

Data Analysis Session

Methods Overview

- You were presented with spoken words paired with text at 4 levels of noise (0dB, 65dB, 67dB and 69dB).
- The words could be:
 - Matching (i.e. you heard 'dog' and saw 'dog').
 - Not Matching (i.e. you heard 'chisel' and saw 'burger').
 - Phonologically similar (i.e. you heard 'gown' and saw 'noun').
 - Semantically Similar (i.e. you heard 'studio' and saw 'workshop').
- After each word pair you were prompted to recall either what you heard or what you saw.
- You also performed auditory and visual controls at each of the 4 noise levels.
- You are only required to analyse the data where the participant was asked to recall what they heard.

Data Analysis

- Two excel files have been made available to you:
 - ‘*PHY3111 2014 Cohort 2 Percentage Data.*’ Use this data to plot your graphs.
 - ‘*PHY3111 2014 Cohort 2 Transformed Data.*’ Use this data to conduct ANOVAs’
- The percentage data file includes the data for the % of words which were correctly recalled at each of the tested noise levels and for each of the different text-speech relationships.
- The files also include the % of responses for which the subject mistook text for speech.
 - I.e. If a participant heard ‘dog’ and saw ‘cat’ and then incorrectly said ‘cat’ when prompted to recall what they heard.
- In the transformed data file the percentage data has been arcsin sqrt transformed .
 - So if a participant originally scored 90% this would become $\text{asin}(\sqrt{90/100})=1.25$.

Data Analysis

- Use the files to plot and analyse the following:
 - % correct at no noise (single factor repeated measures ANOVA)
 - % wrong modality at no noise (single factor repeated measures ANOVA)
 - % correct at the 3 noise levels (two factor repeated measures ANOVA)
 - % wrong modality at the 3 noise levels (two factor repeated measures ANOVA)

- We will go through how to do the required analysis for the correct at 3 noise levels data in GraphPad

Step 1: Create a new project

Welcome to GraphPad Prism

GraphPad PRISM[®]
Version 6.04

New Table & Graph

- XY
- Column
- Grouped**
- Contingency
- Survival
- Parts of whole

Existing File

- Open a file
- LabArchives
- Clone a graph
- Graph portfolio

Prism Tips

Grouped tables have two grouping variables, one defined by columns and the other defined by rows

Table format		A			B		
		Control			Treated		
		A:Y1	A:Y2	A:Y3	B:Y1	B:Y2	B:Y3
1	Male						
2	Female						

[Learn more](#)

Enter/import data:

- Enter and plot a single Y value for each point
- Enter replicate values in side-by-side subcolumns
- Enter and plot error values already calculated elsewhere

Enter:

Use sample data:

- Two-way ANOVA - Ordinary - two data sets
- Two-way ANOVA - Ordinary - three data sets
- RM two-way ANOVA - matched values stacked
- RM two-way ANOVA - matched values in same row
- Grouped bar graph - Entering replicate data
- Grouped bar graph - Entering preaveraged data

Cancel Create

Step 2: Name the columns and the rows

The screenshot displays the GraphPad Prism interface with a data table titled "Two-way ANOVA with RM by columns". The table has 42 rows and 22 columns. The columns are organized into 11 groups (A through K). Group A is labeled "Audio Only" and has two subcolumns, "A:Y1" and "A:Y2", which are currently selected. A context menu is open over the "A:Y2" subcolumn, listing various actions such as Cut, Copy, Paste, and "One More Subcolumn". The status bar at the bottom indicates "Selected: Rows 500000, Columns 1".

	Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H	Group I	Group J	Group K
	Audio Only	Matching	Not Matching	Phonological	Semantic	Title	Title	Title	Title	Title	Title
1	65										
2	67										
3	69										
4	Title										
5	Title										
6	Title										
7	Title										
8	Title										
9	Title										
10	Title										
11	Title										
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40	Title										
41	Title										
42	Title										

Step 3: Create the 22 subcolumns for each of the participants

Step 4: Copy relevant data from the '*...Transformed Data.xlsx*' file to graphpad using paste transpose

The screenshot shows the GraphPad Prism interface. The title bar reads "GraphPad Prism - [CorrectAnalysis_Noise 752014.pzfx:Two-way ANOVA with RM by columns]". The menu bar includes File, Edit, View, Insert, Change, Arrange, Window, and Help. The toolbar contains various icons for file operations, analysis, and formatting. On the left, a project tree shows "Two-way ANOVA with RM" selected. The main workspace is a data table with columns labeled A:Y1 through A:Y18. The first row contains the value "65" in cell A:Y1. A context menu is open over cell A:Y1, listing options such as Cut, Copy, Paste, Paste Transpose (highlighted), Paste Special..., Import Data..., Insert..., Delete..., Exclude Values, Format Points, Highlight Points, Decimal Format..., Column Width, One More Subcolumn, Data Object, Select, Use Larger Font, and Use Smaller Font. The status bar at the bottom indicates "Two-way ANOVA with RM by columns" and "Row 1, A: Audio Only".

Step 5: Click Analyze

GraphPad Prism - [CorrectAnalysis_Noise 752014.pzfx:Two-way ANOVA with RM by columns]

File Edit View Insert Change Arrange Window Help

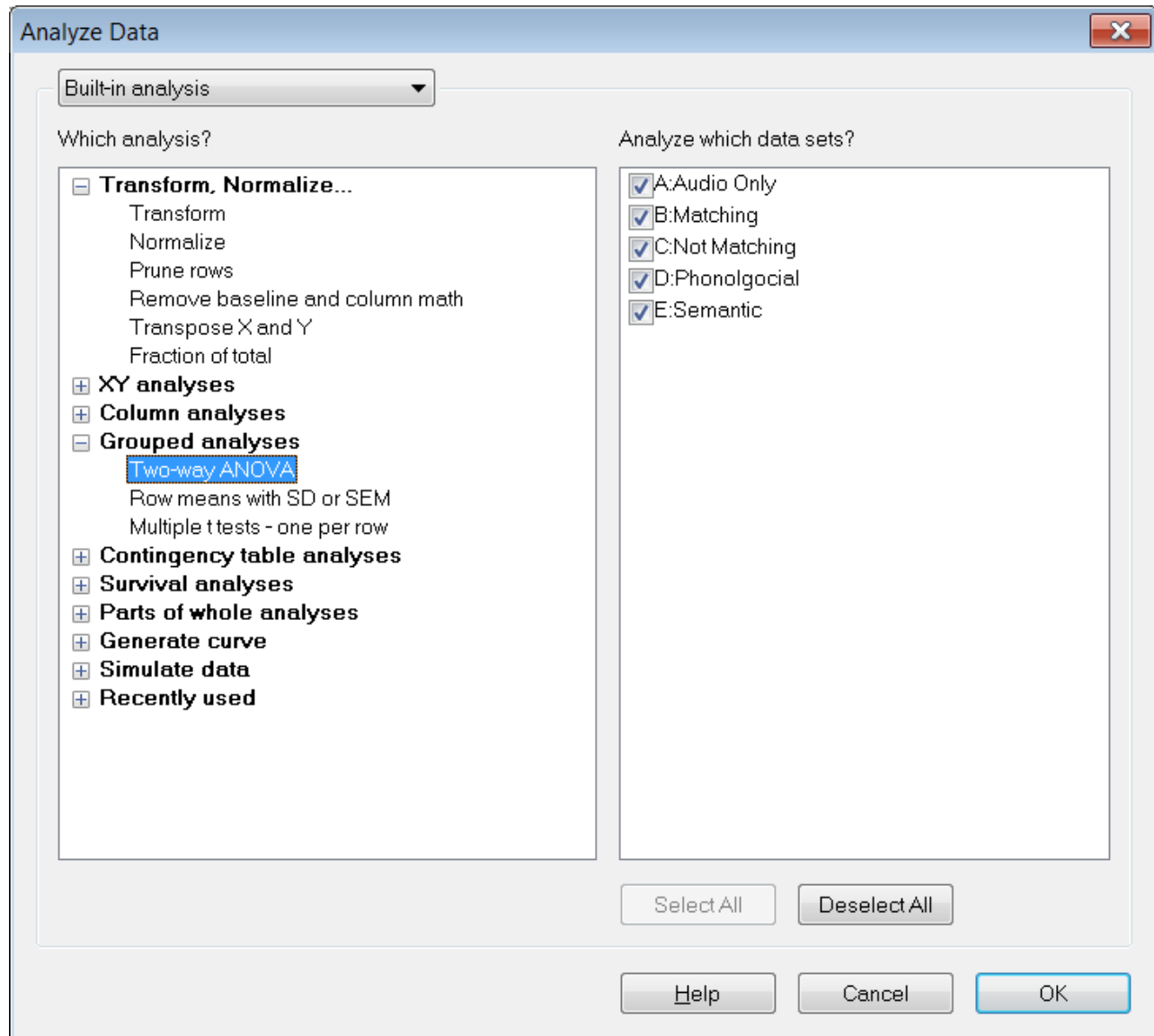
Prism File Sheet Undo Clipboard Analysis Change Import Draw Write Text Export Print Send LA Help

