I. Why Statistics?

Physicists and chemists rarely use statistics, but psychologists use them all the time in their research – why?

The problems of individual differences and error: separating the signal from the “noise”

II. Descriptive Statistics

a. The central purpose of descriptive statistics: to summarize and simplify the presentation of large amounts of data

b. Frequency distributions
   • Most often used for nominal and ordinal data, for both single variables and cross-tabulation of two (or more) variables
   • Also used for interval and ratio data (also known as score data) by creating a grouped frequency distribution
   • Frequency distributions are often represented graphically, using bar graphs (histograms) or line graphs (frequency polygons)
• Symmetric (e.g., the curve of the normal distribution) and skewed (positively or negatively) distributions

c. Measures of central tendency
• Whatever the frequencies, do the data revolve around some central point(s)?
• Mode (unimodal, bimodal, etc.), median, and mean
• Mean (depicted as capital letter X, in italics, with bar over it; or by capital letter M) is the most often used, but it can be misleading
• Beware of the word “average”: mean, median, and mode can give very different pictures (the company where salaries grew by an average of 10%)

d. Measures of variability
• How much do all the individual pieces of data vary from the central tendency?
• Range, average deviation, variance ($s^2$), and standard deviation ($s$)

e. Measures of the strength of a relationship
• The concepts of correlation and regression
• Scatter-plot diagrams
• Measures the degree of relationship (from -1.00 to +1.00) and direction of relationship (positive or negative)
• Pearson product-moment correlation ($r$) (when data are both either interval or ratio)
• Spearman rank-order correlation (when one or both is ordinal)
• Correlation is not used if either is nominal

f. Measures of differences between means: $t$-tests and analysis of variance (ANOVA) or $F$ tests

g. Standard scores (also known as $Z$ or $Z$-scores): transforming data into scores such that each $Z$-score tells us how it compares to the rest of the scores
III. Inferential Statistics

a. What do the results really mean?
b. The concept of probability: what is the probability ($p$) that these results could simply have occurred by chance?
c. Alpha levels: the .05 and .01 thresholds to avoid a Type I error
d. When $p$ values fall at the .05 level or below, results are said to be “statistically significant” and, when testing a hypothesis, we say that we have “supported” our hypothesis
e. Why don’t we say “prove”? 
f. The statistical significance of a correlation or $t$ or $F$ (or any other descriptive statistic)
g. Effect sizes and practical significance: meta-analysis