Using Stats, Tables, Pictures, Diagrams and Graphs Effectively in Your Writing

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To obtain a copy of the PowerPoint:
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Subject: tables and figures
Why do authors use pictures, tables, charts, graphs, diagrams etc.?

- A picture is worth a thousand words.
- Some sorts of information are grasped more readily by a reader if it is presented in a form other than text.
  - Some information is inherently visual – e.g. schematic of an experimental apparatus.
  - Patterns in data are more easily seen if the data is organised into a graph or a table.
  - Any more than a couple of numbers in a paragraph and readers start to struggle.
- Pictures in particular can help bring a piece of text to life.

- But many students (and academics) do not use supporting elements like tables and pictures very effectively in their writing.

⇒ purpose of this workshop
What’s wrong with this?

The value of the Australian Stock Market as measured by the All Ordinaries Index, has generally grown exponentially over recent decades, though there have been some stagnant patches and some downturns. For example, the yearly average from 1970 to 1973 was fairly steady, being 385, 322, 387 and 361 respectively. There was then a downturn in 1974 and 1975 when the yearly average was 268 and 252 respectively. Following a recovery and another steady patch, large growth was achieved from 1978 to 1981 when the yearly average of the All Ords increased from 339 to 650. A large drop to 496 in 1979 was then followed by good growth to 1987 when the yearly average hit 1732. There was then another stagnant patch from 1988 to 1992 when the All Ords hovered around 1500 points. …

- The amount of information is overwhelming.
- When you have more than a couple of numbers in a paragraph you should think about organising them into a table or chart.
As shown in Fig. 1, the value of the Australian Stock Market as measured by the All Ordinaries Index has generally grown exponentially over recent decades, though there have been some stagnant patches such as during the 1970s and late 1980s, and some downturns, such as around 1982, 1988 and 2003. This overall long term growth, coupled with short and medium term downturns and stagnant patches, is why investment advisers have generally advised that shares should be considered at least a medium term investment option.

Figure 1. Yearly average for the ASX All Ordinaries Index from 1970 to 2005. (Source: http://www.wrenresearch.com.au/downloads/files/yxaoi.csv)

Answer: Qualitative descriptions of patterns condense the amount of information that needs to be absorbed.
Tables and figures should be used to support arguments, not just to present observations.

... This overall long term growth, coupled with short and medium term downturns and stagnant patches, is why investment advisers have generally advised that shares should be considered at least a medium term investment option.
“Overkill”: How much data do I need to make my point?

- If a writer decides that their purpose is to demonstrate that the market for a certain product has grown rapidly over the last decade, do they need a table with market size for each year over the decade to do this?
- No, it would be enough to simply say, “The market size for product X has grown markedly over the last decade, from $15 million dollars in 1995 to $2.4 billion in 2005 (ref.)”
- You could also use phrasing like, “quadrupled in size”, but from a reader’s perspective, what else is needed beyond saying, “The market size for product X quadrupled in size over the decade to 2005.”?
- Another example: Suppose your analysis of a large number of compounds generates a graph for each compound which you then analyse to determine a certain number. How many graphs should you include in your writing? If they are all basically the same, then one or two representative examples would be enough, with a table for the numbers you got from each graph.
Exercise: Learning how to analyse the strengths and weaknesses of writing for yourself

Good writing aids comprehension of the writer’s message and meets the needs of readers.

Compare and contrast the two samples of a section from a report and answer the following questions.

1. Where should the text which refers to a table or figure go in relation to that table or figure, before or after? Why?

2. What sorts of things should the text say about a table or figure? Why?

3. If tables and figures are talked about in the main text, why do they need titles or captions?

4. Why are tables and figures numbered? (At least two reasons.)

5. Why is the discussion of the data in Version 2 better than in Version 1?
1. Where should the text which refers to a table or figure go in relation to that table or figure, before or after? Why?

Ideally, the text which refers to a table or figure should go before the table or figure, otherwise the reader won’t know what they are looking at or why they are looking at it and so will just skip it.

2. What sorts of things should the text say about a table or figure? Why?

The text should:

a. introduce the contents of the table or figure and
b. point out any important features the reader should pay attention to, such as trends or patterns which support the argument being made by the writer.

c. Draw conclusions from the patterns or trends.
3. If tables and figures are talked about in the main text, why do they need titles or captions?

