

## Analyses of K-Group Designs

### Analytic Comparisons & Trend Analyses

- Analytic Comparisons
  - Simple comparisons
  - Complex comparisons
  - Trend Analyses
- Errors & Confusions when interpreting Comparisons
- Comparisons using SPSS
- Orthogonal Comparisons
- Effect sizes for Analytic & Trend Analyses

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Analytic Comparisons -- techniques to make specific comparisons among condition means. There are two types...

Simple Analytic Comparisons -- to compare the means of two IV conditions at a time

Rules for assigning weights:

1. Assign weight of "0" to any condition not involved in RH
2. Assign weights to reflect comparison of interest
3. Weights must add up to zero

	Tx2	Tx1	C
	40	10	40
E.g. #1 RH: Tx1 < C (is 10 < 40 ?)	0	-1	1
E.g. #2 RH: Tx2 < Tx1 (is 40 < 10?)	-1	1	0

How do Simple Analytic Comparisons & Pairwise Comparisons differ?

- Usually there are only k-1 analytic comparisons (1 for each df)

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So, what happens with these weights?

The formula  $SS_{comp} = \frac{n(\sum w * mean)^2}{\sum w^2}$  &  $F = SS_{comp} / MS_{error}$

The important part is the  $\sum w * mean \rightarrow$  multiply each mean by its weight and add the weighted means together

- if a group is weighted 0, that group is "left out" of the  $SS_{comp}$
- if the groups in the analysis have the same means  $SS_{comp} = 0$
- the more different the means of the groups in the analysis the larger  $SS_{comp}$  will be

Tx2	Tx1	C
40	10	40

-1    0    1     $\sum w * mean = (-1 * 40) + (0 * 10) + (1 * 40) = 0$   
 -1    1    0     $\sum w * mean = (-1 * 40) + (1 * 10) + (0 * 40) = -30$

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**Advantages and Disadvantages of Orthogonal comparison sets**

**Advantages**

- each comparison gives statistically independent information, so the orthogonal set gives the most information possible for that number of comparisons
- it is a mathematically elegant way of expressing the variation among the IV conditions --  $SS_{IV}$  is partitioned among the comps

**Disadvantages**

- "separate research questions" often doesn't translate into "statistically orthogonal comparisons" (e.g., 1 -1 0 & 1 0 -1)
- can only have # orthogonal comparisons =  $df_{IV}$
- the comparisons included in an orthogonal set rarely address the set of research hypotheses one has (e.g., sets of orthogonal analyses usually include one or more complex comparisons)

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**Trend Analyses** -- the *shape* of the IV-DV relationship



Trend analyses can be applied whenever the IV is quantitative.

- There are three basic types of trend (w/ two versions of each)

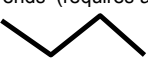

**Linear Trends**

positive  negative 

**Quadratic Trends** (requires at least 3 IV conditions)

U-shaped  inverted-U-shaped 

**Cubic Trends** (requires at least 4 IV conditions)

Note: Trend analyses are computed same as analytics -- using weights (coefficients) from "table" (only for =n & =spacing)

Note: As set of trend analyses are orthogonal – separate info @

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Not only is it important to distinguish between the two different types of each basic trend, but it is important to identify shapes that are combinations of trends (and the different kinds)

Here are two different kinds of "linear + quadratic" that would have very different interpretations

+ linear & U-shaped quadratic  ("accelerating returns" curve)

+ linear & inverted U-shape quad  ("diminishing returns" curve)

Here is a common combination of + linear & cubic  ("learning curve")

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"How to mess-up interpreting analytic comparisons"

Simple Comparisons:  
 -- ignore the direction of the simple difference (remember you must have a difference in the **correct direction**)

Complex Comparisons:  
 -- ignore direction of the difference (remember you must have a difference in the **correct direction**)  
 -- misinterpret complex comparison as if it were a set of simple comparisons

Trend Analyses:  
 -- ignore specific pattern of the trend (remember you must have a shape in the **correct direction or pattern**)  
 -- misinterpret trend as if it were a set of simple comps  
 -- ignore combinations of trend (e.g., the RH of a linear trend "really means" that there is a significant linear trend, and no significant quadratic or cubic trend)  
 -- perform trend analyses on non-quantitative IV conditions

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Effect Sizes for the k-BG or k-WG → Omnibus F

The effect size formula must take into account both the size of the sample (represented by df<sub>error</sub>) and the size of the design (represented by the df<sub>effect</sub>).

$$r = \sqrt{(df_{\text{effect}} * F) / (F + df_{\text{error}})}$$

The effect size estimate for a k-group design can only be compared to effect sizes from other studies with designs having exactly the same set of conditions.

There is no "d" for k-group designs – you can't reasonably take the "difference" among more than 2 groups.

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Effect Sizes for the k-BG or k-WG → Analytic Comps (Simple, Complex & Trend Analyses)

Since all three kinds of analytic comparisons always have df<sub>effect</sub> = 1, we can use the same effect size formula for them all (the same one we used for 2-group designs).

$$r = \sqrt{F / (F + df_{\text{error}})} \quad \text{or} \quad r = \sqrt{t^2 / (t^2 + df)}$$

Effects size estimates from simple & complex comparisons can be compared with effect sizes from other studies with designs having the same set of conditions (no matter what other differing conditions are in the two designs).

Effect size estimates from trend analyses can only be compared with effect sizes from other studies with designs having the same set of conditions.

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