Experimental Designs

Non factorial designs (one independent variable: one way):

- Between subject design
- Within subject design

Factorial design:

- Between subjects
- Within subjects
- Mixed

One way between subject design

Independent Groups

1 independent variable at x levels

variable at 2 levels → Group 1 / Group 2

Between subject design (variable)

Advantage
- No contamination
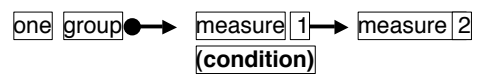
Disadvantages
- Matching
- Randomization (enough n)

Between subject "variable"

Threats of internal validity:

- Research expectation
- Subject expectation
- Subject selection
- Lost of subject

One-way within subject design

1 independent variable at x levels

one group ●→ measure 1 → measure 2
(condition)

Within subject
Design (variable)

Advantages
  – Same subjects used
  – Own control
  – Longitudinal relation

Disadvantages
  – Carry over effects
  – Regression towards the mean

Within subject "variable"

Threats to internal validity:

- Researcher expectancy
- Subject expectancy
- Maturation and historical factors
- Habituation and fatigue
- Statistical regression

Controls:

· Constancy

· Systematic variation
    —Counterbalancing:
        Latin Square

· Random variation

Latin Square

Order of administration

	1	2	3
sequence 1:	A	B	C
sequence 2:	B	C	A
sequence 3:	C	A	B

Factorial design:
- ## Between-subject
- ## Within-subject
- ## Mixed

What is the research design?

1. Find the independent variables

2. For each I. V.:
· Within-subject or between subject?
· levels (names & numbers)

2 X 2 mixed design with the independent variables x (within) & y (between)

BURNHAM (1966) — Expectancy Control Design

Brain state	Expectancy		
	Lesioned	Unlesioned	Totals
Lesioned	46.5	49.0	95.5
Unlesioned	48.2	58.3	106.5
Totals	94.7	107.3	

I. V.?

- Brain state
  Within- or Between-Subject ?
  Levels?   2
  Lesioned vs. Not lesioned
- Researcher Expectancy
  Within- or Between-Subject ?
  Levels?   2
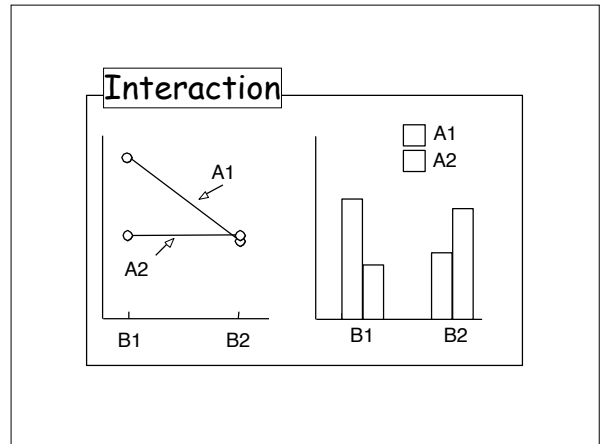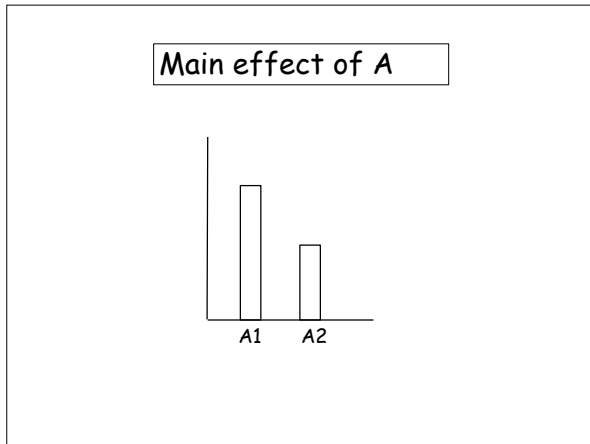 Lesioned vs. Not lesioned

---

2 X 2
Between-subject Design
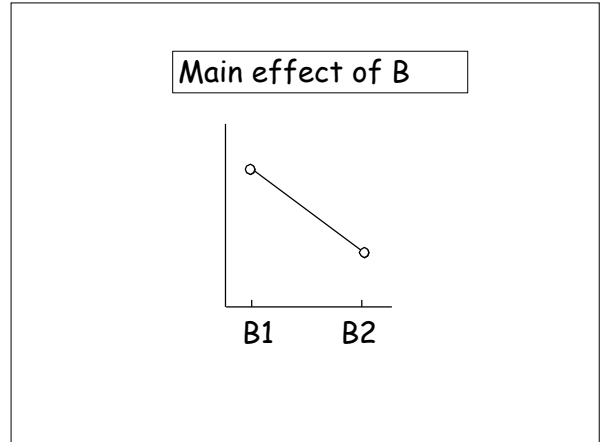
Brain state

Lesioned   Not-Lesioned

Belief: Belief: Belief: Belief:
lesion   No lesion   lesion   No lesion
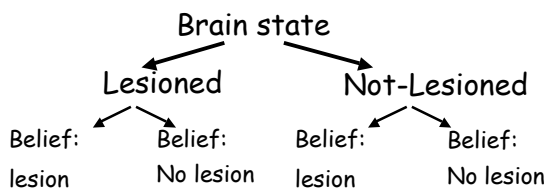
Factorial designs

Hypotheses:

