One Independent Variable Between-Groups Design

Instead of just one treatment versus a control group or one treatment versus another, we often use designs that compare several levels of the same factor.

One Independent Variable Between-Groups Design

Instead of just one treatment versus a control group or one treatment versus another, we often use designs that compare several levels of the same factor.

T-test cannot be used to analyze the data; instead, ANOVA (Analysis of Variance) is used.

Sometimes we use ANCOVA or MANOVA. All discussed later.

One Independent Variable Between-Groups Design

Examples:

From Book--No Arousal, Low Arousal, Moderate Arousal, High Arousal

What is IV?

How many levels of IV?

One Independent Variable Between-Groups Design

Examples:

From Book--No Arousal, Low Arousal, Moderate Arousal, High Arousal

What is IV?

How many levels of IV?

Practice times: 15 minutes, 10 minutes, 5 minutes

What is IV? How many levels of IV?

One Independent Variable Between-Groups Design

Examples:

Treatment study: Treatment alone; Treatment with spouse or partner; Treatment with whole family involved

IV? Levels of IV?

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Examples:

Treatment study: Treatment alone; Treatment with spouse or partner; Treatment with whole family involved

IV? Levels of IV?

Standing 6 inches away from speaker; standing one foot away from speaker, standing two feet away from speaker; standing four feet away from speaker

One Independent Variable Between-Groups Design

Hypotheses with each of these studies?

(Hint, need to have dependent variables)

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What does the “Between Groups” part of the design mean?

How do you decide which participant is given which condition?

How many participants needed for each study?

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Why NOT do t-tests to compare the means of each group versus the other?

Let’s try it---

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Group A versus Control Group $p < .05$

Group B versus Control Group $p <$?

Group C versus Control Group $p <$?

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Group A versus Control Group $p < .05$

Group B versus Control Group $p < .10$

Group C versus Control Group $p < .15$

Are we finished with all the comparisons?

One Independent Variable Between-Groups Design

Group A versus Control Group $p < .05$

Group B versus Control Group $p < .10$

Group C versus Control Group $p < .15$

Group A versus Group B $p < .20$

Group A versus Group C $p < .25$

Group B versus Group C $p < .30$

Probability of Type 1 Error Greatly Increased

One Independent Variable Between-Groups Design

Instead Analysis of Variance is used

AKA ANOVA

Instead of doing many comparisons with the same data over and over, you look at how the IV created variance instead of the normal distribution.