Table format Group A
Analyze these data (regression, statistics, transforms, ...)

		A:Y1	A:Y2	A:Y3	A:Y4	A:Y5	A:Y6	A:Y7	A:Y8	A:Y9	A:Y10	A:Y11	A:Y12	A:Y13	A:Y14	A:Y15	A:Y16	A:Y17	A:Y18	A:Y19
1	58	0.650432	0.818756	0.818756	0.886077	0.852264	0.752040	0.785398	0.815480	0.650432	0.852264	0.785398	0.955317	0.752040	0.818756	0.852264	0.718532	0.752040	1.066666	0.818756
2	67	0.684719	0.818756	0.542639	0.852264	0.752040	0.650432	0.852264	0.373792	0.542639	0.785398	0.818756	0.684719	0.650432	0.752040	0.785398	0.650432	0.684719	0.718532	0.650432
3	69	0.420534	0.183604	0.504130	0.463648	0.261157	0.504130	0.321751	0.373792	0.321751	0.542639	0.420534	0.463648	0.321751	0.463648	0.373792	0.420534	0.463648	0.504130	0.504130
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Two-way ANOVA with RM by columns Row 1, Column RT

Step 6: Select Two-way ANOVA and click OK



Step 7: In the Experimental Design tab choose Repeated measures by both factors and name the column and row factors.

Parameters: Two-Way ANOVA

Experimental Design | Multiple Comparisons | Options

Experimental design

No matching. Use regular two-way ANOVA (not repeated measures)

Each column represents a different time point, so matched values are spread across a row.

Each row represents a different time point, so matched values are stacked into a subcolumn.

Repeated measures by both factors

Table format:		Group A		Group B		Group C	
Grouped		Title		Title		Title	
		A:Y1	A:Y2	B:Y1	B:Y2	C:Y1	C:Y2
1	Title						
2	Title						
3	Title						
4	Title						

Factor names

Name the factor that defines the columns: Relationship

Name the factor that defines the rows: Noise Level

Based on your choices (on all three tabs), Prism will perform:

- RM two-way ANOVA, matched values are both stacked and spread across a row.
- Tukey's multiple comparisons test.

Learn Cancel OK

Step 8: In the Multiple Comparisons tab choose the type of Multiple Comparison you would like to make.

Parameters: Two-Way ANOVA

Experimental Design Multiple Comparisons Options

What kind of comparison?

