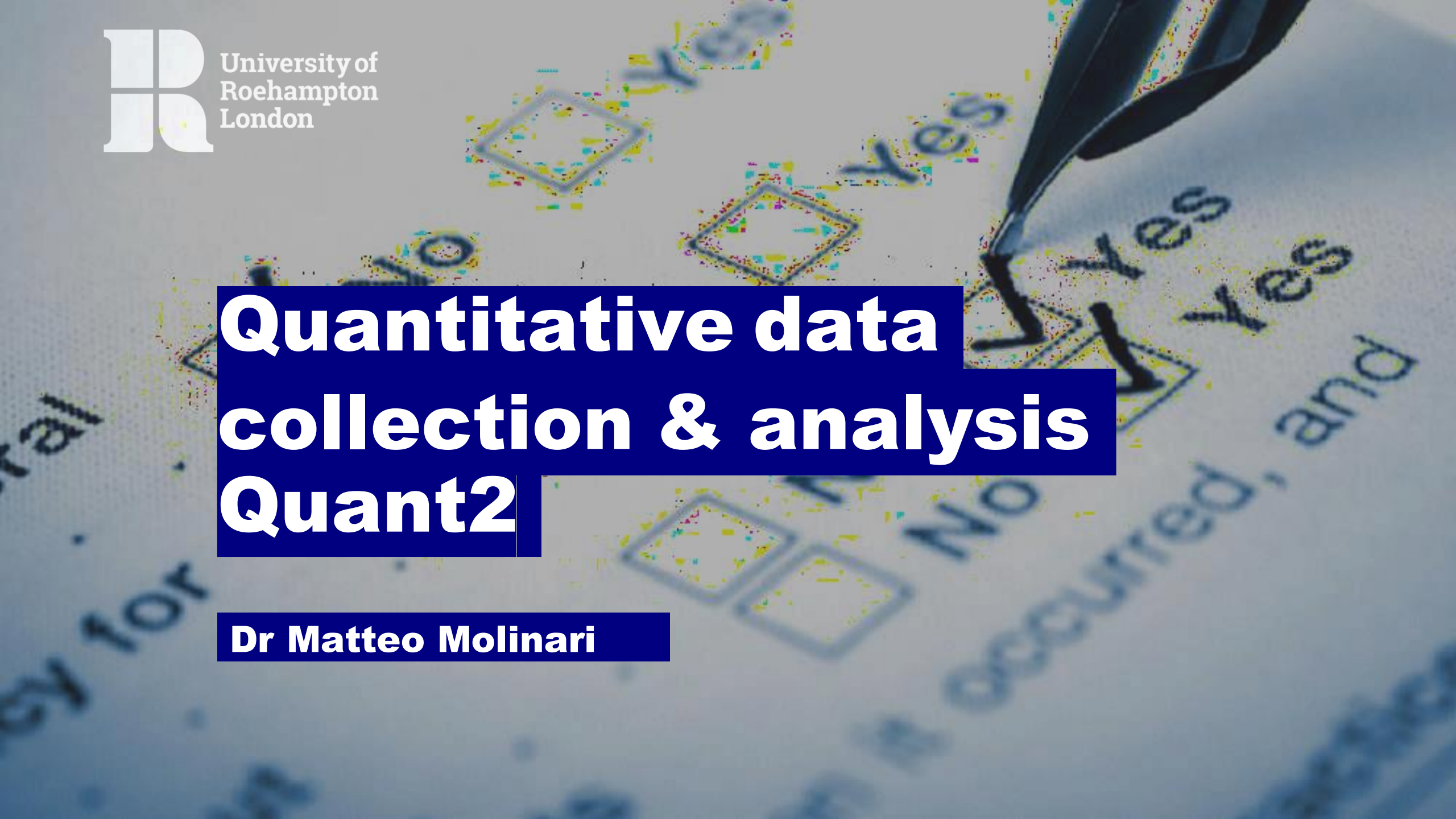

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Quantitative data collection & analysis Quant2

Dr Matteo Molinari

University of Roehampton London

Agenda

- **To understand rigour and validity of adequate analysis.**
- **To follow high standards in data collection.**

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Outline

- Descriptive Data Analysis
- Hypothesis Testing
- Regression Analysis

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Scale of measurement

Discrete	Nominal	Gender, Religious
	Ordinal	Education
Continuous	Interval	Temperature, IQ
	Ratio	Income, age

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General rule- Type of analysis

