Windows-Based Meta-Analysis Software

Package

Version 2.0

The Hunter-Schmidt Meta-Analysis Programs Package includes six programs that implement all basic types of Hunter-Schmidt psychometric meta-analysis methods. Brief descriptions of the six programs are provided in section 4, "Types of Analyses.'' A full description of the output of each program is given in section 12, "Full Description of Output of Individual Programs." These programs are intended to be used in conjunction with the meta-analysis book by Schmidt and Hunter (Sage, 2014), henceforth referred to as "the text''. This program requires a 64 bit version of Windows. It will not run on the older 32 bit computers.

In response to feedback from users, we have made a number of improvements to the current version of these programs (version 2.0) that were not available in previous versions (versions 1.0 and 1.1). These include the following:

1. The programs now allow importation of data files from Excel. To do this, users enter data using the included Excel template. (To do this, the user must have Excel on his/her computer.)

2. The programs now include a method of checking for publication bias—cumulative meta-analysis. See Chapter 13 of the text for a discussion of this procedure. Cumulative meta-analysis is also discussed in Section 10 of this Read Me file.

3. A future version of the programs will produce forest plots. Like cumulative meta-analysis, forest plots can be useful in detecting potential publication bias. Forest plots are different from cumulative meta-analysis. Forest plots plot the *r* or *d* value (and its confidence interval) *from each study individually*, starting with the study

with the largest N and working downward. If the small N studies have larger effect sizes, this could indicate publication bias.

4. Confidence intervals (in addition to credibility intervals) are now provided for all mean values except bare bones meta-analysis means.

5. Output for corrected r and d values is now presented in tabular form, as well as in the more detailed output form. The tabular form results are the values that should be reported in all tables of meta- analytic results in papers submitted for publication. In the printed results the tabular results are presented first (at the top of page 1).

6. Studies can now be coded for potential moderator analysis, making it more convenient to subgroup studies for moderator analysis. [To conduct moderator analysis, the user must use the "Enter data by Excel" option. More details are provided in the Moderator Analysis section (section 9)].

7. Output now includes the correlation between observed *r* or *d* values and artifact effects on these values. (This correlation is the square root of the proportion of variance accounted for by artifacts.)

8. The maximum number of studies in a meta-analysis has been raised from 200 to 1000.

9. It is now possible to select saved data files for analysis by just clicking on the red oval in front of the file name. (In older versions, the file name had to be typed in.)

10. It is now easier for users to access the supplementary programs for computing composite correlations and for converting point-biserial correlations to biserial correlations. See section 11 of this file. These programs are no longer password protected. They can now be accessed by clicking on the *Extras* icon on the opening page of the programs.

11. Three small technical adjustments have been made. First, in the previous version, if an r or d value was entered as zero, the program would not run. This has been corrected. Second, the correction for the small bias in the observed r when *N* is small has been added. Third, in computing the sampling error variance of d values, the programs now use Equation (7.23a) instead of Equation (7.23). (These equations are in Chapter 7.) In

cases in which the sample size for one group is very small compared to the other group, use of Equation (7.23a) is slightly more accurate. It is also accurate when the group sample sizes are less unequal or equal in size. To use this option, the user must enter the data via Excel. That is, the user must use the "Enter data by Excel" option. More detail is provided later in the section on Data Management (Section 5).

The programs are provided on a CD or downloaded from the internet and are compatible with Microsoft Windows ® operating systems (Windows 95, 98, 98SE, ME, 2000, XP, and Windows 7). Program interface is logically and intuitively arranged so that people with basic familiarity with Windows-based applications can easily learn to use the program functions. Navigating through the different steps (pages) of the programs is achieved by single-clicking appropriate buttons or icons. Throughout all the steps (pages), there are built- in help functions in the form of roll-over pop-ups (i.e., help statements that appear when the cursor is rolled over certain predetermined areas) explaining the options and instructing the user in how to execute his or her desired tasks.

1. What Is in the Download or the CD Program Package?

All the files of the program package are included in a password-protected zip file ("HSMAPrograms.zip"). In addition to the core meta-analysis programs and supporting files, the program package contains (1) the Readme.pdf file (the file you are now reading), and (2) two utility programs in the form of Microsoft ® Excel templates (Composites.xls and Point-Biserial.xls; details of these programs are described in section 11). These auxiliary programs help users convert correlations in the primary studies to appropriate forms before inputting them into the meta-analysis programs.

