Factorial Designs

Does alcohol cause aggression?

1) One Factor Between Groups Design:

Alcohol versus No alcohol, measure aggression (IV? DV?)

Factorial Designs

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BAC = 0.0%; 0.02%; 0.05%; 0.08%, then measure aggression (How many levels of IV?)

Factorial Designs

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Alcohol versus No alcohol, measure aggression (IV? DV?)

2) One Factor Between Groups Design with several levels:

BAC = 0.0%; 0.02%; 0.05%; 0.08%, then measure aggression (How many levels of IV?)

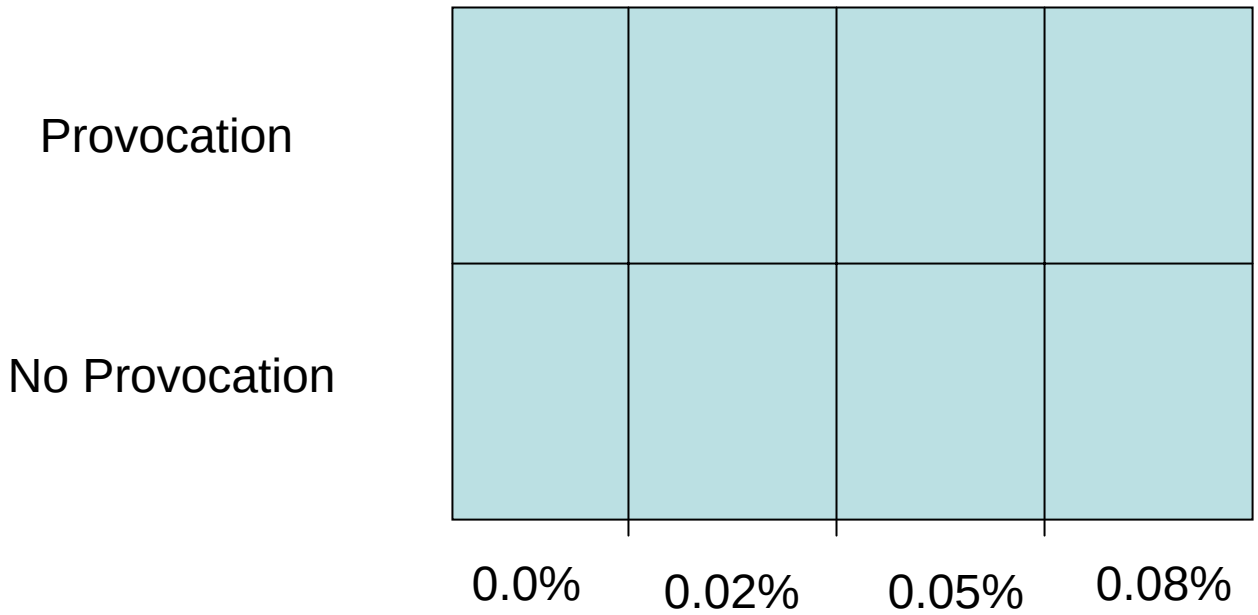
3) Suppose aggression must be provoked?

