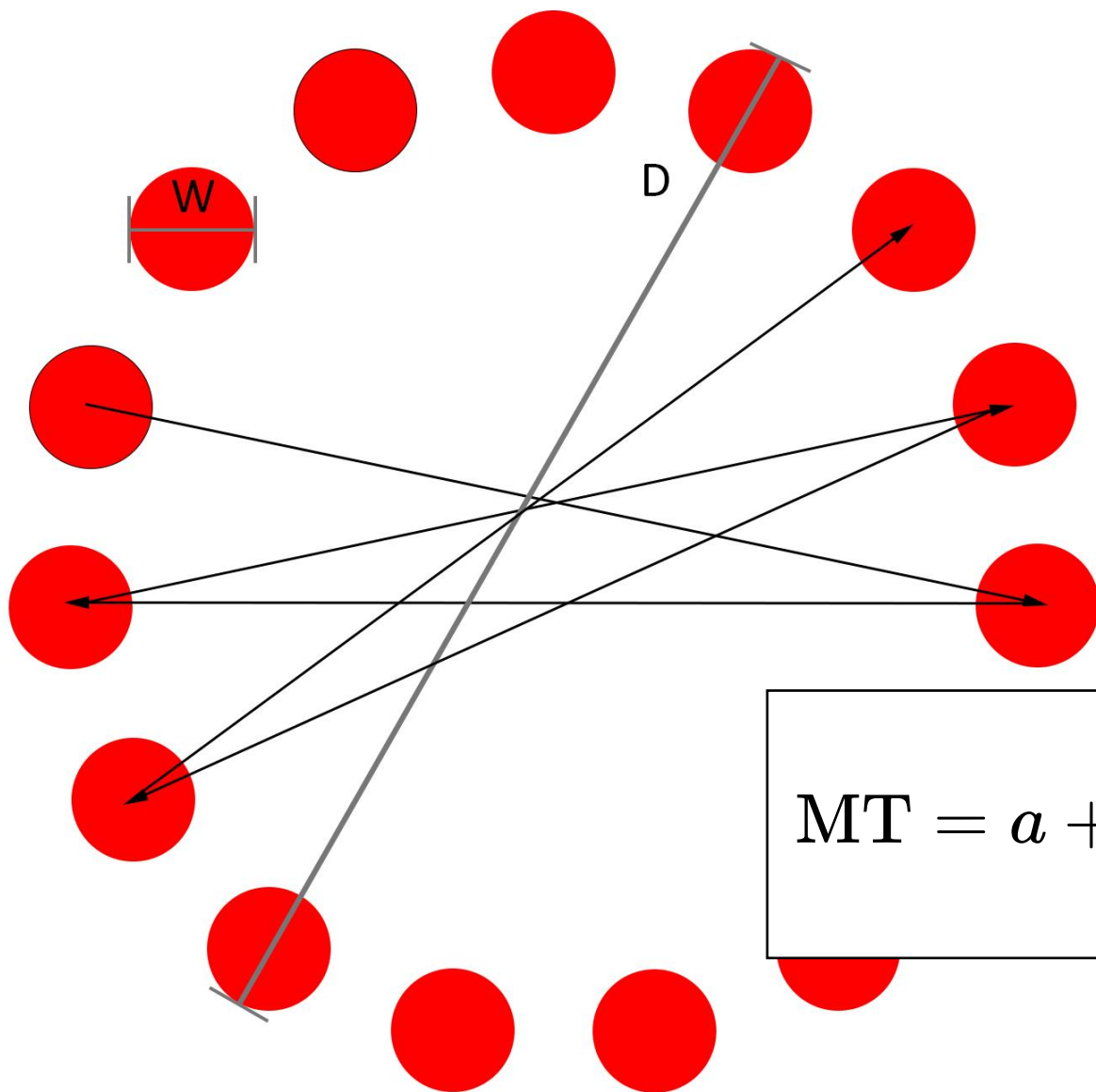


# UI Evaluation

A beginners guide to statistics for HCI



## Predictive Models

$$MT = a + b \cdot ID = a + b \cdot \log_2 \left( \frac{2D}{W} \right)$$

A person wearing a VR headset and holding two hand controllers is standing in a room with a large projection screen. They are wearing a green sweater and black pants. A man in a red hoodie is sitting at a desk with multiple monitors, observing the user. The room has a light-colored floor with some black markers and a white wall with a large dark projection screen. A blue text box is overlaid on the image.