2. Installation

If you have an earlier version of the program package (version 1.0 or 1.1), you should uninstall it before installing the current version. Uninstallation can easily be done by using the "Remove Hunter-Schmidt Meta Analysis Programs'' option available in the Windows Programs taskbar.

The programs can be installed by simply unzipping the "HSMAPrograms.zip" file using the provided serial number and copying the contents at the root directory ("C:\" for most computers). The main programs and all the supporting files can then be found under the

folder "C:\Meta Analysis Programs'' on your hard drive (unless you specify a different drive).

3. Starting the Program

The programs can be activated by selecting (clicking on) the ``Hunter Schmidt Meta Analysis Programs.exe'' in the "C:\Meta Analysis Programs'' folder. You will be presented with the Start Page, where you can access the Readme file by clicking on the notepad icon at the upper right corner of the page.

In the upper left corner, there is a link which allows you to access the extra programs for computing composite correlations or point biseral correlations (the Extras icon). To move on to the next page, where you can select types of meta-analyses to be run, click on the red arrow icon at the lower right corner of the page. The "Type of Analyses'' page will then appear, presenting you with four options of analyses (described next).

4. Types of Analyses

The programs in this package do the following types of meta-analysis:

1. Meta-analysis of correlations corrected individually for the effects of artifacts. (These two programs are collectively referred to in the text as VG6.) These programs are used when (1) the user desires to estimate the correlation between variables or constructs, and (2) information on the statistical and measurement artifacts (i.e., range restriction, reliabilities on both variables) is available in all (or the majority) of the primary studies. These programs are illustrated in Chapter 3 of the text.

There are two subprograms under this type of meta-analysis:

A. A program that corrects for direct range restriction: To be used when range restriction is direct (i.e., selection occurs on one of the two variables being correlated). (This program is referred to in the text as VG6-D; see Chapter 3.)

B. A program that corrects for indirect range restriction: To be used when range restriction is indirect (i.e., selection occurs on a third variable that is correlated with both the variables of interest). (This program is referred to in the text as VG6-I; see Chapter 3.)

Both programs ask the user if there is any range restriction. If the answer is "No", the data entry field for the range restriction statistic (the *u* value) does not appear when the user enters data within the main program. When the user enters data via Excel, this field does

appear and the user must enter 1s in this field for all studies. When there is no range restriction, the results provided by the subprograms 1A and 1B are identical.

2. Meta-analysis of correlations using artifact distributions. These programs are used when (1) the user desires to estimate the correlation between variables, and (2) information on the statistical and measurement artifacts is *not* available in most of the primary studies. (These two programs are collectively referred to in the text as INTNL; see Chapter 4.)

This meta-analysis program also includes two subprograms:

A. A program that corrects for direct range restriction: To be used when range restriction is direct (i.e., selection occurs on one of the two variables being correlated). (This program is referred to in the text as INTNL-D; see Chapter 4.)

B. A program that corrects for indirect range restriction: To be used when range restriction is indirect (i.e., selection occurs on a third variable that is correlated with both the variables of interest). (This program is referred to in the text as INTNL-I; see Chapter 4.)

Both programs ask the user if there is any range restriction. If the answer is "No", the data entry field for the range restriction statistic (the *u* value) does not appear when the data is entered via the main program. When the date is entered via Excel, this field does appear and the user must enter 1s in this field for each study. When there is no range restriction, the results provided by the subprograms 2A and 2B are identical.

3. Meta-analysis of *d* values corrected individually for measurement error.

This program is used when (1) the user desires to estimate the effect size (*d* value; standardized difference between groups), and (2) information on the reliability of the measure of the dependent variable is available in all (or most) of the primary studies. (This program is referred to in the text as D-VALUE; see Chapter 7.)

4. Meta-analysis of *d* values using artifact distributions.

This program is used when (1) the user is estimating the effect size (*d* value; standardized difference between groups), and (2) information on the reliability of the measure of the dependent variable is *not* available in most of the primary studies. (This program is referred to in the text as D-VALUE1; see Chapter 7.)

The ``Type of Analyses'' page of the program shows four types of meta-analysis (1 to 4, listed above), and the user selects the most appropriate analysis. If the user selects option 1 or

2, the subprograms (1A and 1B or 2A and 2B) will appear on subsequent pages (under the Analysis section) for further choice of the exact program to be used (depending on whether range restriction is direct or indirect). As noted earlier, the user can also indicate that there is no range restriction.

