Case Background

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Class 11 Case Study: Improve User Engagement on Social Media Platforms

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November 8, 2023

Case Background

A/B Testing for Twitter

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Section 1

Procedures of A/B Testings

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Motivating Example with Tom's Loyalty Program

- Tom is considering whether or not to introduce a loyalty program for his bubble tea business. This decision is essentially a cost-benefit analysis
 - Cost: it takes money and time to develop the loyalty program
 - Benefit: it may increase spending and retention rate, and hence future CLV
- Cost can be estimated through budgeting, but how to estimate the benefit from introducing LP?

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Step 1: Decide on the Unit of Randomization

We decide **the granularity of randomization unit** based on the research question at hand.

- individual (often chosen)
- household
- store
- others even more granular (e.g., device level) or even less granular (e.g., city level)

Step 1: Decide on the Unit of Randomization

Proposal 1: Randomize the loyalty program to West London and East London.

• Do you expect the "randomize" to be true randomization?¹

Proposal 2: Randomize the loyalty program among individual customers.

- Is this true randomization?
- What problems can we still have?

 $^{^1}$ All answers to questions in the slides are on the webpage version of lecture notes: $_{-+}$ \equiv $_{--}$ \sim $_{-}$ \sim \sim \sim

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Step 1: Pros and Cons of Granularity

Disadvantages of granularity:

- Costs and logistics
- Spillovers and crossovers

Advantages of granularity:

• Increase the chance of successful randomization, thereby mitigating any systematic unbalance of covariates before the experiment.

Exercise:

• How can we randomize individualized price discounts to customers?

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Step 2: Mitigate Spillover and Crossover Effects

- **Crossover Effects**: A crossover occurs when an individual who was supposed to be assigned to one treatment is accidentally exposed to another or more treatments.
 - e.g., For online A/B testing, a notorious crossover effect is that when browsers reset the cookies, the same individual customer may be treated as a different new customer.
- **Spillover effects**: The behavior of the treatment group can affect control group as well
 - e.g., customers may share the promotions with family members and friends.

Question: How should Tom mitigate spillover and crossover effects?

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Step 3: Decide on Randomization Allocation Scheme

- Individuals (or the relevant unit of randomization) are allocated at random into a treatment condition based on some decision rules.
- Due to the high costs and potential risks of A/B testing, we often select a small percentage of customers into the treatment condition, while the remaining customer should do "business-as-usual".

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Step 4: Collect Data

- Any field experiment should be aware of the need for a sufficiently large sample size, or sufficient statistical power.
 - The larger sample size, the higher statistical power for the experiment; meanwhile, larger sample size brings higher costs and risks.
 - Run a power calculation in R
- Collect both data on the outcome variables of interest and consumer characteristics data

Proposal: We need to collect customers' retention rate data and link the retention data with their treatment assignment.

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Step 5: Interpreting Results from a Field Experiment

Step 5.1: Randomization check

• We need to check if the treatment group and control group are well-balanced in terms of their **pre-treatment** characteristics, especially the outcome variables.

Step 5.2: Analyze the data and estimate the ATE

- t-test to examine the difference in the average outcome between the treatment group and control group. In R, we can use t.test()
- **Regression analysis** when analyzing A/B/N testing or multivariate experiments.

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Situation Analysis

- Business model of Twitter, and other social media platforms in general?
- How does Twitter make money?
- Who are Twitter's customers?
- Who are the collaborators of Twitter?
- Who are Twitter's direct and indirect competitors?
- Which PESTLE factors should we focus on?

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Business Objective

[...] we are going to draw upon **social comparison theory** and **gamification** to help Twitter further improve its user engagement in its newly introduced feature called "Communities" on the platform. "Communities" is a twitter feature that aims to enrich user engagement by catering to specific interests and subjects. These Communities offer users a dedicated space to convene around shared topics of interest, spanning domains such as celebrity fandoms, movie enthusiasts, and various hobbies.

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Theoretical Motivation

When proposing business ideas, we should base our proposals on scientific, well-established theories from different disciplines such as Psychology and Behavioral Economics:

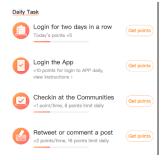
- Social comparison theory (Twitter's case study)
- Framing effect
- Prospect theory
- Bandwagon effect

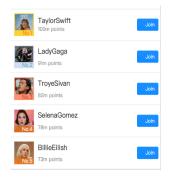
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Business Proposal

• We propose to implement a leaderboard to rank different communities based on points based on **Gamification Theory** and **Social Comparison Theory**.





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Section 3

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Step 1: Decide on the Unit of Randomization

• What would be the best unit of randomization?

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Step 2: Mitigate Spillover and Crossover Effects

• What are the potential problems for spillover and crossover?

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Step 3: Decide on Randomization Allocation Scheme

• How should we determine the randomization scheme?

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Step 4: Collect Data

- What is the sample size we need?
- What data should we collect?

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Step 5: Data analytics

- Randomization checks
- How to estimate the treatment effects?