ABSTRACT

The department-store retailer John Wanamaker famously stated, “Half the money I spend on advertising is wasted—I just don’t know which half.” Compared with the measurement of advertising effectiveness in traditional media, online advertisers and publishers have considerable data advantages, including individual-level data on advertising exposures, clicks, searches, and other online user behaviors. However, as I shall discuss in this talk, the science of advertising effectiveness requires more than just quantity of data - even more important is the quality of the data. In particular, in many cases, using various statistical techniques with observational data leads to incorrect measurements. To measure the true causal effects, we run controlled experiments that suppress advertising to a control group, much like the placebo in a drug trial. With experiments to determine the ground truth, we can show that in many circumstances, observational-data techniques rely on identifying assumptions that prove to be incorrect, and they produce estimates differing wildly from the truth. Despite increases in data availability, Wanamaker's complaint remains just as true for online advertising as it was for print advertising a century ago.

In this talk, I will discuss recent advances in running randomized experiments online, measuring the impact of online display advertising on consumer behavior. Interesting results include the measurable effects of online advertising on offline transactions, the impact on viewers who do not click the ads, the surprisingly large effects of frequency of exposure, and the heterogeneity of advertising effectiveness across users in different demographic groups or geographic locations. I also show that sample sizes of a million or more customers may be necessary to get enough precision for statistical significance of economically important effects - so we have just reached the cusp of being able to measure effects precisely with present technology. (By comparison, previous controlled experiments using split-cable TV systems, with sample sizes in the mere thousands, have lacked statistical power to measure precise effects for a given campaign.) As I show with several examples that establish the ground truth using controlled experiments, the bias in observational studies can be extremely large, over- or underestimating the true causal effects by an order of magnitude. I will discuss the (implicit or explicit) modeling assumptions made by researchers using observational data, and identify several reasons why these assumptions are violated in practice. I will also discuss future directions in using experiments to measure advertising effectiveness.

Categories and Subject Descriptors
H.2.8 [Database Management]: Data Mining.

General Terms
Algorithms, Experimentation, Human Factors, Management, Measurement.

Keywords
Data Mining, Computational Advertising, Advertising Effectiveness, Experimentation.

Bio
David Reiley is a Principal Research Scientist at Yahoo! Research, where he is using experiments to measure the effects of display advertising. A leader in the field-experiments revolution in economics and the social sciences, he has published experiments on diverse topics, from auction bidding to charitable fundraising, in leading economics journals. Before coming to Yahoo!, Reiley was Arizona Public Service Professor of Economics at the University of Arizona. He has also taught at Vanderbilt University and at the Kellogg School of Management at Northwestern University. Reiley is the Co-Editor for Field Experiments at Economic Inquiry, and a coauthor (with Avinash Dixit and Susan Skeath) of the best-selling game theory textbook Games of Strategy, Third Edition. He holds a bachelor's degree in Astrophysical Sciences from Princeton University, and a PhD in economics from MIT.