5. ***Data Management***

After selecting the appropriate type of analysis, the user is presented with the ``Setting up the data'' page. Here the user can opt to input (enter) new data, to load existing (previously saved) data files, or to import data files from Excel (when selecting this option, the user will be provided with an Excel template for entering data). In all programs, when entering data via Excel, users can elect to code studies by potential moderators to make subsequent moderator subgroup analysis more convenient. This is done by following the instructions in the programs (described in section 9 "Moderator Analysis"). The user can also conduct analysis to examine publication bias based upon the cumulative meta-analysis method described in Chapter 13 of the book (also see section 10 "Cumulative Meta-Analysis" in this Read Me file).

a. Entering Data:

For meta-analysis type 1 (i.e., meta-analysis for correlations, with information on statistical and measurement artifacts available in most primary studies; VG6 programs), the user need only enter data into one general data file. This data file can be entered by Excel or created with the program. To enter data by Excel, the users should click on the button "Enter Data by Excel". An Excel template will be opened with pre-assigned fields/columns for the users to enter data from the primary studies. **Note: When users open the Excel templates, a security warning that reads "*Security Warning: Some active content has been disabled. <Options>*" may appear in the upper left corner of the screen. The user should then click on the "*Options*" button next to this and then enable both the "Macro" and "Data Connection" sections of Excel (by selecting "*Enable this content*" under each of these sections. This must be done each time Excel is used or data cannot be saved. Alternatively, the user can reset his/her Windows settings to disable these Macros and enable data saving and eliminate the above steps.** After completing data entry, the users can click on the "Save Data" button inside the Excel Template to save the data. The users will need to give a name for the dataset which can be used to load the data later. (The signal that the data has been

saved to the main program is the shaking or vibrating of the screen, as in all usages of Excel.) After that, the Excel Template should be closed. To create the data file inside the program (i.e., not using Excel), the user should click on the ``Enter data from primary studies'' button which then presents a page having a spreadsheet-like layout with six fields (spaces) so that relevant information for each study (i.e., correlation, sample size, reliability of variable X [independent variable reliability, R_{xx}, reliability of variable Y [dependent variable reliability, R_{yy}], and range restriction ratio [u]) can be entered accordingly.(The user will also see a field for moderator code but this code is inoperative in this data entry mode.) Data are entered sequentially for each study. When corrections are needed, the user can click on the ``Modification'' buttons available in front of the data holder for each study. All the data fields must be filled. When there is no range restriction in a particular study, ``1'' should be entered in the range restriction (u) cell. Similarly, when a variable is assumed to be perfectly measured (very rare case), ``1'' should be entered in the corresponding reliability cell. In situations where information on an artifact ($R_{xx}$, $R_{yy}$, or u) of a study is not available, the user can simply enter ``99'' into the corresponding cell. The program will then automatically use the mean of all the relevant artifact values provided in other studies to replace the missing value.

There are spaces to enter data for eight studies in each page. After entering the data for each page, the user clicks on the ``Continue'' button to proceed to the next page. The two buttons, ``Back'' and ``Continue,'' can be used to navigate through the pages to modify and/or enter data. The maximum number of studies is 1000. After completing data entry, the user can press the ``Done'' button to exit to the previous page and start analysis (or choose other options, such as printing, saving, or modifying the data, as described later).

For meta-analysis type 2 (i.e., meta-analysis for correlations when information on statistical and measurement artifacts is *unavailable* in most primary studies; INTNL programs), the user enters data separately into several data files: The first data file consists of the code for correlations and the corresponding sample sizes of the primary studies (r and N). The second data file consists of the distribution of reliability coefficients of the independent variable (R_{xx} and freq). The third data file consists of the distribution of reliability coefficients of the dependent variable (R_{yy} and freq). And the fourth data file consists of the distribution of range restriction (u and freq). Alternatively, these data files can be entered using Excel templates by selecting the four Excel buttons corresponding to the four above-mentioned distributions. <u>*It is*</u>

very important to note here that when asked to name the data files, the user must give the same name for all the four data files so that they will be loaded together later when the meta-analysis is run in the main program. If information is not available (or the artifact is not applicable) for an artifact distribution (e.g., when there is no range restriction), the program will assume that such artifacts have values fixed at 1.00 and automatically place 1.00s in the relevant data file(s). This means no correction will be made for these artifacts.