Three reasons:

a) Because on second or later readings, *readers often want to be able to locate and understand tables and figures independently of the main text.*

b) So that there is a place to put explanatory notes or detail that a writer wouldn’t want to put in the main text.

c) Because for empirical papers it’s the data which are the key results so busy readers often try to skim a paper by just looking at the tables and figures!
Figure 1. Longitudinal momentum density, $g$, for a string as a function of the material coordinate $X$ for counterpropagating Gaussian pulses that have constructively interfered. The plot is shown at a time sufficiently after the pulses have finished interacting so that the generated L-waves have separated from the T-waves. Consequently, **regions A and D are** regions of pure L-waves traveling to the left and right respectively with speed $c_L$, and **regions B and C are** regions of pure T-waves traveling to the left and right respectively with speed $c_T$. 
Example 2: Be kind to your reader: anticipate and address their needs

Table 3  Adjusted odds-ratios of young adults (n = 2150) being nicotine dependent by age 21 years, comparing childhood sexual abuse (penetrative and non-penetrative) with no abuse.

<table>
<thead>
<tr>
<th>Model no.</th>
<th>No abuse</th>
<th>Non-penetrative</th>
<th>Penetrative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1†</td>
<td>1.00</td>
<td>2.24 (1.71, 2.93)</td>
<td>3.48 (2.53, 4.80)</td>
</tr>
<tr>
<td>2‡</td>
<td>1.00</td>
<td>2.09 (1.59, 2.74)</td>
<td>3.31 (2.39, 4.59)</td>
</tr>
<tr>
<td>3§</td>
<td>1.00</td>
<td>2.04 (1.53, 2.82)</td>
<td>3.07 (2.14, 4.39)</td>
</tr>
<tr>
<td>4¶</td>
<td>1.00</td>
<td>2.14 (1.61, 2.83)</td>
<td>3.27 (2.31, 4.62)</td>
</tr>
<tr>
<td>5**</td>
<td>1.00</td>
<td>2.08 (1.54, 2.80)</td>
<td>2.88 (1.99, 4.16)</td>
</tr>
</tbody>
</table>

†Adjusted for age and sex. ‡Adjusted for maternal education, family income and parental racial origin. §Adjusted for number of partner changes over first 5 years of child birth, maternal depression and maternal smoking at 5-year follow-up. ¶Adjusted for child behavioural problems. **Adjusted for all potential confounding factors mentioned above.

Source: Mamun et al. (2007)

Note how the footnotes make the table more self-explanatory – the reader doesn’t have to search the text to find the details of each model.
Example 3

Figure 1. Time dependence of drug concentration in the blood (solid curve). The horizontal dashed line indicates the minimum efficacious concentration and hence the point $A$ indicates the latest time at which more drug should be administered if continuous effectiveness is to be achieved.
Example 4

Fig. 4. A taut string is initially displaced transversally from equilibrium in the shape of a triangular wave (the solid curve) and released from rest. This results in waves with the same shape but half the amplitude travelling in both the positive and negative x directions (dashed curves).

Figure 1. Plots of shape parameter $m$ versus normalized total power $I$ for the super-Gaussian trial function (---) and the super-sech trial function (----) for $R = 10.0$. 

Most common approach.
Example 5: Even if “pictures speak a thousand words”, they still need explaining! And labelling helps you do that.

Figure 2. Underneath views of a lawnmower looking at the cutting blade design. (a) Side view illustrating how the bolt holding the cutting blade is recessed (labeled A) and how the rear edge of the blade is bent upwards to lift cut grass and create a fan to blow the cut grass into the catcher (labeled B). (b) View from beneath again illustrating the recessed bolt (labeled A) together with a polished part indicating location of wear (labeled C).

Note: for a non-colour publication, these pictures would need to be replaced by black and white line art.

Photos and design analysis provided by W. L. Rowland.
The rotary lawn mower (Fig. 1) is an ancient piece of technology used by the Suburbites to ... (ref. 1). The design of the cutting blade assembly, illustrated in Fig. 2, shows a number of design features which illustrate the engineering sophistication of this civilisation. For example, the cutting blade was not held fixed in place, but was allowed to swivel on a recessed bolt, thus allowing it to swivel out of the way if something hard is hit, protecting the blade from damage. Note also ...
Show error bars on graphs and charts

- Readers need them to determine the significance of a difference or the accuracy of a result.

