

Theory, Observation, and the Role of Scientific Understanding in the Aesthetic Appreciation of Nature

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Much recent discussion in the aesthetics of nature has focused on Scientific cognitivism, the view that in order to engage in a deep and appropriate aesthetic appreciation of nature, one must possess certain kinds of scientific knowledge.¹ The most pressing difficulty faced by this view is an apparent tension between the very notion of aesthetic appreciation and the nature of scientific knowledge. In this essay, I describe this difficulty, trace some of its roots and argue that attempts to dismiss it fail. I then develop a response to the problem, drawing on the notion of the theory-ladenness of observation. I conclude by considering the relationship between this response and one common approach to the problem, the appeal to expressive qualities in nature.

I The Fusion Problem

It has long been commonplace to view scientific knowledge as antithetical to the aesthetic appreciation of nature. This view extends back at least to the Romantics, whose remarks on science manifest it memorably. Wordsworth (1798), for instance, famously bemoaned the 'meddling intellect' that 'Mis-shapes the beauteous forms of things.' There were

1 For general defences of this view, see Carlson (2000), Eaton (1998), Rolston (1995), and Parsons (2002).

exceptions: Shelley had a keen interest in the natural philosophy of his day and ideas from it permeate his poetry, especially the great *Prometheus Unbound* (Grabo, 1968). Nonetheless, the Romantic temperament appeared to view science mainly in light of its potential for disrupting, rather than enhancing, experiences of nature. Poe, in a somewhat over the top expression of this attitude, depicted science as an intellectual thug who had 'driv'n the Hamadryad from the wood,' and pleaded that it leave the poet 'in his wandering,/ To seek for treasure in the jewell'd skies' (Poe, 1845).

The notions of nature appreciation found in Romantic poetry and criticism, suffused with mysticism as they tend to be, have had little influence in philosophical aesthetics. Nonetheless, the idea that something about scientific understanding is corrosive of aesthetic appreciation cannot be simply dismissed, for it can be given philosophical substance. In order to describe the philosophical basis for this idea, it will be useful to focus initially on the role of understanding in aesthetic appreciation more generally.

At the root of this idea is the venerable view that aesthetic appreciation is concerned primarily with sensory experience, rather than 'higher' forms of cognition, such as belief. The depth of this association is reflected in the very word 'aesthetic,' which is derived from the Greek term for sense perception. However, this association in itself does not warrant the conclusion that all forms of higher cognition are incompatible with, or destructive of, aesthetic appreciation. Rather, only those forms of belief or understanding that distract one from the object of sensory experience (i.e., the object of aesthetic appreciation) have been so considered. For example, beliefs such as 'this object is red,' 'this object is a cube,' and so forth are, although not sensory experiences, universally held to be compatible with aesthetic appreciation because they do not distract one from such experiences. In fact, such beliefs may help to focus awareness and attention upon them, and so may be, not only compatible with, but also conducive to, appropriate aesthetic appreciation. These beliefs are instances of *observational belief*, in the sense that they are about, and are justified on the basis of, sensory experiences. Given this intimate association with sensory experience, it is not surprising that such beliefs are widely held to be compatible with aesthetic appreciation.

Compatibility is less obvious, however, in the case of non-observational, or as they are typically called, *theoretical* beliefs. Such beliefs are not justified on the basis of sensations alone, but via (often complex) inferences from sensations *and* some body of theory. This means that theoretical beliefs lack the very immediate association with sensory experience possessed by observational beliefs. Consequently, there is an increased potential for them to distract one's attention from the object of sensory experience. This consideration has led many aestheticians to the

view that certain theoretical beliefs are harmful to or even destructive of aesthetic appreciation. An extreme version of this view is the Formalist theory of art appreciation developed by Clive Bell. On his account, beliefs about what scene, event or idea an artwork represents, while not necessarily blocking aesthetic appreciation, have the potential to do so by distracting our attention from its proper focus: that arrangement of 'lines and colours combined in a particular way, certain forms and relations of forms' that Bell calls 'Significant Form' (1913, 17).² Few philosophers, however, now support Bell's austere conception of the aesthetic appreciation of art. Most would readily admit that, in addition to observational beliefs, a number of theoretical beliefs pertaining to artworks are compatible with, and perhaps essential to, their appropriate aesthetic appreciation. Such beliefs include not only those pertaining to a work's representational content but also beliefs regarding its genre and style, its history of production, and the conventions that govern its appreciation.³

This expansion of the range of theoretical beliefs considered compatible with aesthetic appreciation appears to rely on two features of these beliefs. First, although not about the sensory surface of the object exclusively, they are typically about that particular object, or some more or less restricted class of objects to which the particular object belongs. For instance, although the belief that a particular painting was produced by Rembrandt is not a belief exclusively about its sensory properties, it is a belief focused upon that object, rather than some other one. Second, many of these beliefs can be justified on the basis of sensory experience of the work and only a small, uncomplicated body of theory. Consequently, these beliefs, although not purely observational, are not *highly* theoretical. The belief that a certain work is a Mannerist painting, for example, might be supported, in part, by appeal to its manifest arrangement of shapes and colours in conjunction with a theory describing the nature and characteristic features of Mannerism. Being a Mannerist work may involve more than simply looking like one, of course, but looking like one has much to do with it, and is an important indicator of it. Both of these features of the theoretical beliefs that are widely thought to be compatible with the aesthetic appreciation of art make it unlikely that, in attending to them, one's attention will be distracted from the object of

2 Bell famously warned that 'the representational element in a work of art may or may not be harmful; always it is irrelevant. For, to appreciate a work of art we need bring with us nothing from life, no knowledge of its ideas and affairs' (1913, 27).

