Chapter 10: Personality Testing

This chapter shows how to construct a simple personality test with surveyWiz. SurveyWiz is well suited to making personality tests. You could also make the HTML directly by the methods explained in Chapters 2—5, but surveyWiz will save you a lot of tedious typing. This chapter will also review basic concepts of psychological testing, and it will illustrate these ideas with analyses of data for the personality test. These data are included on the CD that accompanies this book.

In a personality test, the participant's task is to evaluate him or herself. Rather than judging the sizes of numbers (as in the last chapter), the participant judges his or her own personality traits and behaviors. This chapter will describe the construction of a simple personality test to measure shyness and masculinity/femininity. The survey will permit you to correlate personality measures with students' grades, heights, and genders. You will also learn how to use SPSS to calculate a correlation matrix, and to perform a factor analysis.

A. Constructing a Simple Personality Test

First, push the *Reset* button on SurveyWiz to erase everything from your previous use, such as the exercises in the last chapter. (Be sure to save any work you need to save first). Type in the name, *Personality Questionnaire*, for the *Survey Name*, and *personality* for the *Short Name*. Next, push button *1. Start Form*. Then enter the questions below; for each of the items, use the default 5-point radio button scale, with labels of "strongly disagree" to "strongly agree." Type the following questions, and press the *3b. Radio Button Scale* key after each item:

I am a shy person.

I am an extrovert.

Those who know me say I'm extroverted.

Those who know me say I'm shy.

For a person of my gender, I'm considered masculine.

For a person of my gender, I'm considered feminine.

I think I'm masculine in my personality compared to people of both genders.

I think I'm feminine in my personality compared to people of both genders.

For the next items, use text box inputs; press the *3a. Text Input* button after you enter each item:

What is your grade point average? (4 = A, 3 = B, 2 = C, 1 = D, 0 = F; if you have a perfect A average, your GPA would be 4.0)

What is your height in inches? (5 feet = 60 inches; 6 feet = 72 inches; if you are 5'4'', then put 64 in the box)

Next, push the *3c. Demographics* button. Then push the *4. Finish the Form* button.

Study the HTML in the textarea, and replace *(put your instructions here)* with the following instructions: *Please rate how well each item describes your personality*. Look at the HTML at the end of the document, and carefully change the value of Male from "M" to 1; change "F" to 0. This coding will allow you to correlate gender with other numerical variables such as height and the masculinity items. Remember: on this scale of gender, a positive correlation with gender means that males are higher on the scale than females. One expects a positive correlation between gender and height with this coding, since males are usually taller on average than females. Copy the HTML to a text editor and save it as *personality.htm*. Compare your version with *personalityA.htm* on the CD. This questionnaire is pretty easy to make with surveyWiz.

Be sure to print out a copy of the questionnaire (and the HTML). Make a record of the variables, including the “hidden” variables, so that you know exactly how the variables will be returned to the data file. At this point, when you are sure that you know the order of the variables, you could cut and paste the HTML to make a new ordering of the items in the questionnaire. A copy of this questionnaire is included on the CD as *personalityA.htm*. A slightly more advanced version (which presents feedback) is also included on the CD, *personalityB.htm*. Load and complete the questionnaire in *personalityB.htm*. The more advanced version will be explained in Chapter 19.

When you get the data, you can import them into Excel and filter by the techniques described in Chapter 6, saving the data as a CSV file. The CD contains data for *personalityB.htm* in the file, *personality.csv*. To compute correlation coefficients between columns of data in Excel, you click in a cell where the correlation will be placed, and then from the **Insert** menu, select *Function.* From the *Functions* dialog box, choose C*orrelations*. Select the two columns that you want correlated, and click *OK*.

