
The Building-Block Universe

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IN HIS ESSAY ON “Newtonianism, Reductionism, and the Art of Congressional Testimony,” physicist Steven Weinberg (2001) tries to get a grip on why “we all do have a sense that there are different levels of fundamentalness”—why, for example, DNA is “fundamental to biology,” and particle physics is “fundamental to everything.” In science, he says, “we try to discover generalizations about nature,” and these, it turns out, give us a sense of direction because “some generalizations are ‘explained’ by others.” After all, “does anyone doubt that real materials exhibit [higher-level] phenomena because of the properties of the particles of which the materials are composed?” So it is that

There are arrows of scientific explanation, which thread through the space of all scientific generalizations These arrows seem to converge to a common source! Start anywhere in science and, like an unpleasant child, keep asking “Why?” You will eventually get down to the level of the very small.

And further:

no biologist today would be content with an axiom about biological behavior that could not be imagined to have an explanation at a more fundamental level. That more fundamental level would have to be the level of physics and chemistry, and the contingency that the earth is billions of years old. In this sense, we are all reductionists today.

Weinberg not only finds the arrows of explanation in nature consistently pointing downward; he also suspects we may be close to the “final source” of explanation. For as we study smaller and smaller structures, the physical principles we discover become simpler and simpler. They become increasingly coherent and universal, reflecting “something that is built into the logical structure of the universe at a very deep level.”

Building Blocks Without Substance

The attempt to find ultimate explanation at “the level of the very small” leads naturally to a building-block view of the world. If the small things are fundamental, then the secondary, bigger things must result from their aggregation. The world, we can imagine, is built up from parts, rather as we construct the various objects and mechanisms of mod-

ern life from their constituent parts. There is no over-estimating the compelling force of this view upon the modern mind. As physicist David Bohm remarks,

When it comes to the informal language and mode of thought in physics, which infuses the imagination and provokes the sense of what is real and substantial, most physicists still speak and think, with an utter conviction of truth, in terms of the traditional atomistic notion that the universe is constituted of elementary particles which are “basic building blocks” out of which everything is made. (Bohm 1980, pp. 14-15)

The strange thing about the bottom-up, building-block universe is that it receives no support whatever from science itself. As another physicist, Nick Herbert, puts it: “the unremarkable and common-sense view that ordinary objects are themselves made of objects is actually the blackest heresy of establishment physics” (1985, p. 22). Herbert is here acknowledging how physicists have brought no end of trouble upon themselves by imagining their smallest entities to be like the things of ordinary experience—for example, waves and particles. Their “building blocks” have dissolved into probabilities and abstruse mathematical formulas with no thing-like reference at all.

Actually, we see something like the reverse of the building-block model. The interference pattern (along with the entire experimental set-up) in the famous double-slit experiment explains the behavior of the presumed individual photon at least as much as the photon explains the pattern. (See “Quantum Puzzles” in this issue.)

The building-block universe is a holdover from 19th-century science. If it has a death-grip upon our imaginations, this is at least in part due to inadequate notions of scientific explanation. Weinberg speaks of a search for generalizations where “some generalizations are ‘explained’ by others” and eventually, as with an “unpleasant child,” our why-questions lead us down to the very small. But this downward spiral is wholly dependent upon the kinds of questions we ask and the kinds of answers we are willing to hear.

If our entire method is one of *analysis*, so that we would explain every whole by looking downward, dissecting, logically distinguishing—if, like the child, we know only how to pull things apart—then obviously we will be led to smaller and smaller pieces. But, at the same time, we will be left with

a problem: how do we say anything meaningful about a world we never consider in its own, unfractured terms? How do we avoid an endless regress of explanation, where each thing we cite is in turn “explained” by other things lower down, none of which we can ever stop and experience for what it is? Which also means: we can never stop and *say* what it is.

Generalizing Toward Emptiness

Nature herself suggests a need for much more than downward-directed analysis alone. Do organisms explain their environment, or does the environment explain the organisms (Holdrege 2000)? Does the stream explain its local meanders and eddies, or do the latter explain the stream (Bohm 1980, p. 10)? It always works both ways. We never find in any meaningful context—which is to say, in any meaningful whole—that the chain of cause and effect works only in one direction. Even with a machine it makes no sense to say that cause and explanation flow upward from the smallest parts. Our intellects may need to focus successively on isolated parts as we work toward an understanding of the whole, but we should not mistake our own needs for the working of the machine.

What misleads someone like Weinberg is the fact that we do discover a kind of syntactic structure or lawful regularity in the world’s phenomena, and this structure can be traced downward into the very small. The entire analytical thrust of science has aimed at this downward tracing. But this is where the great confusion occurs. For while there is no sphere of human or natural activity that does not exhibit syntactic structure and lawful regularity in the relations of its parts, this lawfulness *never* explains the actual course of events taken as a whole (Talbot 2004). Rather, it characterizes only certain abstract aspects of events.

Consider for a moment the analysis of one particular phenomenon—human language. We can indeed abstract lawful regularity from all language. For example, we can obtain a grammatical or logical syntax, and this in turn can lead us to the notion of grammatical or logical atoms as basic building blocks of speech. Without such a regular and more or less predictable, particulate structure, we could not speak meaningfully. Yes, there is a grammatical and logical structure implicit, for example, in Martin Luther King’s “I Have a Dream” speech. But once you have gone as far as possible in abstracting such a formal structure, you could never, by looking at the empty structure alone, find your way back to the actual content of the speech. (Imagine looking at a page of logical symbols and wondering what they might be *about*.) But you *can* find your way from the content to the

abstraction. This is hardly surprising, since any content explains what is abstracted from it in a much fuller sense than the abstraction explains the content.

It is, in the end, self-evident: in every sphere where we find law, we also recognize that whatever is capable of “obeying” this law must have a substance and character that is more than the law it obeys. This substance and character is exactly what the prevailing scientific method simply refuses to look at. As Weinberg points out, the scientist seeks laws that are *generalizations*. We generalize by looking only at what things have in common—just as we seek a law of gravity that applies equally to moon and apple, fish and rock. We can find such a law, but we do so by ignoring everything that makes the fish a fish and not a rock. By abstracting from things only what they have in common, and by moving downward toward ever more universal generalizations of the sort Weinberg celebrates, we eventually arrive at those “simple” and “coherent” statements that apply to almost everything and therefore tell us almost nothing about any actual content of the world. This, of course, is no problem if we have already managed to develop a disinterest in all meaningful content.

There is another way to seek law in the world. That will be the subject of the next article in this space. Meanwhile, please note that the topics addressed here are dealt with at much greater length in a collection of essays on our new website. You will find them at <http://qual.natureinstitute.org>. See in particular “The Reduction Complex.”

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