

Construction and Cognition

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ABSTRACT: *The Structure of Appearance* presents a phenomenalist system, constructing enduring visible objects out of qualia. Nevertheless Goodman does not espouse phenomenism. This is not because he considers his system inadequate. Although details remain to be filled in, he considers his system viable. And he believes his constructional methods could readily yield extensions to other sensory realms. Why isn't Goodman a phenomenalist? This paper suggests an answer that illuminates Goodman's views about the nature and functions of constructional systems, the prospects of reductionism, and the character of epistemology. These non-standard views present attractive alternatives to currently popular positions.

Keywords: Nelson Goodman, construction, reduction, phenomenism, constructional systems.

In *The Structure of Appearance*, Nelson Goodman presents a well worked out phenomenalist system which constructs enduring visible objects out of qualia. Nevertheless Goodman does not espouse phenomenism. This is not because he considers his system somehow defective or inadequate. Although details remain to be filled in, he considers his system viable. And he believes his constructional methods could readily yield extensions to other sensory realms. So the question arises, why isn't Goodman a phenomenalist? Answering this question sheds light on Goodman's views about the nature and functions of constructional systems, the prospects of reductionism, and the character of epistemology.

Phenomenalism

The idea behind phenomenism is this: Since all knowledge of the external world depends on observation, it should be possible to rigorously derive all knowable truths about the external world from truths about observations — truths that refer only to what is sensory. Philosophers such as Russell and Moore were convinced that this possibility could be realized — see Russell, 1914/1993; Moore, 1953. But although they were committed to the reality and importance of sense data, they did not attempt to create the systematic constructions that would show just how sense data constitute knowledge of the external world.

No one claims that the basic units of a phenomenist system — qualia, or sense data, or *Elementarerlebnisse* (hereafter “erlebs”), or whatever — are the stuff of common sense. They are theoretical posits introduced to characterize experience in purely sensory terms. The justification for their introduction is held to lie in the efficacy of the systems they figure in. The justification for believing in the reality of the entities a phenomenist theory adduces then depends on the success of the system. According to phenomenists, we would have reason to believe in the reality of basic phenomenal



elements — qualia, erlebs, sense data or whatever — if and only if phenomenalism underwrites physicalism.

Underwriting is a matter of derivation. Truths about everyday physical objects are to be deduced from truths expressed in purely phenomenal terms. Logic alone cannot do the job, for the two accounts employ different terminologies. Ordinary talk involves terms like “table” and “chair”, not “qualia” or “erleb”. So reduction of the physical to the phenomenal requires “bridge laws” or “correspondence principles” — identity statements that translate physical predicates into their phenomenal counterparts. Phenomenalism is vindicated if and only if, with the aid of such identity statements, all the truths expressed in physical-object language can be derived from phenomenalist truths. Phenomenalism is thus a form of epistemological reductionism. Knowledge of physical objects is supposed to derive from knowledge of something epistemologically more basic — ultimately from something we know immediately and directly as a result of the way the world imposes itself on us.

Reductionism

The reduction of the physical to the phenomenal is an instance of a general pattern. Theory 1 reduces to Theory 2 when and only when Theory 1 is connected to Theory 2 in such a way that Theory 1 in conjunction with the appropriate bridge laws can be derived from Theory 2. For example, thermodynamics is said to reduce to statistical mechanics, since bridge laws, such as “temperature =_{df} mean translational kinetic energy”, connect the vocabularies of the two theories in such a way that the laws of thermodynamics can be derived from the laws of statistical mechanics. This sort of reduction is ontological, not epistemological. The issue for physicalist reduction is, in Aristotle’s terms, what is first in the order of being, rather than, as is the case of phenomenalist reduction, what is first in the order of knowing. But the structure of the two types of reduction is the same. So many of the problems that afflict one afflict the other.

Many scientists and philosophers of science believe that all the natural sciences are ultimately reducible to physics. They think that, since chemical reactions, biological processes, even psychological conditions are just special, complicated sorts of matter in motion. So an adequate theory of matter in motion should be able to explain them. Successful reduction, they believe, would show that the vocabulary of the reduced theory is just a *façon de parler*. Talk of neuroses, cytoplasm, or molecular bonds may be efficient, but it is not strictly necessary to fully describe the world since the entities and properties recognized by the reduced theory are nothing but (perhaps highly complex) entities and properties fully describable and explicable in the reducing theory. If global reductionism is true, the truth-makers for all claims about the material world are truths of fundamental physics.

