Digital Business Experiments

Sagit Bar-Gill, TAU

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Before we jump right in...

- I’m an assistant prof at TAU’s Coller School of Management + digital fellow at MIT’s IDE
- My research: econ of online markets, the impacts of digitization on firms and consumers
- Currently teaching:
  - Doctoral seminar: Advanced topics in technology management and digital markets.
  - Introduction to business analytics (applied in R)
  - *Digital Business Experiments*
Course Outline

- ~13 * 1.5hr sessions
- Successfully adapted to a full day executive workshop

- Theory
  - 3 sessions

- Practice
  - 4-5 sessions

- Real World Applications
  - ~5 sessions

- Final Presentations
  - Final session
Course Outline

- ~13 * 1.5hr sessions
- Successfully adapted to a full day executive workshop

- 3 sessions
- Exec.: 1.5hr

- 4-5 sessions
- Exec.: 1.5hr demo, 2hr design + run, 2hr present+ discuss

- ~5 sessions

- Final session
Motivating example:

- [https://hbr.org/2010/12/while-he-was-at-amazon](https://hbr.org/2010/12/while-he-was-at-amazon)

Topics:

- Why do we need an experiments course in the Big Data program?
- Research question/business problem → research design
- Correlation ≠ causation, how to get from correlation to causation
- Controlled experiment → causality
- Validity: statistical, construct, internal, external
Statistical validity (I)

**Type I Error**
- False Positive
- You’re pregnant!

**Type II Error**
- False Negative
- You’re not pregnant!

**Allow 5% (α)**

**Power = prob. of finding effect when it exists (N, d, α)**
Statistical validity (II)

https://xkcd.com/882/
https://projects.fivethirtyeight.com/p-hacking/
Theory: Additional topics

- Statistical vs. economic significance
- Heterogeneous treatment effects
- Experiment types: lab, field, quasi-experiments → online?
  - https://www.youtube.com/watch?v=BiPm9Esx4DE
- Multi-armed bandits vs. A/B/n testing
Theory is simple!

Version B is better than version A.
“The difference between theory and practice is greater in practice than in theory”

Learning from Microsoft’s experience --

“Trustworthy Online Controlled Experiments: Five Puzzling Outcomes Explained” Ron Kohavi, Alex Deng, Brian Frasca, Roger Longbotham, Toby Walker, Ya Xu.
Vote on the winning variant →

We’re bad at evaluating our own ideas!

**Trustworthy** Online Controlled Experiments:
“Generating numbers is easy; generating numbers you should trust is hard!”
Bug in Bing experiment degraded search results...

...In that buggy experiment:

- Distinct queries per user ↑ (> +10%)
- Revenue per user ↑ (> +30%)

What happened?
What should be the OEC?
Bug in Bing experiment degraded search results...

In that buggy experiment:

- Distinct queries per user $\uparrow (> +10\%)$
- Revenue per user $\uparrow (> +30\%)$

Discussion:
Short run vs. long run
Puzzle V

- Experiment ➔ Impact on variables that are unrelated to the tested feature

- Experiment re-run ➔ Effects disappear!

What happened?
Experiment → Impact on variables that are unrelated to the tested feature

Experiment re-run → Effects disappear!

Beware of carryover effects + Run A/A tests!

Figure 9: Long Lasting (3 Months) Carryover Effects
Hands-On Practice

- 4-5 lab sessions
- Students work on projects
- Present in final session
Hands-On Practice

- 4-5 lab sessions

- Students work on projects

- Present in final session
Measuring social influence on Facebook:

- “Social influence in social advertising: Evidence from field experiments” (Bakshy, Eckles, Yan, Rosenn 2012)
- “Social advertising: How advertising that explicitly promotes social influence can backfire” (Tucker 2016)
- “Experimental evidence of massive-scale emotional contagion through social networks” (Kramer, Guillory, Hancock 2014)
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  - → Ethics in tech!
The ROI of Online Advertising:

- “I know half the money I spend on advertising is wasted, but I can never find out which half.” (John Wannamaker) → Experiment!
- “Consumer heterogeneity and paid search effectiveness: a large scale field experiments” (Blake, Nosko and Tadelis 2015)
- “Ghost Ads: Improving the economics of measuring online ad effectiveness” (Johnson, Lewis and Nubbemeyer 2017)
More Digital Experiments

- “The search engine manipulation effect (SEME) and its possible impact on the outcomes of elections (Epstein and Robertson 2015).

- “Mobile Targeting Using Customer Trajectory Patterns” (Ghose, Li, and Liu 2019)

- More –

Hands-On Practice: Demo

https://www.qualtrics.com/
Hands-On Practice: Extensions

Online lab experiments

Action learning components:
- Design
- QA
- Participate
- Analyze
- Present
Hands-On Practice: Extensions

Online lab experiments

Action learning components:
- Design
- QA
- Participate
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- Present
Hands-On Practice: Extensions

Online lab experiments
- Quick Start
- qualtrics
  - Participate
- Google Sites
  - Analyze
- weebly
  - Present

Online field experiments
- qualtrics
- Google Analytics
- weebly
- Google Optimize
- Google Analytics

Action learning components:
- Design
- QA
- Participate
- Analyze
- Present
Hands-On Practice: Extensions

Online lab experiments
- Quick Start
- Google Sites
- Weebly
- Qualtrics
- Google Analytics

Online field experiments
- Google Optimize
- Weebly
- Qualtrics
- Google Analytics

More tools:
- Amazon Mechanical Turk
- Facebook
- R
Sample exam questions

- Design an experiment to answer the following question:
  - Does content contribution increase monetary donations?
  - Do search engines affect piracy?

- You own an e-commerce site active in England, US, Canada, and Australia (local url in each country). Dev team has developed a new recommendation system, and you need to decide whether or not to replace the existing system with the new one.
  - PR concerns / no PR concerns

- What is the impact of fake news on political opinions?
  - Suppose you own Facebook. How would you use FB to answer this question?
Thank you

Sagit Bar-Gill
Tel Aviv University
sagitb@tauex.tau.ac.il
sإبريد at mit.edu
tau.ac.il/~sagitb