ANY STUDENT OF PSYCHOLOGY is hopefully aware of the meta-analysis procedure. This is a very useful method for getting a quantitative overview over a debated issue that lacks statistical certainty or a quantitative narrative (Rosenthal & DiMatteo, 2001). However, it is not common for psychology students to actually conduct such an analysis as part of their dissertation, with the possible exception of PhD students. In this essay I aim to outline certain benefits for PG students with using this method for their dissertation, especially if you are considering a career in academic psychology.

What is a meta-analysis, and why use it?
If you are unfamiliar with the meta-analysis, let me outline it briefly. It involves calculating the available effect sizes (usually Cohen’s $d$ or $r$) from all available studies on a particular topic and calculating the weighted mean effect size across all studies. This is not be confused with a systematic review, which is an attempt to review and summarise all the findings on a particular topic. Such a review is much more extensive than a literature review one might read in a standard experimental paper, because it involves identifying, selecting, and critically analysing the available studies. For instance, Bjorklund and Kipp (1996) reviewed all available evidence on gender differences in inhibition in an attempt to investigate if a female inhibition advantage existed. This is a somewhat subjective approach because conclusions are based on the researcher’s perceived patterns. However, systematic reviews are made more empirical by following a pre-planned protocol, and one highly recommended approach is the PRISMA Statement, outlined in great detail in Liberati et al. (2009), an article which is free online in several journals.

The meta-analysis, by contrast, is objective and involves mathematical calculations. In critique of Bjorklund and Kipp (1996), Silverman (2003) did a meta-analysis on a specific type of inhibition called delay gratification, and this approach involved calculating the effect size from all available studies on delay gratification and finding a weighted average. A meta-analysis, therefore, involves mathematical properties which combines multiple statistical results into a single estimate (Green, 2005), while a systematic review is an extensive overview and critique of available evidence in the literature on a particular topic (Liberati et al., 2009). However, it is perfectly possible to use both in the same study: Renehan et al. (2008) did a systematic analysis of all studies suggesting a link between BMI and cancer, followed by several meta-analyses to determine statistically how big any effects were.

A meta-analysis often involves looking at differences in performance between two groups. For instance, Bushman and Cooper (1990) investigated the effects of alcohol on aggression using the meta-analysis procedure, and they used groups such as alcohol vs. placebo or alcohol vs. controls. The analysis takes into account the number of participants in each study as well as the strength of any group differences. In other words, we are not interested in the significance value of each study because the significance value is affect by the number of participants involved (Rosenthal & DiMatteo, 2001). Instead, we are interested in finding out what the overall effect size is across all available studies. When conducting...
the analysis you are in effect treating individual studies as if they were participants. You might wonder why you can’t simply average the effect sizes, but if you do this you are ignoring the fact that different studies have different number of participants, each influencing the significance differently.

Based on talks with my own lecturers I got the impression that the vast majority of students do not show initiative when choosing a dissertation topic. Most students will choose a topic and method from a list provided by the available supervisors. However, if you suggest a topic yourself this will usually boost your mark as it shows creativity, personal investment, and evidence of external reading. Should you propose to do a meta-analysis then this is likely to impress the markers, because such a project can involve huge quantities of literature searches and complicated methods.

In my own case I suggested a meta-analytic review of gender differences on the Stroop (1935) task. I found it very surprising that this had not been done before considering that over 80 years of research had gone into this popular psychology concept. Previous reviews existed, but these were very subjective and had concluded that no differences were present (e.g. MacLeod, 1991). While there were some studies that had explicitly investigated the effects of gender on the Stroop task (e.g. Baroun & Alansari, 2006; Golden, 1974), a systematic investigation had never been conducted. Hence, it was not known if a gender difference existed, how profound this difference was, or even how well investigated it was.

Conducting the analysis: Learning the ropes and systematically searching for articles

Doing a meta-analysis is a very ambitious project for a student and involves many challenges. For starters, it is possible that you have never been taught by your lecturers how to conduct the analysis. If you have received such training you may impress your supervisors by showing them what you have learned. If you have not then you need to spend some time to figure out the mechanics and calculations. Don’t be surprised if most of the staff in your department has themselves never done a meta-analysis. Your markers may be impressed if you use a methodology that is not covered in any great detail in your modules, provided you execute the methods correctly. The PRISMA Statement provides a great overview on how to approach with both a meta-analysis and a systematic review (Liberati et al., 2009), and Moher et al. and The PRISMA Group (2009) provides a very viewable checklist you can use. I can also recommend the Cochrane manual for systematic reviews and meta-analysis, which is available free online (Higgins & Green, 2011). A review article by Rosenthal and DiMatteo (2001) also gives great insight into the limitations of meta-analyses and how these can be overcome.

A meta-analysis can require an immense amount of time going through a systematic literature search because you want to make sure no relevant studies are missed. Before you start the search you want to make sure that you have a clear hypothesis and a suitable protocol for which studies are to be included/excluded. Using guidelines from PRISMA is a good idea (Moher et al., 2009). The ideal meta-analysis also includes unpublished studies, which may be hard to come by, but one idea is to ask leading authors for papers. This will also cast light on the file drawer problem (Rosenthal, 1979), which refers to a tendency where only significant results are published, creating a biased view of a field.

In my own case I typed ‘Stroop AND gender OR sex’ into Google Scholar and come up with over 32,000 results! Reviewing or coding such an amount of studies would take an unimaginably long time, especially for a Master’s student who is operating within a deadline. In such cases it is prudent to exclude certain keywords. For instance, in my case I excluded studies that used the Stroop test on participants with mental illness. If your own topic involves only a few
available studies, selection criteria may not be needed, depending on what your hypothesis is.