Such a picture is attractive. Physicalist reductionism presents a plausible sketch of the way the various sciences hang together. Phenomenalist reductionism presents a plausible sketch of the way knowledge of the external world is grounded in observable evidence. But even if whatever is matter in motion, and all knowledge of the external world is grounded in empirical evidence, it is far from obvious that reductionism is

correct. As Davidson, Fodor, and Kim have argued “whatever is physical” does not entail that every cognitively significant characterization of every real item can be deduced from the laws of physics — see Davidson, 1980; Fodor, 1981; Kim, 1993. Reductionism rests on a variety of strong and potentially problematic assumptions — assumptions that Nelson Goodman denies. His denials carry particular weight because he is one of very few to have actually constructed the sort of system that reductionists seek. By appeal to the system devised in *The Structure of Appearance* he can show, rather than merely say, that things are not the way would-be reductionists optimistically imagine them to be.

Order

A critical, if tacit, assumption of reductionism is that reduction is unidirectional. There is a natural order that dictates which systems are more basic, and which are derived. Material object talk is to be reduced to talk about sensory presentations, not vice versa. Belief/desire psychology is to be reduced to neurology, not vice versa. But identity statements are symmetrical. If *a* is identical to *b*, then *b* is identical to *a*. As far as the logic of reduction is concerned, derivations involving such identity statements could go either way.

The direction of reduction in the natural sciences is not argued for. If there is a justification, it seems to be that the reducing theory is more capacious than the reduced theory. It may make sense then to think that psychology reduces to neurology rather than the other way around because (it seems) even if all psychological states are neurological states, there are some neurological states that are not psychological states. If reductionism requires that entire theories be reduced en bloc, the more capacious theory will always be the reducing theory, and the less capacious one, the reduced theory. But that requirement has not been established. If, for example, belief/desire psychology can be reduced to neurology, then the part of neurology that is implicated in the reduction can in turn be reduced to belief/desire psychology. The neural states identified with psychological states then would be nothing but those psychological states.

It might seem, instead, that the size of the basic elements settles the matter. In familiar natural scientific models, basic elements are typically smaller than what they comprise. Molecules are composed of atoms; atoms are composed of protons, neutrons, and electrons; these subatomic particles in turn are composed of yet tinier things. So we develop what might be called a “building block” conception of composition. Little things make up bigger things. But this is not the only mode of composition. Goodman notes that it is possible to define a geometrical point as the intersection of two lines [PP, 33-40].¹ Then even though lines are bigger than points, points are made out of lines. In *The Structure of Appearance*, complexes are constructed out of overlapping qualia. The areas of overlap are clearly less extensive than the individual qualia that overlap. So the presumption that the bigger is always made up of the littler

¹ Reference to Goodman’s works in this paper will use the following abbreviations: [LA] *Languages of Art*; [PP] *Problems and Projects*; [SA] *The Structure of Appearance*; [WW] *Ways of Worldmaking*.

itself needs to be justified. Depending on what the atoms are and what modes of composition are permitted, it need not be so.

Phenomenalism assumes that the basic units are the given elements in experience, the way the world immediately and directly presents itself to us. They are the inputs, and concepts of physical entities are constructed out of them. Goodman argues, however, that we are not passive recipients of sensory inputs. From the outset we actively engage in imposing order on things [LA 241-242, WW, 6-7]. We dissect experience to arrive at basic elements [SA, 263]. We develop systems based on *erlebs*, or qualia, or sense data. And any of these construals may be effective. But the reason they are effective is not because such a construal characterizes the basic units in which we really, primordially experience things. Rather it is because the construal provides a theoretical structure in terms of which theorists can organize, systematize, and make sense of our ordinary, complex, variously conceptualized ways of experiencing things. We can construct systems that take qualia, *erlebs*, or sense data as the basic units. But such items are not given in experience. They are introduced in theorizing. The fan of qualia cannot argue against the advocate of *erlebs* that experience *really comes to us* by way of qualia rather than *erlebs*. If he wants to argue against a system based on *erlebs*, he must argue that that system is somehow inadequate. In one way or another it fails to do what we want such a system to do. That means that the argument turns on pragmatics, not on the way the world is.

Goodman maintains that order is something we create and impose on things through systematization. It is not impressed on us by nature. The status of an item as basic or non-basic depends on the structure of the system it belongs to. An item is basic if and only if it is treated as a primitive in the system. And that depends on systems we construct.