- A result presented like this is not very informative.
- **Need SEMs** marked to judge whether observed difference is even statistically significant or not. (The difference might be quite significant for a large class, but not for a small class.)
- **SDs** would allow me to judge the effect size: was the shift significant compared to natural population variation?
The standard deviation is a measure of the variability of a population:
- For a large sample, approximately 68% of results lie within 1 s.d. of the mean.

A confidence interval is a measure of how accurately the mean has been determined by a sample:
- For a 95% confidence interval, for 95% of samples of that size, the true population mean will lie within the confidence interval.

The standard error of the mean is again a measure of how accurately a sample has determined the mean:
- For a large sample, the 95% confidence interval is approximately ±2 SEMs.
Which one do you report or graph? (generally)

- **When comparing the means of groups** (e.g. control vs experimental), you generally want to know if the difference between the means is statistically significant, i.e. you want to know how the difference compares to sampling error and so the SEM or CI is appropriate.

- **When characterising a population** (e.g. what’s a normal body temperature? How did my class perform on the final exam?), you are interested in population variability and so the s.d. is generally appropriate.

Error bars on graphs and charts are often SEs, but might also be SDs or confidence intervals, thus you need to check and as a writer you need to specify in caption.
Because error bars could be SDs or SEMs or CIs …

- Figure captions MUST tell the reader what sort of error bar has been plotted.

- Error bars and statistical significance: http://www.graphpad.com/articles/errorbars.htm

- Error bars with Excel: http://www.ncsu.edu/labwrite/res/gt/gt-stat-home.html
Conclusions you can reach when two error bars do or do not overlap: Comparing two means with an unpaired t-test (Adapted from Motulsky, p. 229)

<table>
<thead>
<tr>
<th>Type of Error Bar</th>
<th>Conclusion if they overlap</th>
<th>Conclusion if they don’t overlap</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>No conclusion</td>
<td>No conclusion</td>
</tr>
<tr>
<td>SEM</td>
<td>Difference NOT statistically significant</td>
<td>No conclusion</td>
</tr>
<tr>
<td>95% CI</td>
<td>No conclusion</td>
<td>Difference IS statistically significant</td>
</tr>
</tbody>
</table>
But which error bar is best to use does require some thought!

Example: 2009 NAPLAN Grade 5 reading results

- How are we to judge the significance of the difference without more information?
- SEMs are pointless here: the sample size is so large that the SEMs would be tiny.
- The issue is not whether the difference is statistically significant, the issue is how big the difference is in terms of the natural variation in student abilities – the effect size.

Giving error bars in terms of SDs would in this case give an indication as to the size of the effect.

(Search “effect sizes” or “Cohen’s d”.)
4. Why are tables and figures numbered? (At least two reasons.)

(a) To make it easy for writers to refer to them (e.g. Figure 1 shows …)

(b) To make it easy for readers to locate which table or figure is being referred to (this is especially important in a large document like a thesis where cross referencing between chapters might be necessary).
Answers to first exercise (4)

5. Why is the discussion of the data in Version 2 better than in Version 1?

Version 1 just made observations:

“The most common mistake was to think that the units of the 100 term were mg and those of the -0.01D² term either mg or mg².”

Version 2 interpreted the observations as well:

“Note also that about one third were consistent in thinking that the terms on the right hand side of the equation were in units of “amounts” (i.e. mg), indicating that they were interpreting the differential equation as giving the amount of drug in the body as a function of time rather than as giving the rate of change of this amount.”
Second Exercise

Suppose you are a social policy analyst working for the Australian Government and you are writing a report for the government on issues relating to differences in rural versus capital city life in Australia. Decide what the following pieces of information might mean from a social policy perspective and write a paragraph using this information to make a case for some policy changes. Include a table or bar chart in your paragraph.

- Woop Woop is a rural town with a total population of 42,345 (1996 ABS Census Data).
- Woop Woop has a Community Development Organisation chaired by Mrs Concerned.
- Number of GPs: 32 (equivalent to 75.6 per 100,000; capital city average: 103.4 per 100,000 (AIHW, 1996)).
- Number of retail pharmacists: 22 (equivalent to 52.0 per 100,000; capital city average: 62.5 per 100,000 (AIHW, 1996)).
- Three locals when interviewed complained that, “the local GPs are not taking on any new patients, so Woop Woop residents have to travel to Notsofarout to see a GP”.

