



# THE UNIVERSITY OF CHICAGO

Department of Statistics  
STATISTICS COLLOQUIUM

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## Safe Testing

MONDAY, February 10, 2019 at 4:30 PM

Jones 303, 5747 S. Ellis Avenue

*Refreshments before the seminar at 4:00 PM in Jones 304*

## ABSTRACT

We present a new theory of hypothesis testing. The main concept is the S-value, a notion of evidence which, unlike p-values, allows for effortlessly combining evidence from several tests, even in the common scenario where the decision to perform a new test depends on previous test outcomes. 'Safe' tests based on S-values generally preserve Type-I error guarantees under such 'optional continuation', thereby potentially alleviating one of the main causes for the reproducibility crisis. By focusing on optional continuation, a weakening of optional stopping, we can show that nontrivial S-values exist for essentially arbitrary (also composite /nonparametric)  $H_0$  and  $H_1$ . While the prime interpretation of S-values is in terms of gambling or investing, the optimal S-values, which lead to fastest capital growth, are also Bayes factors, but based on nonstandard priors which are determined by the joint KL projection between the set of all Bayes marginals on  $H_0$  and  $H_1$ . We illustrate the theory using two classical testing scenarios: the t-test and the 2x2 table. Optimal S-values for the t-test are based on the right Haar prior on the variance, like in Jeffreys' Bayesian t-test and the Robbins-Lai always-valid t-test. The optimal 2x2 table S-values do not seem to resemble anything done before. Sharing Fisherian, Neymanian and Jeffreys-Bayesian interpretations, and being extendible to confidence interval settings as well, S-values and safe tests may provide a methodology acceptable to adherents of all three schools.

Joint Work with R. de Heide, W. Koolen, A. Ly, R. Turner and J. Ter Schure.

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For further information and inquiries about building access for persons with disabilities, please contact Jonathan Rodriguez at 773.702.8333 or send him an email at [jgrodriquez@galton.uchicago.edu](mailto:jgrodriquez@galton.uchicago.edu). If you wish to subscribe to our email list, please visit the following website:  
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