Section D will teach you how to use SPSS to calculate correlation coefficients and to perform a simple factor analysis. To prepare data for SPSS, it is a good idea to filter them first in Excel, copy them to a fresh page worksheet, and use *Save As* to save the data as a *Comma Separated File (.csv).* Also included on the CD is an SPSS data file, *personality.sav*. Before you analyze the data, however, it is important that you understand a few things about personality, correlation, and test theory.

B. Causation and Correlation

A personality test is an instrument designed to measure individual differences. Some people are tall and others are short, some are thin and some are heavy. Just as people differ in these physical characteristics, people differ in dimensions or traits of personality: some are shy and some are outgoing; some are emotionally calm and others seem nervous or anxious; some people are socially conservative and others are nonconformists; some are honest and some are not. The idea is that people are different, and if we could measure aspects of their personalities, we might be able to predict who would behave one way and who would behave differently when placed in the same situation.

If we could predict behavior from a test of personality, it does not mean that personality caused the behavior. Finding a correlation between gender and height does not mean that gender causes height, or that height causes gender. Finding a correlation between shyness and GPA would not mean that being shy causes people to spend more time with books thereby increasing their GPAs, nor does it mean that being smart causes people to be shy. It would merely mean that one can predict GPA from our measure of shyness or predict shyness from GPA.

If two variables are correlated, then you can predict one from the other. *Causation* means you can change things. Causation and correlation are two completely different concepts, but people often confuse them and think that evidence of correlation somehow is related to causation. One of the hardest ideas to get freshmen in psychology to give up is the fallacy that causation and correlation are somehow related. To understand the distinction between causation and correlation, it helps to consider two studies of the relationship between antibiotics and death.

If one conducts a *survey* and correlates the amount of antibiotics taken last year with death (whether a person is alive or dead this year), one finds that people who took a lot of antibiotics last year are more likely to be dead this year than people who took no antibiotics last year. Thus, antibiotics are *positively* correlated with death—more antibiotics is associated with more likely dead. However, if one does an *experiment* on the effect of antibiotics, one finds the opposite relation—people who were *randomly assigned* to receive antibiotics instead of placebo are more likely to be *alive* this year. In the experiment, antibiotic treatment is negatively correlated with death—more antibiotics means less likely to be dead. Thus, these two types of studies yield opposite relations.

What happens in an experiment is often the opposite of what happens in the so-called, "real world" of confounded variables. That is why scientists who want to understand causation prefer to do experiments in controlled situations. In the so-called "real" world, antibiotics predict death because sick people in wealthy countries are given antibiotics, and medicines do not always work. If you are in the life insurance business, you do *not* want to sell life insurance to a person who has been taking a lot of antibiotics because they are sick and likely to die. However, from double-blind experiments with random assignment, we learn that taking antibiotics has the causal effect of *decreasing* the likelihood of death. So, if you already insure a person who gets sick, you would advise that person to take antibiotics because that treatment *causes* a decrease in the death rate. Thus, correlation and causation can be and often are opposites.

As another example, ask yourself: do you think students would learn more in a small or large class in high school? However, what is the correlation between class size and scholastic performance? Think of your high school. Which students are enrolled in the smallest classes? The mentally or behaviorally challenged students are in the smallest classes. Which was larger in your high school, the class of AP (honors) English or the class for people with learning disabilities? So, if an investigator correlated a scholastic achievement test with class size, that person would find that larger class sizes are positively correlated with better performance. Does that mean that we should make all classes larger? No, because correlation does not imply causation; it might help to reduce class size, just as it might help to give antibiotics. Do not be confused by correlation and confounded variables. Remember: correlation and causation are two different ideas, they are not related to each other, and they can and will easily yield opposite relations. Surveys are used to assess correlation, and experiments are used to assess causation.

Here is a test item that all students of psychology will receive in one form or another.

If A and B are positively correlated, it means:

(a) A causes B;

(b) B causes A;

(c) Some third factor C causes both A and B;

(d) We know that a, b, or c is true, but we do not know which;

(e) None of the above.