3 Seminal accounts of this line of thought are Walton (1970) and Dickie (1974).

appreciation. Indeed, not only are these beliefs thought to be compatible with attention to the object of appreciation, they are considered essential in order to direct our attention to the 'sensory surface' of the artwork in an appropriate manner.

Scientific cognitivists have argued for a similar position regarding theoretical beliefs concerning natural objects: such beliefs are not only compatible with aesthetic appreciation, but required for appropriate aesthetic appreciation. However, a difficulty arises from the fact that theoretical beliefs about natural things come from the natural sciences, such as ecology, geology, chemistry, natural history and so forth. In contrast to the theoretical beliefs about artworks described above, such scientific knowledge is often highly theoretical. Consider some paradigm examples of scientific facts: that the earth is moving around the sun, that the earth's core is molten and that the molecular structure of a diamond is a three-dimensional carbon lattice. Certainly none of these qualifies as observational belief, in the traditional sense, since each is about more than can be apprehended in sensation alone. We believe that the earth's core is molten not because we perceive this, but because it is entailed by a theory that has a high degree of agreement with what we can perceive. Because such beliefs are highly theoretical, the notion that they will not distract from, but instead will enhance, appreciation of the sensory surface of the object is dubious.

For instance, anyone who claimed that his belief that diamonds have the molecular structure of a three-dimensional carbon lattice contributes to the aesthetic appeal of a particular diamond would stand accused of failing to appreciate the diamond itself. The fact that the diamond has this molecular structure is certainly not given in our sensory experience of it. It can only be connected to that sensory experience, as it were, through consideration of a highly convoluted body of chemical theory. So if we find that his knowing this fact enhances the beauty of the diamond for him, it would not be unreasonable to think that it must be that he is appreciating this fact in addition to, or perhaps instead of, what he *is* sensing. He may be deriving pleasure from contemplating this fact, or its inference from chemical theory, or from imagining what such an atomic structure might look like, if he had different perceptual capacities. But this pleasure would not be aesthetic pleasure because it is not pleasure taken in sensation. In short, since scientific knowledge is highly theoretical, it is incompatible with aesthetic appreciation, which is, by all accounts, appreciation of the sensuous.⁴

4 A number of philosophers have articulated this tension within the scientific cognitivist view. Yuriko Saito asserts that some scientific information 'seems too removed

To overcome this worry, the scientific cognitivist apparently has to provide some account of how it is that this highly theoretical knowledge actually is 'connected' to our sensuous experience after all. In the words of Ronald Hepburn, she must show that knowledge is 'fused with the sensory components, not a meditation aroused by these' (1996, 192). Following Hepburn's nice phrase, I will call the problem of providing such an account 'the fusion problem' for Scientific cognitivism.

II Dismissing the Fusion Problem

We should first take note of one unsatisfactory way of addressing this problem. This response begins by pointing out that science does not involve *only* theoretical beliefs, but observational ones as well. Indeed if it did not, no theoretical beliefs could be justified. In the example of the earth's core being molten, we noted that we believe this because it is entailed by a theory. But we accept this theory, of course, ultimately because it is supported by observations. That is, there are certain propositions that our theory entails, perhaps things such as 'hot water is rising from certain thermal vents in the ocean floor,' and these propositions can be confirmed by observation (and a little effort). Observational beliefs are therefore part and parcel of any science. One could respond to the fusion problem, therefore, by asserting that scientific beliefs do play a role in the aesthetic appreciation of nature, with the caveat that only observational ones do. So the fact that the beliefs which can figure in the aesthetic appreciation of a moose are limited to observational ones like 'this animal is brown' or 'this animal moves slowly' does not entail that no scientific knowledge figures in aesthetic appreciation, since these beliefs are nonetheless scientific.

from our immediate perceptual arena to be realizable on the sensuous surface' and is therefore 'aesthetically irrelevant' (1998a, 149). Ronald Moore writes that 'aesthetic regard concerns itself fundamentally with the manifold of *sensory awareness*, and not with all that causes it or is caused by it' (1999, 45). Thomas Heyd argues that theoretical scientific knowledge 'may draw me away from taking note of the *concrete* character of the particular thing I seek to aesthetically appreciate,' emphasizing that the object must be appreciated as 'sensuous' (2001, 129). Noël Carroll notes (though he does not defend) the position that Scientific cognitivism, 'insofar as it involves the subsumption of particulars under scientific categories and laws, is not an *aesthetic* mode of appreciation at all' (1993, 246). The *prima facie* force of this objection is also acknowledged by Scientific cognitivism's principal advocate, Allen Carlson (1995, 395).