Within each row, compare columns (simple effects within rows)

	Group A		Group B		Group C	
	Data Set-A		Data Set-B		Data Set-C	
	A:Y1	A:Y2	B:Y1	B:Y2	C:Y1	C:Y2
1	Mean	Mean	Mean	Mean	Mean	Mean
2	Mean	Mean	Mean	Mean	Mean	Mean
3	Mean	Mean	Mean	Mean	Mean	Mean

How many comparisons?

Compare each cell mean with every other cell mean on that row.

Compare each cell mean with the control cell mean on that row.

Control column: Group A : Audio Only

How many families?

One family per row (recommended)

Learn Cancel OK

- You can compare each cell mean with just the audio only condition.
- OR
- You can compare each cell mean with every other cell mean, if you require this comparison to check your hypotheses.
 - Note that as this option performs more comparisons, the significance tests may produce different results.
- When you perform this analysis for the wrong modality responses you will have to compare each cell mean with every other cell mean.

Step 9: In the Options tab choose to Report multiplicity adjusted P value for each comparison

Parameters: Two-Way ANOVA

Experimental Design | Multiple Comparisons | Options

Multiple comparisons test

- Correct for multiple comparisons: Compute CIs and significance. Recommended.
Test: Dunnett
- Correct for multiple comparisons: Compute significance only (no CIs) to gain power.
Test: Holm-Sidak
- Don't correct for multiple comparisons. Each comparison stands alone.
Test: Fisher's LSD test

Multiple comparisons

- Swap direction of comparisons (A-B) vs. (B-A).
- Report multiplicity adjusted P value for each comparison.
Each P value is adjusted to account for multiple comparisons.

Family-wise significance and confidence level: 0.05 (95% confidence interval)

Graphing options

- Graph confidence intervals.

Additional results

- Narrative results
- Show 4 significant digits.
- Make options on this tab be the default for future ANOVAs.

Learn Cancel OK

Step 10: Press OK

Step 11: The repeated Measures ANOVA results will be in the Tabular results tab

GraphPad Prism - [CorrectAnalysis_Noise 752014.pzfx:2way ANOVA of Two-way ANOVA with RM by columns]

File Edit View Insert Change Arrange Window Help

Prism File Sheet Undo Clipboard Analysis Interpret Change Draw Write Text Export Print Send LA Help

Family Search results Data Tables Two-way ANOVA with RM by columns Info Project info 1 Results 2way ANOVA of Two-way ANOVA Tabular results Multiple comparisons Graphs Two-way ANOVA with RM by columns Layout

2way ANOVA						
Tabular results						
1	Table Analyzed	Two-way ANOVA with RM by columns				
2						
3	Two-way RM ANOVA	Matching: Both factors				
4	Alpha	0.05				
5						
6	Source of Variation	% of total variation	P value	P value summary	Significant?	
7	Noise Level	10.13	< 0.0001	****	Yes	
8	Relationship	69.28	< 0.0001	****	Yes	
9	Interaction: Noise Level x Relationship	2.715	< 0.0001	****	Yes	
10	Interaction: Noise Level x Subjects	2.971				
11	Interaction: Relationship x Subjects	4.164				
12	Subjects	4.191				
13						
14	ANOVA table	SS	DF	MS	F (DFn, DFd)	P value
15	Noise Level	4.037	2	2.019	F (2, 42) = 71.60	P < 0.0001
16	Relationship	27.62	4	6.904	F (4, 84) = 349.4	P < 0.0001
17	Interaction: Noise Level x Relationship	1.082	8	0.1353	F (8, 168) = 8.707	P < 0.0001
18	Interaction: Noise Level x Subjects	1.184	42	0.02819		
19	Interaction: Relationship x Subjects	1.860	84	0.01976		
20	Subjects	1.670	21	0.07955		
21	Residual	2.610	168	0.01554		
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- Report the F statistic, not just the p value.
- If there is a significant interaction the main effects cannot be interpreted reliably.
- You will need to use the multiple comparisons test results.

Step 12: The Multiple comparisons are in the Multiple comparisons tab.

Purpose

- Why does matching text rescue the recall of degraded speech?
- Your explanation should be grounded in the literature.

