Experiments in Marketing Research

(Check icon for audio)
Criteria for Establishing Causal Relationships

- Concomitant variation
- Temporal ordering of variables
- Control over other possible causal factors
Preliminary Definitions: Independent Variable

- Experimenter controlled variable
- Value can be manipulated by experimenters to whatever they wish it to be
Dependent Variable

- Value should depend on experimenter’s manipulation
- Criterion or standard by which results are judged
Test Units

Subjects or entities whose response to the experimental treatment are measured or observed.
What is an Experiment?

• Research study under controlled conditions
• At least one independent variable is manipulated
• Its effect on at least one dependent variable is measured
• Purpose: To test hypothesis
Basic Experimental Design Issues

- Manipulation of independent variable
- Selection of dependent variable
- Assignment of subjects (or other test units) to treatments/conditions
- Control over extraneous variables
By Smiling or Looking Solemn, Experimenters Can Modify Subjects’ Behavior
How Can Experimenters Control for Extraneous Variation?

- Hold Conditions Constant
- Randomization
- Matching Subjects
- Blinding
- Presentation Order
Control Groups

Isolate extraneous variation
Erroneous Inferences Caused by Lack of Control

**Case A**
- **Z**
- **X**
- **Y**

Erroneous inference: $X$ has a positive influence on $Y$

**Case B**
- **Z**
- **X**
- **Y**

Erroneous inference: $X$ has no influence on $Y$

**Case C**
- **Z**
- **X**
- **Y**

Erroneous inference: $X$ is solely responsible for changes in $Y$
Field vs. Laboratory Experiment
Types of Research Environments

- **Laboratory**
  - Concept tests
  - Simulated test markets
  - Taste tests
  - Advertising copy testing
  - Video game or movie tests
  - Package tests

- **Field**
  - Store audits
  - Home use tests
  - Test markets (manual and scanner based)
  - On-air advertising testing
Artificiality of Laboratory vs. Field Experiments

Diagram:
- Laboratory experiments
- Artificial environmental setting
- Natural environmental setting
- Field experiments
Laboratory Experiment

- High Internal Validity
- Demand Artifacts Low
- Few Extraneous Variables
- High Control
- Low Cost
- Short Duration
- Subjects Aware of Participation
- Few Participants
- Easier to Do

Field Experiment

- High External Validity
- Demand Artifacts Low
- Many Extraneous Variables
- Low Control
- High Cost
- Long Duration
- Subjects Unaware of Participation
- Many Participants
- Harder to Do
Demand Artifact

Caused by experimental procedure that induces unnatural response by study participants

- Guinea pig effect
- Hawthorne effect
Internal Validity

• Ability of experiment to determine if the experimental treatment was the sole cause of changes in a dependent variable
• Did the manipulation do what it was supposed to do?
Threats to Internal Validity

- History
- Maturation
- Testing
- Instrumentation
- Selection bias
- Mortality
<table>
<thead>
<tr>
<th>Type of Extraneous Variable</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>History</strong> - Specific events in the environment between the Before and After measurement that are beyond the experimenter’s control</td>
<td>A major employer closes its plant in test market area</td>
</tr>
<tr>
<td><strong>Maturation</strong> - Subjects change during the course of the experiment</td>
<td>Subjects become tired</td>
</tr>
<tr>
<td><strong>Testing</strong> - The Before measure alerts or sensitizes subject to nature of experiment or second measure.</td>
<td>Questionnaire about the traditional role of women triggers enhanced awareness of women in an experiment.</td>
</tr>
<tr>
<td>Type of Extraneous Variable</td>
<td>Example</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Instrument</strong> - Changes in instrument result in response bias</td>
<td>New questions about women are interpreted differently from earlier questions.</td>
</tr>
<tr>
<td><strong>Selection</strong> - Sample selection error because of differential selection comparison groups</td>
<td>Control group and experimental group is self-selected group based on preference for soft drinks</td>
</tr>
<tr>
<td><strong>Mortality</strong> - Sample attrition; some subjects withdraw from experiment</td>
<td>Subjects in one group of a hair dying study marry rich widows and move to Florida</td>
</tr>
</tbody>
</table>
Unit Pricing Experiment
Types of Experimental Designs

- **Experimental Designs**
  - Pre-Experimental
    - One-Shot
      - Case Study
    - One Group
    - Pretest-Posttest
      - Static Group
  - True Experimental
    - Pretest-Posttest
      - Control Group
    - Posttest-Only
    - Control Group
    - Solomon
    - Four-Group
  - Quasi-Experimental
    - Time Series
      - Multiple
      - Time Series
  - Statistical
    - Randomized Blocks
    - Latin Square
    - Factorial Design
Sample Marketing Experiments Using Different Experimental Designs
Beer Branding: Example of Before and After Without Control Design

The purpose of this experiment was to measure the effect of brand labeling upon consumer beer preferences.

