

Introduction to the Factorial Anova

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Introduction

- ▶ What is a Factorial Anova
- ▶ Types of Factorial Anova
- ▶ How to input a Factorial Anova into SPSS
- ▶ Reporting the 2x2 Anova into your results section
- ▶ Things you must find (in SPSS) to fully report your 2x2 Anova.

What is the factorial Anova

- ▶ Remember back to last weeks lecture – A Factorial ANOVA is two or more factors (each of which with at least two levels), levels can be either independent, dependent, or both (mixed)
- ▶ A 2x2 Anova is an example of a factorial Anova – 2 factors (IVs) with two levels.
 - ▶ For example investigating Age and Gender differences in social media usage
 - ▶ IV 1 (Gender – 2 Levels Male / Female)
 - ▶ IV 2 (Age – 2 Levels Young / Old)
 - ▶ DV – Social Media usage.

Types of Factorial Anova – Between Groups or Independent.

- ▶ The previous example, is an example of a **2x2 Between groups** (or independent) **Anova**. You are separating the participants into groups and you are investigating differences between groups in relation to both Ivs or Factors.

	Male	Female
Young (18-30)		
Old (35+)		

IV 1 –
Gender
(Placed
into
Groups)

IV 2 – Age
(Placed into 2
groups)

Between Groups (Indedepent) Factorial Anova.

- ▶ So if you have designed your study in which you have **grouped** the **participants** in accordance to **BOTH Factors (IVs)** then you have a **between groups** (independent) **Anova**.
- ▶ So lets look at the example - Age and Gender differences in social media usage
 - ▶ Factor 1 (IV 1) – Gender – We have grouped participants into Male and Female – to look at between group differences.
 - ▶ Factor 2 (IV 2) – Age – We have grouped participants into age categories (Young and Old) to look at between group differences.
 - ▶ DV = Social Media Usage.

How to input a 2x2 between subjects design into SPSS

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

	Gender	Age	SocialMediaUsage Score	var	var	var	var	var	var	var
1	1.00	1.00	15.00							
2	1.00	1.00	13.00							
3	1.00	1.00	15.00							
4	1.00	1.00	15.00							
5	1.00	1.00	15.00							
6	1.00	2.00	6.00							
7	1.00	2.00	6.00							
8	1.00	2.00	7.00							
9	1.00	2.00	6.00							
10	1.00	2.00	7.00							
11	2.00	1.00	16.00							
12	2.00	1.00	18.00							
13	2.00	1.00	19.00							
14	2.00	1.00	20.00							
15	2.00	1.00	16.00							
16	2.00	2.00	12.00							
17	2.00	2.00	11.00							
18	2.00	2.00	12.00							
19	2.00	2.00	9.00							
20	2.00	2.00	8.00							

*Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor

	Gender	Age	SocialMediaUsage Score	var	var	var	var	var	var	var
1	Male	Young	15.00							
2	Male	Young	13.00							
3	Male	Young	15.00							
4	Male	Young	15.00							
5	Male	Young	15.00							
6	Male	Old	6.00							
7	Male	Old	6.00							
8	Male	Old	7.00							
9	Male	Old	6.00							
10	Male	Old	7.00							
11	Female	Young	16.00							
12	Female	Young	18.00							
13	Female	Young	19.00							
14	Female	Young	20.00							
15	Female	Young	16.00							
16	Female	Old	12.00							
17	Female	Old	11.00							
18	Female	Old	12.00							
19	Female	Old	9.00							
20	Female	Old	8.00							

Types of Factorial Anova – Within Groups or Dependent.

- ▶ In this 2x2 design you are NOT grouping participants to look at between group effects, but you are looking at within group differences on both your factors. In other words – you are not grouping your participants and **all** participants will partake in **all elements (or conditions)** of the study.
- ▶ Exemplar
 - ▶ In a study looking at mobile phone usage and time of day on car driving simulation performance. For it to be a within subjects design all participants will take part in all conditions.
 - ▶ So each participant will perform on the driving simulation 4 times.
 - ▶ 1 – During the day No Mobile Phone.
 - ▶ 2 – During the night No Mobile Phone.
 - ▶ 3 – During the day with Mobile Phone
 - ▶ 4 – During the night with Mobile Phone.

Types of Factorial Anova – Within Groups or Dependent.