## User Evaluations



Measures

Efficacy





Measures

Efficiency



Measures

Satisfaction



# Standard Questionnaires

## System Usability Scale Questionnaire

1. I think that I would like to use this product frequently.
2. I found the product unnecessarily complex.
3. I thought the product was easy to use.
4. I think that I would need the support of a technical person to be able to use this product.
5. I found the various functions in the product were well integrated.
6. I thought there was too much inconsistency in this product.
7. I imagine that most people would learn to use this product very quickly.
8. I found the product very awkward to use.
9. I felt very confident using the product.
10. I needed to learn a lot of things before I could get going with this product.

Strongly Disagree

Strongly Agree

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

## Mental demand

How much mental and perceptual activity was required - thinking, deciding, calculating, searching? Was the task easy or demanding, simple or complex, exacting or forgiving?

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Very Low										Very High									

## Physical demand

How much physical activity was required - pushing, pulling, turning? Was the task easy or demanding, slow or brisk, restful or laborious?

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Very Low										Very High									

## Temporal demand

How much time pressure did you feel? Was the pace slow and leisurely or rapid and frantic?

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Very Low										Very High									

## Effort

How hard did you work mentally and physically to accomplish your level of performance?

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Very Low										Very High									

## Performance

How successful did you feel in accomplishing the goals of the task? How satisfied were you with your performance?

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Very Low										Very High									

## Frustration level

How discouraged, stressed, irritated, and annoyed versus gratified, content, and relaxed did you feel during the task?

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Very Low										Very High									

NASA-TLX (Task Load Index), Hart 88



Multiple Approaches

# Statistics

Ratio:

$$A^{\text{raw}}(Q^2, W) / A^{\text{raw}}(Q^2) = \frac{A_p^{\text{raw}}(Q^2, W) / A_p^{\text{raw}}(Q^2, e)}{\text{quantity of interest} \cdot \text{known from el. Form Factors}}$$

Correction factor close to 1 can be determined theoretically

$$RDF = \frac{\frac{1 + (\sigma_p A_p)^2 / (\sigma_p A_p) (-\frac{1}{3} P_{SN})}{1 + (\sigma_p A_p)^2 / (\sigma_p A_p) (-\frac{1}{3} P_{SN})}}{\frac{1 + \sigma_{SN}^2 / 3\sigma_p^2 + (\sum \dots)^2 / (3\sigma_{SN} \sigma_p^2)}{1 + \sigma_{SN}^2 / 3\sigma_p^2 + (\sum \dots)^2 / (3\sigma_{SN} \sigma_p^2)}}$$

Ratio of dilution factors = RDF

$$RDF = \frac{\frac{\sigma_p}{\sigma_{el}}}{\frac{3\sigma_{SN} \sigma_p^2 + \sigma_{SN}^2 + \sum \dots}{3\sigma_{SN} \sigma_p^2 + \sigma_{SN}^2 + \sum \dots}}$$