<table>
<thead>
<tr>
<th>Woop Woop Population</th>
<th>Woop Woop GPs</th>
<th>Woop Woop Retail Pharmacists</th>
<th>Woop Woop Travel to Notsofarout</th>
</tr>
</thead>
<tbody>
<tr>
<td>42,345</td>
<td>32</td>
<td>22</td>
<td>No</td>
</tr>
<tr>
<td>103.4 per 100,000</td>
<td>75.6 per 100,000</td>
<td>52.0 per 100,000</td>
<td></td>
</tr>
</tbody>
</table>
Table 1: Access to primary health care providers in rural Woop Woop is significantly lower than in capital cities.*

<table>
<thead>
<tr>
<th></th>
<th>Woop Woop</th>
<th>Capital City Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPs per 100,000</td>
<td>75.6</td>
<td>103.4</td>
</tr>
<tr>
<td>Pharmacists per 100,000</td>
<td>52.0</td>
<td>62.5</td>
</tr>
</tbody>
</table>


Figure 1. Access to primary health care providers in rural Woop Woop is significantly lower than in capital cities (AIHW, 1996).
One measure of social disadvantage is relative access to primary health care. As Table 1 shows, in comparison to capital city residents, Woop Woop’s residents have **significantly lower** per capita access to both GPs and pharmacists. This social disadvantage resulted in three locals complaining when interviewed that: “the local GPs are not taking on any new patients, so Woop Woop residents have to travel to Notsofarout to see a GP.” This suggests that governments should look at ways of encouraging more doctors and pharmacists to move to rural areas.

Topic sentence identifies the issue the data will help address. The main thing to note in Table 1 is pointed out. Note the **qualitative** discussion (“significantly lower”: the reader can consult the table for specific numbers).

Note also that until the reader reads this, they won’t know what a table is about or what it is demonstrating, so in general it is best if tables and figures go after the text which refers to them.

Data should be used to support an argument, not merely presented as though they were an end in themselves, so a conclusion is drawn.
A design question: Tables or Charts?

- What is the advantage of the table over the bar chart?
  - Get precise numbers.

- What is the advantage of the bar chart over the table?
  - Easier to make the comparison.

In each case, writers need to consider what the reader might want and what best allows them to communicate their message in order to decide whether to present as a table or a chart.

Note that generally, **table titles go above the table**, while **figure captions go beneath the figure**.
Captions / Titles: What the figure / table is about or the key takeaway message for the reader?

- If you wanted to quickly see for yourself the key results of an empirical study, where would you look?
  - At the tables and figures.
  - What’s the problem with looking at the author’s verbal conclusion?

- To make sense of and appreciate the significance of what you were looking at, what then would you want the figure caption / table title to tell you?
  - The key takeaway message(s) of the table or figure and not just what the data is of?
Definitely on posters, where words should be kept to a minimum, pointing out in the title/caption the takeaway message of the figure or table would be a good tactic. See for example:

spawned to collect eggs and sperm for in vitro fertilization.
- Hatched larvae were weaned from a natural diet (rotifers Artemia) to high protein pelleted feed and fed until satiation at least twice daily.
- Upon reaching a mean total length of 40 mm, the juvenile flounder were stocked at equal densities into one of three temperatures 18, 23, or 28°C for 245 days.
- Gonads were preserved and later sectioned at 2-6 microns.
- Sex-distinguishing markers were used to distinguish males (spermatogenesis) from females (oogenesis).

**Histological Analysis**

**Southern Flounder Exhibit Temperature-Dependent Sex Determination**
J. Adam Luckenbach*, John Godwin and Russell Borski
Department of Zoology, Box 7617, North Carolina State University, Raleigh, NC 27695

**Temperature Affects Sex Determination**

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>% Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>64</td>
</tr>
<tr>
<td>23</td>
<td>53</td>
</tr>
<tr>
<td>28</td>
<td>49</td>
</tr>
</tbody>
</table>

(**P < 0.01 and ***P < 0.001 represent significant deviations from a 1:1 male:female sex ratio)

**Rearing Temperature Affects Growth**

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Body Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>37</td>
</tr>
<tr>
<td>23</td>
<td>51</td>
</tr>
<tr>
<td>28</td>
<td>37</td>
</tr>
</tbody>
</table>

**Growth Does Not Differ by Sex**

**Results**
- Sex was discernible in most fish greater than 120 mm long.
- High (28°C) temperature produced 4% females.
- Low (18°C) temperature produced 22% females.
- Mid-range (23°C) temperature produced 44% females.
- Fish raised at high or low temperatures showed reduced growth compared to those at the mid-range temperature.