The correct answer is e, none of the above. From correlation, we know nothing about causation. It is possible that A caused B; it is possible that B caused A; it is possible that A causes B *and* B causes A; it is possible that a third factor, C, causes both A and B. However, it is also possible that there is *absolutely no causal relation at all*. Just as the Alchemists tried to make gold by mixing lead and sulfur, there are statistical alchemists who try to draw causal inferences from correlation. Do not be fooled.

C. Assessing Tests: Internal Consistency, Reliability, and Validity

Any test or measure can be analyzed for internal consistency, reliability, and validity (Anastasi, 1982; Nunnally, 1978). *Internal consistency* is measured by correlations among items that make up the scale. In our personality test, there were four items that were intended to measure introversion/extroversion (*I am a shy person, I am* *an extrovert, Those who know me say I'm extroverted,* and *Those who know me say I'm shy).* The two items should correlate negatively, since a person who is an "extrovert" is not likely to be "shy." Similarly, a person who describes him- or herself as shy would also tend to think that acquaintances would describe them in the same way, so the first and fourth items should be positively correlated. To construct a *total shyness* measure, we can add the responses to the two shyness items and subtract the responses to the two items measuring extroversion. This scale would have high internal consistency if the items making up the scale correlate properly with each other. The higher the average inter-item correlation and the more items there are in the scale, the higher the internal consistency. If the items all measure the same construct, then higher internal consistency means higher reliability.

If a test is reliable, then one can predict from one assessment of the measure to another assessment. *Test-retest* reliability is the correlation between scores of a test and the scores obtained when the same people are tested again with the same test on another occasion. If the same personality test is given twice, the person who is shy today should be shy next week. The *alternate-forms* definition of reliability is measured by the correlation between two different versions of the same test.

If a scale is unreliable, then it is not a useful measure. For example, suppose you got on a bathroom scale and it gave a reading of 125 lbs. Suppose you stepped off and on again and got a measure of 367 lbs. Suppose you get on again and it reads 41 lbs., and next it reads 212 lbs. If a scale gives different readings each time the same measure is taken, that scale is unreliable. You certainly would not want to use that scale to measure the outcome of a diet study, nor would it be fair to use that scale to weigh in fighters before a prizefight. If a test is not reliable, then it is not valid.

If a test *is* reliable, it may or may not be a valid measure of what the test is supposed to measure. Validity is the correlation between a test and the construct that the test is supposed to predict. A test of marital satisfaction should predict which couples will get divorced and which will stay together. A behavioral test of drunkenness used by the police should predict how well a driver could operate his or her vehicle. A test of law school aptitude should predict who will succeed and who will flunk out or fail the bar exam. If a test is valid, then it can be used to predict what the test is supposed to measure.

Consider a behavioral measure of shyness, measured by a student's willingness to give a presentation to a class. Students might be paired to work on a project, with the assignment that one student from each pair must give a presentation to the class. Which person do you think will volunteer to give the talk? One expects those students with higher extroversion (less shyness) should be more likely to volunteer to give a talk. If the measure correctly predicts which student would give the talk, then such a correlation would be an index of the *convergent validity* of the test. At the same time, the test of masculinity/femininity should not predict this same behavior. Thus, the test battery should *discriminate* between behaviors that are and are not measures of a given construct.

Ask yourself: Which test (shyness, extroversion, or masculinity/femininity) should more accurately predict if a woman is wearing pants or a skirt? Which test should predict if a person is willing to perform in a skit for the class? Which test should predict if a person likes to play football? Which test should predict if a person prefers to socialize with many friends or with only one? These studies would be ways to assess the convergent and discriminant validity of the personality scales on the test.

Another approach to validation of personality tests is to examine if the test discriminates between *criterion groups* that should differ systematically on the test. For example, a test of mental illness should distinguish patients in mental hospitals from people who work there. Which group do you think would score higher in masculinity, Navy Seals or interior decorators? Which group should score higher in shyness, members of the drama club or members of the computer club? Buchanan (in press) has discussed how newsgroups on the Internet (groups of people who subscribe according to specific interests) can be used as criterion groups to validate personality tests.