known from E1 run

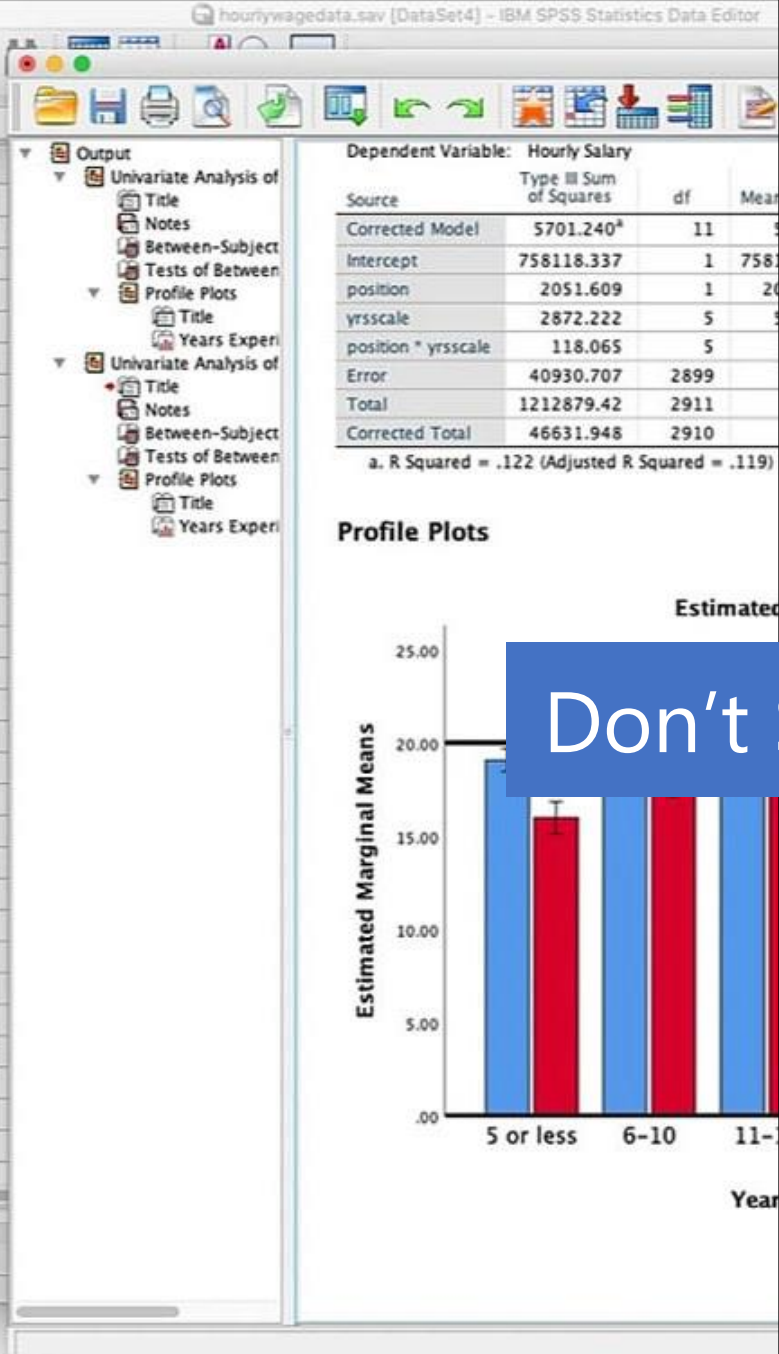
Ratio of measured counts in the elastic peak region to the full  $NH_3$  target in the elastic peak region

the full  $NH_3$  target in the elastic peak region





position	agerange	yrsscale	hourwage
1	1	2	13.74
0	1	2	16.44
0	1	3	21.39
1	1	1	11.38
0	1	3	21.56
0	1	1	18.12
1	1	3	13.14
0	1	1	24.73
0	1	2	15.70
1	1	1	18.94
0	1	1	25.45
0	1	1	19.71
1	1	2	21.14
0	1	2	20.53
0	1	2	20.83
1	1	2	16.81
0	1	2	17.59
0	1	3	18.73
1	1	2	14.77
0	1	3	19.36
0	1	2	17.03
1	1	3	.
0	1	3	20.67
0	1	2	19.41
1	1	3	20.22
0	1	1	20.23
0	1	3	16.48
1	1	3	12.27
0	1	3	23.51
0	1	2	17.67
1	1	2	11.20
0	1	1	20.44



Take the

# One-way ANOVA in SPSS Statistics

## Introduction

The one-way analysis of variance (ANOVA) is used to determine whether there are any statistically significant differences between the means of three or more independent (unrelated) groups (although you tend to only see it used with two groups).

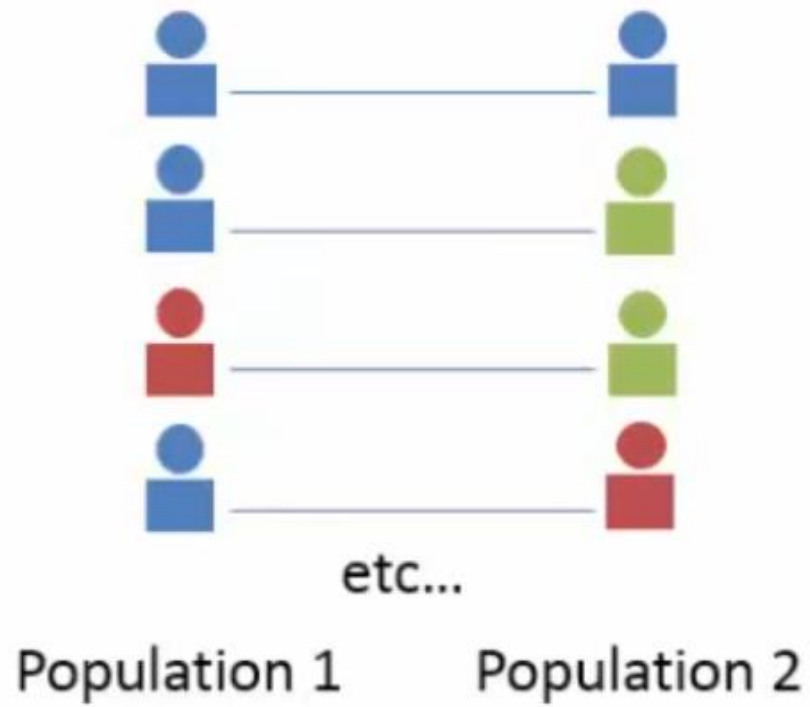
For example, you could use a one-way ANOVA to understand whether there are any differences in test scores amongst students, dividing students into three independent groups (e.g., low, medium, and high ability).