A preliminary difficulty with this response is that it places the scientific cognitivist in peril of equivocation, taking 'science' in its standard sense of theoretical belief when articulating her view, but switching to the non-standard sense of 'observational belief involved in science' when addressing the fusion problem.⁵ The cognitivist making this response must be clear that Scientific cognitivism is the view that observational beliefs involved in science play a role in the aesthetic appreciation of nature. Understanding it in this way, however, ultimately trivializes the view. Scientific cognitivists want to claim that scientific understanding provides us with an aesthetic appreciation that is deeper and more significant than appreciation that is uninformed by science, and that scientific knowledge can guide and shape appreciation, determining what Allen Carlson calls 'foci of aesthetic significance' in nature (2000, 51; see also Parsons and Carlson, 2004). But if we reject, as aesthetically irrelevant, all theoretical scientific knowledge, this claim loses any substance. When the 'science' that can inform aesthetic appreciation is limited to observation, then there is really no distinction between scientifically uninformed appreciation and scientifically informed appreciation, since observational beliefs play a role in the former as well as the latter.⁶ Therefore, it is ultimately self-defeating for defenders of Scientific cognitivism to respond to the fusion problem in this way.⁷

A different response to the fusion problem would be to accept that scientifically informed appreciation of nature is not really *aesthetic* appreciation after all but question the significance of this. After all, a similar slip away from aesthetic appreciation, in its strict philosophical sense, is common in art. When we appreciate art, we often slip from appreciating the sensuous surface to appreciating the ideas or emotional responses dealt with by the artwork, revelling, for example, in their profundity. No decent appreciation of Goya's *The Third of May 1808*, for instance, could fail to mention the depth and significance of the ideas it raises. Some

5 This danger is real, since as Malcolm Budd notes, 'it is a common weakness of advocates of the view that scientific knowledge is essential to the proper aesthetic appreciation of the natural world not to provide any criteria for determining, for particular natural objects or phenomena, which knowledge enhances aesthetic appreciation' (2002, 137n18 and also 141).

6 A Formalist would presumably want to hold that some knowledge about natural objects is necessary for their appropriate aesthetic appreciation: for instance, 'this object is red,' 'this object is roughly textured,' and so forth. The formalist view is only that theoretical knowledge is not required for appropriate aesthetic appreciation. I owe an appreciation of this point to discussion with Nick Zangwill.

7 For a line of reasoning that moves in this direction, see Carlson (1995).

philosophers would argue that, strictly speaking, this is not aesthetic appreciation of *The Third of May 1808*. But this hardly worries us: we happily refer to profundity as part of the 'artistic value' of the work, rather than part of its aesthetic value. In the end any pleasure or satisfaction we derive from contemplating the ideas and emotions raised by the work will redound to the glory of the artwork anyway.⁸ Is not the fact that some nature appreciation turns out to be, strictly speaking, non-aesthetic, similarly unproblematic?

I think not, because we are misled here by the analogy with art. Whatever it takes for an artwork to be profound, it is not merely that it leads one to think of something profound. We do not say that *The Third of May 1808* is profound because it is about something profound (war) for this is equally true of *Rambo III*, which is not (I take it) profound. *The Third of May 1808* is deserving of being called 'profound' only insofar as it presents these ideas in a very particular and ingenious way, revealing what is significant about them and why. That is to say, *The Third of May 1808* is a profound artwork, it has artistic value, not because its topic is profound (though it is) but because it is an indispensable and unique guide to understanding that idea. Thus, although in appreciation we do sometimes focus upon the abstract ideas or emotions to which artworks lead us, rather than the aesthetic qualities of the works themselves, in doing so we acknowledge the essential role of the artwork in revealing what is important in those ideas, and it is because of this indispensable function that these particular artworks acquire their artistic value.

But in the case of nature, the situation is otherwise. For although natural things are characterized by various interesting scientific facts, particular natural objects rarely serve as indispensable and unique guides as to what is interesting about those facts and why. A profound artwork like *The Third of May 1808* reveals to us something about war and suffering, something that no other painting quite lays bare, and so *The Third of May 1808* is extremely valuable in that regard. But although observing a particular waterfall may turn our minds to an appreciation of the elegant and surprising principle of inertia that governs its behaviour, once there we have no call to return to the water itself, nor to bestow any particular value upon *this* waterfall. For an infinite number of other natural things serve just as well to bring out the elegance of the idea; in fact, mathematical illustrations probably serve better than any physical objects do. In short, the different relationships between art and its content, on the one hand, and natural objects and the laws that govern

8 For an overview of issues arising from the distinction between aesthetic and artistic value, see Kieran (2001).

them, on the other, mean that in general there is no analogue of 'artistic value' for nature.

Consequently, the danger of reconciling nature appreciation to intellectual pleasure is that we end up with no account of the appreciation of *natural objects* at all, but only of the appreciation of the ideas, theories and laws that characterize those natural objects. Admittedly, the latter has a certain allure. In the *Republic*, Socrates remarks, perhaps rather optimistically, that once people grasp the wonders of the intellectual realm, 'there's nowhere else their mind would ever rather be than in the upper region' (Plato, 517c). Yet lovers of nature must resist, bearing in mind that Platonic love deprives not only lover of beloved, but beloved of lover as well.

III If Perception were Theory-Laden

The fusion problem as I have described it rests on the assumption that our observational beliefs, those which are very intimately related to sensory experiences, are discrete from our theoretical beliefs. For the problem is that in order to engage in aesthetic appreciation, and hence sensory experience of the object, we must keep the highly theoretical beliefs of science out of play. But this requirement is sensible only if those highly theoretical beliefs *can* be separated from observational ones. Precisely this view, however, has been widely called into question in recent philosophy of science. According to its critics, one's theoretical beliefs affect what one observes to be the case: observation is 'theory-laden.'