After measuring extroversion/shyness and masculinity/femininity, one could ask how each of these scales correlates with grade point average. These relationships are not really measures of validity; they are measures of empirical relationships.

D. Analysis of Personality Data in SPSS

Start SPSS and open the file, *personality.sav*. For SPSS, the variable names must be short, so the question, *I am a shy person*, has been given the variable name, *Im_shy*; similarly, the question, *For a person of my gender, I'm considered masculine*, has been given the variable name, *con_masc*. The variables are in the same order in the data file as that in the questionnaire, starting with the hidden variables of *experiment* (short name), *date*, *time*, *remote address* (which has been deleted), and ending with the person's judgment of *accuracy* and their *comments*.

The first task is to compute the matrix of correlation coefficients among all of the variables in the study. To do this, select *Correlations*, then *Bivariate* from the **Analyze** menu, as shown in Figure 10.1. That brings up the dialog of Figure 10.2.

Insert Figure 10.1 and 10.2 about here.

In the dialog of Figure 10.2, select all of the numerical variables with the mouse, then click the right-pointing arrow to send the selected variables to the list of variables to be intercorrelated. Variables can be added or removed from the list by selecting them individually and clicking the arrow to send them back to the list of variables omitted from the analysis or to the list chosen. For this analysis, include all of the numerical variables. Check the box beside *Pearson correlations*. Click *OK*. SPSS displays the results in a screen of output. You can double click on parts of the output to adjust the fonts and appearance of the tables. You can save or print the output.

Figure 10.1. To compute a matrix of correlations in SPSS, select *Correlate*, then *Bivariate* from the **Analyze** menu.