It is important to realize that the one-way ANOVA is an **omnibus** test statistic and cannot tell you which groups are significantly different from each other; it only tells you that at least two groups were different. To determine which groups in your study design, determining which of these groups differ from each other is important (N.B., we discuss post hoc tests later in this guide).

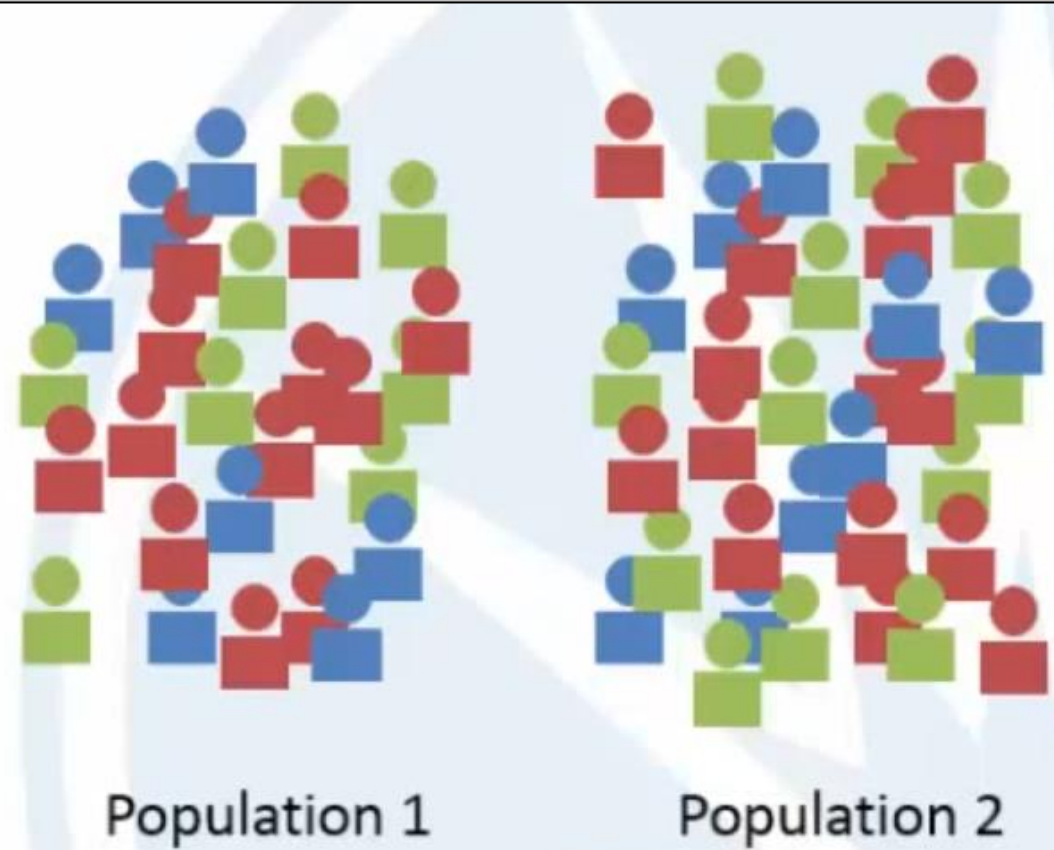
**Note:** If your study design not only involves one dependent variable and one independent variable (or a "covariate") that you want to "statistically control", you may need to perform an ANCOVA. This is thought of as an extension of the one-way ANOVA. To learn more, see our SPSS Statistics guide on ANCOVA. If your dependent variable is the time until an event happens, you might need to run a [Kaplan-Meier survival analysis](#).

