

causing abnormal freezing temperatures as far south as Oklahoma and Georgia.

Probabilistic causation. Many weather phenomena are probabilistic. What is caused is a probability distribution. Although you can't predict whether a flipped coin will come down heads or tails, you can predict that over the course of a large number of flips, almost exactly 50 percent will come down heads and another 50 percent tails.

Yes, global warming systemically caused freezes in the American south. Yes, global warming systemically caused Hurricane Sandy—and the Midwest droughts and the fires in Colorado and Texas, as well as other extreme weather disasters around the world. Let's say it out loud: It was causation, systemic causation! Network causes, feedback loops, multiple causes—all acting probabilistically as part of the global weather system—have been systemically causing weather disasters. Yes, systemically causing untold human harm and billions, if not trillions, of dollars in damage.

Systemic causation is familiar. Smoking is a systemic cause of lung cancer. HIV is a systemic cause of AIDS. Working in coal mines is a systemic cause of black lung disease. Driving while drunk is a systemic cause of auto accidents. Sex without contraception is a systemic cause of unwanted pregnancies, which are a systemic cause of abortions.

Systemic causation, because it is less obvious than direct causation, is more important to understand. A systemic cause may be one of a number of multiple causes. It may require some special conditions. It may be indirect, working through a network of more direct causes. It may be probabilistic, occurring with a significantly high probability. It may require a feedback mechanism. In general, causation in ecosystems, biological systems, economic systems, and social systems tends not to be direct, but is no less causal. And because it is not direct causation, it requires all the greater attention if it is to be understood and its negative effects controlled.

Above all, it requires a name: *systemic causation*.

The precise details of Hurricane Sandy could not have been predicted in advance, any more than when, or whether, a smoker develops lung cancer, or