- DV and IV are Nominal scale-Cross tab
- DV and IV are Interval –Regression , Pearson correlation
- IV (2 categorical) DV (Interval)- T test
- IV (3 categorical) DV (Interval)-ANOVA

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Descriptive Analysis with One Variable

- We will look at the following statistics:

➢ Frequency Distributions (ordinal and nominal variables)

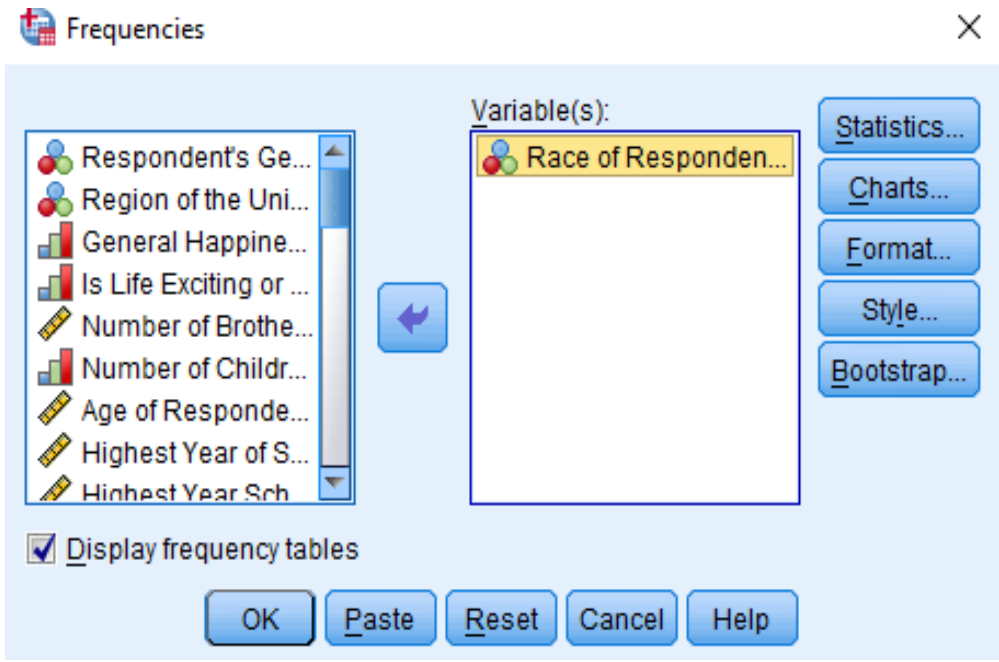
- SPSS provides a range of output e.g. cell count, percentages (%) total, as well information on missing cases

➢ Descriptive statistics (scale variables)

- measures of central tendency and dispersion e.g. min, max, mean, and standard deviation.

Frequencies

- Select *Analyze>Descriptive Statistics>Frequencies*
- Highlight the variable(s) you want in the left hand panel and click on the arrow to move it into the right hand panel and click on 'OK'
- Your frequency table will appear in the output window
- Other options for descriptive statistics include percentiles (more appropriate for scale variables)
- You can sort your results in the output (e.g. using categories)



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Frequency Distribution for Race

Statistics

Race of Respondent

N	Valid	1517
	Missing	0

Race of Respondent

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White	1264	83.3	83.3	83.3
	Black	204	13.4	13.4	96.8
	Other	49	3.2	3.2	100.0
	Total	1517	100.0	100.0	

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Descriptives

- Select *Analyze>Descriptive Statistics>Descriptives*
- Highlight the variable (e.g. age) and move it across.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age of Respondent	1514	18	89	45.63	17.808
Valid N (listwise)	1514				

- To obtain the median or quartiles, you will find it as an option under *Frequencies>Statistics* or use the *Analyze>Explore* option
- Stats can be affected by missing values and thus, you may need to discard or apply corrective measures on missing cases/values

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Descriptive Analysis with Two Variables

We will now look at the following techniques:

- Cross Tabulations
- Descriptive statistics by category
- Correlations

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Cross-Tabulations

- To examine the relationship between two nominal variables, select *Analyze>Descriptive Statistics>Crosstabs*
- Select the variables you want as the row and column variables and move them into the respective boxes
  - e.g. to see how happiness varies by gender, select happy as your row variable and gender as your column variable
- Click 'OK' to see the frequencies for each category
- Percentages of the results can be obtained by clicking on the *Cells* button on the right hand side of the screen
  - e.g. click on the 'row' option under *Cells* to get row percentages
- Contingency (and other) tests can be obtained under *Statistics*

