Digital Business Experiments

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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
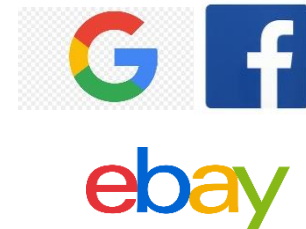
- Successfully adapted to a full day executive workshop

Theory	Practice	Real World Applications	Final Presentations

- 3 sessions
- 4-5 sessions
- ~5 sessions
- Final session

Course Outline

- ~13 * 1.5hr sessions

- Successfully adapted to a full day executive workshop

Theory → Practice → Real World Applications → Final Presentations

- 3 sessions
- Exec.: 1.5hr

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

- ~5 sessions
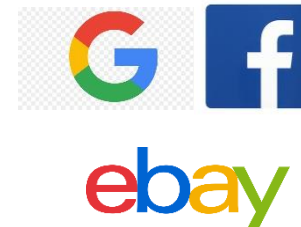
- Final session

Part I: Theory

- Motivating example:

  - http://glinden.blogspot.com/2006/04/early-amazon-shopping-cart.html

  - 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

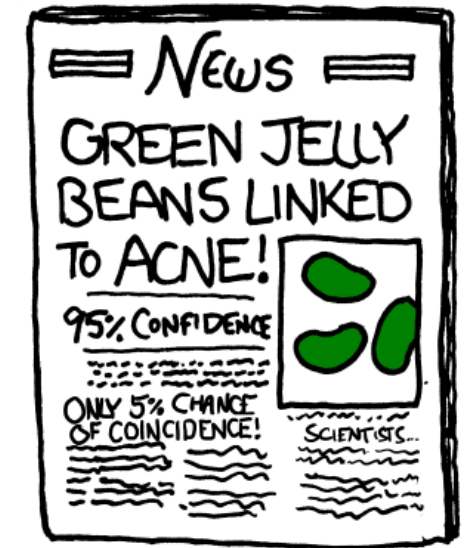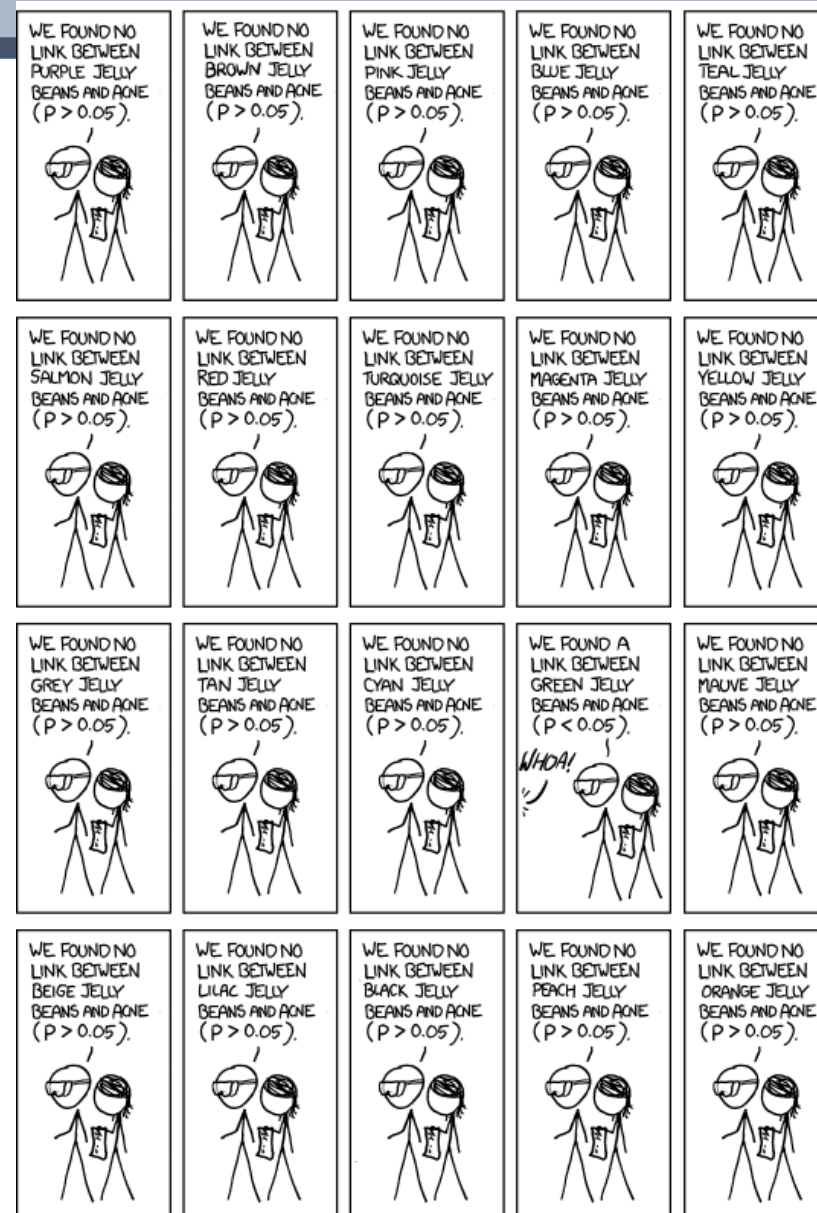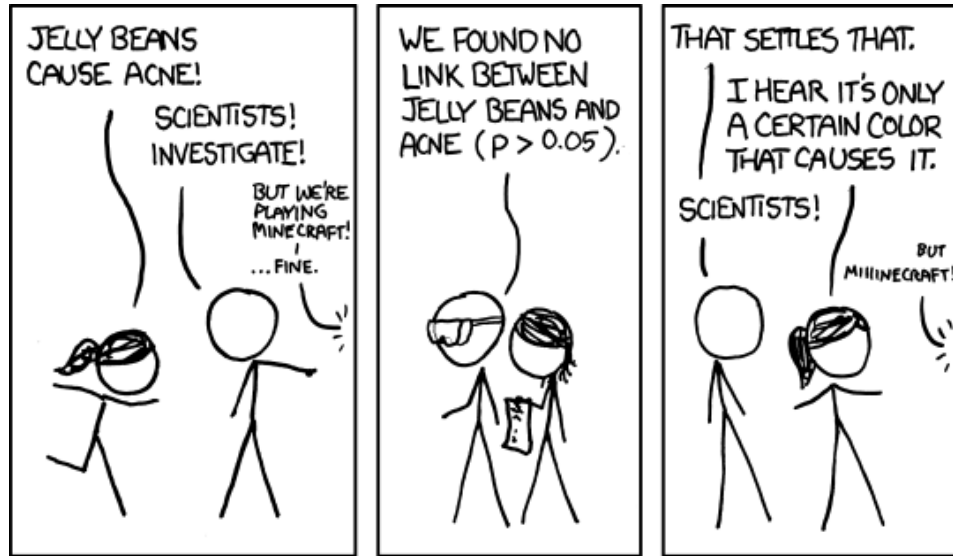You're pregnant!