Explanatory Variables (Brand Labeling of Beer)  →  Test Units (Male Beer Drinkers)  →  Dependent Variable (Preference Rating Scale)

Model of Experiment

The test group was 326 males who drank beer at least three times a week. Five different brands of beer were tested. Each participant was given a six-pack of unlabeled beer. One week later, a new six pack of labeled beer was given to the test group. Each bottle of beer was rated by the participants using a preference scale.

Test Groups

Preference Rating For Unlabeled Beer ($Y_1$)  →  Preference Rating for Labeled Beer ($Y_2$)

Treatment effect = ($Y_2 - Y_1$)

The preference rating results were:

<table>
<thead>
<tr>
<th>Brand</th>
<th>Unlabeled Beer Preferences</th>
<th>Labeled Beer Preferences</th>
<th>Treatment Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>65</td>
<td>71</td>
<td>+ 6</td>
</tr>
<tr>
<td>B</td>
<td>64</td>
<td>73</td>
<td>+ 9</td>
</tr>
<tr>
<td>C</td>
<td>63</td>
<td>68</td>
<td>+ 5</td>
</tr>
<tr>
<td>D</td>
<td>63</td>
<td>77</td>
<td>+14</td>
</tr>
<tr>
<td>E</td>
<td>63</td>
<td>67</td>
<td>+ 4</td>
</tr>
</tbody>
</table>

The test results show that all five labeled brands were rated higher than the same products without a brand label.
Product Line Modification: Example of Before-and-After With Control Design

The purpose of this experiment was to measure the effect on profits of dropping unprofitable products from the total product line.

![Diagram of experiment model]

Model of Experiment

Two sales territories were randomly selected as experimental and control territories. In the experimental territory, 592 unprofitable items were eliminated from the original product line of 875 items. No product changes were made in the control territory. The profit contribution of each territory was measured for 18 months before and after eliminating the unprofitable items.

Experimental Territories

- Profit Contribution Before Change ($Y_1$)
- Profit Contribution After Elimination of Unprofitable Items ($Y_2$)

Control Territories

- Profit Contribution Before Change ($X_1$)
- Profit Contribution After No Change ($X_2$)

Treatment effects = ($Y_2 - Y_1) - (X_2 - X_1$)

The experimental results were:

<table>
<thead>
<tr>
<th>Test Units</th>
<th>Profit Contribution Before Change (%)</th>
<th>Profit Contribution After Change (%)</th>
<th>Change (%)</th>
<th>Treatment Effect (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Territories</td>
<td>100.0</td>
<td>123.4</td>
<td>+23.4</td>
<td>+23.9</td>
</tr>
<tr>
<td>Control Territories</td>
<td>100.0</td>
<td>99.5</td>
<td>−.5</td>
<td></td>
</tr>
</tbody>
</table>

The experimental results indicated an increase of almost 24 percent in profit contributions when the unprofitable products were eliminated. Consequently, the unprofitable products were eliminated in all sales territories.
Impact of TV Commercials: Example of After-Only With Control Design

The purpose of this experiment was to measure the effectiveness of two different TV commercials.

Three different group of shoppers were interviewed in a shopping center just before entering a large Los Angeles supermarket. Two of the groups then viewed certain TV commercials which included one advertisement in each group for the product which was to be evaluated. All three groups were given a gift packet of ten different cent-off coupons redeemable for various items that the supermarket carried, including the test product. All three groups of shoppers were randomly selected, so the sales redemption rate of coupons in the supermarket was assumed to measure the effectiveness of the two different commercials.

The actual sales redemption rates were:

<table>
<thead>
<tr>
<th>Test Units</th>
<th>Sales Redemption Rate</th>
<th>Treatment Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group</td>
<td>14.5%</td>
<td></td>
</tr>
<tr>
<td>Test Group 1</td>
<td>21.7</td>
<td>+7.2%</td>
</tr>
<tr>
<td>Test Group 2</td>
<td>30.0</td>
<td>+15.5</td>
</tr>
</tbody>
</table>

The experimental results showed that both TV commercials increased the sales redemption rate, but that the second commercial was the more effective of the two.
The Price-Quality Relationship:
Example of Completely Randomized Design

The purpose of this experiment was to measure the effect of different prices upon perception of quality of a soft drink concentrate. The experimental model was

![Diagram showing the relationship between Explanatory Variables, Test Units (Students), and Dependent Variables (Quality Ratings).]