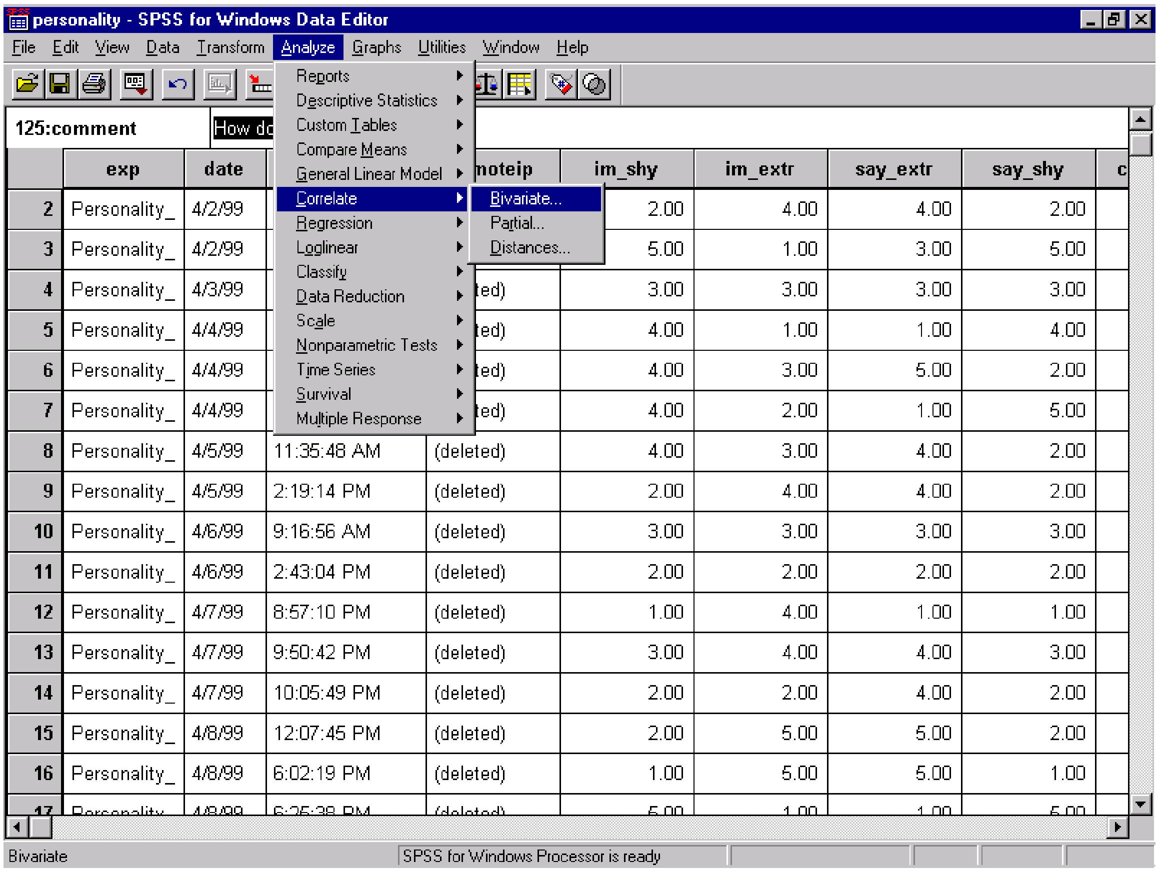


Figure 10.2. The Bivariate Correlations dialog box. Select the numerical variables, by clicking with the mouse and dragging. Then click the arrow, which will move the selected variables to the list to be correlated. From the *Options* key in the lower right corner, you can also obtain other statistics including means and standard deviations. When everything is completed, click *OK*.