Allow 5% (α)

Type II Error
False Negative

You're not pregnant!

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

amazon mechanical turk

EXPLORATION
Playing the other machines to see if any pay out more.

EXPLOITATION
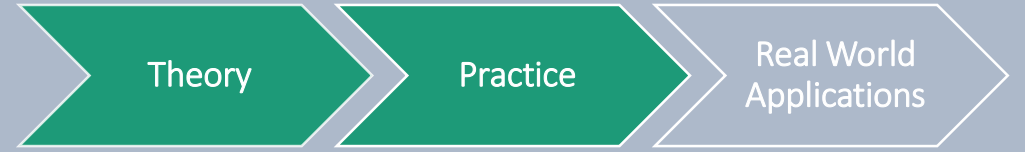Playing the machine that (currently) pays out the most.

Theory is simple!

Visitors randomly distributed

version *a*

version *b*

Page Title

News Block | Singup Form

Content Body

Nav. Bar

Nav. Bar

Content Body

Singup Form | News Block

Page Title

50 signups

75 signups
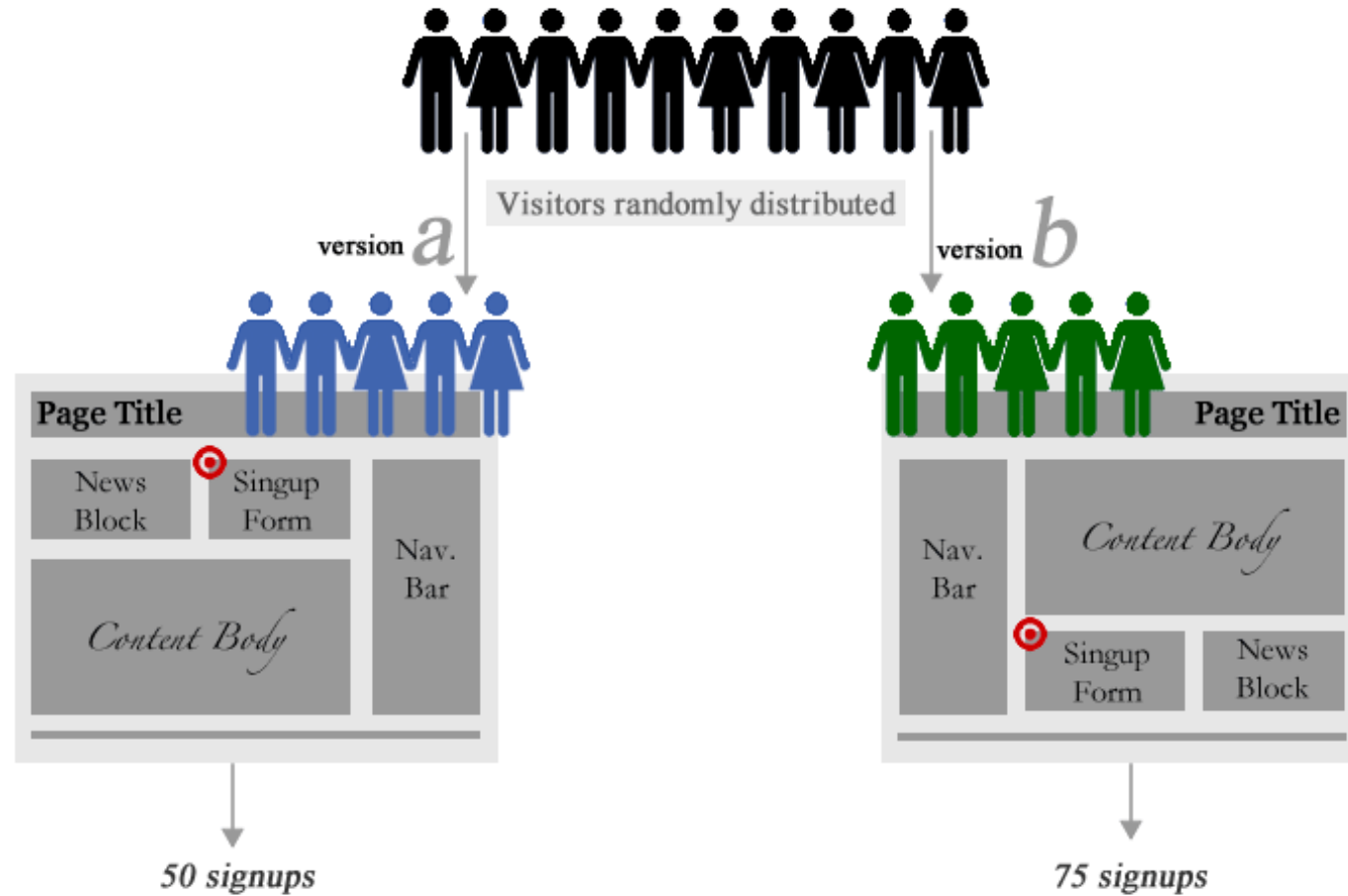
Version B is better than version A

From theory to practice...

"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.
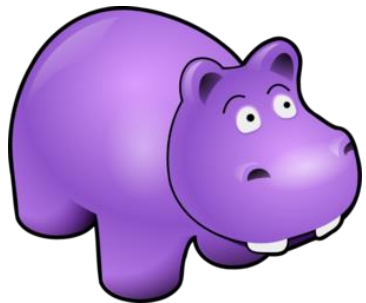
From theory to practice…

- 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!"