One of the early exponents of this notion, Norwood Russell Hanson, illustrated it by arguing that when someone holding a geocentric theory of the solar system (e.g. Tycho Brahe) and someone holding a heliocentric view (e.g. Kepler) look to the east at dawn, they do not see the same thing. Where Tycho sees a mobile sun, the Copernican Kepler sees a static one (1958, 17). So, far from it being the case that the 'theoretical' belief that the sun is moving has nothing to do with what we can observe, this theoretical belief actually helps to shape perception: in virtue of having this belief, Tycho literally sees *that the sun is moving*, whereas Kepler, lacking this belief, sees no such thing.⁹ If the hypothesis of theory-laden-

9 It is worth noting that many writers on theory-laden observation describe it, not in terms of seeing *that such and such is the case*, but rather in terms of seeing an object *as a so and so*. However, these different formulations seem to be equivalent, since the notion of 'seeing as' seems to be generally understood in terms of 'seeing that.' For example, Hanson says that

ness is true, then, there is a sense in which the distinction between observational and theoretical beliefs breaks down: as Paul Churchland puts it, 'all knowledge (even perceptual knowledge) is theoretical ... there is no such thing as *non*-theoretical understanding' (1979, 2).

This is all apt to seem like welcome news for the scientific cognitivist, as it suggests that the fusion problem fails to arise because it is of the very nature of observation to involve theoretical belief. The chemist who knows the molecular structure of diamond, and who thereby delights in viewing a particular crystal of diamond, is not necessarily drifting away from observation, off into the pleasure afforded by some intellectual reverie. On the contrary, he may be engaging in aesthetic appreciation of the crystal, of what he is experiencing in sensation. It is just that what he experiences in sensation is something different than what the layman, or even a scientist with an alternative theory, experiences in sensation. Part of what the chemist sees when he looks at the crystal may well be that the crystal has a three-dimensional lattice structure, just as part of what Tycho saw when he looked to the east at dawn was the 'theoretical' fact that the sun is moving.

There are, alas, problems with this solution to the fusion problem. One is that it is hypothetical: *if* the theory-ladenness hypothesis is true, then the problem fails to arise. But the hypothesis remains contentious. One of the main lines of argument for theory-ladenness given by Hanson, Thomas Kuhn and others involved psychological experiments which appeared to show that our observational beliefs are not determined by patterns of sensation alone — background assumptions on our part are used, and must be used, to tacitly infer one of many possible beliefs from that pattern of sensation. Looking at the notorious duck-rabbit figure, for instance, one can have two very different perceptual experiences: one

to see [a Necker cube] as a transparent box, an ice-cube, or a block of glass is to see that is six-faced, twelve-edged, eight-cornered. Its corners are solid right angles; if constructed it would be of rigid or semi-rigid material.... It would be tangible. It would take up space in an exclusive way, being locatable here, there, but at least somewhere. Nor would it cease to exist when we blinked. Seeing it as a cube is just to see that all these things would obtain. (1958, 21)

Malcolm Budd holds that it is a 'general truth' that we experience things *as a so and so*, or 'under certain concepts or descriptions,' but glosses this by saying that 'to experience O under description D is for it to seem to you in your experience that O is D: this is how your experience represents O' (2002, 10n12). Also Paul Churchland says of one of his perceptually bizarre imaginary peoples that 'they perceive hot objects *as* hot (warm, cold); they can visually perceive *that* they are hot (warm, cold)' (1979, 9; Churchland's emphasis). In what follows I will employ the more basic *seeing that* formulation, though what I say could easily be translated into *seeing as* terminology.

can see that it depicts a duck, or that it depicts a rabbit. But in either case the pattern of retinal sensations one has is exactly the same. Hence there must be something else at work: we cannot be simply 'reading off,' from the pattern of sensation, that this resembles a rabbit (or a duck). Rather, we are (very rapidly) inferring it. Another way to put this is that the sensations on the basis of which we form observational beliefs underdetermine those beliefs. To get from raw sensation to observation we need some background assumptions, and this makes observation a matter of inference. But from the fact that observation depends on, and so is affected by, *some* theory it does not follow that it depends on and is affected by *all* theory. Jerry Fodor (1984) has suggested that observation is 'modular': it does involve inference from sensations and a small number of background assumptions, but it is isolated from, and insensitive to, the bulk of our theoretical beliefs. So although what we see when we look at the sun may depend upon some very basic background beliefs, about the character of physical objects for instance, it is not affected by what particular astronomical theory we happen to hold. In an important sense, then, Fodor insists that observation is 'theory-neutral.' Who is correct in this debate about theory-ladenness is a large issue and not one I mean to consider here; I only point out that it is still a live one.¹⁰ For this reason, the scientific cognitivist should be wary of resting her hopes too squarely on this doctrine.

But there is, in any case, a more important reason for the scientific cognitivist not to do this, which is that the truth of the theory-ladenness hypothesis renders the assessment of rival theories notoriously problematic. We usually think that rival theories, heliocentric and geocentric astronomical theories, for example, are to be assessed in an objective manner: whichever agrees more closely with observation is more worthy of belief. But if observations are themselves laden with theory then rival scientists will not agree as to what the observations *are*. In short there could be no neutral court of adjudication for rival theories: the evidence cited by a theory's opponent (the sun is moving) would be rejected by its proponent (the sun is static). Hence objective assessment is stalemated, and theory selection is left to factors less noble than predictive success. For the scientific cognitivist, this is highly problematic, since it is precisely the objectivity of scientific knowledge that, the cognitivist argues, gives it pride of place in the aesthetic appreciation of nature (Carlson, 2000). However, I will now argue that the scientific cognitivist

10 The Churchland-Fodor debate continues in Churchland (1988) and Fodor (1988). Recent discussions include Gilman (1992), DesAutels (1995) and Brewer and Lambert (2001).

can sidestep this difficulty by employing some of the insights of the theory-ladenness approach without endorsing the truth of the theory-ladenness hypothesis itself.