- ▶ So the example of the previous slide – still fits with a 2x2 design, but in this example all participants are involved in all conditions (doing all elements of the study) and you are NOT placing the participants into groups.
 - ▶ Factor 1 (IV1) = Mobile Phone (2 x Levels – with or without)
 - ▶ Factor 2 (IV2) = Time of Day (2 x Levels – Day and Night)
 - ▶ DV = Car simulation performance scores.

	With Mobile Phone	Without Mobile Phone
Day		
Night		

Whilst you can see this fits a 2x2 design important to remember that for a within subjects design all participants perform all conditions and no grouping of participants.

How to input a 2x2 within subjects design into SPSS.

2x2 Anova Within Data Set to accompany PowerPoint..sav [DataSet1] - IBM SPSS Statistics Data Editor

	MobilePhoneDay	MobilePhoneNight	NoMobilePhoneDay	NoMobilePhoneNight	var	var	var	var
1	6.00	15.00	2.00	6.00				
2	6.00	17.00	3.00	7.00				
3	7.00	15.00	4.00	7.00				
4	8.00	16.00	3.00	8.00				
5	6.00	15.00	3.00	5.00				
6	8.00	17.00	2.00	7.00				
7	6.00	18.00	5.00	8.00				
8	5.00	9.00	3.00	6.00				
9	5.00	9.00	1.00	4.00				
10	8.00	14.00	6.00	8.00				
11	5.00	13.00	5.00	5.00				
12	7.00	9.00	4.00	7.00				
13	6.00	10.00	3.00	6.00				
14	6.00	10.00	4.00	5.00				
15	9.00	13.00	5.00	9.00				
16	10.00	14.00	6.00	10.00				
17	8.00	19.00	3.00	7.00				
18	5.00	9.00	2.00	6.00				
19	5.00	9.00	1.00	5.00				
20	6.00	10.00	2.00	5.00				
21	9.00	13.00	4.00	9.00				
22	11.00	12.00	5.00	12.00				
23	12.00	15.00	6.00	13.00				
24	9.00	10.00	4.00	8.00				
25	14.00	18.00	7.00	14.00				
26	7.00	16.00	3.00	6.00				
27	6.00	9.00	2.00	5.00				
28	9.00	15.00	6.00	9.00				
29	11.00	17.00	6.00	10.00				
30	10.00	18.00	4.00	10.00				
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Types of Factorial Anova – Mixed Design Anova

- ▶ In this 2x2 design you are manipulating **one** of the factors (IV) to between subjects but the other IV is a within subjects. This is often the scenario where all the participants are doing the same elements of the study, but you are grouping the participants for other factor (IV).
- ▶ Exemplar.
 - ▶ To investigate gender differences and the impact of a math anxiety intervention on math anxiety. All participants math anxiety score is measured pre and post (to look at within group differences) but you dividing the participants into Male and Female.

Types of Factorial Anova – Mixed Design Anova

- ▶ So the example of the previous slide – still fits with a 2x2 design, but we've manipulated one factor(IV) into between subjects (Gender) and the other factor (IV) is within subjects (Math Anxiety Intervention).
 - ▶ Factor 1 (IV1) – Gender (2 Levels = Male and Female).
 - ▶ Factor 2 (IV2) – Math Anxiety Intervention (2 Levels – Pre Intervention, Post Intervention).
 - ▶ DV = Math Anxiety Score.

Factor 2 (IV2)
Math Anxiety
Intervention –
Comparing
within groups

	Male	Female
Pre Math Anxiety Intervention		
Post Math Anxiety Intervention		

Factor 1 (IV1)
Gender
comparing
between
groups

How to input a 2x2 mixed design into SPSS

*Untitled2 [DataSet1] - IBM SPSS Statistics Data Editor

	Gender	MathAnx Pre	MathAnx Post	var	var	var	var	var	var	var
1	1.00	25.00	14.00							
2	1.00	31.00	25.00							
3	1.00	28.00	23.00							
4	1.00	22.00	16.00							
5	1.00	30.00	17.00							
6	1.00	23.00	21.00							
7	1.00	18.00	8.00							
8	1.00	23.00	15.00							
9	1.00	25.00	10.00							
10	1.00	11.00	5.00							
11	2.00	34.00	26.00							
12	2.00	36.00	21.00							
13	2.00	24.00	21.00							
14	2.00	37.00	12.00							
15	2.00	34.00	21.00							
16	2.00	30.00	19.00							
17	2.00	26.00	21.00							
18	2.00	23.00	17.00							
19	2.00	20.00	19.00							
20	2.00	28.00	14.00							