Control

Treatment1

Treatment 2

Treatment 3

Treatment 4

Treatment 5

Puzzle I

- 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?

Puzzle I
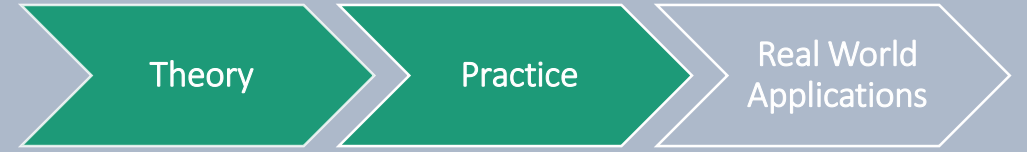
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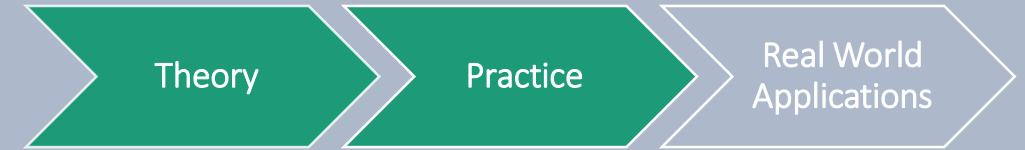
Discussion:

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?

Puzzle V

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

- Experiment re-run → Effects disappear!

A/A   **A/B**   **A/A**
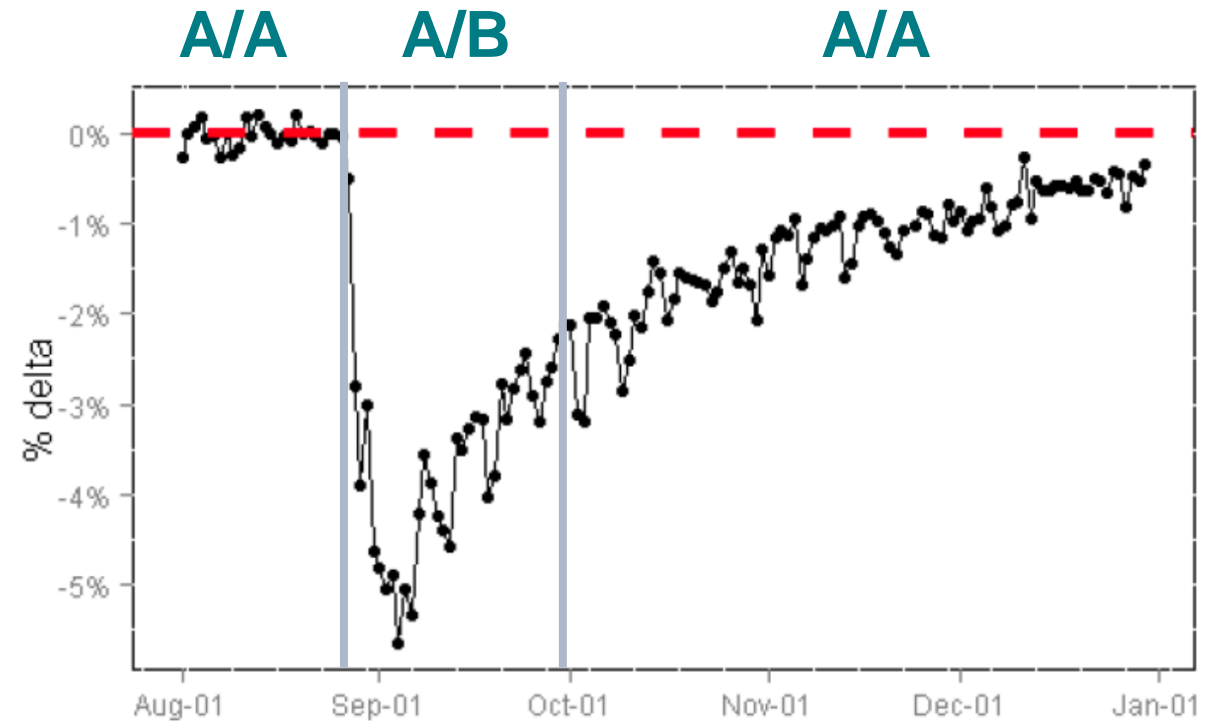
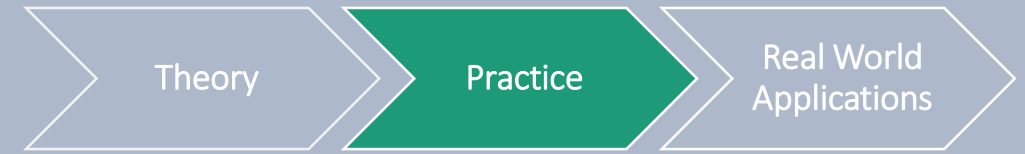Beware of carryover effects +

