conclude that they should "entertain" it primarily for the purposes of identifying its flaws and weaknesses so as to minimize unjustified societal enthusiasm for it. Unfortunately, while the cognitive attitude of "entertaining" a hypothesis merits a great deal of further discussion, we do not have the space to do so here. Our point is that this case illustrates a dialectical relationship between cognitive attitudes and values. The choice of a cognitive attitude determines the range of values that are relevant to evaluating a hypothesis. However, the process of evaluating the hypothesis may in turn suggest that alternative cognitive attitudes are more justifiable.

5. Conclusions. We have argued that the analysis of cognitive attitudes should play an important role in developing more sophisticated accounts of the proper roles for values in science. We showed that recent efforts to delineate appropriate roles for values in science would be strengthened by making clearer distinctions among cognitive attitudes. We then argued that a careful account of the distinction between the attitudes of belief and acceptance can contribute to a better understanding of the proper roles for values in evaluating the male provisioning hypothesis. First, acceptance is a more appropriate cognitive attitude than belief in this case because scientists are confronted with a situation of prevailing underdetermination. Therefore pragmatic and ethical values have a legitimate role to play alongside epistemic values in evaluating this hypothesis. Second, a dialectical relationship appears to hold between values and cognitive attitudes. As scientists consider the ethical factors that are relevant in this case, some may conclude that alternative cognitive attitudes (such as entertaining the hypothesis for the sake of identifying its weaknesses) are more appropriate. While these sorts of insights about values are not unique to us, we hope to have shown that they can be placed in a more rigorous and systematic framework by paying more careful attention to cognitive attitudes.

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