For meta-analysis type 3 (i.e., meta-analysis for effect sizes [*d* values], with information on statistical and measurement artifacts available in most primary studies; D-VALUE program), the procedures are similar to those of the type 1 meta-analysis described previously, except that the user enters only information on dependent variable reliability (R_{yy}); information on independent variable reliability (R_{xx}) and range restriction (u) is not required. This data file can be entered by Excel by following the same procedure as described above. As noted earlier, by using Excel to enter data, the user has the option of using the more accurate formula to estimate sampling error for the effect size when one group has a very small sample size compared to that of the other group (i.e., using equation 7.23a instead of 7.23). To do this, the user needs to enter the sample size of the larger group (group 1) in column "N1" and the size of the smaller group (group 2) in column "N2" in the Excel Template. However, if the two groups have similar sample sizes, equation 7.23a is not needed and the user can simply enter the total sample size in column "N1" and leave column "N2" blank (in this case, equation 7.23 will be used). See chapter 7 for more details.

For meta-analysis type 4 (i.e., meta-analysis for effect sizes [*d* values] when information on statistical and measurement artifacts is *unavailable* in most primary studies; D-VALUE1 program), the procedures are similar to those of the type 2 meta-analysis described previously, except that the user enters only information on the distribution of dependent variable reliability (R_{yy}); information on distributions of independent variable reliability (R_{xx}) and range restriction (u) is not required. Hence, there are only two data files rather than the four data files required for meta-analysis type 2. Again, these data files can be entered by using Excel. The discussion above of equations 7.23 and 7.23a also applies for type 4 meta-analysis.

In all cases, a date file entered via Excel and then saved is stored in the main program and the meta-analysis is then run from the main program by loading and running that data file.

b. Saving Data

After completing the entry of the data via the main program data entry mode (by clicking on the "Done'' button), the user is taken back to the previous page where several options are presented: "Save'', "Print'', "Analyze'', and "Exit''. Selecting the "Save'' option allows the user to save the data file he or she has just entered. The user will be asked to provide the name for the data set so that it can be easily retrieved when needed. The data will then be saved at the following location: C:\Meta Analysis Programs\Data$i$\"datasetname'', with i being the number corresponding to the type of meta-analysis. The data set will be available under the "Load" option on the "Setting Up Data" page.

Alternatively, the user can simply start analyzing the data. After the meta-analysis results are presented, the user is given another opportunity to save the current data set.

c. Loading Previously Saved Data

To load the previously saved data, select the "Load'' option on the "Setting Up Data'' page. The user will be presented with names of all the previously saved data sets. He or she can select the appropriate data set to load into the program by clicking on the red oval next to the name of that data file. *(Note: Sometimes the programs initially cannot find the data, even when the user has clicked on the button showing the data set name. If that happens, the user should go back to the previous page and select the dataset in question again. Doing that solves the problem.)*

d. Viewing/Modifying Saved Data

After loading/entering data via the main program mode, the user can view the data by selecting the ``Entering/Modifying'' option. Data will be presented in the spreadsheet-like layout. Modifications (corrections) can be made by clicking the icon in front of each individual study.

e. Printing Data

The user can print the current data set (i.e., the data that have just been entered, loaded, or imported from Excel) for easy reviewing by selecting the "Print'' option (i.e., the Printer icon). The program always sends the data to the default printer that is set on the user's computer. If the user wants to send it to another printer, he/she needs to change the default printer using the usual procedure for that.

f. Conducting publication bias analysis

Section 10 below ("Cumulative Meta-Analysis") explains the procedure for the cumulative meta-analysis method described in Chapter 13 of the book. Cumulative meta-analysis can be useful in detecting possible publication bias.

6. ***Analyzing Data***

After entering/loading/modifying the data, the user can start analyzing the data by clicking on the "Analyzing the Data'' button. For correlation-based meta-analysis (i.e., types 1 and 2; VG6 and INTNL programs), if the user has previously indicated there is range restriction, the user will next be asked to indicate the nature of range restriction existing in his or her data (i.e., direct or indirect, which means selecting between type 1A [VG6-D program] or 1B [VG6-I program] or selecting between 2A [INTNL-D program] or 2B [INTNL-I program]).

Both *direct range restriction programs* (VG6-D and INTNL-D) automatically assume that the independent variable reliabilities *(Rxx)* are from the unrestricted samples, and the dependent variable reliabilities (*Ryy*) are from the restricted samples. These assumptions agree with the nature of data available in research and practice. (See the text, Chapters 3, 4, and 5, for a more detailed discussion.)

Both *indirect range restriction programs* (VG6-I and INTNL-I) require the user to specify whether (1) the independent variable reliabilities (*Rxx*) are from the restricted or unrestricted samples and (2) whether the range restriction ratios are for true scores (u_T) or observed scores (u_X). For all cases, the program assumes that the dependent variable reliabilities are from the restricted samples. (See the text, Chapters 3, 4, and 5, for a detailed discussion.)