Comprehensiveness

We do not now have either the reductions, or the resources for the reductions that physicalist reductionism requires. The problem is not just that no one has bothered to construct the systems or carry out the deductions. Reduction is supposed to relate true, regimented theories to one another. If the truths of thermodynamics derive from the truths of statistical mechanics, then thermodynamics is just a special case of statistical mechanics. If the truths of psychology are deducible from the truths of neurology, then psychology is just a special case of neurology. We know enough about psychology and about neurology to venture some rough correlations (between, for example, emotional reactions and activity in the amygdala). But we do not know the truths of psychology or neurology. At best we have a body of claims that we think are not far from the truth. So there is no current prospect of actually reducing psychology to neurology, much less to physics. Nor, apart from the case of thermodynamics to statistical mechanics,² do we have any other viable candidates for reduction. So minimally, re-

² Which turns out to be less straightforward than philosophers of science are apt to think. See Teller, 1999.

ductionists are resting a lot more on hope than on evidence that their project can succeed.

The problem may be deeper than just that we do not yet have the resources to perform the reductions. Behind the reductionist aspiration is the idea that there is a fixed and final set of truths about the world that science will eventually discover. Once all the truths have been discovered, they can be regimented and the reductions carried out. So, in effect, reduction is the last step before the end of science. When all the truths are in and the relations between them are properly mapped, we can shut off the lights in the lab, close the door, and go home.

But conceivably science is not like that. Perhaps there is no end. If new answers always provoke new questions, and every investigation has the potential to undermine previous findings, then however successful our science is, science will never be complete. So we will never be in a position to take the last step. This does not mean that we could not, or should not undertake reductions, but they would be riskier. They would establish correlations between pairs of theories both of which we know to be incomplete and suspect to be flawed. To conclude that the *As* are nothing but *Bs*, and thus that henceforth the *As* may be treated as nothing but *Bs*, may be rash if our grounds are known to be so vulnerable. A real question then is when, if ever, the risk is worth taking — see Elgin, 1997.

Moreover, the reductionist assumes that all genuine (non-logical) truths are discoverable by science. But if, as Goodman and others believe, the arts, the humanities and philosophy afford understandings reality, which are expressible in propositions, and those understandings are not captured in scientific claims, then there are genuine truths that elude reduction. And if the arts convey accurate insights in ways that are nonpropositional (as, for example, pictures and music seem to), then those insights too are not candidates for reduction [LA 130-143]. Rather than being overly ambitious, physicalist reductionism may not be ambitious enough. Reducing all science to physics would not show that all truths about the world are physical truths.

Uniqueness

If bridge laws are identity statements, then there is exactly one reduction of a theory at one level to another level. If, for example, a visible object is identical to a combination of qualia, and no combination of qualia is identical to a combination of erlebs, then the visible object is not identical to a combination of erlebs. But if we look at what the proposed reductions accomplish, we can find no justification for so strong a claim. Rather, Goodman maintains, if one reduction works, others are apt to do so too. A system such as his that characterizes visible objects as constituted of qualia does not, he believes, discredit one such as Carnap's that characterizes them as constituted of erlebs [SA]. This may be why Goodman speaks of *construction* rather than *reduction*. To say that visible objects can be constructed out of qualia does not even suggest that they cannot be constructed out of erlebs. Goodman thus argues for multiple realizability. Rather than showing that the entities of Theory 1 are identical to, or are nothing but, entities recognized by Theory 2, a successful reduction shows that the entities of Theory 1 may be identified with entities of Theory 2.

Goodman's criticisms of comprehensiveness manifest his skepticism about physicalism. Although he recognizes the success of science in discovering many truths about many things, he does not believe that science can discover all truths. Nor does he believe that all accurate takes on things are articulable as truths. His criticism of uniqueness manifests a deeper skepticism. He denies that there is exactly one way the world is. Rather, he suggests, there are many ways the world is [PP, 24-32, WW]. If his constructional project works, then one way that visible objects are is expressible in terms of qualia; if Carnap's works (or can be modified to work), then another way that visible objects are is expressible in terms of *erlebs*.