At this point I should warn that while Google Scholar is a very useful tool, it can easily miss available studies and search very loosely for what you wish to find. For me there were a handful of useful articles with highly relevant titles that did not appear in Google Scholar. I highly recommend using several different databases in your search, such as Sage Journals, ScienceDirect, and PsychArticles. In addition, it is often worth asking your librarian for help in locating articles, as some librarians specialise in finding psychology articles (my own library had a Psychology Specialist who assisted me on several occasions) and provide courses to aid in your search.

I would recommend creating a spreadsheet where you log all relevant articles. This has several useful benefits. First, if you have a large amount of studies in your analysis, creating a spreadsheet (preferably in Excel) makes it much easier to organise all the studies you have reviewed. I also cannot stress enough the importance of using a citation manager such as EndNote (2013) or Mendeley (2013), which will not just help you keep track of articles, but also make referencing a lot easier. Such programs will store the reference in a database, and during your write-up you can simply add the reference to the text, and the program automatically creates a bibliography which keeps track of your cited articles. This will save you a lot of time, and should you find out that you have used the wrong format then this can be corrected in a few quick steps rather than going through your entire reference list one by one.

Second, you might find articles that do not provide effect size data, but which are still useful for your paper nonetheless. Making a note of these articles and their main content will remind you that it may still be useful in the write-up of your paper. There could be several highly relevant papers that you want to discuss in your write-up, even if they did not provide any data for your analysis.

Third, you should also write down why an article was not used in the analysis, in the event you forget or someone asks why the data was not used. Some papers may be expected to be included in your analysis, and you’d want to specify why it was not (Higgins & Green, 2011). Having such a list shows that you have been very thorough, but have also had specific selection criteria that excluded certain studies.

To give an idea of the potential vastness of the literature review, some numbers are presented in Figure 1. It took approximately 10 weeks of searching, emailing, reviewing, and coding before the collection was complete. In my particular case, most articles had gender effects as a secondary hypothesis and did not report any data, so a large number of authors were emailed to ask for additional data.

Establishing a network with other researchers

As a student one can probably imagine certain obstacles in doing a meta-analysis in addition to the limited timeframe allowed. For instance, there were many articles that my university did not have access to, and inter-library loans are limited for students. The way around this was to track down and contact the authors themselves to obtain copies where possible. This part of the process has one major benefit: it is an excellent opportunity to establish a network of communication between others in the field, which is useful for future collaborations. It is also a useful way to identify so-called ‘invisible colleges’, which is a collection of researchers working on the same topic, but who does not belong together in any official school (Price & Beaver, 1966).

Meta-analytic calculations

The calculations behind the meta-analysis can easily become confusing. There are several helpful textbooks available, and there are multiple ways to conduct the
Figure 1: An overview of the systematic literature review process.

Identification

1172 records identified through database searching

28 records identified through other sources

Screening

1200 records identified in total, after duplicates removed

891 records removed

Eligibility

309 articles assessed for eligibility

195 articles excluded, with a valid reason

Included

114 articles included in qualitative synthesis

60 studies included in quantitative synthesis (meta-analysis)

Analysis. Choosing the best approach really depends on what you are looking for, and sometimes it depends on whether you are using $d$, $r$, or another type of effect size. Personally I recommend Howell (2013) and Lipsey and Wilson (2001) as they clearly describe the processes with helpful tips. They also provide formulae for converting various effect sizes. It is also possible to download meta-analysis plug-ins and spreadsheets for MS Excel. I would especially recommend using Excel calculators to assist in converting data into effect sizes as this can be tiring and time consuming to do manually. I highly recommend Jared DeFife’s (2009) effect size calculator. There are also meta-analysis programs you can use, such as Revman (2012), but if you create your own spreadsheet in Excel you will learn the procedure more effectively, in my opinion.

After you have analysed the data, you will also have calculated if the mean weighted effect size is homogenous. If it is, the studies in your analysis are replications of each other (Howell, 2013). If your analysis is heterogeneous, the studies differ between each other in some respect (for instance, maybe some were conducted on children and some on adults and the results are not comparable), and you need to find out how these variables affect each other.

Once your analysis is complete you will have added a statistical aspect to a previously subjective topic. It will have given new insight into a topic where results may have been ambiguous and your research is likely to carry academic weight and may even be publishable. In my case I found a small to moderate female advantage on the Stroop task, contrary to previous reviews.
Final remarks
I would certainly recommend the meta-analysis approach to students and researchers investigating a topic where no systematic analysis of effect sizes exist. Not only will this give new insight into a topic, but it is an excellent excuse to get in touch with other scientists in the field. Be warned, however, that depending on the topic you might be subjected to a large amount of literature review. While this process may be very time consuming, it is nonetheless rewarding. You will learn a substantial amount of new knowledge in the field of interest, establish a network of relevant researchers, and also vastly improve your statistical knowledge. If you use a meta-analysis in your dissertation you may also increase your chances of having it published, especially if your analysis is the first on the topic in question. In my own case no meta-analysis on gender and the Stroop effect had ever been conducted, and my dissertation is currently being prepared for publication. Upon publication your paper may also be cited more often than an experimental paper, because it provides a useful summary of the field in question. I therefore highly recommend using the meta-analysis and/or systematic review approach in your dissertation, especially if you are investigating a topic with debated results and unclear statistical outcomes.

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