When there is no range restriction, it does not matter which type of analysis (A or B) the user chooses; the programs will provide identical results.

The user will be asked to provide the title for the analysis (e.g., "Interviews and job performance---Meta-analysis 1'') and the name of the output file where results will be saved (see next paragraph).

7. ***Reporting Results***

Results of the analyses are provided three different ways: (1) on screen (partial output), (2) on disk (at C:\Meta Analysis Programs\Output\``filename'', with ``filename'' being the name the user provided for the current analysis), and (3) print out (optional; which can be

activated by clicking on the ``Printer'' option). As noted earlier, the printed output is presented both in table form (some of the output) and in the more traditional output format (complete output). Due to space limitations, only partial output is presented on the screen. Complete output is saved to disk and printed with the print-out option. The printer it is sent to is the default printer, as set on the user's computer. The user can reset to a different computer, if desired.

A full listing and description of the output of each program is given later. The following are *some* of the items provided as output of the analysis:

1. Number of correlations (or *d* values) and total sample size.
2. Mean true score correlation (or mean corrected *d* value), the corresponding standard deviation (true score correlation SD_ρ or true effect size $SD_{\delta)}$, and the corresponding variances. These values are corrected for the biasing effects of all the artifacts considered in the meta-analysis.

   These values are estimates of mean construct-level relationships. Credibility intervals and confidence intervals are also provided.
3. Weighted mean observed correlation (or *d* values), observed variance and observed standard deviation, and variance and standard deviation corrected for sampling error only.
4. Sampling error variance, percentage of the observed variance due to sampling error variance, variance accounted for by all artifacts combined, and percentage of the observed variance due to all the artifacts combined.
5. The correlation between observed values and artifact effects is also presented. This is the square root of the proportion of variance accounted for by all artifacts combined.
6. For types 1 and 2 analyses (i.e., correlation-based meta-analyses), certain output is provided that is relevant to employment or educational selection research. The VG6 and INTNL programs provide the mean true validity and its standard deviation. Credibility intervals and confidence intervals are also provided. The true validity (also called operational validity) is the correlation between the predictor (X) and the criterion (Y) corrected for all the artifacts except for the attenuating effect of measurement error in the predictor X. This value represents

the mean correlation of the predictor *measure* with the criterion of interest. (In contrast, the true score correlation represents the mean construct-level correlation between the independent variable and the dependent variable.)

8. ***Illustrating Examples***

The programs include several data sets used as examples in Chapters 3, 4, and 7 of the 2014 Schmidt and Hunter book. These include examples representing all six types of meta-analyses discussed previously. The user can practice doing analyses based on these data sets to familiarize him- or herself with the programs. [Note: These data files from tables in Schmidt and Hunter (2014) will yield output trivially different from the values given in the book. This is because the book values were computed using Version 1.1 of the program (which is slightly different—see No. 11 at the beginning of this file), or for illustrative purposes were computed manually and/or computed using shortcut approximation formulas. These differences are usually trivial and not larger than rounding error.]

9. ***Moderator Analysis***

The programs allow users to conduct analyses separately for each moderator value/category. Results in the printouts are presented separately for each value/category of the moderator. *In the current version of the programs, moderator analysis requires that the user enter the data using the Excel templates (click on "Enter data by Excel").* [When entering data in the other mode (i.e., not using Excel), the user can enter moderator values for moderator categories, but moderator analysis cannot currently be conducted when data is entered that way. A future version of the programs will allow this.] To specify moderator analysis, the user enters the values of the moderator of interest in the field labeled "Moderator value". Values of the moderator should be entered for each study using a number from 1 to k (with k being the number of categories of the moderator). If no moderator analysis is needed, the user can leave the field for moderator blank. After entering the data, click on the Save Data icon to save the Excel data file to the main program.

To conduct Moderator Analysis on a saved Excel data file, the user first needs to specify the appropriate analysis (out of the four types of analyses described above) and then go to the "Setting Up Data" page and click on the "Load" button. At this point, do *not* select any

datasets in the "Loading Existing Data" page; instead, go to the bottom of the page and click on the "Moderator Analysis" button on the right. Upon clicking on this button, the users will again be presented with all available datasets. The user can then select the appropriate dataset for the moderator analysis by clicking on the red button on the left of its name. Results of the Moderator Analysis will automatically be printed out and also saved in the C:\Meta Analysis Programs\OutputM\ folder in separate files which are named after the Moderator categories (i.e., "1.txt", "2.txt", ….). The output is sent to the default printer, as set on the user's computer. Then, by clicking on the Excel icon, the user can see the mean corrected correlation or *d* value (MR) and its standard error (SE). This table can also be printed out using the normal Excel print out option at the top left of the Excel screen.