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Crosstab of Happiness and Gender

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
General Happiness * Respondent's Gender	1504	99.1%	13	0.9%	1517	100.0%

General Happiness * Respondent's Gender Crosstabulation

			Respondent's Gender		
			Male	Female	Total
General Happiness	Very Happy	Count	206	261	467
		% within General Happiness	44.1%	55.9%	100.0%
	Pretty Happy	Count	374	498	872
		% within General Happiness	42.9%	57.1%	100.0%
	Not Too Happy	Count	53	112	165
		% within General Happiness	32.1%	67.9%	100.0%
Total		Count	633	871	1504
		% within General Happiness	42.1%	57.9%	100.0%

Descriptives

	Respondent's Gender			Statistic	Std. Error
Highest Year of School Completed	Male	Mean		13.23	.125
		95% Confidence Interval for Mean	Lower Bound	12.99	
			Upper Bound	13.48	
		5% Trimmed Mean		13.27	
		Median		13.00	
		Variance		9.876	
		Std. Deviation		3.143	
		Minimum		3	
		Maximum		20	
		Range		17	
		Interquartile Range		4	
		Skewness		-.203	.097
		Kurtosis		.425	.194
	Female	Mean		12.63	.096
		95% Confidence Interval for Mean	Lower Bound	12.44	
			Upper Bound	12.82	
		5% Trimmed Mean		12.65	
		Median		12.00	
		Variance		8.062	
		Std. Deviation		2.839	
		Minimum		0	
		Maximum		20	
		Range		20	
		Interquartile Range		2	
		Skewness		-.199	.083
		Kurtosis		1.006	.165

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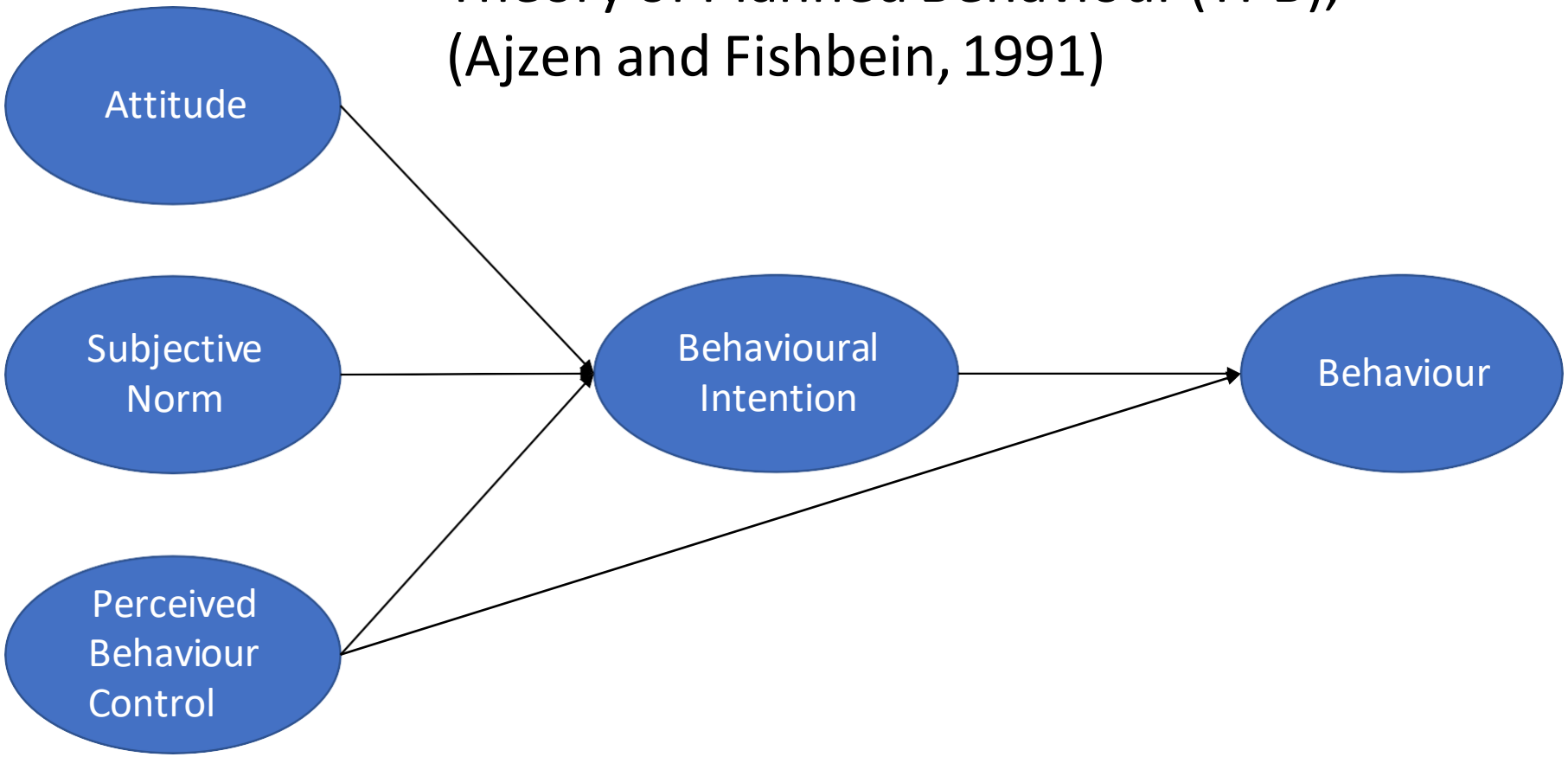
Theory of Planned Behaviour (TPB), (Ajzen and Fishbein, 1991)



