

WG ANOVA

Analysis of Variance for Within-groups or Repeated measures

- Between Groups and Within-Groups ANOVA
- WG ANOVA & WG t-tests
- When to use each
- Similarities & Differences
- Selecting ANOVA variables for SPSS
- Computation & notation stuff

ANOVA (F) - - - 2 Types

- Between Groups ANOVA
 - we collect the quantitative variable from each participant, who is only ever in **one** condition of the qualitative variable
 - also called “between subjects”, “independent groups”, “independent subjects”, and “cross sectional”
- Within-Groups ANOVA
 - we collect the quantitative variable from each participant, who is in **all** conditions of the qualitative variable (one at a time, of course)
 - also called “within-subjects”, “dependent groups”, “dependent subjects”, “repeated measures” designs, and “longitudinal” designs

Between Groups Design

Paper Hw Computer Hw

Golda	Ja
Lanito	Sally
Burma	Kishon
Amaru	Manuel
Todd	Rae
Wendy	Kris

Different participants in each treatment/condition

Within-Groups Design

Paper Hw Computer Hw

Pat	Pat
Sam	Sam
Kim	Kim
Lou	Lou
Tangella	Tangella
Brais	Brais

Same participants in both treatment/condition

Comparison of BG & WG ANOVA

- Data collection is different for the two
 - BG - each participant is only in one condition
 - WG - each participant will be in all conditions
- Same H0: (No mean difference)
- Same kind of RH (expected mean difference)
- Computation is slightly different for BG & WG
- H0: testing is the same $p < .05$ or $F\text{-crit} < F\text{-obt}$
- Determining Causality is the Same
 - random assignment (initial equivalence)
 - manipulation of IV (temporal precedence and ongoing eq)
 - control of procedural variables (ongoing equivalence)

What about within-groups t-tests?

- Whenever you want to compare the means on a quantitative variable for a group of participants who provide data in two conditions, you can use either a WG ANOVA or a WG t-test
- The two procedures will produce exactly the same
 - group means
 - p-value & NHST results
 - $t^2 = F$
 - ANOVA $df_{\text{error}} = t\text{-test } df$
- We will emphasize ANOVA in this class, because it is used somewhat more often, and because, unlike t-tests, can be used for larger designs (with more IV conditions – later!)

Practice With Determining Whether Design is BG or WG

Here's two different versions of a study to test that "more practice leads to better performance"-- which is BG and which WG

- Each person is introduced to the task and either performs immediately (score is # correct of 10), or is given 30 practices first and then performs (and is scored the same way). **BG**
- Each person is introduced to the task and immediately performs (score is # correct out of 10) and is then given 30 practices and performs again (getting another scores of #correct out of 10). **WG**



people 70+ years old
 night or during daylight hours. WG
 day and then during the night,
 (usi



A researcher has decided that watching
 you demented. 10 people were in the 'N
 another 10 people watched the Simpson
 the end of the week, the participants filled

To test the notion that Tokay Geckos are more active feeders at
 night than during the day, the researcher followed each of 12
 geckos around for 24 hours and recorded the number of bugs
 (pets, small children, whatever) they ate during lighted and dark
 hours.

W
 G



A bit about BG & WG ANOVA on SPSS...

For BG designs:

- we describe the design using the IV & the DV
- the SPSS data set includes the IV condition value & the DV score for each participant
- when requesting a BG ANOVA – we specify the IV & the DV

For WG designs:

- we describe the design using the IV & the DV
- the SPSS data set includes the DV score for each IV condition for each participant
- when requesting a WG ANOVA – we specify the DV score for each IV condition

Example: IV = #Practices → 10 vs. 20 DV = % correct

BG – RA each participant to 10 or 20 practices record % on last practice

- put into SPSS → #Practices (10, coded as 1 or 20, coded as 2) & % correct

WG – Each participant practices 20 times; measure DV from 10th and 20th practice

- put into SPSS → % correct on 10th practice & % correct on 20th practice

Your turn – tell type of design & pick which 2 variables to specify in SPSS ...

We wanted to know whether Psysc or Business majors studied more hours per week for this class.

Design ? BG What's the IV? major What's the DV? # hours

Which two variables would go into SPSS (yes, pick 2 – only 2)

<ul style="list-style-type: none"> • major • # hours study 	<ul style="list-style-type: none"> • # hours Psy study • # hours Bus study 	Draw the boxes!	
		Psy	Bus
		<input type="text"/>	<input type="text"/>

We wanted to know whether students studied more hours per week for the lecture or the laboratory of this class.

Design ? WG What's the IV? Lecture vs. Lab What's the DV? # hours

Which two variables would go into SPSS (yes, pick 2 – only 2)

<ul style="list-style-type: none"> • lecture vs. lab • # hours study 	<ul style="list-style-type: none"> • # hours study for lecture • # hours study for lab 		
		Lab	Lecture
		<input type="text"/>	<input type="text"/>



A bit about computational notation for WG ANOVA...

As before, sort the DV data (X) from the study into two columns – one for each condition.

Then make a column of squared values (X²) for each condition

- sum each column -- making a $\sum X$ & $\sum X^2$ for each group

Make a new column that is the sum of each participants scores

Make another column that is the square of each participants sum

- sum the squared values

Before Therapy (k1)		After Therapy (k2)		S	S ²
X	X ²	X	X ²		
3	9	5	25	8	64
5	25	6	36	11	121
4	16	8	64	12	141
12	50	19	125		329
$\sum X_{k1}$	$\sum X_{k1}^2$	$\sum X_{k2}$	$\sum X_{k2}^2$		$\sum S^2$

A bit about computational notation for WG ANOVA, continued ...

The computations for WG ANOVA are slightly different – there are more kinds and some of the formulas are different – but all the various calculations will use combinations of these five terms – be sure you are using the correct one !

$$\sum X_{k1} \quad \sum X_{k1}^2 \quad \sum X_{k2} \quad \sum X_{k2}^2 \quad \sum S^2$$

Other symbols you'll need to know are...

- N = total number of data pairs (i.e, # of participants)
- n = number of participants in each condition of the study
- Yep ... N = n
- k = number of conditions in the study