10. ***Cumulative Meta-Analysis***

Like moderator analysis, cumulative meta-analysis involves multiple meta-analyses. The first result presented is based on the study with the largest *N*, the second result is a meta-analysis based on the two largest *N* studies, and so on. Cumulative Meta-Analysis can be conducted by following a similar procedure to that of Moderator Analysis described in the previous section. But instead of clicking on the "Moderator Analysis" button, the users should choose the "Cumulative Meta-Analysis" button at the left side of the bottom of the "Load Existing Data" page. Results will be saved in the C:\Meta Analysis Programs\OutputN\ folder in separate files which are named based on the number of studies included in the analysis (e.g., "1.txt" is result of analysis based on one study with the largest sample size, "2.txt" includes result based on two studies with largest sample sizes,…and so on). These output files are not automatically printed out, but the user has the option of printing these files out by accessing the saved files on the C drive. The essential results are presented on Excel:

> On the Excel screen, the mean effect size and its standard error (SE) are presented for each cumulative meta-analysis. If the mean corrected correlation or mean corrected *d* value increases in size as the small sample studies are added, this indicates the possibility of publication bias in the low *N* studies. In that case, a meta-analysis omitting the small sample studies might be more accurate. These displayed results are typically all that is needed for interpretation of the cumulative meta-analysis. See Ch. 13 in the text for more details.

11. ***Extras (Auxiliary Programs)***

There are two utility programs in the form of Microsoft Excel templates that aid in examining and processing data before entering data into the meta-analysis programs. The user must have Microsoft Excel to use these programs. During the process of installing the main (meta-analysis) programs, these utility programs will be automatically copied onto your hard drive at the following location: "C: \ Meta Analysis Programs \ Extras.'' The first program ("Composite.xls'') combines correlations within a study; it computes the correlation between a composite (summed) independent or dependent variable and the other variable. (The other variable can also be a composite.)

This program also computes the reliability of the composite measure. Both the coefficient Alpha reliability and the Mosier reliability are presented. These procedures are described in Chapter 10 of the text. The second program ("Formula to compute biserial r.xls'') computes the biserial correlation from a point biserial correlation provided in a primary study. This conversion should be carried out when a continuous (and normally distributed) variable has been artificially dichotomized in a primary study, as described in Chapters 6 and 7 of the text.

12. ***Full Description of Output of Individual Programs***

The standard program output is divided into three sections: (1) Main Meta-Analysis Output, which presents results corrected for all artifacts; (2) Bare Bones Meta-Analysis Output, which presents results corrected for sampling error only; and (3) Validity Generalization Output, which presents validity results relevant to tests and other procedures used in employment and educational selection. Section 3 is provided only for meta-analyses of correlations (i.e., type 1 meta-analysis [based on the VG6 programs] and type 2 meta-analyses [based on the INTNL programs]). It is not provided for meta-analyses of *d* values (type 3 meta-analysis [based on the D-VALUE program] and type 4 meta-analysis [based on the D-VALUE1 program]). The printed sections of program output always appear in the same order. The tabular results are presented first (showing the results that need to be included in report tables), followed by the Main Output, followed by the Bare Bones Output, followed by the Validity Generalization Output (if applicable). The Bare Bones output is identical for VG6 and INTNL program output. Hence, to avoid repetition, we present this first below.

A. Bare Bones Output for VG6 (type 1 meta-analysis) and INTNL (type 2 meta-analysis).

1. Sample-size-weighted mean observed correlation.
2. Variance of correlations after removing sampling error variance.
3. Standard deviation (*SD*) of correlations after removing sampling error variance. (This is the square root of item 2.)
4. Sample-size-weighted variance of observed correlations.
5. Sample-size-weighted *SD* of observed correlations. (This is the square root of item 4.)
6. Variance due to sampling error variance.
7. *SD* predicted from sampling error alone. (This is the square root of item 6.)
8. Percentage of variance in observed correlations due to sampling error variance.
9. The Correlation between observed values of *r* and their sampling errors. (This is the square root of the *proportion* of variance accounted for by sampling error; see item 8.)