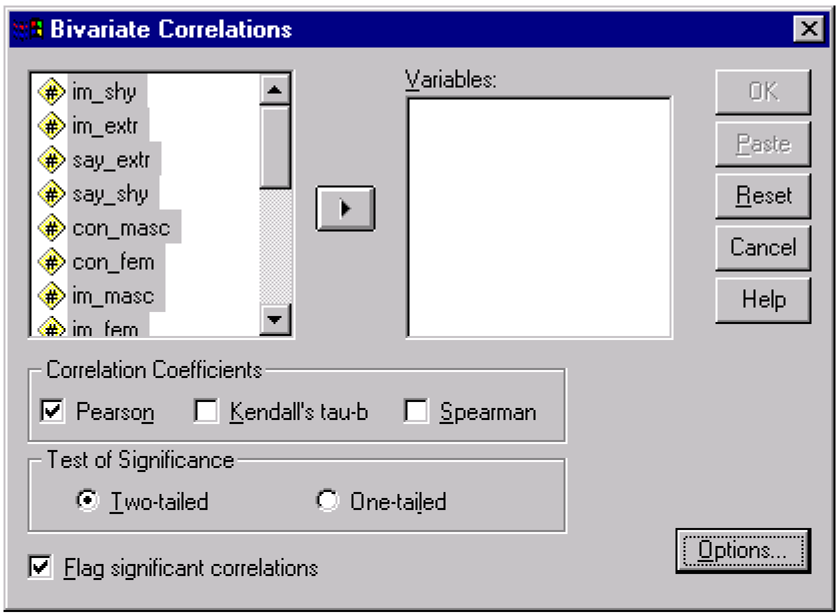
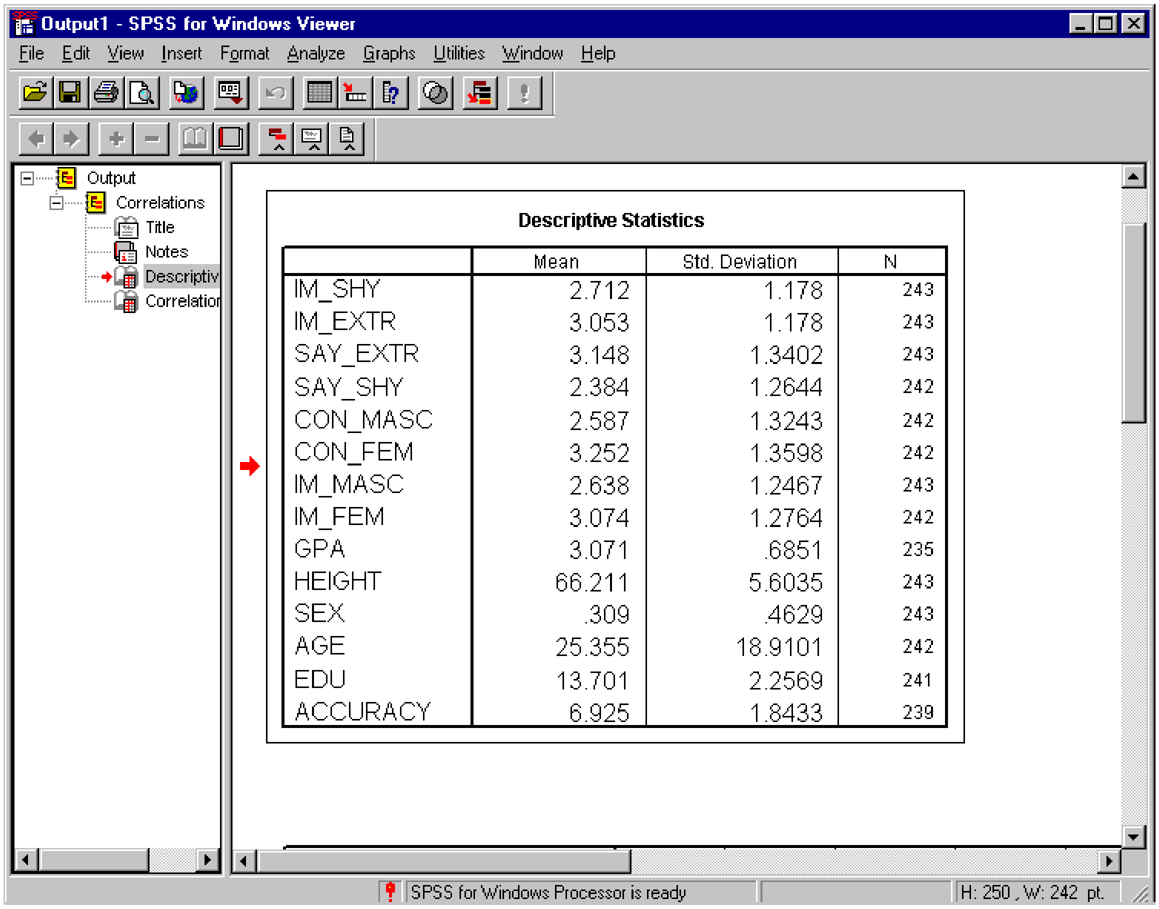