Factorial Designs

Four levels of Alcohol dose

Plus

Two levels of Provocation



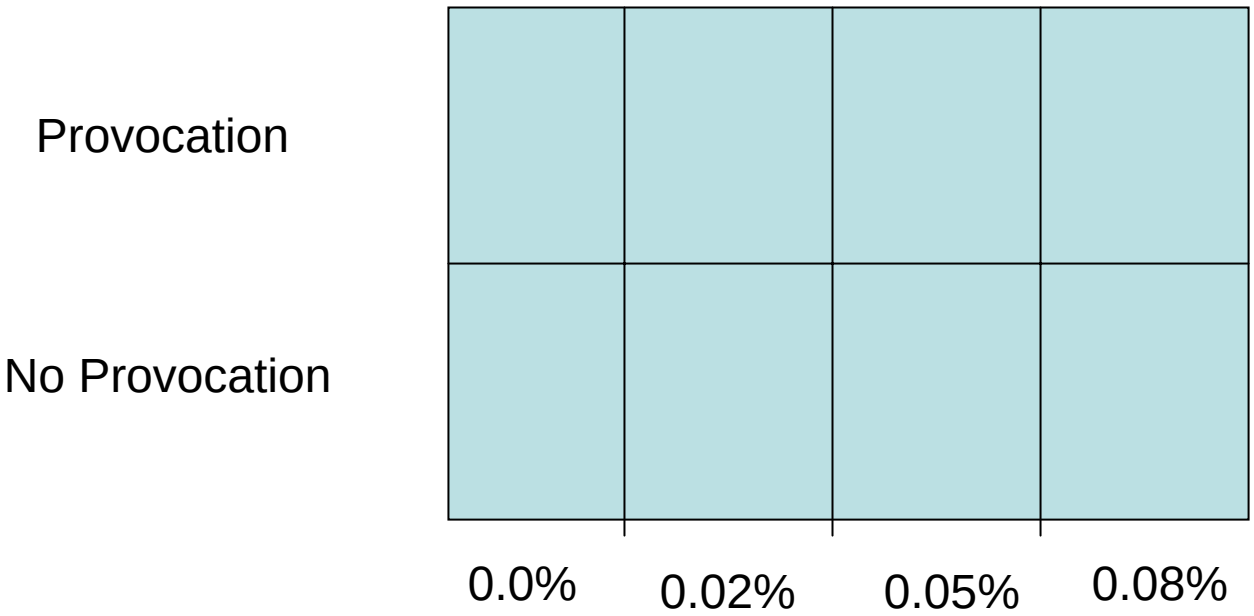
Factorial Designs

Four levels of Alcohol dose

Plus

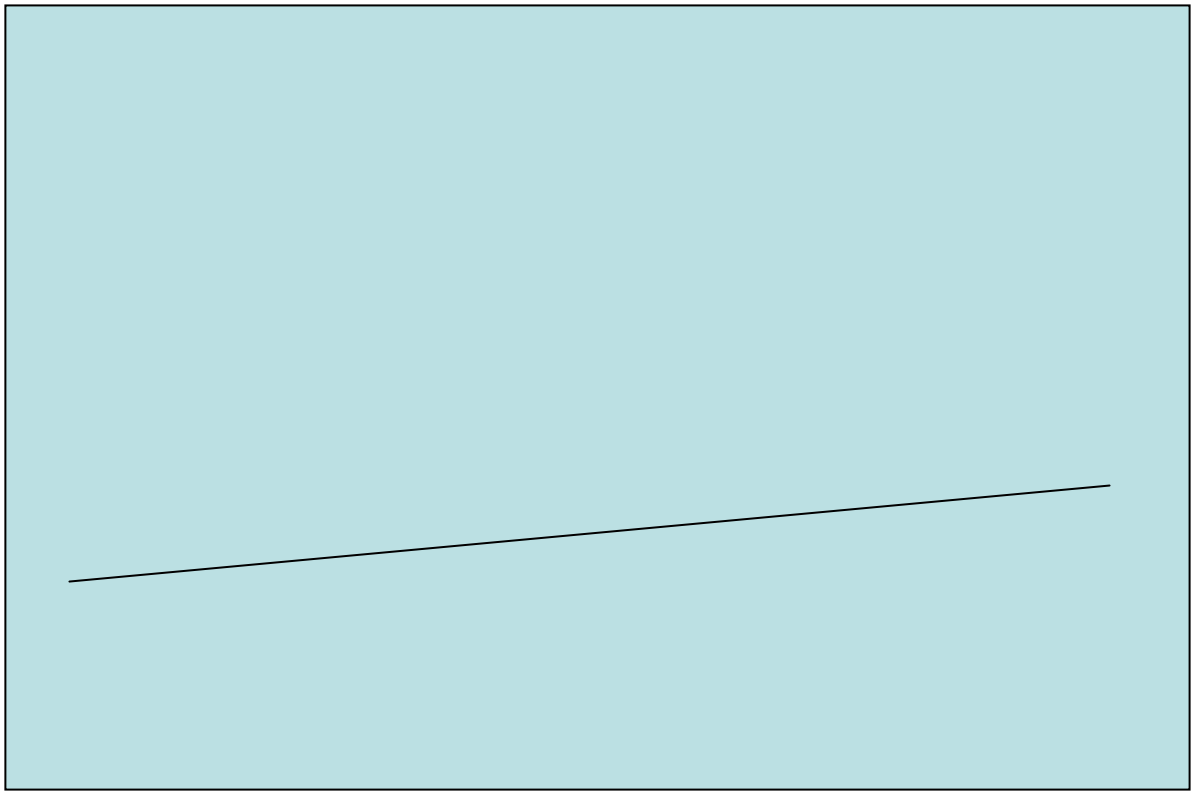
Two levels of Provocation

What kind of design? (___ x ___ what?)