B. Main Output for VG6 programs (type 1 meta-analysis)

1. Number of correlations in the meta-analysis.
2. Total sample size. (Sum of study sample sizes.)
3. Mean true score correlation $\overline{\rho}$.
4. Variance of true score correlations (S_ρ^2).
5. *SD* of true score correlations (SD_ρ). (This is the square root of item 4.) Note: For most purposes, the key output is items 3 and 5.
6. 80% credibility interval for true score correlation distribution (See Chapter 5.)
7. 95% confidence interval around the mean true score correlation (See Chapter 5.)
8. Observed variance of the corrected correlations $(S_{r_c}^2)$. (Each correlation is first corrected for measurement error and other artifacts; then the variance of these corrected correlations is computed. This is the variance of the corrected correlations before sampling error variance is removed. As described in Chapter 3, the corrections for artifacts, while eliminating systematic downward biases, increase sampling error.)
9. Observed *SD* of the corrected correlations (*SDrc*). (This is the square root of item 8.)
10. Variance in corrected correlations due to sampling error. [Note: This figure is larger than the variance in *uncorrected* (*observed*) correlations due to sampling error variance, which is reported in the Bare Bones Output section. This is because the artifact corrections, while removing systematic downward biases, increase sampling error

variance. Note: variance due to other artifacts is included in this variance because the effects of these artifacts have been previously corrected for.]

11. *SD* of corrected correlations predicted from sampling error. (This is the square root of item 10.)
12. Percentage of variance in corrected correlations due to sampling error and other artifacts.
13. The correlation between the corrected *rs* and their sampling errors. (This is the square root of the *proportion* of variance in the corrected correlations accounted for by all artifacts; see item 12.)

C. Validity Generalization Output for VG6 programs (type 1 meta-analysis)

1. Mean true validity. (Same as mean true score correlation, except it is not corrected for the attenuating effects of measurement error in the independent variable; see Chapter 3 of text.)
2. Variance of true validities.
3. *SD* of true validities. (This is the square root of item 2.)
4. 80% credibility interval for true validity distribution. (See Chapter 5)
5. 95% confidence interval around mean true validity. (See Chapter 5)
6. Observed variance of the corrected validities. (Each validity is first corrected for measurement error in the dependent variable and for range restriction; then the variance of these corrected validities is computed. This is the variance of the corrected validities before sampling error is subtracted out. As described in Chapter 3, the corrections for artifacts, while eliminating systematic downward biases, increase sampling error.)
7. Observed *SD* of the corrected validities. (This is the square root of item 6.)
8. Variance in corrected validities due to sampling error. [Note: This figure is larger than the variance in uncorrected (observed) validities due to sampling error variance, which is reported in the Bare Bones output section. This is because the artifact corrections, while removing systematic downward biases, increase sampling error. Note: Variance due to other artifacts is included in this variance because the effects of these artifacts have previously been corrected for.]
9. *SD* of corrected validities predicted from sampling error and other artifacts. (This is the square root of item 8)
10. Percentage of variance in corrected validites accounted for by sampling error. (Note:

variance due to other artifacts is included in this because these artifacts have previously been corrected for.)

11. The correlation between corrected *rs* and artifact effects. (This is the square root of the *proportion* of variance in the corrected *rs* accounted for by artifacts; see item 10.)

D. Main Output for INTNL programs (type 2 meta-analysis)

1. Number of correlations in the meta-analysis.
2. Total sample size. (Sum of study sample sizes)
3. Mean true score correlation ($\bar{\rho}$) .
4. Variance of true score correlations (S_ρ^2).
5. *SD* of true score correlations (SD_ρ). (This is the square root of item 4.) Note: For most purposes, the key output is items 3 and 5.
6. 80% credibility interval for true score correlation distribution. (See Chapter 5)
7. 95% confidence interval around mean true score correlation. (See Chapter 5)
8. Variance in observed correlations due to all artifacts combined. (See Chapter 4)
9. *SD* of observed correlations predicted from all artifacts. (This is the square root of item 8.)
10. Variance of observed correlations after removal of variance due to all artifacts (residual variance $[SD_{res}]$; see Chapter 4).
11. Percentage of variance in observed correlations due to all artifacts.
12. Correlation between observed rs and artifact effects. (This is the square root of the *proportion* of variance in observed rs accounted for by artifacts; see item 11)

