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

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Section 1

Procedures of A/B Testings

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)

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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?

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[1]All answers to questions in the slides are on the webpage version of lecture notes.

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?

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?

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".

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.

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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Section 2

Case Background

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?

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.
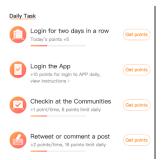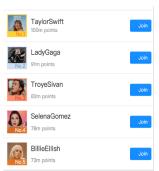
Theoretical Motivation

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

Business Proposal

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

Section 3

A/B Testing for Twitter

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?

Step 5: Data analytics

- Randomization checks
- How to estimate the treatment effects?