Factorial Design

- Two or more independent variables
- Simplest case: a 2 x 2 design (2 factors and 2 conditions per factor)

A factorial design

- In a 2 x 2 factor design, you have 3 hypotheses:
  - (1) Hypothesis on the effect of factor 1
  - (2) Hypothesis on the effect of factor 2
  - (3) Interaction hypothesis: when the effect of one factor depends on the level of the other factor

Effect of Attraction x Emotion

- **Question:** How can the physical characteristics of a person influence judgments of how guilty you think a person is?
  - **Factor 1 Attractiveness:** Attractive vs. Unattractive
  - **Factor 2 facial expression:** neutral vs. smiling

Effect of Attraction x Emotion: Possible outcomes

- Interpretation?
- Blue line?
- Red line?
- Dark dashed line?
- What's missing from the graph?
- Lines graph: is this correct?

Effect of Attraction x Emotion: Possible outcomes

- Main effect (effect of one factor, averaged over all levels of the other factor): What is the effect of the facial expression?
- Interaction: when the effect of one factor depends on the level of the other factor
- Smiling reduces judgments of guiltiness is true only for the unattractive faces
Effect of Attraction x Emotion: Possible outcomes

• Conclusion:
  • An unattractive face is judged less guilty if it is smiling, but
  • an attractive face is judge less guilty if it has a neutral expression.

Method

• Factor 1: Type of change (3 levels)
  • Presence/absence
  • Color change
  • Location change

• Factor 2: Location of the change (2 levels)
  • Center of interest
  • Marginal interest

• Dependent variable: Number of alternations to detect the change

Control condition: no blank between the two images

Change Blindness’s paradigm

Figure removed due to copyright restrictions.

Rensink et al., 1997
Visual Search

- Most of researchers separate the analyses of target present and target absent (they do two different ANOVAs).
- e.g. For CogLab 2:
  - A within-subject ANOVA
    Target present: 2 factors (set size x type of feature)
    Another within-subject ANOVA
    Target absent: 2 factors (set size x type of feature)
  - Reaction Time
    Set size (# of items)
    - Inefficient search
    - Efficient search
    - "cost" intercept

The case of visual search
Coglab 2

- Single Feature
  - Factor 1: Target present or absent
  - Factor 2: Type of feature (single feature or conjunction)
  - Factor 3: Number of items (3 different set size of items)

  How do we proceed?
  - It all depends of your hypotheses and the factors you manipulate in the experiments.
Visual search in real scenes: 
The role of clutter

Set size or "clutter"

Figures removed due to copyright restrictions.

Visual search: 
the role of viewpoint

Figures removed due to copyright restrictions.

Visual search: Faces
Is it easy to find an happy face among angry faces or an angry face among happy faces?

Happy group  Angry group

A factorial design
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Interaction effects: Implicit and Explicit memory tests
• Textbook: chapter 12: Factorial Designs
• Background:
  • Explicit memory measures are those that require a person to consciously recollect the materials that she/he studied during an earlier part of the experiment
  • Implicit memory test: tasks that can be performed without specific reference to the previous experiences in the lab.

Recall Tasks

Figure removed due to copyright restrictions.
Implicit Memory Tests

- (1) The word fragment completion task: complete the letters by the first word that comes to mind (e.g. _ l _ p _ a _ t)
- (2) The word stem completion test: e.g. ele_______ Complete the stem with the first word that comes to mind

Word completion study

- The facilitation to supply the missing information is called priming.
- Fragments of words can be from new words or words previously seen. Subjects are not told that some words might have been in the initial list (this is an implicit memory test).
- Priming for fragments completion does not decrease (much) over time (hours vs. days).
- But performance in a recognition task (explicit test) does decrease over time.

Amnesia

- Amnesia: deficits in memory as a function of brain damage, disease or psychological trauma.
- Amnesia can involve either the inability to learn new things or a loss of previous knowledge, or both.
- Amnesia can differentially affect short-term/working memory and long term memory abilities.
- Amnesia types and the type of memory tests can show all types of interaction between 2 variables.
Interaction

• **Goal:** In an experiment, you compare the explicit and implicit memory of amnesic and control subjects.

• **Experiment design (2 x 2):** Amnesic patients and control subjects studied 24 words.
  - Factor 1: Group (amnesic vs. control)
  - Factor 2: Type of memory test: implicit (word identification) explicit (free recall)

  
  Word identification test: subjects saw perceptually degraded word (pieces of each letter were obliterated) and were instructed to name the word (measure of priming)

• **Dependent variable:** Proportion of correct responses

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**Interaction A**

![Interaction A graphs](Image)

What is the main effect of factor “group”? What is the main effect of factor “type of tests”? Describe the interaction

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**Interaction A**

![Interaction A graphs](Image)

There is no interaction between the variables. Main effect of types of subjects: the control group perform better than the amnesics on both the explicit and implicit tests.

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**Interaction B**

![Interaction B graphs](Image)

What is the main effect of factor “group”? What is the main effect of factor “type of tests”? Describe the interaction

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**Interaction B**

![Interaction B graphs](Image)

Interaction: controls performed better than amnesics on the explicit free recall test. But amnesics perform as well as controls on the implicit test. The difference between amnesic and control group disappears when memory is measured implicitly.

*The effect of one independent variable (presence or absence of a memory deficit) changes depending on the level of the other independent variable (test type)*

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**Interaction C**

![Interaction C graphs](Image)

What is the main effect of factor “group”? What is the main effect of factor “type of tests”? Describe the interaction
A cross over interaction: the control show better memory than amnesics on the explicit test. But the amnesics show better memory than the controls on the implicit test.

What is the main effect of factor “group”? What is the main effect of factor “type of tests”? Describe the interaction.

Interaction: the amnesic deficit is more pronounced on the explicit test than on the implicit test. Although control subjects performed substantially better than amnesics on the implicit test, the superiority of control’s memory to amnesics’ memory is even greater on the explicit test. These data would suggest that the implicit test is a less sensitive measure of amnesic deficits than is the explicit test.

Interpretation: Although amnesic perform poorly on the explicit recall test, the amount of priming they showed on the word fragment recognition task was identical to performances of normal subjects.

Conclusion: the amnesic’s problem seems to lie in gaining conscious access to these stored experiences.