E. Validity Generalization Output for INTNL programs (type 2 meta-analysis)

1. Mean true validity. (Same as mean true score correlation, except not corrected for the attenuating effects of measurement error in the independent variable.)
2. Variance of true validities.
3. *SD* of true validities. (This is the square root of item 2.)
4. 80% credibility interval of true validity distribution. (See Chapter 5)
5. 95% confidence interval around mean true validity. (See Chapter 5)

6. Variance in observed validities due to all artifacts combined. (See Chapter 4)
7. *SD* of observed validities predicted from all artifacts. (This is the square root of item 6.)
8. Variance in observed validities after removal of variance due to all artifacts (residual variance

   $[SD_{res}]$; see Chapter 4).
9. Percentage of variance in observed validities due to all artifacts.
10. Correlation between observed validities and artifact effects. (This is the square root of the *proportion* of variance in observed validities accounted for by artifacts; see item 9.)

F. Bare Bones Output for D-VALUE and D-VALUE1 programs (meta-analysis types 3 and 4). (Bare Bones Output is identical for these two types of meta-analyses.)

1. Sample-size-weighted mean effect size (mean *d* value).
2. Variance of *d* values after removing sampling error variance.
3. *SD* of *d* values after removing sampling error variance. (This is the square root of item 2.)
4. Sample-size-weighted variance of observed *d* values.
5. Sample-size-weighted standard deviation of observed *d* values. (The square root of item 4)
6. Variance in observed *d* -values due to sampling error variance.
7. *SD* predicted from sampling error variance alone. (This is the square root of item 6.)
8. Percentage of variance in observed *d* values that is due to sampling error variance.
9. Correlation between observed *d* values and their sampling errors. (This is the square root of the *proportion* of variance accounted for by sampling error; see item 8.)

G. Main Output for D-VALUE program (type 3 meta-analysis)

1. Number of effect sizes (*d* values) in the meta-analysis.
2. Total sample size. (Sample sizes summed across studies.)
3. Mean true effect size $\overline{\delta}$.
4. True variance of effect sizes (S_δ^2).
5. *SD* of delta (SD_δ). (This is the square root of item 4.) Note: For most purposes, the key output is items 3 and 5.
6. 80% credibility interval for delta distribution. (See Chapter 8)
7. 95% confidence interval around the mean delta. (See Chapter 8)

8. Observed variance of corrected *d* values $(S^2_{d_c})$. (Each *d* value is corrected for measurement error in the dependent variable; then the variance of these corrected *d* values is computed. This is the variance of the corrected *d* values before sampling error variance is removed. As described in Chapter 7, the correction for measurement error, while eliminating the systematic downward bias, increases sampling error variance.)
9. Observed *SD* of the corrected *d* values (SD_{d_c}). (This is the square root of item 8.)
10. Variance in corrected *d* values due to sampling error. (Note: This figure is larger than the variance in *uncorrected* [*observed*] *d* values due to sampling error variance, which is presented in the Bare Bones Output section. This is because the correction for measurement error, while removing the systematic downward biases, increases the sampling error variance. Note: Variance due to measurement error differences is included in this variance figure, because measurement error has previously been corrected for.)
11. *SD* of corrected *d* values predicted from sampling error variance. (This is the square root of item 10.)
12. Percentage of variance in corrected *d* values due to sampling error variance. (Note: Variance due to measurement error differences is included in this value because the effects of this artifact have previously been corrected for.)
13. Correlation between corrected *d* values and their sampling errors. (This is the square root of the *proportion* of variance accounted for by sampling error; see item 12.)

H. Main Output for D-VALUE1 program (type 4 meta-analysis)

1. Number of effect sizes (*d* values) in the meta-analysis.
2. Total sample size. (Sample sizes summed across studies.)
3. Mean true effect size $\bar{\delta}$.
4. True variance of effect sizes (S^2_δ).
5. *SD* of delta (SD_δ). (This is the square root of item 4.) Note: For most purposes, the key output is items 3 and 5.
6. 80% credibility interval for delta distribution. (See Chapter 8)
7. 95% confidence interval around mean delta. (See Chapter 8)
8. Variance in observed *d* values due to sampling error and measurement error differences between studies. (See Chapter 7)

9. *SD* of observed *d* values predicted from sampling error and measurement error differences. (This is the square root of item 8.)
10. Variance in observed *d* values after removal of variance due to sampling error and between-study measurement error differences (residual variance $[S^2_{res}]$see Chapter 7).
11. Percentage variance in observed *d* values due to sampling error and differences in measurement error.
12. Correlation between observed *d* values and the combined effects of sampling error and differences in measurement error. (This is the square root of the *proportion* of variance due to all artifacts in item 11.)