Summary

Goodman repudiates the imperialistic metaphysical claims of reductive physicalism. He denies that all accurate insights about the way the world is are captured in or capturable by natural science. And he denies that all accurate scientific insights need be captured in or capturable by physics. A position that held the insights of psychology hostage to psychology's eventual reduction to physics would be unacceptably arrogant. A position that repudiated the insights afforded by the arts and the humanities would be intolerably impoverished.

Such a dismissal might seem high-handed. Why shouldn't we just suspend judgment and see whether the reductionist program works out? The reason is this: The course of inquiry depends on choices inquirers make. When we systematize a body of somewhat inchoate cognitive commitments, we cannot feasibly incorporate every extant commitment. We exclude outliers and mold the remainder to fit the demands of our system. These demands in turn are controlled by our cognitive agendas. If we are attempting to systematize a cluster of psychological commitments purely for the purposes of psychology, such paring and pruning is reasonable. But to exclude or modify well founded psychological commitments solely to facilitate reduction to neurology or physics is unwarranted. Psychologically valuable insights could be sacrificed in the quest to satisfy the dictates of a science with different specific cognitive objectives.

Goodman likewise repudiates the grand epistemological aspirations of phenomenism. He denies that there is a uniquely best phenomenalist base — a unique structure of appearances. He believes it is senseless to say that some items are intrinsically more basic than others. He argues that the success of one system for a given realm does not preclude the success of others. Different systems can be constructed for the same realm, exhibiting different, but equally valuable features. So the conviction that bridge laws are identity statements, and that therefore successful reduction discloses *the* truth-makers for higher level theories is unfounded. He denies that there is just one way the world is, and in consequence denies that even if the most ambitious aspirations of reductionists were realized, the result would be the end of inquiry. The question, "How else might the world be fruitfully characterized?" always arises.

Antireductionism

It might seem then that Goodman is simply an antireductionist. In some respects, he is. He insists that various mutually irreducible world versions of equal significance can be constructed [WW]. He denies that the adequacy of the arts, the humanities, or the special sciences depends on their reducibility to or construction on a physicalist basis. His reason is not just that the claims of reductive physicalism wildly outrun the available evidence. Nominalism undermines global reductionism and cognitivism undermines physicalism.

Nominalism recognizes that virtually every collection of entities, however motley it seems, constitutes an extension. Few extensions figure, directly or remotely, in natural science or, for that matter, in any other comprehensive system. Nevertheless, all extensions are equally real. The extension of “grue” is as real and as determinate as the extension of “green”. So the way the world is does not privilege extensions recognized by science over other extensions or privilege those that can be incorporated into more comprehensive systems over those that cannot be so incorporated. If there is reason to favor some extensions over others, it is because some suit our purposes better than others. If there is reason to favor some extensions over others on cognitive grounds, it is because some suit our cognitive purposes better than others. “Green” is preferable to “grue” then because “green” fits with our inductive practices and serves our inductive purposes better than “grue” does. But, Goodman maintains, if we look at our cognitive goals and accomplishments, we see that natural science has no monopoly on cognitive value. The insights we gain from art or history or philosophy are at least as deep and enduring as those we gain from science. Even within science, purposes can be various. Separate sciences may have reason to favor mutually irreducible kinds — see Fodor, 1981. Once we recognize the reality of all the extensions, and the multiplicity of our cognitive purposes, the argument for physicalist reductionism is hard to maintain.

Some truths elude systematization entirely. They need not be cognitively less valuable on that account. Metaphors, for example, may be utterly ad hoc. They suit their local cognitive purposes, but make no claims to general utility. An enthusiastic undergraduate might be described metaphorically as a panting puppy. Since metaphorically panting puppies are different from other enthusiasts, there seems to be no literal way to express that particular truth. Hence there is likely to be no way to incorporate it in a science of human behavior. Nor is there anything exceptional about this metaphor. Many metaphors elude literal paraphrase, for they pick out extensions that are semantically unmarked — see Glucksberg and Keyser, 1990. Because we have no enduring interest in such extensions, we have never introduced predicates to designate them. But since they are semantically unmarked, their extensions are not likely to exhibit the sort of regularities science seeks. The truths they express are not suitable for incorporation in rigorous deductive systems suitable for science.

Because pictures are syntactically dense, they convey more than can be captured in an articulate verbal system [LA, 135-137]. Any attempt to express in words what is conveyed in a picture inevitably leaves something out. But pictures cannot enter into deductions. So if, for example, Titian’s portrait of Pope Paul III is accurate, it conveys

something about the pope that cannot be put into words, hence cannot be reduced to physics.