*Untitled2 [DataSet1] - IBM SPSS Statistics Data Editor

	Gender	MathAnx Pre	MathAnx Post	var	var	var	var	var	var	var	var
1	Male	25.00	14.00								
2	Male	31.00	25.00								
3	Male	28.00	23.00								
4	Male	22.00	16.00								
5	Male	30.00	17.00								
6	Male	23.00	21.00								
7	Male	18.00	8.00								
8	Male	23.00	15.00								
9	Male	25.00	10.00								
10	Male	11.00	5.00								
11	Female	34.00	26.00								
12	Female	36.00	21.00								
13	Female	24.00	21.00								
14	Female	37.00	12.00								
15	Female	34.00	21.00								
16	Female	30.00	19.00								
17	Female	26.00	21.00								
18	Female	23.00	17.00								
19	Female	20.00	19.00								
20	Female	28.00	14.00								

Reporting a 2x2 Anova results in APA.

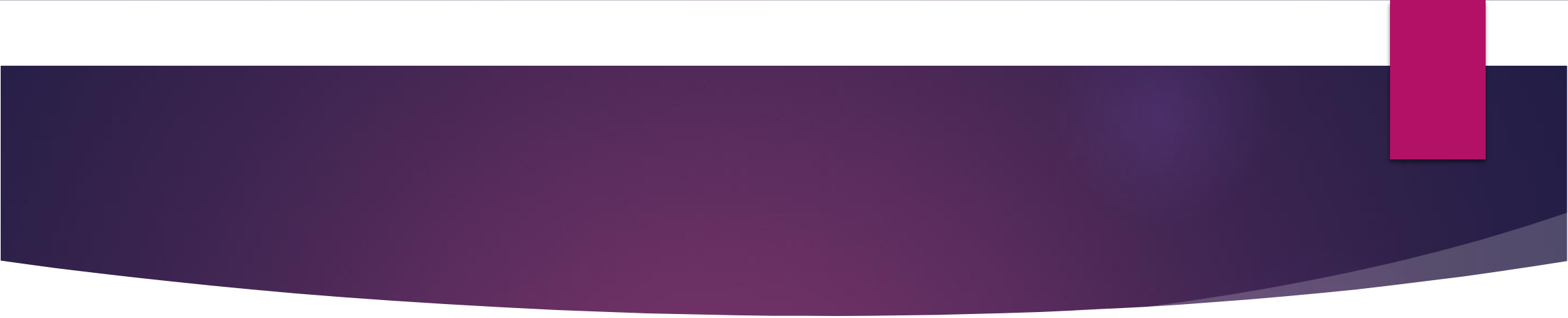
- ▶ No matter what your design (e.g. between groups, within groups or mixed) you report the results of your 2x2 Anova in the same way, using the same information.
- ▶ Remember you are reporting this for your 3 hypotheses.
 - ▶ Main effect 1 – e.g. hypotheses linked to Factor 1 alone.
 - ▶ Main effect 2 – e.g. hypotheses linked to Factor 2 alone.
 - ▶ Interaction hypotheses.
- ▶ So you will need to find and report the following information (on next slide) 3 times. PLEASE REMEMBER THESE WILL BE DIFFERENT VALUES / SCORES FOR EACH OF THE THREE HYPOTHESES.

Information you need to find when reporting your 2x2 Anova.

- ▶ Please see the respective videos on how to find these....
- ▶ But to report your findings in your results section you will need the following.
- ▶ Descriptive Statistics – Means and Standard Deviations – Please note this is for each factor individually AND the Interaction Means and Standard Deviation.
- ▶ The degrees of freedom – remember this is the df and the df error
- ▶ The F value
- ▶ The P value (the level of significance)
- ▶ And the Measure of effect size (where applicable) – Partial Eta Squared (η_p^2)

So essentially it is the following.

- ▶ $F(df, df \text{ error}) = \text{place } f \text{ value here, } p = / < \text{ place sig value here, } \eta_p^2 . \text{place partial eta squared value here,}$



THE END