

15.840 Experimental Design (Marketing PhD Seminar)

MIT Sloan School of Management

Spring 2016

Professor Dean Eckles

Thursday 3:05pm – 5:55pm in E62-687

Randomized experiments are important tools for testing theories, exploring design spaces, and evaluating or finding policies. It is increasingly possible to conduct field experiments in many empirical contexts. We will approach learning how to design and analyze experiments through a mix of methodological content (readings and lectures) and critical readings of important experimental work.

Textbooks

Required:

Gerber, A., & Green, D. (2012). *Field Experiments: Design, Analysis, and Interpretation*.

Excerpts from:

Shadish, W.R., Cook, T.D., & Campbell, D.T. (2001). *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. [excerpts]Imbens, G. W., & Rubin, D. B. (2015). *Causal Inference in Statistics, Social, and Biomedical Sciences*. [excerpts]Owen, A. B. (draft). Monte Carlo Theory, Methods and Examples. <http://statweb.stanford.edu/~owen/mc/> [excerpts]

Schedule with assigned reading

Feb 4: Overview of class, Fisherian randomization inference

Feb 11: Fisherian and Neymanian randomization inference

Gerber & Green, Ch. 2 - 3.

Imbens & Rubin, Ch. 6 (available online)

Imbens & Rubin, Ch. 5 (optional)

Optional:

Samii, C., & Aronow, P. M. (2012). On equivalencies between design-based and regression-based variance estimators for randomized experiments. *Statistics & Probability Letters*, 82(2), 365-370.

Abadie, A., Athey, S., Imbens, G. W., & Wooldridge, J. M. (2014). Finite population causal standard errors. NBER Working Paper 20325.

Feb 18: Optimal design, covariates, and blocking

Gerber & Green, Ch. 4.

Higgins, M. J., Sävje, F., & Sekhon, J. S. (2016). Improving massive experiments with threshold blocking. To appear in *PNAS*. <http://sekhon.berkeley.edu/papers/algorithmthreshold.pdf>

Optional:

Lin, W. (2013). Agnostic notes on regression adjustments to experimental data: Reexamining Freedman's critique. *The Annals of Applied Statistics*, 7(1), 295-318.Miratrix, L. W., Sekhon, J. S., & Yu, B. (2013). Adjusting treatment effect estimates by post-stratification in randomized experiments. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, 75(2), 369-396.

Feb 25: Validity, power, and practical issues in experiments

Shadish, Cook & Campbell, ch. 2

Bakshy, E., Eckles, D., & Bernstein, M. S. (2014). Designing and deploying online field experiments. In *Proceedings of the 23rd international conference on World wide web* (pp. 283-292). ACM.

Optional:

Lewis, R. A., & Rao, J. M. (2015). The unfavorable economics of measuring the returns to advertising. *The Quarterly Journal of Economics*, 130(4), 1941-1973.

Mar 3: Randomization inference with spillovers / interference / peer effects

Athey, S., Eckles, D., & Imbens, G. (2015). Exact p-values for network interference. NBER Working Paper 21313. <http://arxiv.org/abs/1506.02084>

Bond, R. M., Fariss, C. J., Jones, J. J., Kramer, A. D., Marlow, C., Settle, J. E., & Fowler, J. H. (2012). A 61-million-person experiment in social influence and political mobilization. *Nature*, 489 (7415), 295-298.

Optional:

Choi, D. S. (2014). Estimation of monotone treatment effects in network experiments. Working paper. <http://arxiv.org/abs/1408.4102>

Jones, J. J., Bond, R. M., Bakshy, E., Eckles, D., & Fowler, J. H. (2016). Social influence and political mobilization: Further evidence from a randomized experiment in the 2012 U.S. Presidential Election. Working paper.

Cai, J., De Janvry, A., & Sadoulet, E. (2015). Social networks and the decision to insure. *American Economic Journal: Applied Economics*, 7(2), 81-108.

Mar 17: Combining observational and experimental data

Aronow, P. M., & Middleton, J. A. (2013). A class of unbiased estimators of the average treatment effect in randomized experiments. *Journal of Causal Inference*, 1(1), 135-154.

Optional:

Chen, A., Owen, A. B., & Shi, M. (2015). Data enriched linear regression. *Electronic Journal of Statistics*, 9(1), 1078-1112.