Standardly, the reply to this sort of argument is aesthetic non-cognitivism. Many philosophers simply deny that the arts function cognitively. They insist that we are using our terms in an extended sense when we claim to have gained understanding through encounters with art. They maintain, despite the evidence, that if a metaphor has any cognitive content, that cognitive content is capturable in a literal paraphrase. Rather than being independently motivated such a position seems to be a consequence of the view that there is exactly one way the world is. If there is only one true theory of everything, and that theory has no room for the view that Titian's portrait conveys Pope Paul III's veniality and corruption, then we have reason to conclude that the portrait does no such thing. But it certainly seems to convey the pope's character. And absent an overriding theory that explains why it cannot in principle do so, we should take the appearance at face value. This is not to say that by itself it justifies the contention that the pope was venial and corrupt. But if it presents a characterization of its subject that is worth entertaining by those who seek to understand him, then it functions in the cognitive realm.

A similar sort of argument can be made within the sciences. If cytology has its own cognitive agenda, then we limit its intellectual freedom if we insist on forcing it into a framework that would make it a candidate for physicalist reduction. Goodman's position is that insusceptibility to physicalist or phenomenalist reduction is not a cognitive defect in a representation of a way things are.

Still, to construe Goodman simply as an antireductionist raises the question: Just what was he doing in *The Structure of Appearance* and "Steps Toward a Constructive Nominalism"? Were these merely youthful flirtations with positions that he eventually repudiated? I think not. I suggest that Goodman's views about the nature and function of constructional systems reveals a good deal about his view of epistemology. It shows that reduction or construction, as he prefers to call it, has a more significant role than merely tidying up at the end of the day.

Extensional Isomorphism

The correlations I call "bridge laws" are what Goodman calls "constructional definitions". I use a different term to highlight their divergence from ordinary definitions. These correlations are not, and are not supposed to be, relations of synonymy. No one believes that "temperature" means "mean translational kinetic energy". Rather, it is standardly held, such correlations are grounded in coextensiveness. The connection between temperature and mean translational kinetic energy is secure if and only if for suitable m and n , whatever has temperature m has mean molecular kinetic energy n .

Goodman maintains, however, that even coextensiveness is an overly demanding criterion. The relation between reducing and reduced systems should be extensional isomorphism rather than identity. If two systems are extensionally isomorphic, then although the objects of the two theories may be different, there is mapping of one onto the other such that structural relations in the one are identical to structural relations in the other. Extensional isomorphism thus preserves structure, not identity.

Obviously there is a question what structures need to be preserved. Formalism will not supply the answer. Goodman maintains that in devising a system we decide what relations among its elements are worth preserving. Constructional definitions or bridge laws “must be such that every sentence that we care about that can be translated into the system shall have the same truth value as its translation.” [SA, 12] Because extensional isomorphism is not identity, the reducing theory may have a finer grain than the reduced theory. That is, it may have additional structure that the reduced theory lacks. Thus we can identify an underlying substructure for the regularities we discern in the original theory. We may then be able to show how underlying structural relations can account for the manifest relations that we see. If, for example, we identify lightning with an electrical discharge, we can appeal to the fine structure of electricity to account for the observed behavior of lightning.

That isomorphism is not identity has the consequence that multiple, mutually incompatible fine grained systems will be extensionally isomorphic with a single coarse grained system. So rather than saying that the *As* of the coarse grained system are the *Bs* of the fine grained system, the most we can say is that the *As* of the coarse grained system are identified with the *Bs* of the fine grained system. We need to recognize that the *As* can equally be identified with the *Cs* of another fine grained system, even though the *Bs* and the *Cs* are mutually irreducible. Thus, for example, visible objects are identified, under Goodman’s system, with overlapping qualia. They are identified under Carnap’s system with combinations of *erlebs*. Had Russell and Moore formalized their theory, visible objects would also be identified with clusters of sense data. Arguably the same holds for physical systems, some of which identify light rays with waves and others of which identify them with particles.

At this point, one might be inclined to demand impatiently: “Well which is it? Granted that visible objects *can be identified with* qualia, *erlebs*, or sense data. But which identification is correct? A visible object cannot *be* all three. Which system supplies the real underlying structure of visible objects? This question is probably unanswerable. If each of the fine grained systems accurately reflects the structure of the coarse grained theory and satisfies whatever theoretical desiderata we have managed to impose, we have no grounds for favoring one over the others. Nor is there any reason to think that we will be able to identify enough well-motivated desiderata so that in the long run a uniquely correct answer will emerge.