**Cf. “Impact of temperature on sex determination.”**

**Cf. “Dependence of body weight on rearing temperature.”**

**Acknowledgements**
The authors acknowledge the Saltonstall-Kennedy Program of the National Marine Fisheries Service and the University of North Carolina Sea Grant College Program for funding this research. Special thanks to Lea Ware and Beth Shumps for help with the work.
Including vs not including key takeaway message in caption/title


Another footnote example: results of statistical tests

Table of correlations:

<table>
<thead>
<tr>
<th></th>
<th>Team task performance</th>
<th>Team social integration</th>
<th>Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team social integration</td>
<td>0.40**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>0.30** 0.29**</td>
<td>0.29**</td>
<td></td>
</tr>
<tr>
<td>Team reward contingency</td>
<td>0.07 -0.07 0.38**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

n = 144

** p < 0.01

Explanatory note: starred correlations are statistically significantly different from zero, the unstarred correlations are not. Common convention:

* p < 0.05; ** p < 0.01; *** p < 0.001
Figure 1. Graph of Yearly average for the ASX All Ordinaries Index from 1970 to 2005. (Source: ...)

Table 1: Table showing that Access to primary health care providers in rural Woop Woop is significantly lower than in capital cities.*

<table>
<thead>
<tr>
<th></th>
<th>Woop Woop</th>
<th>Capital City Average</th>
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<tbody>
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</tr>
<tr>
<td>Pharmacists per 100,000</td>
<td>52.0</td>
<td>62.5</td>
</tr>
</tbody>
</table>
It’s not just numerical data which might be best illustrated by a figure: Descriptions of complex systems or of a complex set of interactions are often best summarised with diagrams – the text would still need to fill in the details.

When do you put tables or figures in an appendix?

- Only if most readers will not want to consult the table or figure as they are reading your text.

- **Example: the exact questions of a survey**
  - In the main text, most readers would only want to know *in general terms* what sorts of questions were asked, not read the entire list of questions, especially if this list was quite long.
  - At some point though, some people might want to see the exact questions, which is why you would provide them in an appendix.
Some further thoughts on chart and figure design
Warning! Fancier is NOT always better. 3D bar charts may look impressive, but are much harder to read accurately than 2D graphs and so should NOT be used.

Also, check that your beautiful full colour diagrams are still interpretable when printed in grey scale.
Preparing figures for journals

- Particularly for double column journals where figures might get significantly reduced in size, check that when reduced, axis labels and numbering are still readable and that line thicknesses are still sufficient.

- Alternatively, prepare figures at more or less the same size they will appear in the journal and use the magnify function in the graphics package to make working on the figure manageable – but regularly check that at its real size, the figure is readable!

- Also check what file formats are preferred (.eps, .tif, etc.) – see Information for Authors pages.
Example

Automatic font size not too bad at this size.
Example

Getting to be a problem at this size even though the graph itself is still readable.

Overriding and enlarging the automatic font sizes and axis units improves things.
What are all the problems for journal publication of this default style chart produce by MS Excel?

• Beware the use of coloured lines: they may look good on screen, but be uninterpretable when printed grey scale.
• Grey background provides poor contrast when printed grey scale.
• Font size too small if figure reduced in size.
How is this better?
- Solid and dashed lines distinguishable even in black and white.
- Labels next to lines rather than off to the side makes reading easier.
- Font size bigger (but still too small?)
- White background provides better contrast and hence better readability.
Has there been a precipitous fall?

But wait, where’s the zero of the scale?

Same data, zero of scale included. Does the change look so dramatic now?

Version 1 exaggerates the change, version 2 hides it. Aim for a balance and note for the reader that the bottom of the vertical axis is not zero.
Mathematics anxiety level

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (s.d.) on Maths Achievement Test</td>
<td>320.68 (66.98)</td>
<td>283.33 (61.52)</td>
<td>243.04 (58.38)</td>
</tr>
</tbody>
</table>

“As expected, a factorial analysis of variance showed a significant anxiety effect, $F(2, 69) = 10.11, p < 0.01$, with the students with high mathematics anxiety showing lower achievement than the students with low mathematics anxiety.”

- Note that calculations were not included as these can be looked up in a text book if the reader doesn’t know the test being used.
Accurately, clearly (& honestly) presenting the size of an effect – the problem with percentage increases

- According to one study, a woman’s risk of breast cancer increases by 6% for every extra alcoholic drink consumed on a daily basis.
- Sounds bad, doesn’t it?
- But, a woman’s risk of getting breast cancer is about 9%, so a 6% increase takes this to about 9.5%.
- Or more clearly: In every 100 women, about 9 will typically get breast cancer. If they all had two extra drinks per day, about 10 would.