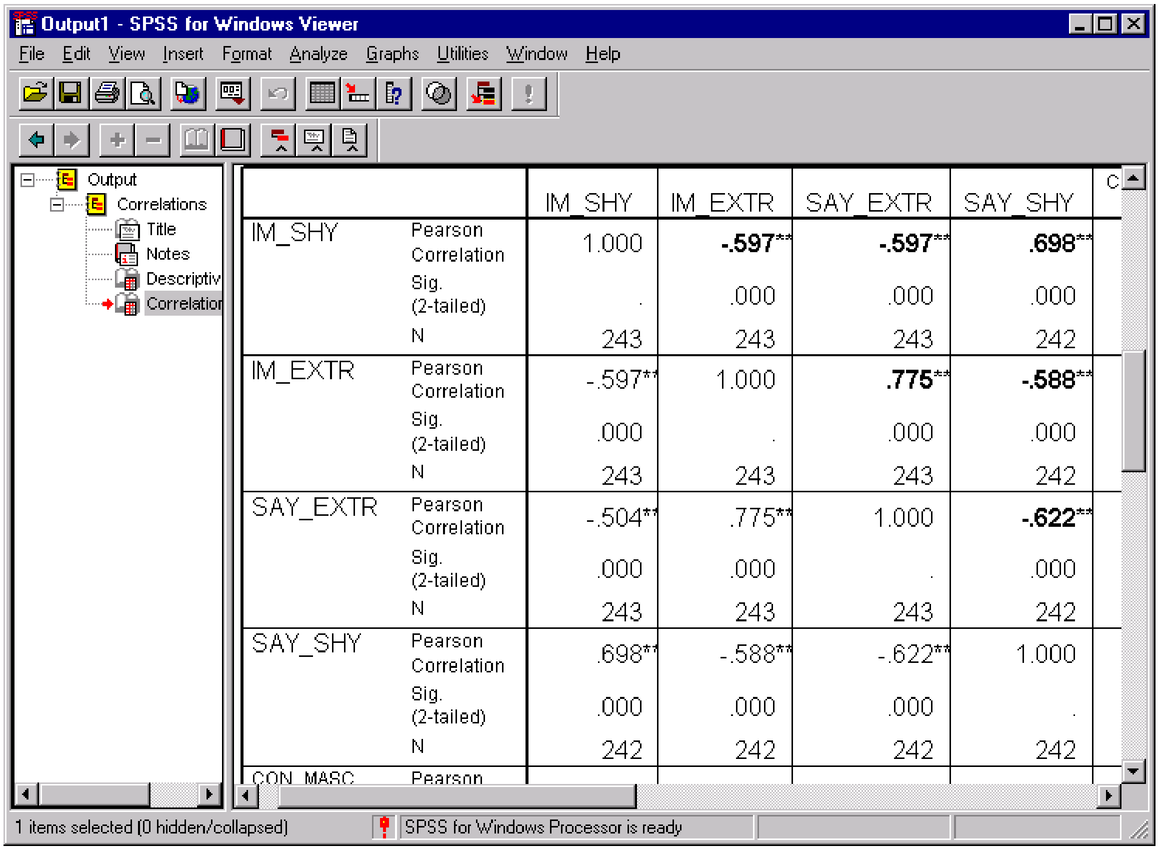
Figure 10.3. Appearance of the means and standard deviations of the variables in SPSS output.



Descriptive Statistics

	Mean	Std. Deviation	N
IM_SHY	2.712	1.178	243
IM_EXTR	3.053	1.178	243
SAY_EXTR	3.148	1.3402	243
SAY_SHY	2.384	1.2644	242
CON_MASC	2.587	1.3243	242
CON_FEM	3.252	1.3598	242
IM_MASC	2.638	1.2467	243
IM_FEM	3.074	1.2764	242
GPA	3.071	.6851	235
HEIGHT	66.211	5.6035	243
SEX	.309	.4629	243
AGE	25.355	18.9101	242
EDU	13.701	2.2569	241
ACCURACY	6.925	1.8433	239

Figure 10.4. Correlations among items that relate to shyness/extroversion, as shown in SPSS viewer. To see the rest of the matrix, one needs to scroll on the screen or print the output. By double-clicking on the table and selecting cells, you can change fonts and formats.



		IM_SHY	IM_EXTR	SAY_EXTR	SAY_SHY
IM_SHY	Pearson Correlation	1.000	**-.597****	**-.597****	**.698****
	Sig. (2-tailed)	.	.000	.000	.000
	N	243	243	243	242
IM_EXTR	Pearson Correlation	-.597**	1.000	**.775****	**-.588****
	Sig. (2-tailed)	.000	.	.000	.000
	N	243	243	243	242
SAY_EXTR	Pearson Correlation	-.504**	.775**	1.000	**-.622****
	Sig. (2-tailed)	.000	.000	.	.000
	N	243	243	243	242
SAY_SHY	Pearson Correlation	.698**	-.588**	-.622**	1.000
	Sig. (2-tailed)	.000	.000	.000	.
	N	242	242	242	242
CON_MASC	Pearson				

