

The End of Insight

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I WORRY that insight is becoming impossible, at least at the frontiers of mathematics. Even when we're able to figure out what's true or false, we're less and less able to understand why.

An argument along these lines was recently given by Brian Davies in the *Notices of the American Mathematical Society*. He mentions, for example, that the four-color-map theorem in topology was proved in 1976 with the help of computers, which exhaustively checked a huge but finite number of possibilities. No human mathematician could ever verify all the intermediate steps in this brutal proof, and even if someone claimed to, should we trust them? To this day, no one has come up with a more elegant, insightful proof. So we're left in the unsettling position of knowing that the four-color theorem is true but still not knowing why.

Similarly important but unsatisfying proofs have appeared in group theory (in the classification of finite simple groups, roughly akin to the periodic table for chemical elements) and in

geometry (in the problem of how to pack spheres so that they fill space most efficiently, a puzzle that goes back to Kepler in the sixteenth century and arises today in coding theory for telecommunications).

In my own field of complex-systems theory, Stephen Wolfram has emphasized that there are simple computer programs known as cellular automata whose dynamics can be so inscrutable that there's no way to predict how they'll behave. The best you can do is simulate them on the computer, sit back, and watch how they unfold. Observation replaces insight. Mathematics becomes a spectator sport.

If this is happening in mathematics, the supposed pinnacle of human reasoning, it seems likely to afflict us in science, too—first in physics and later in biology and the social sciences (where we're not even sure what's true, let alone why).

When the End of Insight comes, the nature of explanation in science will change forever. We'll be stuck in an age of authoritarianism, except it will no longer be coming from politics or religious dogma but from science itself.