One Independent Variable Between-Groups Design

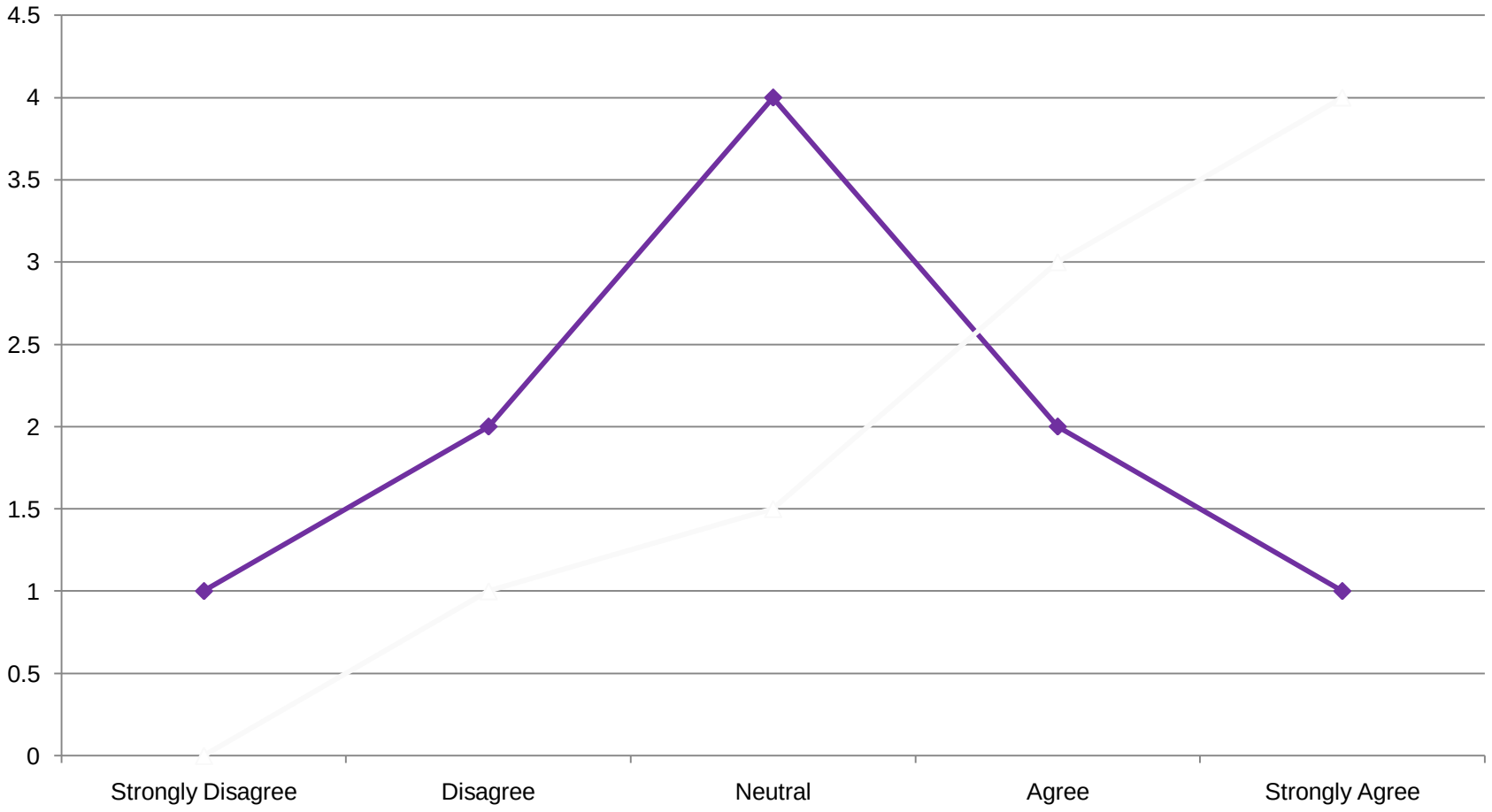
Variance review:

Remember Normal (Bell shaped) curve?

If you did Nothing to a population, you just assessed them, then (theoretically), you would see a Normal Distribution.

This is equivalent to your Control group.