IV The Expansion of Perceptual Consciousness

Let us assume, for the sake of this discussion, that Fodor's suggestion is correct and that observation is not theory-laden in the sense that Hanson, Churchland and others suggest. What this means is that there are some beliefs about an object that will be held by any normal person attending to it in sensory experience, regardless of what theoretical beliefs they hold. These are the observational beliefs of yore, appealed to in testing rival theories: e.g., this moose is brown, it has large antlers, it moves slowly, etc. The existence of such a set of beliefs, however, does not entail that theoretical beliefs cannot also play a role in shaping additional observational beliefs.

As they are usually characterized, observational beliefs have two important features: they are formed on the basis of sensory patterns alone (give or take a few basic assumptions, if the modularity thesis is true), and they are formed relatively quickly. If reality accords with this conception, then there is a set of beliefs that anyone will acquire rapidly upon looking at a given object, perhaps beliefs like 'this is white,' 'this is small,' and 'this has a certain jagged shape.' From a pattern of sensations alone (plus, perhaps, a limited stock of assumptions) these beliefs 'pop' into mind. The latter feature is taken, of course, to follow from the former, but these features are logically distinct. Now theoretical beliefs by definition lack the first of these two characteristics: they are justified by more than sensory pattern (and a small stock of assumptions). But it is possible for them to have the second feature of traditional observational beliefs: that is, they may be acquired relatively rapidly in the presence of appropriate sensory patterns. That is, they may 'pop into mind' as well. In virtue of this characteristic, such beliefs might be said to be *quasi-observational*: like observational beliefs, one acquires them, in a causal sense, 'just by looking,' as it were. Unlike observational beliefs, however, their logical relationship with the sensory pattern will be indirect, in that their justification depends upon quite involved inferences from sensory experience and a complex body of theory.

Paul Churchland, from whom the title of this section is taken, has described this sort of expansion of our observational powers at length (1979; 1988). In support of this, he points out that our patterns of sensation contain much more information than we typically make use of. Science has revealed, for instance, that things that taste sour to us are more acidic, having a higher concentration of hydrogen ions than non-

sour tasting substances (Churchland 1979, 29). So our sour sensations actually contain information about hydrogen ion concentration. Those of us that are ignorant of, or uninterested in, our acid-base chemistry make no use of this. But for someone trained in chemical theory, someone for whom its concepts and categorizations have become a habitual 'second-nature,' this information could be exploited in observation, allowing them to form a belief about hydrogen ion concentration 'spontaneously' upon having sour taste sensations. Such individuals could reasonably be said to simply *observe* (in the sense of 'quasi-observation' outlined above) that the substance in question has a high concentration of hydrogen ions.

Since it will be important later, it is worth emphasizing that this sort of expansion of our perceptual powers to encompass what is normally 'theoretical' requires more than the possession of theoretical belief. Many of us believe, implicitly at least, that sourness is correlated with high hydrogen ion concentration, but we do not thereby quasi-observe that our lemonade is stocked with H^+ ions, since we do not acquire that belief upon tasting lemonade. The reason for this is that we lack the training that would cause such a belief to spring to mind upon sour sensations. Acquiring the capacity to quasi-observe that H^+ ions are present would take familiarity with theory, observational practice and habituation (Churchland 1988, 174f). Scientists, who continually apply theoretical concepts to the things around them are the most likely to attain such habituation, but it is not out of the question for it to be acquired by the layperson, with some effort. Churchland, actually, recommends this project to humanity at large, offering it up as the next step in a 'breathtaking adventure of self-reconstruction' (1988, 186). Millennial implications aside, theory-laden quasi-observation offers a solution to the fusion problem, since persons sufficiently habituated to the conceptual framework of science, unlike most of us, may actually *observe* the 'highly theoretical' facts and things described in scientific knowledge.

An immediate concern about this solution is that adding the prefix 'quasi' does not change the fact that quasi-observation is *not* observation (Fodor 1988, 195). If one could be said to 'observe' that lemonade is full of hydrogen ions only in some metaphorical and unreasonably extended sense, then there is no genuine solution here to the conflict between scientific theory and aesthetic appreciation. It does not seem unreasonable, however, to say that tasting that the lemonade is sour and tasting that it is full of hydrogen ions are instances of observation in a unitary sense. The person who engages in the latter does, after all, acquire this belief very rapidly from what she senses: like the person who tastes the sourness, she does not carry out any conscious inference to form her belief. Rather, this person's belief is tied directly and vividly to the occurrence of a particular pattern of sensation. This psychological prox-

imity to sensation justifies us in grouping observation and quasi-observation together, and in saying that the scientist can literally 'see' something more, when she looks at nature, than the layperson does.