There were 235 students randomly assigned to the eight treatments. Each student tasted the concentrate (which was identical in every respect except the price tag for all treatments), and rated the product on a seven-point quality rating scale. The mean quality rating for each treatment was:

<table>
<thead>
<tr>
<th>Price</th>
<th>Treatment</th>
<th>Mean Quality Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>29¢</td>
<td>$T_1$</td>
<td>3.74</td>
</tr>
<tr>
<td>39</td>
<td>$T_2$</td>
<td>4.29</td>
</tr>
<tr>
<td>49</td>
<td>$T_3$</td>
<td>3.81</td>
</tr>
<tr>
<td>59</td>
<td>$T_4$</td>
<td>4.54</td>
</tr>
<tr>
<td>69</td>
<td>$T_5$</td>
<td>4.21</td>
</tr>
<tr>
<td>79</td>
<td>$T_6$</td>
<td>3.52</td>
</tr>
<tr>
<td>89</td>
<td>$T_7$</td>
<td>3.13</td>
</tr>
<tr>
<td>No price given</td>
<td>$T_8$</td>
<td>3.00</td>
</tr>
</tbody>
</table>

The results show that there was a nonlinear relationship between price and perceived quality of a soft drink concentrate, at least in this experiment.
The Shelf Space Study: Example of a Randomized Block Design

The purpose of this experiment was to measure the effect of shelf space upon the sale of branded products. Here is the experimental model:

Explanatory Variables (Shelf Spaces of Branded Products) → Test Units (Six Supermarkets) → Dependent Variables (Unit Sales)

The three treatments were:

- Treatment $T_1 = \frac{1}{3}$ of total available shelf space
- Treatment $T_2 = \frac{1}{2}$ of total available shelf space
- Treatment $T_3 = \frac{2}{3}$ of total available shelf space

The four different branded products tested were Morton and Food Club salt and Coffeeemate and Creamora powdered coffee cream.

Unit sales of these four branded products were measured in six supermarkets over a period of three weeks.

The random allocation of treatments for Morton salt was as follows. (Note that each block received all three treatments in some order during the experiment):

<table>
<thead>
<tr>
<th>Weeks</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store No. 1</td>
<td>$T_1$</td>
<td>$T_3$</td>
<td>$T_2$</td>
</tr>
<tr>
<td>(Blocks) 2</td>
<td>$T_1$</td>
<td>$T_3$</td>
<td>$T_2$</td>
</tr>
<tr>
<td>3</td>
<td>$T_2$</td>
<td>$T_1$</td>
<td>$T_3$</td>
</tr>
<tr>
<td>4</td>
<td>$T_2$</td>
<td>$T_1$</td>
<td>$T_3$</td>
</tr>
<tr>
<td>5</td>
<td>$T_3$</td>
<td>$T_1$</td>
<td>$T_2$</td>
</tr>
<tr>
<td>6</td>
<td>$T_3$</td>
<td>$T_2$</td>
<td>$T_1$</td>
</tr>
</tbody>
</table>

Similar random allocation of treatments was made for the other three branded products. Sales results of Morton salt were:

- Treatment $T_1 = 672$
- Treatment $T_2 = 639$
- Treatment $T_3 = 675$

The experimental result indicated that differences in sales attributable to the three shelf-space treatments for Morton salt were not great.
Testing Promotional Programs: Example of Latin Square Design

The purpose of this experiment was to measure the effect of alternative promotions upon the sale of pears.

