COMPUTATIONAL MODELING AND DATA ANALYTICS

Distinguished Speaker Series

LEONARD SMITH

SEEING THROUGH OUR MODELS:

RETHINKING THE AIMS OF OPERATIONAL FORECASTING

One beauty of mathematical physics is its ability to expose assumptions we did not know we were making. A century and a half ago, Admiral Fitzroy issued storm warnings by embracing the modern technology of his time: the telegraph and barometer. The reaction to his early attempt at scientific disaster risk reduction was mixed. Today, computer simulations inform both science and society, providing valuable information about the likely weather, for instance. Yet both simulation models and the forecast systems they are embedded in are imperfect. The equations which best describe their real world targets (today's "Laws of Physics") are high-dimensional and nonlinear. While chaos can make useful prediction via simulation expensive, we will see that model inadequacy (in particular the loss of topological conjugacy) is much more devastating to traditional goals of even probabilistic forecasting.

Embracing model inadequacy opens the door to interesting applications one might never dream of exploring given a perfect model. Letting go of "optimality" and adopting a Just Enough Decisive Information (JEDI) framework suggests using sculpted ensembles to obtain forewarning of high impact events. Arguably, this goal is closer to what Fitzroy intended when he coined the phrase "weather forecast". But are we sacrificing rigor in favor of relevance? Or simply moving to the acceptance of a more relevant (deployable) notion of rigor?

Leonard Smith holds a PhD in Physics from Columbia University and is Director of the Centre for the Analysis of Time Series and Professor of Statistics at the London School of Economics. He has been a Senior Research Fellow at Pembroke College Oxford since 1992, and last year became a Senior Research Fellow in the Energy Policy Institute at the University of Chicago. His book *Chaos: A Very Short Introduction* is an Amazon #1 Best Seller, available in eight languages. His research interests include the real world as well as our (imperfect) models of it, leading to questions of predictability and probability in practice; he also studies the roles of science to better inform policy making. He has received the Royal Meteorological Society's Fitzroy Prize and an Australian Academy of Sciences Selby Fellowship.

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