Furthermore, it seems evident that scientists do often succeed in 'seeing' theoretical facts and entities in this way. Indeed, doing so is an important scientific skill, especially in contexts where the application of knowledge is a primary concern. For instance, in fieldwork, the scientist's principal concern might be to determine quickly whether a given bridge is stable or whether a particular ecosystem is in equilibrium. In such cases, the ability to directly 'see' the presence of theoretical properties is an obvious advantage. A well-known example is the maize geneticist Barbara McClintock's ability to, as her biographer Evelyn Fox Keller put it, 'simply look at the plants themselves and know what the microscopic examination of the cells' nuclei would later reveal' (Fox Keller, 1983, 102). 'I have learned so much about the corn plant,' McClintock explained, 'that when I see things, I can interpret [them] right away' (Fox Keller, 1983, 98). Although McClintock's skill as an observer was clearly extraordinary, this ability was not unique to her. One of McClintock's coworkers also described eventually being able to 'actually see genes turning on and off' in her maize plants (Fox Keller, 1983, 126).¹¹ Crystallographers, who use X-ray diffraction to determine molecular structures, speak of being able to instantly 'see' the presence of a particular molecular structure in diffraction photographs.¹² This sort of perceptual

11 For this reason, McClintock's quasi-observational abilities should not be viewed as a product of the idiosyncratic and quasi-mystical 'feeling for the organism' that Fox Keller famously ascribed to her. Although Fox Keller does sometimes associate McClintock's perceptual abilities with this approach (198), when describing these perceptual abilities in more detail she explains them in terms of McClintock's deep and intimate knowledge of genetic theory. She notes that these genetic states 'could be seen only with the help of the long chain of logical inference that, to her, had become second nature,' and describes her theoretical understanding as 'a hierarchy of hypotheses, each more abstract and further removed from the objects of perception than the one before, yet, in concert, providing an internal logical so compelling as to give anyone who grasps that logic the sense of being able to "see" the abstractions themselves' (126). In his recent biography of McClintock, Nathaniel Comfort is sceptical of many of Fox Keller's claims regarding McClintock's 'intuitive' and 'non-rational' methodologies, but, like Fox Keller in the passages just quoted, he too links McClintock's perceptual abilities to her theoretical understanding, saying that 'her deep understanding of chromosome behaviour led her to astute observations' (2001, 57).

12 For an illustration of this, see James Watson's description of his epiphany upon seeing Rosalind Franklin's famous photograph 51 of B-form DNA: 'The instant I saw the picture my mouth fell open and my pulse began to race ... the black cross

enhancement is not exceptional but rather a pervasive and natural feature of scientific activities that emphasize the rapid extraction of theoretical information from complex sensory patterns.

We have already seen, however, that appealing to the theory-ladenness of observation is a highly problematic approach to the fusion issue, threatening as it does the idea of objective theory assessment. How is appealing to the theory-ladenness of 'quasi-observation' any different? The important difference is that the original claim of the theory-ladenness theorists was not that theoretical beliefs *sometimes* shape observation but that they *always* do, that there are *no* beliefs that are justified independently of some scientific theory. It was this general claim which seemed to rule out the objective assessment of theories. However, the claim that scientists engage in theory-laden 'quasi-observations' does not imply that they cannot also engage in theory-neutral observation. On the contrary, it may be that observing lemonade results in a set of theory-neutral beliefs: this is yellow, this is liquid, this is sour, and so forth. What the thesis of theory-laden quasi-observation allows is that in addition, a scientifically-habituated observer might also form, along with these observational beliefs, the belief that this is full of hydrogen ions.

One might worry, of course, that reality fails to live up to this ideal, and that scientists actually do engage only or primarily in quasi-observation when collecting the data to be used in assessing theories. If so, then quasi-observation would of course thwart objective theory choice. However, it is implausible to think that scientists are unable or unwilling to attend to observations, and instead engage only in quasi-observation. As noted, in some scientific contexts application of theory is the primary concern and, in such cases, engaging in quasi-observation, quickly extracting information about nature that is latent in our sensory experience, according to an accepted theory, is prudent and expedient. But application is a different context than theory evaluation, and there is no reason to think scientists either unable to tell the difference between these or incapable of attending to what is appropriate in each. Though theory evaluation is important, and it is natural for philosophers to focus on it, the nature of scientific practices is distorted when they are viewed in light of this aim alone.¹³

of reflections which dominated the picture could only arise from a helical structure. With the A form, the argument for a helix was never straightforward, and considerable ambiguity existed as to exactly which type of helical symmetry was present. With the B form, however, mere inspection of its X-ray picture gave several of the vital helical parameters' (Watson, 1968, 107).

13 Churchland says that even if the modularity thesis is true (i.e., there is theory-neutral

V Expressive Qualities in Nature

I have argued that the notion of quasi-observation represents one promising approach to the fusion problem. In this section I will argue that, when compared to a prominent rival approach to the problem, it is both more successful in addressing the problem itself and more illuminating regarding the aesthetic appreciation of nature. The rival approach that I wish to consider involves the idea that theoretical scientific understanding is fused with the sensory surface of natural things in the expressive qualities possessed by those things.

Expressive qualities are typically described as consisting in a kind of 'union' of the sensory surface of an object with a meaning or content, such as a thought or an emotion (see, e.g., Santayana, 1896, 121).¹⁴ By definition, such qualities offer a vehicle for embodying the 'theoretical' in the sensuous, and therefore provide a potential solution to the fusion problem: nature has certain expressive qualities that we can aesthetically appreciate, but to appreciate these qualities one must know their content, which requires scientific understanding. Because this scientific knowledge is expressed by the item's sensory surface, it gets 'blended,' in the right sort of way, into that surface, so that our attention remains focused upon the sensuous experience. Allen Carlson, for example, suggests that a rock in its natural environment may be 'expressive of the particular forces which shaped it and continue to shape it and *displays for aesthetic appreciation* its place in and its relation to its environment' (2000, 44; my emphasis).¹⁵ This line of thought is most fully worked out, however, by Yuriko Saito, who holds that in appreciating natural objects, we should appreciate '*the way in which* its various sensory qualities illustrate or express their important [ecological] role' (1998b, 104). Though she holds that such knowledge informs and shapes our aesthetic appreciation of nature, she insists that it 'must be *presented* in the visual composition, as well as in the smell and texture' of the concrete natural object, that 'our conceptual understanding of the working of the whole ecosystem ... has

observation), the fact that scientists engage in what I have called 'quasi-observation' means that 'they will have a severe communication problem' (1988, 179). But none of his arguments seem to me to address, much less support, this claim.

