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SPEAKER TITLES/ABSTRACT

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"A New, Truth-directed Explanation of Ockham's Razor in Model Inference"

Science aims at true models and theories that stand up in counterfactual situations not yet sampled. All parties agree that science should prefer simpler theories compatible with experience to complex ones. But why? Bayesians explain Ockham's razor with a prior probabilistic bias against complex possibilities that look simple, but that does not begin to explain how such a bias conduces to finding the true model. Frequentists punt on the question entirely, because there is no bound on chance of error for model inference. We propose a new frequentist explanation of how, and in what sense, Ockham's razor helps one find the true model in science. At best, a statistical method can converge to the true model in chance (pointwise consistency). But convergence in chance is not even remotely monotonic---the chance of producing a model may drop precipitously with sample size. When the drop in chance is at least alpha, say that the model has been alpha-retracted. Paying more for a larger sample that eliminates a false conclusion sounds like progress, but paying more to reject the true conclusion is retrograde. Say that a method is alpha-progressive if it is pointwise consistent and never retracts the true hypothesis by more than alpha. A method is alpha-Ockham iff its chance of producing a model more complex than the truth (at an arbitrary parameter) is at most alpha. Think of that as a refined way to converge to the truth. Our main result is that only alpha-Ockham methods are alpha-progressive. As alpha is tuned downward, the method will continue to favor simple theories at more complex parameter settings, which provides a new interpretation of the statistical tradeoff between simplicity and fit. Also, when statistical tests at nominal significance alpha are used to fish for models, as in the discovery of causal DAGs, the significance level can be interpreted rigorously as a bound on alpha progressiveness. Finally, there is the prospect of a new, frequentist foundation for objective simplicity biases in Bayesian prior probabilities of the sort recommended by Harold Jeffreys---what is the least prior bias toward simple models that guarantees alpha progressiveness of Bayesian inference?