This "quick start" guide shows you how to carry out a one-way ANOVA using SPSS Statistics. It also explains how to interpret the results from this test. Since the one-way ANOVA is often followed up with a post hoc test, we also explain how to interpret the results using SPSS Statistics. However, before we introduce you to this procedure, we first explain what ANOVA is. [statistics.laerd.com](https://statistics.laerd.com)

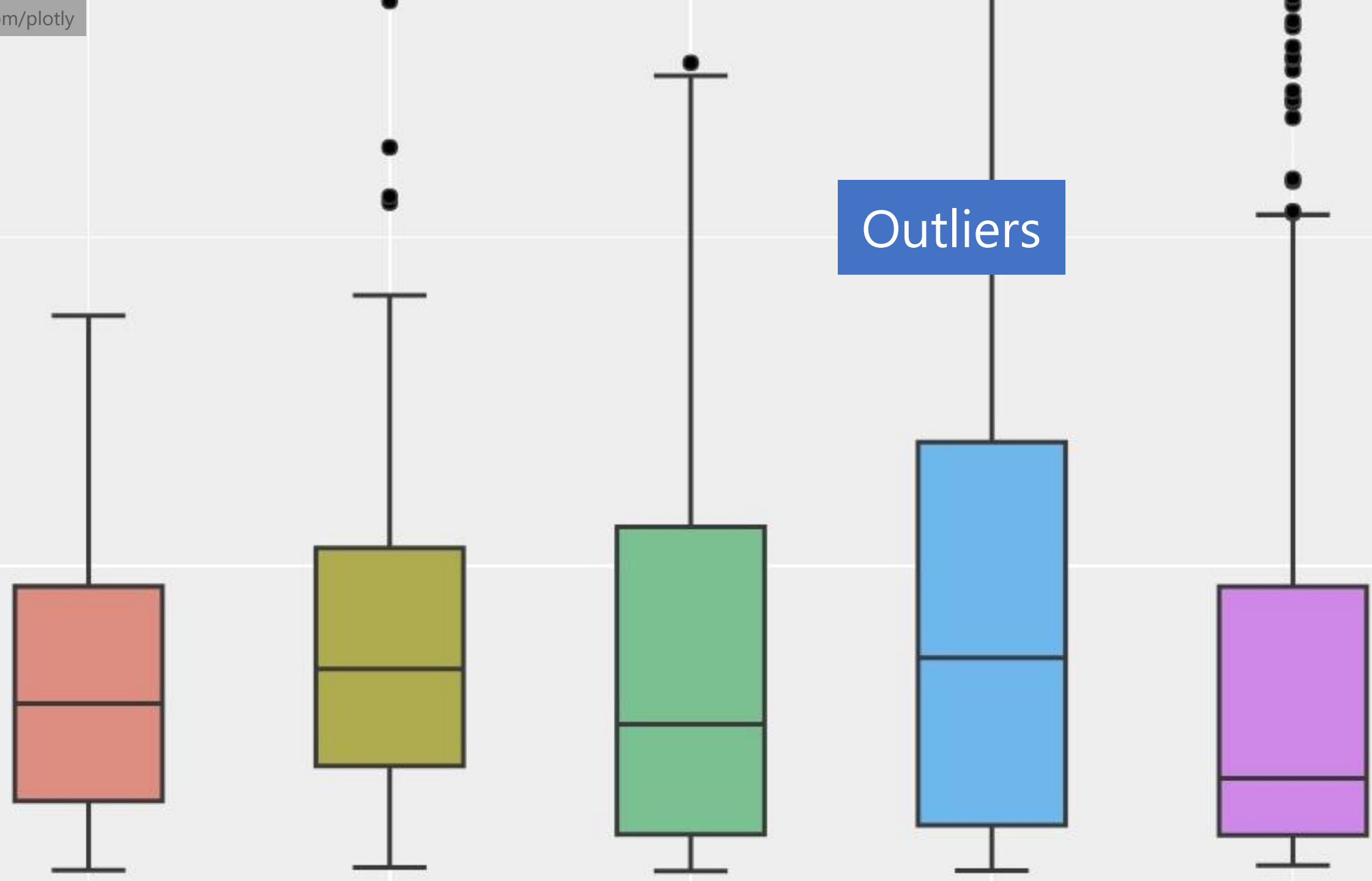
# Samples



Related



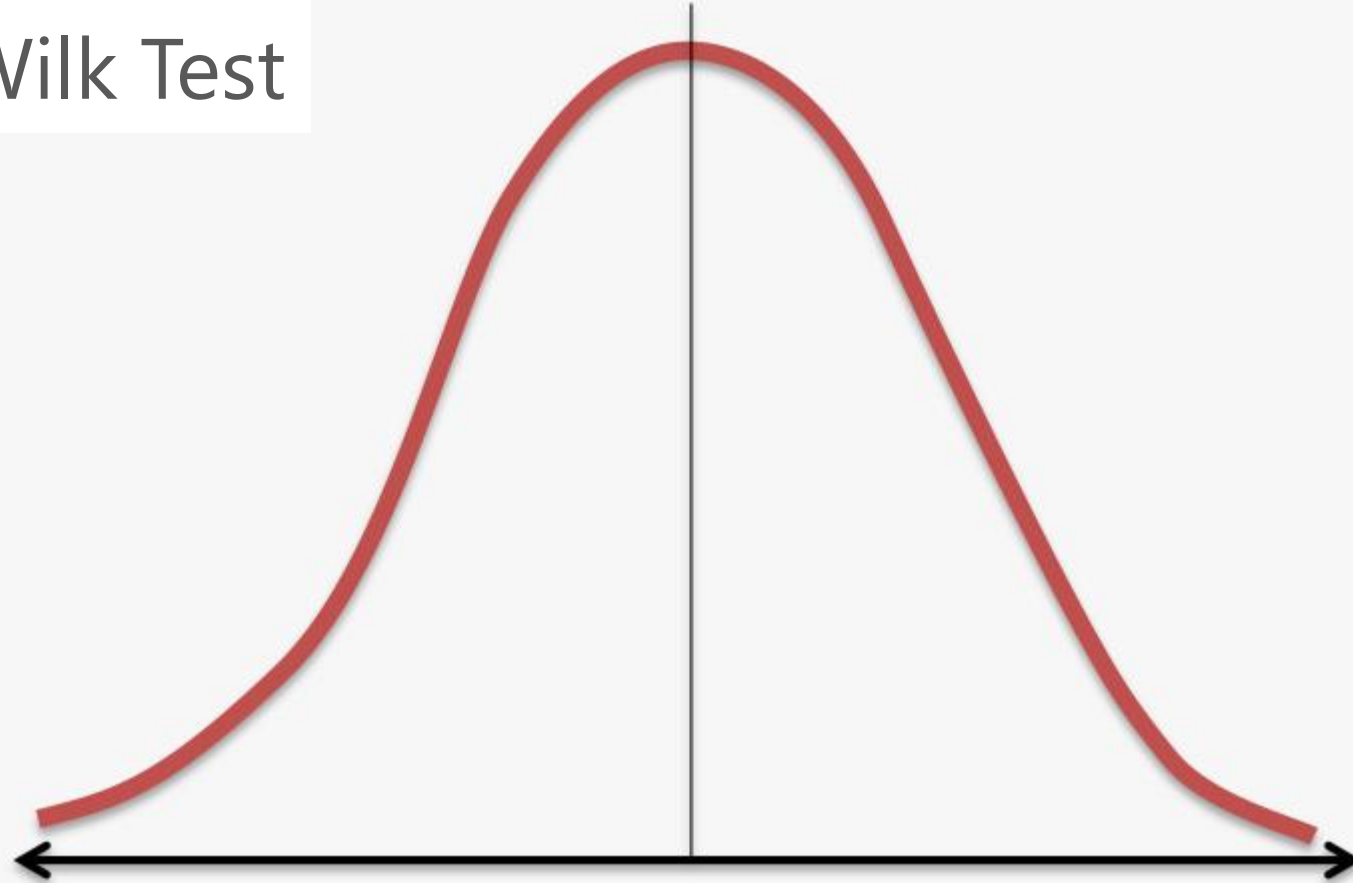
Independent





# Data Normality

## Shapiro-Wilk Test



# Cheat Sheet

Samples		Data normality	
Type	Count	Yes	No
Related	2	Paired T-test	Wilcoxon Signed Ranks
	>2	Repeated Measures ANOVA	Friedman
Independent	2	Student's T-test	Mann-Whitney U
	>2	One-way ANOVA	Kruskal-Wallis

When testing more than two samples, post-hoc test are required. Use them with the Bonferroni correction.



Variable Types



More Tests



Just the start!



Assumptions



Reporting



# Questions?

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