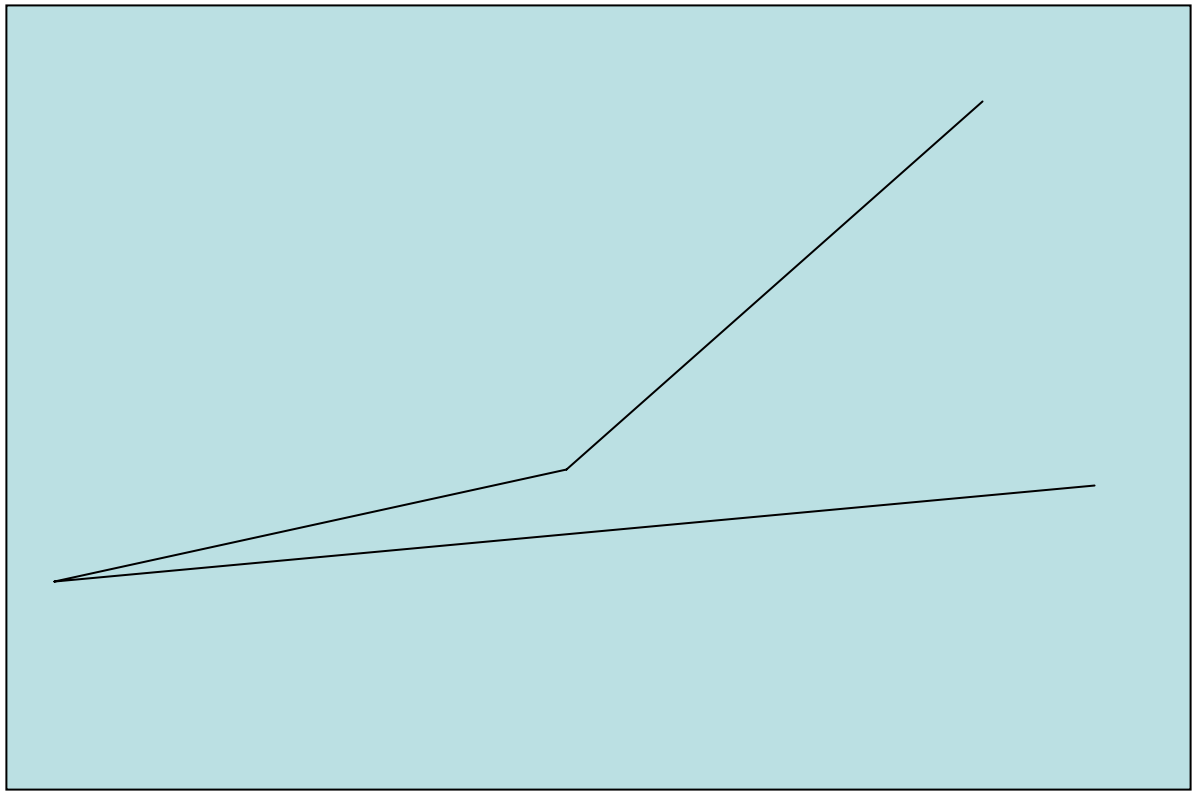
Factorial Design

- No Provocation



Factorial Design

- No Provocation, Provocation



Factorial Design

- Main effects
  - Alcohol Dose has an effect
  - Provocation has an effect
- Interaction
  - Alcohol effect depends on the LEVEL of Provocation or
  - Provocation effect depends on the LEVEL of the alcohol dose

Factorial Design

Marketing Study (adapted from 2008 article)

Does Photo of Attractive Solicitor increase amount of contributions to charity?

Hypothesis: Photo of “attractive” solicitor added to mailed appeal will “personalize” the appeal and increase contributions

Will Gender make a difference?

