Experiments

Powerful tool of causal research

Experiments

Method of inferring causality

- The manipulation of an independent variable and measuring its effect on another under controlled conditions

Experiments

Main design issues

- How to manipulate the independent variable(s)
- How to choose the dependent variable
- How to assign test units
- How to control extraneous variables

Independent variable

Cause

- It is called independent because the researcher can decide on its value. It is also known as the experimental treatment

Independent variable

Types and levels

- Independent variable may be
  - Categorical (which ad layout)
  - Continuous (which price level)
- Experimental treatment may include multiple forms of the independent variable, like:
  - Different prices
  - Different prices and different gifts

Dependent variable

Effect

- Also known as the measurement
- We expect its value to be dependent on the treatments
- Measurements of the dependent variable allow the researcher to judge the experimental results

Test units

Subjects of the experiment

- Researcher measures the responses of the test units to the experimental treatment using appropriate tools such as surveys or observation

Test units

Selection and assignment

- Selection method affects the error level
- To reduce error, the researcher may
  - Randomly select and assign elements
  - Match the units on important variables
  - Take repeated measures to expose all units to all levels of treatment

Control

The environment must be controlled

- Systematic error that may enter the study must be controlled so that the results can be attributed to the experimental treatment

Control

Demand characteristics

- Procedures that intentionally hint to subjects something about the experimenter's hypothesis
- Experimental units may behave differently because
  - The presence of the experimenter may affect their behavior (experimenter bias) resulting in guinea pig effect
  - To reduce this, blinding may be used

Experiments

- Important concepts in experiments
  - Independent variable (experimental treatment, cause)
  - Dependent variable (effect)
  - Extraneous effects (contaminants)
  - Experimental group (exposed to the treatment)
  - Control group (not exposed to the treatment)
  - Randomization (random selection of elements)
  - Validity (internal or external)

Experiments

Concept of validity

- An experiment is valid if it:
  - Measures the effects of the independent variable (internal validity)
  - Its results can be applied to the world outside the experiment (external validity)

Experiments

- Threats to internal validity
  - History, changes in the environment
  - Maturation, changes in units
  - Mortality, losing units
  - Selection bias, nonrandom selection
  - Testing, effect of measurement
  - Instrumentation, changes in the instrument

Experiments

- Frame error in selecting the sample

  No longer a representative sample. Improper definition of the operational population

- Unnatural nature of the experimental environment

  Will they behave the same way in the real world as they have behaved in the laboratory?

Experiments

- Laboratory experiments

  Experiments that take place in controlled environments

- Field experiments

  Experiments that take place in their natural environments

Experiments

- Issues of validity

	Validity	
Experiment	***Internal***	***External***
Laboratory	***High***	***Low***
Field	***Low***	***High***

Experimental design

Notation to describe designs

O A measurement of a dependent variable

X The experimental treatment, independent variable

R Randomization

E Experimental effect

Horizontal placement of symbols signify time sequence

Vertical placement of symbols signify different groups

Experimental design

Quasi experimental designs

- Quasi experimental designs do not use randomization. Consequently, their conclusions are not as robust as real experimental designs

Experimental design

Quasi experimental designs

- After only design
  - X O_1

    $E = O_1$
  - The observed result is presumed to be the effect of the experimental treatment
  - The design is flawed

Experimental design

Quasi-experimental designs

- Static group design
  - EG: X O_1
  - CG: O_2

    $E = (O_2 - O_1)$
  - The difference between the two measurements is presumed to be the effect of the experimental treatment
  - This design too is flawed

Experimental design

Quasi-experimental designs

- One group, before-after design pretest-posttest)
  - O_1 X O_2

    $E = O_2 - O_1$
  - The difference between measurements taken before and after the introduction of the experimental treatment is presumed to be the effect of the experimental treatment
  - Another flawed design

Experimental design

Quasi experimental designs

- Before-after with control group
  - EG: O_1 X O_2
  - CG: O_3 O_4

    $E = (O_2 - O_1) - (O_4 - O_3)$
  - The attempt to control the effects of external elements fails due to lack of randomization

Experimental design

True experimental designs

- True experimental designs require randomization. Elements are randomly selected and randomly assigned to test and control groups.

Experimental design

True experimental designs

- Posttest only with control group
  - EG: (R) X O_1
  - CG: (R) O_2

    $E = (O_2 - O_1)$
  - Decent attempt to create a true experimental design
  - Conditions before the introduction of the treatment are unknown

Experimental design

True experimental designs

- Before after with control group and randomization
  - EG: (R) O_1 X O_2
  - CG: (R) O_3 O_4

    $E = (O_2 - O_1) - (O_4 - O_3)$
  - Many of the external factors are controlled

Experimental design

True experimental designs

- Solomon four-group, six-study design
  - EG I (R) O_1 X O_2
  - CG I (R) O_3 O_4
  - EG II (R) X O_5
  - CG II (R) O_6

Highly complex and expensive design for most marketing research studies

Test marketing

A field experiment

- Test marketing is an experimental procedure that provides an opportunity to test a new product or a new marketing plan under realistic market conditions to measure sales or profit potential

Test marketing

Criteria used in selecting a suitable site

- Population size
- Demographic composition
- Lifestyle considerations
- Competitive situation
- Media
- Self-contained trading area
- Secrecy

Test marketing

Controlling the experiment

- Small city
- Low chance of being detected
- Distribution is forced (guaranteed)