The five promotion treatments were:

- **Treatment $T_1$** — Special point-of-purchase displays
- **Treatment $T_2$** — Store demonstrations
- **Treatment $T_3$** — Dealer contests
- **Treatment $T_4$** — Media advertising program
- **Treatment $T_5$** — No promotion (control)

The average sales of pears was measured in five cities, with 15 supermarkets selected as test units in each city. The random assignment of treatments in this latin square design was:

<table>
<thead>
<tr>
<th>Time Periods</th>
<th>Cleveland</th>
<th>Baltimore</th>
<th>Milwaukee</th>
<th>Houston</th>
<th>Atlanta</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$T_1$</td>
<td>$T_5$</td>
<td>$T_4$</td>
<td>$T_2$</td>
<td>$T_3$</td>
</tr>
<tr>
<td>2</td>
<td>$T_2$</td>
<td>$T_3$</td>
<td>$T_5$</td>
<td>$T_1$</td>
<td>$T_4$</td>
</tr>
<tr>
<td>3</td>
<td>$T_5$</td>
<td>$T_2$</td>
<td>$T_3$</td>
<td>$T_4$</td>
<td>$T_1$</td>
</tr>
<tr>
<td>4</td>
<td>$T_4$</td>
<td>$T_1$</td>
<td>$T_2$</td>
<td>$T_3$</td>
<td>$T_5$</td>
</tr>
<tr>
<td>5</td>
<td>$T_3$</td>
<td>$T_4$</td>
<td>$T_1$</td>
<td>$T_5$</td>
<td>$T_2$</td>
</tr>
</tbody>
</table>

Sales results were:

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Average Sales per Store per Week (pounds)</th>
<th>Percent change from No Promotion</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Special point-of-purchase</td>
<td>227</td>
<td>-12.7</td>
</tr>
<tr>
<td>(2) Store demonstrations</td>
<td>323</td>
<td>24.2</td>
</tr>
<tr>
<td>(3) Dealer contests</td>
<td>317</td>
<td>21.9</td>
</tr>
<tr>
<td>(4) Media advertising</td>
<td>225</td>
<td>-13.5</td>
</tr>
<tr>
<td>(5) No promotion</td>
<td>260</td>
<td></td>
</tr>
</tbody>
</table>

The experimental results showed that store demonstrations and dealer contests were the most effective promotional techniques for selling winter pears.
Diagram for the Time Series Quasi Design

EG: \( O_1 \rightarrow O_2 \rightarrow O_3 \rightarrow O_4 \rightarrow O_5 \rightarrow X \rightarrow O_6 \rightarrow O_7 \rightarrow O_8 \rightarrow O_9 \rightarrow O_{10} \rightarrow O_{11} \)

- Preexposure monthly measurement of:
  - Brand awareness
  - Consumer perceptions
  - Usage

- New competitive diet chewing gum hits the market

- Postexposure monthly measurement of:
  - Brand awareness
  - Consumer perceptions
  - Usage
Test Marketing
Test Market

Field test of a new product or marketing mix element(s) of a current product using experimental or quasi-experimental designs
Uses and Objectives

• Estimate market shares and volumes
• Estimate cannibalization rate on existing product line
• Collect classification data on potential customers
• Analyze competitor reactions
Benefits and Disadvantages

Benefits

• Estimate sales potential under realistic conditions
• Find and correct weaknesses in marketing mix

Disadvantages

• Costs
• Tipping hand to competitors
What to Consider

• Tradeoff of costs and risk of product failure versus potential profits and probability of success
• Speed of competitor response
• Cost to produce product for test market
• Impact of failure on company reputation
Cost of Two-Market Test

Direct costs: $500,000
- POP materials, coupons, samples, syndicated research, media time/space, ad agency payments, initially high trade allowances

Indirect costs
- Management time, diversion from current products, negative internal/external impact of test failure, etc.
Steps in Test Market Study

1. Define objectives
   - Estimate market share, purchase frequency, cannibalization rates
   - Discover who buys product and where

2. Select testing approach
   - Standard
   - Simulated (mall testing facility)
   - Controlled test market (e.g., BehaviorScan)
Steps in Test Market Study

3. Develop marketing plan
4. Select test markets
   • Should reflect regional differences if important, but have similar demographics and little media spillover from/to other markets
   • Avoid over-tested and idiosyncratic markets
## Criteria For the Selection of Test Markets

Test markets should:

1. be large enough to produce meaningful projections: they should contain at least 2 percent of the potential actual population.
2. be representative demographically.
3. be representative with respect to product consumption behavior.
4. be representative with respect to media usage.
5. be representative with respect to competition.
6. be relatively isolated in terms of media and physical distribution.
7. have normal historical development in the product class.
8. have marketing research and auditing services available.
9. not be overtested.
Steps in Test Market Study

5. Run test markets
   • Sales estimates take 6-12 months because initial estimates of repeat purchases high

6. Analyze results
   • Check purchase data (i.e., trial versus repeat purchases), awareness data, competitive response, and sales of all similar products