Correlations

- To examine the relationship between two continuous variables, select *Analyze>Correlate>Bivariate*

- Select the variables you want and move them into the box on the right hand side by clicking on the right arrow
  - e.g. to see how an individual's attitude is associated with their purchasing intention, select att and intention
  - The default correlation coefficient is Pearson

- Click 'OK. The output will include significance levels for the correlations.

- Other coefficients can be added (e.g. Kendall's Tau and Spearman)

- Be careful on how you interpret correlation results: a high correlation does not necessarily imply a causation

Correlation Between Individual's attitude and intention

Correlations

		Attitude	Intention
Attitude	Pearson Correlation	1	.419**
	Sig. (2-tailed)		.000
	N	1510	1232
Intention	Pearson Correlation	.419**	1
	Sig. (2-tailed)	.000	
	N	1232	1233

**. Correlation is significant at the 0.01 level (2-tailed).

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Tests of Statistical Significance

- **Chi-Square Tests**
  - Establishes how confident we are that there exists a relationship between two variables in a population

- **Comparing means (t-tests)**
  - Allows you to test whether a variable's mean is equal to a particular value or is different to that of another variable in a population

- **Tests of Correlation**
  - Provides information about likelihood that variables are statistically associated in a population

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Statistical significance when a relationship is found

- How confident can we be that the findings from a sample can be generalized to the population as a whole?
- How risky is it to make this inference?
- Hypothesis testing is usually applied to probability (or representative) samples

What is a Hypothesis?

An informed speculation about a relationship between some variables based on theoretical underpinnings but has not been proven yet. There are 2 types of hypotheses:

- **Null hypothesis** (H_0): represents the status quo that is adopted until it is proven false i.e. effect is absent, there is no association, difference or relationship:

"There is no relationship between students' attendance and their academic performance"

- **Alternative hypothesis** (H_a): *converse* of null hypothesis which represents the theory that we will adopt when there is corroborative evidence i.e. effect is present, there is an association, difference or relationship:

"Class attendance has a positive effect on students' academic performance"

  - **One-tailed** vs **Two-tailed** hypothesis test
  - **Type I** & **Type II** errors

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What is a Hypothesis (cont.)?

- Single-tailed test: directional $(X > Y \text{ or } X < Y)$
  Predicts the nature of the difference:

  "Female managers earn less than their male counterparts"

  "An increase in the number of promotional emails sent to customers will increase customer complaints"

  - Can also be a default when one of the sides is impossible

- Two-tailed test: non-directional $(X \neq Y)$
  Does not predict the nature of the difference. You are interested in values above or below the hypothesised value (no specific direction)

  "There is a difference in the wages earned between employees working in London and the South East"

  - May be you know that both outcomes are possible or you are not sure

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Steps for Hypothesis Testing

1. **Set up** a null hypothesis (H_0) as well as an alternative hypothesis (H_1);

2. **Decide** on an acceptable level of statistical significance (1% or 5%);

3. **Use** an appropriate statistical test (could either be set up as one or two-tailed alternative);