Will Attractiveness make a difference?

Factorial Design

Send out appeal with photo on cover letter.
What amount of money do people give?

	Attractive	Not Attractive
Male	?	?
Female	?	?

Factorial Design

Gender Effect only

	Attractive	Not Attractive
Male	40	40
Female	60	55

Factorial Design

Attractiveness effect only

	Attractive	Not Attractive
Male	55	30
Female	60	28

Factorial Design

Main effects only

	Attractive	Not Attractive
Male	45	30
Female	60	50

Factorial Design

Interaction effect

	Attractive	Not Attractive
Male	45	30
Female	80	50

Factorial Design

Different Interaction effect

	Attractive	Not Attractive
Male	45	40
Female	80	20

Factorial Design

Even Different Interaction effect

	Attractive	Not Attractive
Male	45	40
Female	80	20

Factorial Design

Even Different Interaction effect

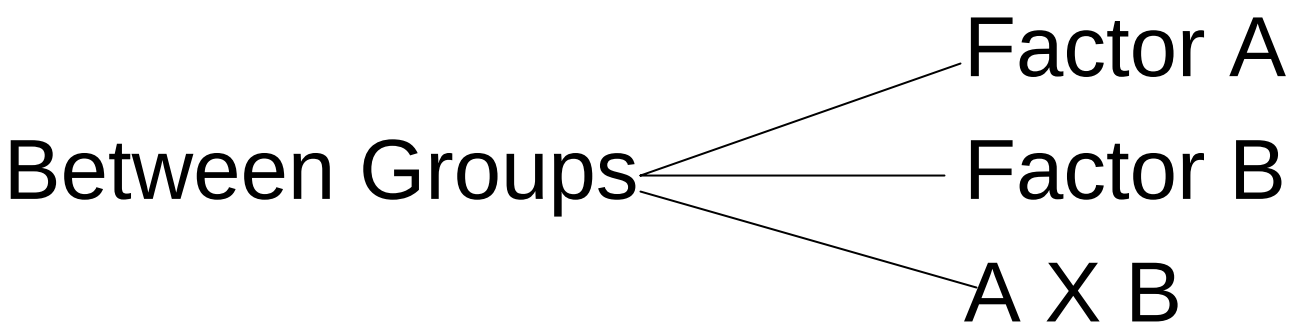
	Attractive	Not Attractive	Downright Ugly
Male	45	40	25
Female	80	20	35

Factorial Design

2 X 2 Analysis of variance

F ratios: Each Factor / error variance

Divide Total variance into:



Within Groups (error variance)

Factorial Design

Degrees of freedom:

df Total = N - 1

df A = $k_{(A)}$-1

df B = $k_{(B)}$-1

df A X B = dfA X dfB

df error = df Total – dfA – dfB – dfAXB

Example of written output for article

“F (1,36) = 12.2, p < .03”

Factorial Design

Variation:

Suppose the researcher wants to do this design completely ***WITHIN*** subjects?

Has 10 subjects and gives each one (random order) all four photos and asks for contributions.

Chapter 11—This is called a Within Subject Factorial Design

Factorial Design

Potential problems same as with repeated measures on one factor design:

1. Will the Intervention have a “carryover” or lasting effect that might bias responses on the next measure?
2. History
3. Maturation
4. Testing effects

Factorial Design

But suppose those problems were dealt with successfully?