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

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Theory → Practice → **Real World Applications**

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!
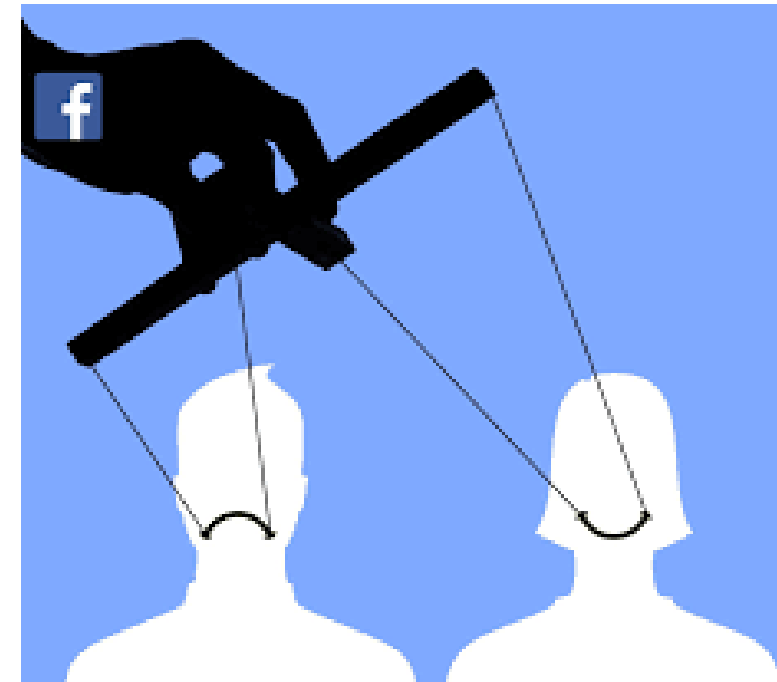
Digital Business Experiments

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)

  - https://www.thinkwithgoogle.com/intl/en-gb/marketing-resources/data-measurement/a-revolution-in-measuring-ad-effectiveness/