4. If acceptable level is attained, **reject** null hypothesis; If not attained, **do not reject** it.

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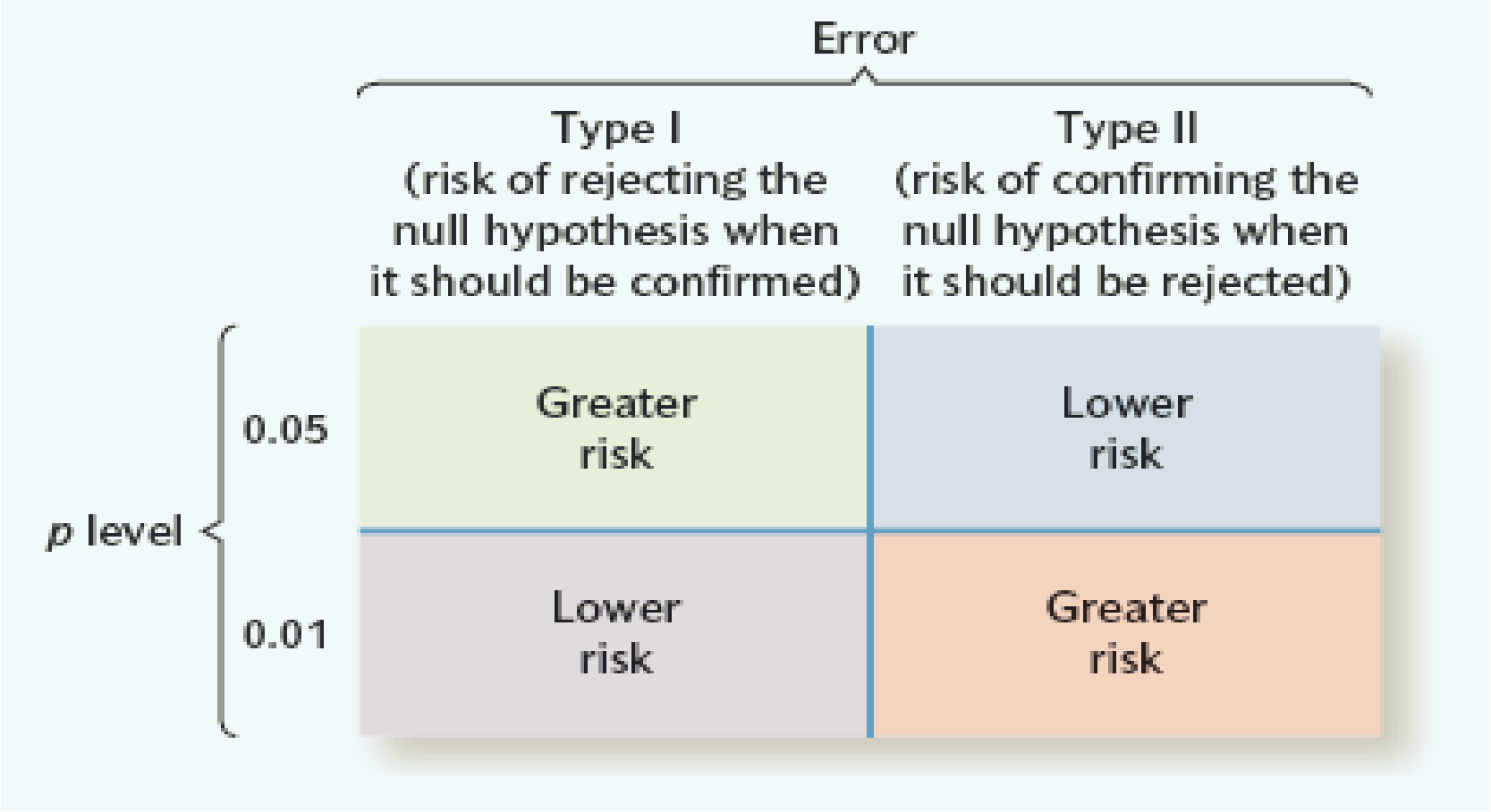
…but you might be wrong to accept or reject the null hypothesis



Type I & Type II errors

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Null Hypothesis	Type I Error / False Positive	Type II Error / False Negative
Wolf is not present	Shepherd thinks wolf is present (shepherd cries wolf) when no wolf is actually present	Shepherd thinks wolf is NOT present (shepherd does nothing) when a wolf is actually present

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Null Hypothesis	Type I Error / False Positive	Type II Error / False Negative
Person is not guilty of the crime	Person is judged as **guilty** when the person actually **did not** commit the crime (convicting an innocent person)	Person is judged **not guilty** when they actually **did** commit the crime (letting a guilty person go free)

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Different Tests in SPSS

- One can test the extent to which two (nominal or ordinal) variables are associated and the most common test of association is the Chi-Square Test

- The null hypothesis in this test assumes that the variables are independent

- These tests can be performed by selecting *Analyze>Descriptive Statistics>Crosstabs* and then clicking on the *Statistics* button and ticking the appropriate boxes.