If we insist, in the face of such inevitable underdetermination, that at most one of the reductions can be correct, we seem forced to skepticism. Either visible objects are combinations of *erlebs* or they are combinations of sense data or they are combinations of qualia or they are combinations of some other basic unit, but we will never be able to determine which. We will just never know. So the demand to treat correspondence rules as identity statements is epistemologically costly. If, however, we recognize that all we are saying is that visible objects can be identified with *erlebs*, or with qualia, or with sense data, then our epistemic prospects are not so bleak. We do seem to be in a position to know that.

Identifications based on isomorphism are obviously weaker than identity statements. But Goodman does not favor them merely as a fallback position or a counsel

of despair. Suppose, per impossible, that we could justify the conclusion that visible objects really are combinations of qualia, and not combinations of *erlebs*, or sense data. Then we could dismiss the systems based on *erlebs* or sense data as spurious. And if, whether or not we could justify our conviction, we believed that exactly one such system is correct, we would have reason to believe that the correlations recognized by the others are spurious.³ But, Goodman believes, to think this is to blind ourselves to information. That visible objects can be equally well identified with combinations of *erlebs*, combinations of qualia, and combinations of sense data reveals something interesting and important about the visible realm. We understand it more fully when we appreciate that it admits of all three divergent characterizations, that it can be structured in all three ways. So rather than thinking that the move from identity to extensional isomorphism constitutes a retreat, Goodman considers it an epistemological advance.

Incompleteness

The same sort of argument holds for partial reductions. Because Goodman and Quine were not able to derive all the mathematics physics requires from a nominalistic basis, many philosophers consider “Steps Toward a Constructive Nominalism” [PP, 173-198] a failure. Goodman probably considers the result disappointing. But he does not consider the investigation a failure, for he considers partial reductions cognitively valuable. The reason is not, or not just, that there is always value in having made such an attempt. Rather, he thinks that the results of a partial reduction are worth having. “Steps” does not nominalize all of mathematics or even enough of mathematics for physics. But it does nominalize some of mathematics. It thus demonstrates that the part it nominalizes does not require classes or other platonistic entities. We learn something significant about the mathematical domain when we discover that part requires platonism and part does not. If we came to believe that Goodman and Quine, or their successors had taken the project of nominalizing mathematics as far as it could go, we would gain important knowledge about mathematical ontology — namely, where the line between the nominalist and the platonist parts is drawn.

Similarly for other partial reductions. Some philosophers believe that unless the hard problem of consciousness can be solved, psychophysical reduction fails. Goodman would say something more nuanced. If it turns out, as philosophers of mind evidently think it might, that propositional attitudes can be identified with neurological states, but that “raw feels” defy reduction, then we learn something significant about the realm of the mental. It is not so uniform as we thought. We might even conclude that the line between the mental and the physical should be relocated, so that consciousness is on the mental side, but the propositional attitudes, being identifiable with brain states, are on the physical side.

³ We have reason to believe this even if we have no clue which of the three are spurious.

Tools

Goodman considers constructional systems to be tools of inquiry. Since not every tool is useful for every job, it is no defect in constructional systems that they cannot explicate the insights that the arts afford. Nor is it a defect in the arts that their products do not admit of incorporation into constructional systems. The value of one tool is not impugned by the existence of other equally good tools. Multiple tools may perform the same function equally well, and different tools may perform different but equally valuable functions. Thus divergent constructional systems that share a realm are not competitors for the title of the one true theory; they are different tools that all may advance understanding of the domain. That a particular tool is limited in its utility need not be a defect in the tool. A drill bit is not ineffective merely because there are materials it cannot pierce. It may be useful for drilling other things. Similarly, a phenomenalist system need not be defective merely because truths about material objects cannot be derived from it. If it yields insights into a structure of appearances, it advances understanding whether or not it sheds light on a structure of the material world. The fuller our toolbox, the more likely we are to have tools suited to our tasks. So the development of a variety of constructional systems with different bases and different constructional methods is a potentially powerful way to foster understanding. We require tools to do a job, not when the job is done. So reduction by means of constructional systems is not the last step before the end of science. It is a method for enabling the sciences, fallibly and corrigibly, to articulate and investigate their commitments in order to pursue their various ends.

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