Same experiment as above with 10 subjects

Interaction effect

	Attractive	Not Attractive
Male	45	30
Female	80	50

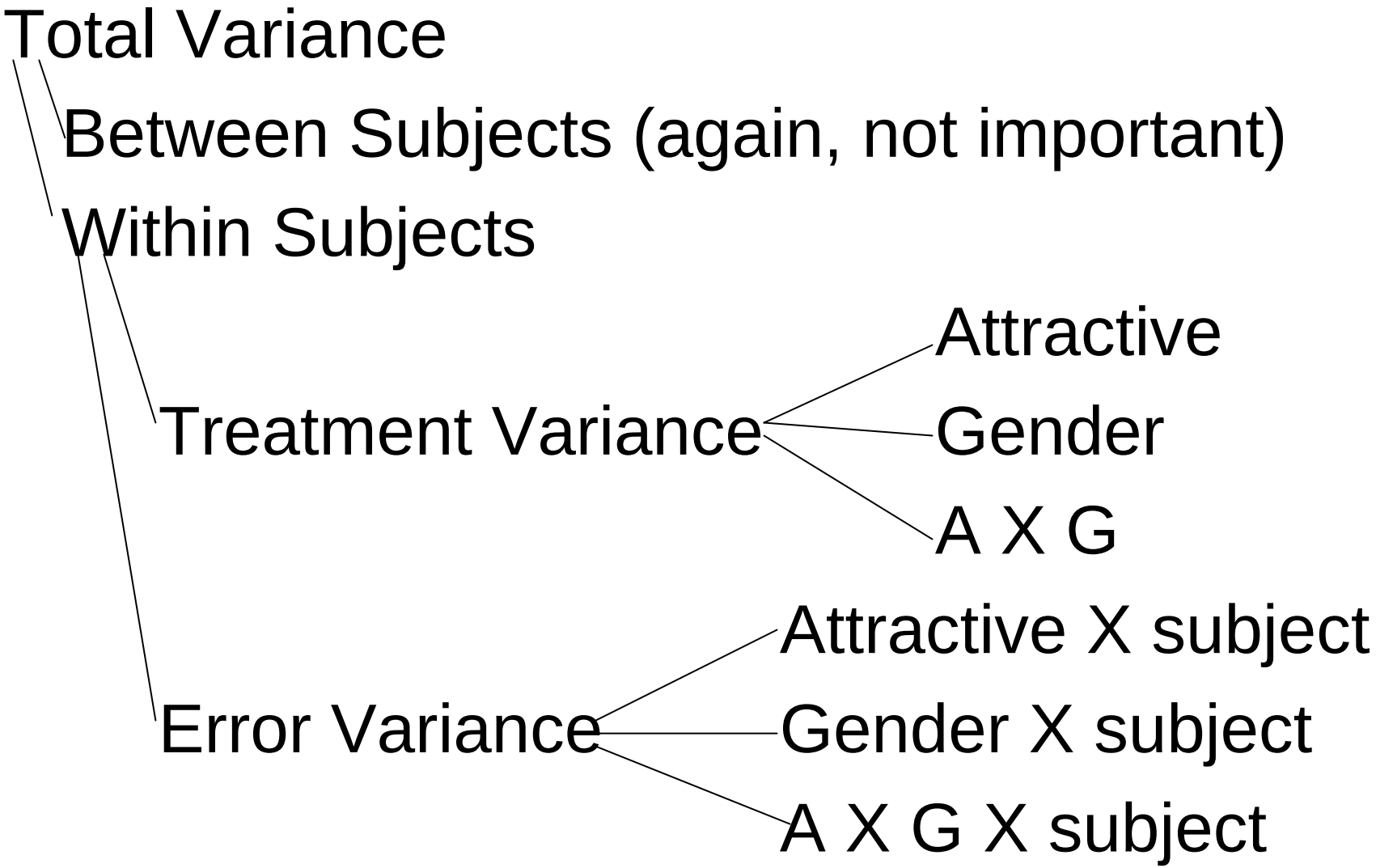
Different analysis: Within Subjects Factorial ANOVA

Factorial Design

Total Variance

- Between Subjects (again, not important)
- Within Subjects
  - Treatment Variance
    - Attractive
    - Gender
    - A X G

Factorial Design



Factorial Design

F ratios: Each factor divided by its own specific term

Examples:

$F_{(Attractiveness)}$ = Attractiveness/ Attractiveness X Subject

$F_{(A \times G)}$ = A X G / A X G X Subject

Factorial Design

Calculating degrees of freedom

Between subjects: # subjects – 1

Attractiveness: # levels of A – 1

A X subject: (A – 1) (# subjects – 1)

Gender: # levels of Gender – 1

G X subject: (G – 1) (# subjects – 1)

A X G: (A – 1) (G – 1)

A X G X subject: (A – 1) (G – 1) (# subj – 1)

Factorial Design

Examine the effects of TWO or more variables at the same time

Can calculate MAIN EFFECTS of each variable

Can calculate INTERACTION (effect of one variable on the other)

Can be done BETWEEN subjects **or**

Can be done WITHIN subjects…

Next: Mixed designs