Hartman, E., Grieve, R., Ramsahai, R., & Sekhon, J. S. (2015). From sample average treatment effect to population average treatment effect on the treated: Combining experimental with observational studies to estimate population treatment effects. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, 178(3), 757-778.

Mar 31 and beyond: Critical readings of empirical papers

Schedule of empirical papers with discussion leaders

1: 3/31

Herbst, D., & Mas, A. (2015). Peer effects on worker output in the laboratory generalize to the field. *Science*, 350 (6260), 545-549.

Godinho de Matos, M., Ferreira, P., & Belo, R. (2015). The ego or the group: Evidence from a randomized experiment. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2591671

2: 4/7

Kim, D. A., Hwang, A. R., Stafford, D., Hughes, D. A., O'Malley, A. J., Fowler, J. H., & Christakis, N. A. (2015). Social network targeting to maximise population behaviour change: A cluster randomised controlled trial. *The Lancet*.

Zhang, J., Brackbill, D., Yang, S., & Centola, D. (2015). Efficacy and causal mechanism of an online social media intervention to increase physical activity: Results of a randomized controlled trial. *Preventive Medicine Reports*, 2, 651-657.

3: 4/14

Bernstein, S., Korteweg, A. G., & Laws, K. (2016). Attracting early stage investors: Evidence from a randomized field experiment. To appear in *Journal of Finance*.

Nosko, C., Blake, T., & Tadelis, S.. (2015). Consumer heterogeneity and paid search effectiveness: A large scale field experiment. *Econometrica* 83(1), 155-174.

4: 4/21

Goldstein, N. J., Cialdini, R. B., & Griskevicius, V. (2008). A room with a viewpoint: Using social norms to motivate environmental conservation in hotels. *Journal of Consumer Research*, 35(3), 472-482.

Neal, D. T., Wood, W., Wu, M., & Kurlander, D. (2011). The pull of the past: When do habits persist despite conflict with motives?. *Personality and Social Psychology Bulletin*, 37(11), 1428-1437.

5: 4/28

Intro to bandit and contextual bandit problems (Dean).

Bottou et al. (2013). Counterfactual reasoning and learning systems: The example of computational advertising. *The Journal of Machine Learning Research*, 14(1), 3207-3260.

Also see recorded talk: <https://www.youtube.com/watch?v=6NDAt0ggFfU>

Urban, G. L., Liberali, G., MacDonald, E., Bordley, R., & Hauser, J. R. (2013). Morphing banner advertising. *Marketing Science*, 33(1), 27-46.

6: 5/5

Lewis, R. A., & Rao, J. M. (2015). The Unfavorable Economics of Measuring the Returns to Advertising. *The Quarterly Journal of Economics*, 130(4), 1941-1973.

Johnson, G. A., Lewis, R. A., & Nubbemeyer, E. I. (2015). Ghost Ads: Improving the Economics of Measuring Ad Effectiveness. http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=2620078

7: 5/12

Return to

Urban, G. L., Liberali, G., MacDonald, E., Bordley, R., & Hauser, J. R. (2013). Morphing banner advertising. *Marketing Science*, 33(1), 27-46.

Requirements

This section provides an overview of the main requirements of the course. More details about the requirements will be provided later.

Class participation (40%)

Attendance is required. Everyone's learning can benefit from informed discussion. After the first few sessions, students will have extra responsibility for particular experimental papers, for which

they will help guide the discussion. This will apply to approximately 6 to 8 of the class sessions. The number of people in the class will affect the nature of this requirement.

Paper (60%)

The recommended format for a term paper is a proposed experiment. The paper would detail the theoretical motivation, practical considerations, the design, and the proposed analysis, along with more methodological motivations for the specifics of this (e.g., power analysis). Students will write a short proposal for the term paper. Ideally, you actually want to run an experiment in this area. Alternatively, it might be that you want to conduct a related observational study, in which case thinking about the ideal, close-to-feasible experiment is quite useful (and you would perhaps have data to do good prospective power calculations with).

Paper proposal: Friday, March 18

Paper: Monday, May 9

Further guidelines and policies

I intend to follow all relevant policies. Let me know if you think I'm missing something.

MIT Sloan Values (<https://mysloan.mit.edu/offices/deans/values/Pages/default.aspx>)