14 Hospers, in a vivid metaphor, described an expressive landscape as 'drenched with the fused association of many scenes and emotions' (1946, 12-13).

15 In an early paper arguing for the existence, in the natural environment, of aesthetic properties whose appreciation requires knowledge about the environment, Carlson focuses particularly on expressive qualities, such as 'serenity, majesty and somberness' (1977, 151).

to be brought back to these individual objects at hand' (104). The fusion problem is addressed, then, by adapting the traditional notion of expressive qualities to allow for the expression of theoretical scientific facts.¹⁶

I do not say that the claim that natural things have such expressive qualities is false. Nonetheless, I believe that attempts to solve the fusion problem by recourse to this claim, such as Saito's, are unsuccessful because they develop the claim in a manner that renders it empty and misleading. With regard to the former, Saito insists that natural things express a scientifically described content: ecological role is, as she says, '*presented* in the visual composition, as well as in the smell and texture' of natural objects. But she never clarifies the notions of expression and presentation, and in fact characterizes them in many different ways. In addition to saying that knowledge of ecological role is presented by perceptual qualities, she says that this knowledge enhances perceptual qualities, modifies them, illuminates them, allows the deciphering of them (105), is telling of them (1998a, 145), and also that perceptual qualities embody this knowledge, illustrate it, manifest it, symbolize it, disclose it (1998b, 104), realize it (1998a, 144) reveal it and bear witness to it (1998b, 105). In itself, the use of these differing descriptions to describe the expressiveness of natural things need not be a problem. However, it raises the issue of whether there is a notion of expressiveness here that is capable of solving the fusion problem, since some of these descriptions are problematic. For example, Saito says that '*scientific understanding is incorporated [into the aesthetic appreciation of nature] insofar as it illuminates the sensuous surface of the immediate object*' (1998b, 105). But illumination, given its standard sense, is too weak a notion to help with the fusion problem: understanding the chemical composition of chlorophyll illuminates the colour of plants, by explaining why they are green. But would not pleasure taken in virtue of knowing this fact simply be pleasure *in that theoretical fact*, or in the satisfaction of explanation, rather than some modification of the pleasure taken in the plant's colour? It is not clear why the plant should *look* any different, simply in virtue of this fact.

It may be that other of Saito's glosses are more explanatory in this regard. If this is so, her account should be regarded as unclear rather than empty, and the inadequate glosses taken as merely infelicitous ways of referring to the adequate gloss of '*present*,' whichever that is. This would not seem to be the case, however, since Saito goes on to say that

16 Note that nature is also commonly described as being expressive of various emotional states (e.g., sadness, anger, etc.). For discussion of this issue, see Howarth (1995) and Budd (2002, 115-18).

While there may be different degrees of nature's skill in storytelling, none of its parts are mute. Simply by virtue of exhibiting various perceptual features, they all bear witness to their own origin, structure, and function, which we articulate verbally in our scientific accounts. (1998b, 105)

'Expression' (or 'bearing witness to ecological role,' as it is glossed here), whatever Saito takes that to be, is therefore something that no natural object can fail to do, to some degree or other, simply in virtue of having perceptual features. Surely this means, not what Saito infers, that everything in nature has some positive aesthetic value, but rather that the claim itself fails to employ any non-trivial conception of expressiveness. For it is implausible to think that the sensory surface of absolutely *every* natural thing could just happen to be such that it expresses, in any substantial sense, its causal history and ecological connections.

We can rescue the notion of natural expression from emptiness by drawing on the notion of quasi-observation: an object is expressive of X just in case (1) the belief that X is not justified on the basis of sensory stimulation by the object alone and (2) such sensory stimulation will cause an observer with certain background beliefs to form a (relatively) spontaneous belief that X is the case. So a rock will be expressive of the geological forces that shaped it, as Carlson suggests, if and only if observers with a knowledge of the relevant geological background are able to tell 'just by looking' (in the quasi-observational sense) that the object was shaped by those forces. An important aspect of this theory is that appreciating expressive qualities requires not only having certain background beliefs relevant to X, but also having the training and habituation required to form the belief that X spontaneously upon undergoing sensory stimulation by the object. This point is important to emphasize, since it reveals the second reason why accounts of natural expression, such as Saito's, are unsatisfactory: they are misleading in implying, or at least suggesting, that one can aesthetically appreciate nature's expressive qualities if one has sufficient scientific *knowledge* about nature. However, such knowledge, though necessary, is not sufficient for quasi-*observation* of nature, and so for a solution to the fusion problem.

