

DEMPSTER AWARD TALK

MONDAY, APRIL 14, 2014

TALK: 4:15 PM — SCIENCE CENTER LECTURE HALL A
RECEPTION: 5:15 PM — SCIENCE CENTER, 7TH FLOOR

“A Paradox from Randomization-Based Causal Inference”

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ABSTRACT

Under the potential outcomes framework, causal effects are defined as comparisons between the potential outcomes under treatment and control. Based on the treatment assignment mechanism in randomized experiments, Neyman and Fisher proposed two different approaches to test the null hypothesis of zero average causal effect (Neyman's null) and the null hypothesis of zero individual causal effects (Fisher's null), respectively. Apparently, Fisher's null implies Neyman's null by logic. It is for this reason surprising that, in actual completely randomized experiments, rejection of Neyman's null does not imply rejection of Fisher's null in many realistic situations including the case with constant causal effect. Both numerical examples and asymptotic analysis support this surprising phenomenon. Although the connection between Neymanian approach and the Wald test under the linear model has been established in the literature, we provide a new connection between the Fisher Randomization Test and Rao's score test, which offers a new perspective on this paradox. Further, we show that the paradox also exists in other commonly used experiments, such as stratified experiments, matched-pair experiments and factorial experiments.

<http://arxiv.org/abs/1402.0142>