- Another study showed that children who spent long hours in day care were 30% more likely [than what?] to develop behavioural problems as they got older. This result generated a lot of hysteria about the ills of day care.
- But if at a rough guess about 3 in 100 children develop behavioural problems, this means that about 4 in 100 will if put in long hours of day care.
Accurately, clearly (& honestly) presenting the size of an effect – **Report Effect Sizes and/or confidence intervals**

- The difference between girls and boys on a particular aptitude test was *highly statistically significant* at the p < 0.01 level of significance. Is this a cause for alarm?
- Test taken by 10,000 boys and 10,000 girls, the girls averaged 65.3 and the boys 64.9 out of 100, with a standard deviation of 15.0. This difference amounts to less than half a question in one hundred!
- **Effect size** = \( \frac{65.3 - 64.9}{15} = 0.03 \) which is miniscule!
- To find out more, do an internet search on “effect sizes” or “Cohen’s d”.
Some thoughts on presenting the results of Likert response questions

Many people turn 5 point Likert scale response (strongly disagree → strongly agree) to a 5 point numerical scale and then report means and standard deviations for the responses.

There are a number of problems with doing this:

- Floor and ceiling effects means the responses are rarely symmetrically distributed.
- The responses are not continuous and aren’t even an interval scale (who’s to say that the difference between agree and strongly agree is the same as the difference between agree and neutral?).
- Means and standard deviations tempt people to compare responses by different groups with t-tests. Should use Mann-Whitney U-Test or Wilcoxin Rank Sum test.

If you actually combine (add) the responses to several Likert questions (e.g. all of which are assessing shyness to get a total shyness score), many of the problems may “disappear”.
Examples

Mean = 3.7, SD = 1.2 ⇒ 68% or responses between 2.5 and 4.9?

Median = 4

83% neutral or above, with 67% agree or strongly agree

M = 3.0, SD = 1.45

M = 3.0, SD = 1.08

Similar means and SDs, very different distributions!
M = 3.33, SD = 1.67 doesn’t really capture what’s going on.

While two thirds of the group agreed or strongly agreed, just over one quarter strongly disagreed, indicating polar opposite views by a sizeable subset of the population.

Conclusion: Don’t mindlessly use means and standard deviations to describe the patterns in Likert scale responses. Think about the best way of describing the observed pattern of responses.
Using *previously published* tables and figures in a journal article for publication

- Are generally required to seek permission from the publisher (who often also asks the author as well) for permission to use.
- Should provide a copy of this permission to the journal submitting to.
- An in-text reference is of course sufficient if you are not copying the table or figure but simply describing the main result shown.
In Summary: Key design questions

- What can you do to help your reader most easily see your key conclusions / results / message?
- What can you do to *avoid* reader confusions and misunderstandings?
  - [Put your work aside for a week and then re-read it as though it was written by someone else and you were trying to learn from it: Is it still clear?]
- Finally, study good examples – examples you found clear and powerful – for what was to done to make them that way.
- Giving feedback on other students’ work helps you to learn what problems to look out for in your own.
Tables and figures checklist

Tables and figures should:

- be numbered so that they are easy to refer to and easy for the reader to identify
- have a descriptive title or caption so that the reader can understand what they are about without having to read the text if they need to when revisiting your work
- be integrated into your argument or presentation so that why they are there and what they are meant to show is clear to the reader
- have the important feature(s) for your argument pointed out to the reader so that they can quickly identify these
- For figures, scale bars, arrows, labels and statement of viewing direction all help the reader make sense of what they are looking at.
- And if they are not your original creation, their source needs to be appropriately cited. Adaptations (modifications) are allowed: citation is then: “Adapted from Smith (2005).”
References & Further Reading

- Comprehensive online graphics tutorial: https://ww2.gpem.uq.edu.au/Graphics

- Another figures and tables checklist: http://www.ldeo.columbia.edu/~martins/sen_sem/thesis_org.html#FandT


  Not a book on how to be dishonest, but a book on the ways statistics can be presented to give misleading conclusions, perhaps unintentionally.


To obtain a copy of the PowerPoint:
Email: d.rowland@uq.edu.au
Subject: tables and figures