Control

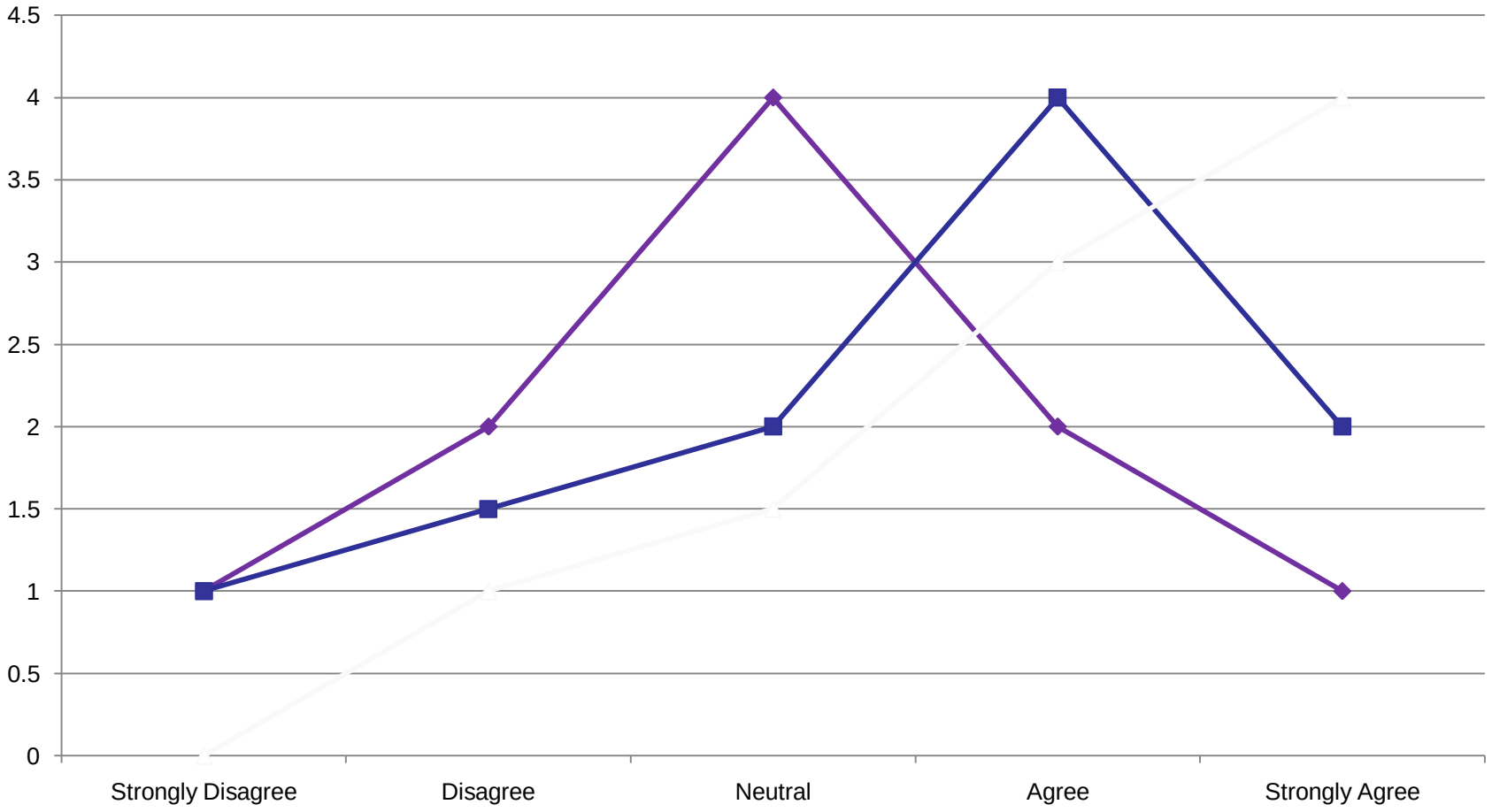

4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

One Independent Variable Between-Groups Design

Now suppose you added one level of IV

- At this point you could still do a t-test and compare the means

Control and A

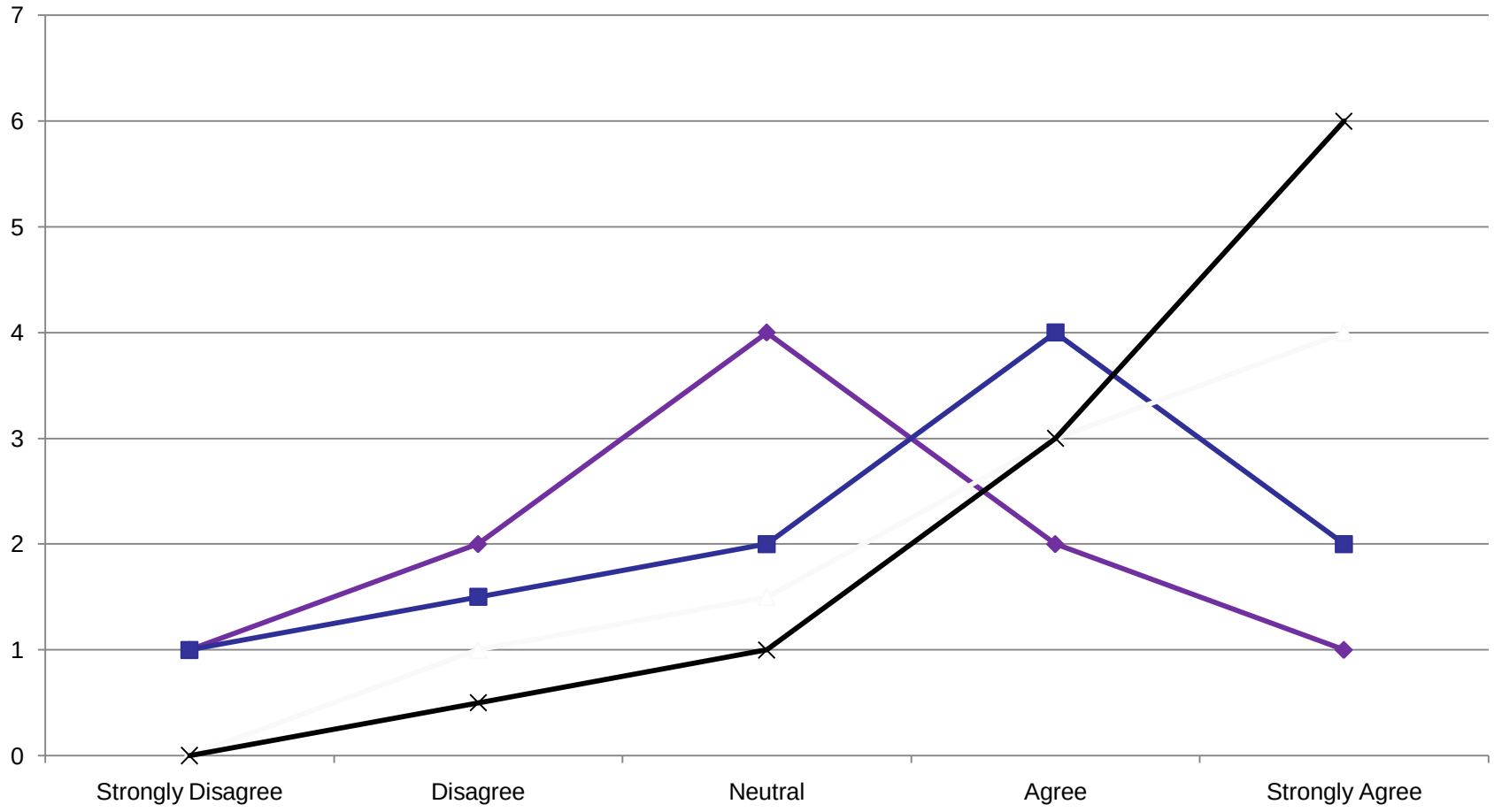


One Independent Variable Between-Groups Design

Now suppose you added two levels of an independent variable.

Question: is the resulting distribution of data points still looking like a normal curve, or is it different enough to attribute to the IV?

Control, A and B



One Independent Variable Between-Groups Design

Different way to put the question:

How much of the variance is due to ordinary, everyday variance among the people who are your subjects/participants? Versus

How much is due to the fact that you applied the IV to one or more groups of subjects?

Mathematically, this calls for a RATIO

(Hint: that's your F-ratio)

One Independent Variable Between-Groups Design

Partitioning the variance:

How much of the variance here is due to just regular old normal individual differences among people

How much is due to MY application of a new condition to them?

One Independent Variable Between-Groups Design

Partitioning the variance:

How much of the variance here is due to just regular old normal individual differences among people

How much is due to MY application of a new condition to them? (Just how much power and control do I have on other people? BWAHAHAHA!)

One Independent Variable Between-Groups Design

Within group variance:

Individual differences (like what)

Sometimes thought of as “error”

Between group variance:

Application of the IV

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F Ratio

$$F = \frac{\text{Between Group Variance}}{\text{Within Group Variance}}$$

ANOVA produces an F ratio

The higher the F-ratio, the higher the probability that there is significant variation due to the IV.

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How do you know if your F-ratio is significantly different from chance?

Use your degrees of freedom and your pre-set alpha level

Alpha conventionally .05 (could be higher)

df between groups = k – 1 (k=number of gps)

df within groups = k (n -1) (n = # sub per gp)

df total for experiment = N – 1 (N=total S's)

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F ratio reported in a Results section of a paper is written so that any researcher can see the F, degrees of freedom, and the probability level.

Example:

$F(3, 278) = 100.32, p < .01$

Review

- Instead of just one treatment versus a control group or one treatment versus another, we often use designs that compare several levels of the same factor
- One Independent Variable Between-Groups Design
- Control group assumed to be what “normal” population would look like
- Other groups: application of IV

Review Continued

How to analyze?

Partition the variance

Calculate an F-ratio (between group variance versus within group variance)

Using an ANOVA

Report your F ratio with your df and alpha level