- Main effects (= number of I. V.)
- Interaction
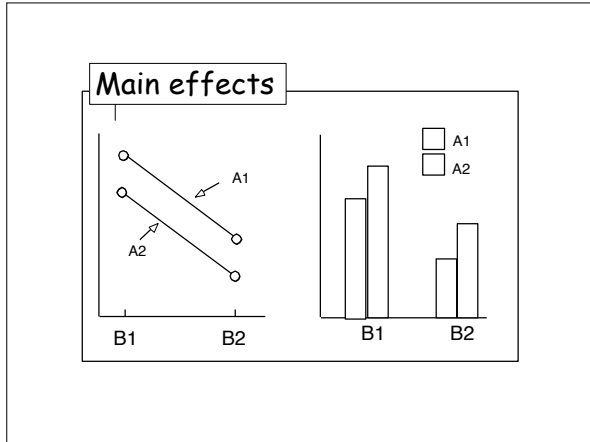
Main effects

A1
A2
B1 B2

A1
A2
B1 B2

Main effect of B

B1 B2

Main effect of A

A1 A2

Interaction

A1
A2
B1 B2

A1
A2
B1 B2

Solomon design

1.	pre-test –	treatment –	post test
2.		treatment –	post test
3.	pre-test –		– post test
4.			– post test

Solomon Design

1.	pre-test –	treatment –	post test
2.		treatment –	post test
3.	pre-test –		– post test
4.			– post test

		Pre-test	
		yes	no
Treatment	yes	1	2
	no	3	4

Null hypotheses

Main effects (as many as # of IV):

1. There is no difference in the DV between the levels of the IV: A

2. There is no difference in the DV between the levels of the IV: B

Null hypothesis

Interaction: There is no interaction

For IV A, level 1,
    IV B: level 1 vs. level 2

       ↕ Similar tendency: no difference

For IV A, level 2,
    IV B: level 1 vs. level 2

Steele, J. R. & Ambady, N. (2006). "Math is hard!" The effect of gender priming on women's attitudes. *Journal of Experimental Social Psychology, 42,* 428-436.

Women's mean attitudes (and standard deviation) towards math by priming condition in Study 1a

	Personal attitudes	
	Arts	Math
Female prime	6.50 (1.38)	4.43 (1.76)
Male prime	5.35 (1.00)	5.26 (2.26)

"Statistical" logic & Hypotheses

Hypotheses

$H_0 \rightarrow$ Null hypothesis
"No difference"

$H_1 \rightarrow$ Alternate hypothesis
Difference due to treatment

Hypotheses
Evaluated by statistical tests

$H_0 \Rightarrow$ **Null Hypothesis**
No "difference" between Gr. A and B

$H_1 \Rightarrow$ **Alternate Hypothesis**
Difference between groups
• In one specific direction:
Gr. A > Gr. B or Gr. A < Gr. B $\rightarrow$ One-tailed test

• In any direction $\rightarrow$ Two-tailed test

t values & their associated one-tailed and two-tailed p values

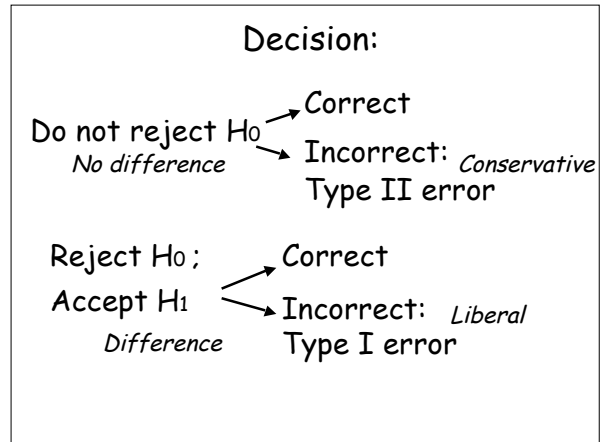|			
p =	0.10	0.05	two-tail
p =	0.05	0.025	one-tail
df = 16	1.746	2.120	
df = 100	1.660	1.984	

Statistical analysis

– Null and alternate hypotheses

– Possible errors:
  type I or type II

– Sample --> Population

  Chance:
  Sampling errors
  Measurement errors

Reality

Population

Your decision	No difference H_0 is true	Difference H_1 is true
Difference	Type I Error: **Liberal**	No error
No difference	No error	Type II error: **Conservative**

Sample

Decision:

Do not reject H_0 → Correct
No difference ↘ Incorrect: *Conservative*
                  Type II error

Reject H_0 ; → Correct
Accept H_1 ↘ Incorrect: *Liberal*
Difference   Type I error

8

Decision	Reality	
	H_0 is true	H_0 is false H_1 is true
Reject of H_0	Type I error	No error
Non Reject of H_0	No error	Type II error

Type I error: significance value ($p < 0.05$)
alpha

Type II error: beta

Probability? / chance?

Between subject design

   Participants selection

   Subject and researcher expectations

Within subject design

   Repeated measures:
      Statistic regression
      Maturation
      Historical factors ...

Null hypotheses

Main effects (as many as # of IV):

1. There is no difference in the DV between the levels of the IV: A

2. There is no difference in the DV between the levels of the IV: B

Null hypothesis

Interaction: There is no interaction

For IV A, level 1,

    IV B: level 1 vs. level 2

        ↕ Similar tendency: no difference

For IV A, level 2,

    IV B: level 1 vs. level 2