This point can also be illustrated with reference to a view of expression described by Cheryl Foster, which she calls 'indexical expression' (1998, 132). The idea of an index is taken from Peirce, who contrasted indexical signs with *icons*, which represent their objects in virtue of an intrinsic feature, such as similarity with those objects, and with *symbols*, which represent only in virtue of conventions (Peirce, 1955, 104). *Indices* differ from icons in lacking an intrinsic similarity to their objects, but also differ from symbols in that their connection to those objects is not mere convention, but is based on a 'real connection,' for example a causal

connection. In virtue of these causal relationships, indices are capable of bringing to mind that which they represent. One of Pierce's examples is of a sundial being an index of the time of day (108); Foster gives the examples of the bright yellow colour of a maple tree serving as an index of its withholding of nutrients from its leaves, and cumulus clouds acting as an index of convective activity in the atmosphere (1998, 131).

Given that many of the natural things that we experience express, in the sense of being an index for, various non-observable (*i.e.* theoretical) states of affairs, Foster holds that we have 'a way of integrating conceptual understanding and perceptual encounter' — that is, a way of solving the fusion problem. As she puts it, we '*read the surface of the environment as a kind of story*' (1998, 131). Doing so 'reveals the surface objects as dramatic ossifications of processes we can no longer see, or are unable to see' (1998, 131).¹⁷ But reading elements of the natural environment in this way, as indexical indicators of unseen processes, is not sufficient to constitute 'a way of integrating conceptual understanding and perceptual encounter,' if this 'reading' is more of a theoretical process than a quasi-observational one. For instance, to use one of Foster's examples, if we know some botany and biochemistry we may succeed in reading the colour of leaves as indicative of the presence and action of certain chemical processes, but on its own this does not entail any difference in what we *see*, any more than the layman's ability to infer upon reflection that his lemonade has a high concentration of hydrogen ions entails that he can perceive this. For this reason, the 'reading a story' metaphor for the aesthetic appreciation of expressive qualities, one that is prominent in Saito's account as well, misleads by obscuring the critical role of training and habituation.¹⁸

17 Note that Foster does not advocate Scientific cognitivism, and her article is not primarily an attempt to solve the fusion problem on its behalf. Nonetheless, her discussion of the issue is illuminating and reveals in an especially clear way the view that I am considering.

18 Patricia Matthews' recent defence of expressive qualities in nature also relies heavily on the reading metaphor. Allowing that nature does not represent a content in the way that art does, she maintains that 'there is an analogous way that nature represents: natural objects can function as natural signs, just as smoke is a natural sign of fire' (2001, 404). She claims that 'there is a sense in which we can read nature within the context of natural science and natural history. In both art and nature, representation can add a layer of meaning that requires interpretation and allows objects to point beyond themselves.' Comparing the appreciation of natural signs to reading a novel, Matthews goes on to say that when we discover what it is that natural signs 'represent,' we 'see the natural object ... in a new light' (405).

This is not to say that laypersons cannot acquire such habituation, however, nor that every instance of it requires the same degree of knowledge and training. We may expect that quasi-observational abilities will form a spectrum, some requiring a higher degree of training and experience than others. In cases where the type of sensory information employed as a trigger for belief acquisition is extremely complex, quasi-observational recognition of the relevant theoretical property may be psychologically impossible, or possible only to exceptional individuals. In other cases, the sensory information will be more readily accessible, but there may be nothing more than a causal relation between this pattern of sensation and the theoretical properties involved. Consequently, one can expect a good deal of habituation to be required in order to establish the relevant quasi-observation. The sourness of lemonade, for instance, would seem to have little more intrinsic aptness to concentrations of hydrogen ions than does sweetness. In still other cases, however, nature provides more of a hand in establishing connections between the sensational and the theoretical. For example, consider the sensory appearance produced by a stratified rock face. The sensational pattern, in this case, displays a certain isomorphism with the geological history of the rock face. In a very concrete sense, though still not a purely observational one, one can 'see' the geological history in the rock itself. In such cases, it is more natural for us to form the relevant theoretical belief (*i.e.*, this rock face has such and such a geological history) on the basis of the pattern of sensation. Between these various cases we would surely find many others, intermediate in type.

The existence of this range of difficulty in acquiring various quasi-observational powers has an important bearing on a common criticism of Scientific cognitivism: that arguments in its favour notwithstanding, its assertion that scientifically uninformed aesthetic appreciation of nature is less appropriate or worth having is unacceptably exclusionary or elitist.¹⁹ If even rudimentary science education, of the sort produced by public agencies and aimed at the level of the layperson, indeed has the capacity to alter the way that we perceive nature, then such claims are, if not unfounded, clearly exaggerated. In that case, the question is not whether the public is excluded from having a rich and appropriate appreciation of natural beauty, but whether the public has sufficient interest in engaging in such appreciation. On the other hand, there is no question that aesthetic appreciation at the opposite end of the spectrum will require a high degree of training, knowledge and habituation to

19 For arguments along these lines, see Heyd (2001), Lintott (2004), and Zangwill (2001).

nature. But in this regard the aesthetic appreciation of nature would be no different than the aesthetic appreciation of art, where it is commonly accepted that appreciation can range from the superficial and cursory to the deep and difficult, and that the latter requires some effort on the part of the appreciator. For both art and nature, this deeper appreciation represents an ideal to which appreciators may aspire, one whose difficulty of realization is only proportionate to the magnitude and dignity of its object.²⁰

Received February 2005

Revised September 2005

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20 An early version of this paper was presented at the 2004 meeting of the Canadian Society for Aesthetics in Winnipeg, Manitoba. In addition to those present, I would like to thank Nick Zangwill, Allen Carlson and two anonymous referees for this journal for helpful comments and discussion. Financial support was provided by a Standard Research Grant from the Social Sciences and Humanities Research Council of Canada.

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