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A Basic Example of Crosstabs

Attitude

Cheated	Liked	Disliked
Yes	12	33
No	44	66

Comparing Means

- Various statistical tests can be found under *Analyze>Compare Means*

- To test whether means are different from zero (or another value)
  - ➢ Select *One-Sample T Test*

- To test whether means are different from each other
  - ➢ Select *Paired-Sample T Test*

Paired sample t-test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Male_time	11.01	974	4.118	.132
	Female_time	11.02	974	3.407	.109

H0= no difference between male and female group

Paired Samples T

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Male_time Female_time	-.007	3.115	.100	-.203	.189	-.072	973	.943

P=0.943>0.05
Null Hypothesis not rejected
No difference between two groups

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Correlation and Significance

- How confident can you be about a relationship between two variables?
- Whether a correlation coefficient is statistically significant depends on:
  - Size of the coefficient (the higher the better)
  - Size of your sample (the larger the better)
- If $p < 0.05$, one can reject the null hypothesis

Correlation and Significance in SPSS

- You can obtain correlation coefficients for more than 2 variables e.g. attitude and their SN and PCB

Correlations

		AVGatt	AVGintention	AVGsn	AVGpbc
AVGatt	Pearson Correlation	1	.213**	.147*	.081
	Sig. (2-tailed)		.003	.045	.270
	N	187	187	187	187
AVGintention	Pearson Correlation	.213**	1	.567**	.380**
	Sig. (2-tailed)	.003		.000	.000
	N	187	187	187	187
AVGsn	Pearson Correlation	.147*	.567**	1	.566**
	Sig. (2-tailed)	.045	.000		.000
	N	187	187	187	187
AVGpbc	Pearson Correlation	.081	.380**	.566**	1
	Sig. (2-tailed)	.270	.000	.000	
	N	187	187	187	187

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05level (2-tailed).

p-values are generated automatically. Stars (*) next to a value signify that there is a significant relationship between the variables

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Regression Analysis

- Similar to correlation but also gives you a coefficient attached to a constant
- OLS estimates a line of best fit with an intercept and slope
- Coefficients should be interpreted differently depending on how the variables have been entered (e.g. in levels or logs)
- Associated *p*-values allow you to test for significant relationships
- The R-squared statistic in the output shows the overall significance of the regression
  - How much the independent variables explain the variations in the dependent variables

Simple Regression Analysis in SPSS

- Select *Analyze>Regression>Linear*

- To estimate the effect of attitude on intention
  - Move intention into the Dependent variable box
  - Move attitude into the Independent variables box
  - Click OK

- A range of other options are available with the *Statistics* button

Simple Regression Output from SPSS

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.213[a]	.045	.040	.70377	.045		1	185	.003

a. Predictors: (Constant), AVGatt

The R and R square value are statistically significant

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.351	1	4.351	8.784	.003[b]
	Residual	91.629	185	.495		
	Total	95.980	186			

a. Dependent Variable: AVGintention

A consumer's intention is expected to be around 2.566 if attitude is zero.

A one unit increase in consumer's intention will result in an increase of 0.261 in the consumer's attit ude.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.566	.355		7.237	.000
	AVGatt	.261	.088	.213	2.964	.003

a. Dependent Variable: AVGintention

The equation for predicting intention is

intention = *2.566+ 0.261**att*

Dr Matteo Molinari

Multiple Regression Analysis in SPSS

- Can add more explanatory variables into the analysis e.g. age, subjective norm, etc.
- Just move SN into the independent variable box and click OK
- Analysis will affect the coefficient on attitude as well as *R-squared*

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Multiple Regression Output from SPSS

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.582[a]	.339	.332	.58716	.339	47.201	2	184	.000

a. Predictors: (Constant), AVGsn, AVGatt

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.451	.321		4.528	.000
	AVGatt	.163	.074	.132	2.185	.030
	AVGsn	.472	.052	.548	9.043	.000

a. Dependent Variable: AVGintention