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 –

CODE@MIT

http://ide.mit.edu/events/2018-conference-digital-experimentation-code-0

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

Google Sites
weebly

qualtrics XM

qualtrics XM
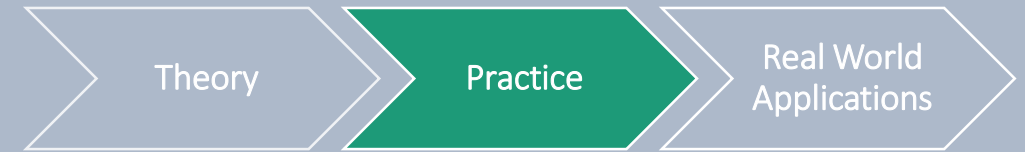
Google Analytics

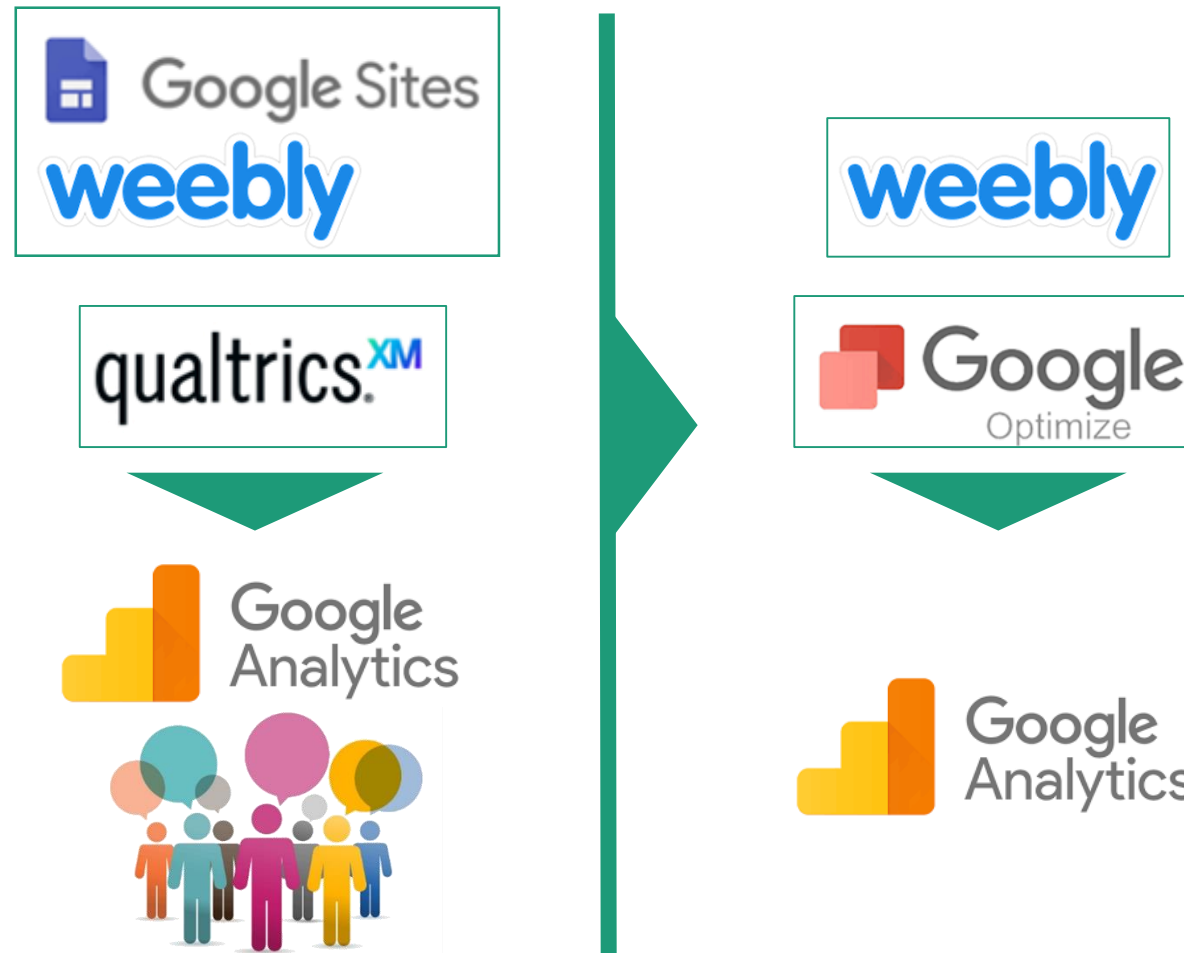Action learning components:

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Hands-On Practice: Extensions

Online lab experiments

Online field experiments

Action learning components:

Design
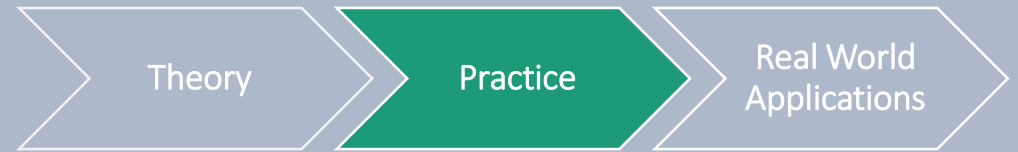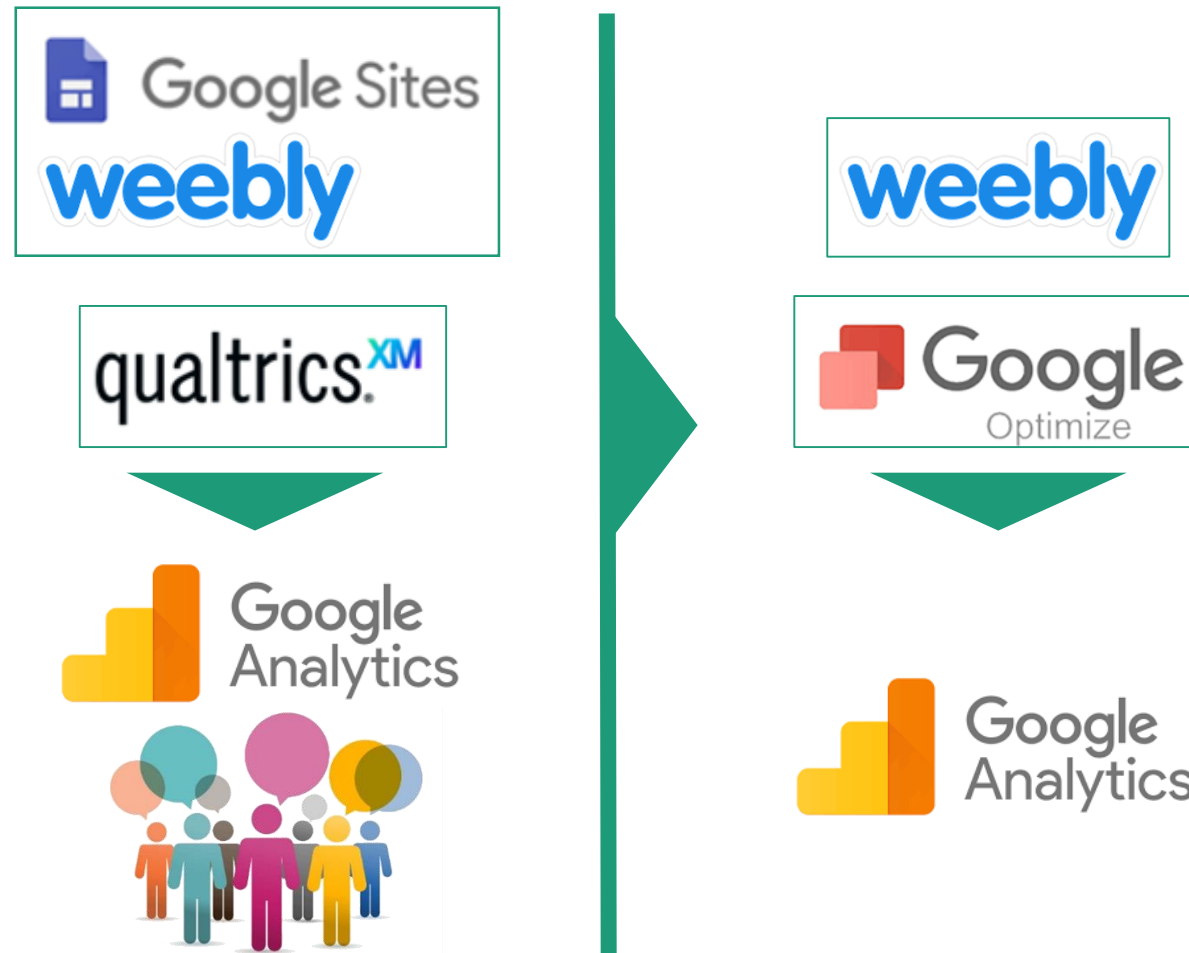
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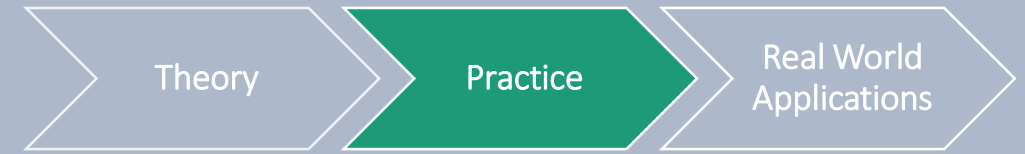
Hands-On Practice: Extensions

Online lab experiments

Online field experiments

More tools:

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

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