Means and standard deviations are shown in Figure 10.3, and the table of correlations are shown (in part) in Figure 10.4. The correlation between the response to the question, *I am a shy person* (*IM_SHY*) and the question, *Those who know me say I'm shy* (*SAY_SHY*), is .698. That means that you can predict from one answer to the answer to another item; those people who describe themselves as shy also think that others who know them tend to say they're shy. The correlation between *IM_SHY* and the question, *I am an extrovert* (*IM_EXTR*) is –.597. The negative correlation means that those who respond high on *IM_SHY* respond low on *IM_EXTR* and vice versa. You can predict from one to the other, but the direction of the relationship is negative.

Insert Figures 10.3 and 10.4 about here

The next task is to construct a score of total shyness from the responses to these four items. First, one must reverse the scales of the two items measuring extroversion to convert them to scales of introversion; one can do that by reflecting their signs. Thus, we can add the responses to the two shyness items, and subtract the responses to the two extroversion items, which will produce a total score that measures shyness and introversion.

To compute a composite score in SPSS, do the following steps. From the **Transform** menu, select *Compute*. That will bring up the dialog box shown in Figure 10.5. In the *Target Variable* box (which will be the name of the new variable), type *TOT_SHY* (for Total Shyness). In the numeric expression box, you can specify the calculations that SPSS will make. To insert a variable name, select it in the box on the left, and use the arrow to send it to the expression box. Type or use the mini-keyboard to enter the minus and plus signs between the variables. Explore this box to see the variety of function calculations available. Press *OK*, and SPSS will create a new column of values from the requested computation. Notice that the scores on this new scale can be positive or negative. A positive sign indicates more shyness than extroversion, and a negative sign represents the opposite. Use the same approach to compute a scale of total masculinity. Insert Figure 10.5 about here.

The internal consistency of total scores can be computed from the Spearman-Brown prophecy formula (Nunnally, 1978, p. 211),

$$r_{kk} = \frac{k\bar{r}_{ij}}{1 + (k-1)\bar{r}_{ij}} \tag{10.1}$$

where r_{kk} is the internal consistency (theoretical reliability) of the total test score, k is the number of items in the total (k = 4 in these examples), and $\bar{r}_{ij}$ is the average inter-item correlation. For the shyness total, the average inter-item correlation (after reflection of the scales) is .631, so the internal consistency is .872. For the masculinity total, the average inter-item correlation is .624, so the internal consistency is .869. This formula assumes that each item in a total is measuring the same true score with homogeneous, independent error. If all of the items are measuring the same factor, then internal consistency, r_{kk}, is an estimate of reliability.

You can also use factor analysis to examine the structure of correlations (Anastasi, 1982; Nunnally, 1978). To run factor analysis from SPSS, from the **Analyze** menu, choose *Data Reduction*, then *Factor…* In the *Factor Analysis* box, move the eight personality items to the list of variables to be factored. Then, click the *Extraction* button and choose *Principal Axes* as the method, *Analyze* the *correlation matrix*, and *Extract Eigenvalues over 1*. These settings will probably be the defaults, as they are the settings that historically have been most often used in factor analysis. Click the *Continue* button. Then click the *Rotation* button and choose *Varimax* as the method, and *Display the Rotated Solution*. Click *Continue*. Explore the other dialog boxes, and then click *OK*. The results indicate that there are two factors in the data. Among the results is the rotated component (factor loading) matrix, shown in Figure 10.6.

Insert Figure 10.6 about here.

Figure 10.5. *Compute Variable* dialog. In this case, a new variable, *TOT_SHY*, will be computed by adding the responses to *im_shy* and *say_shy*, and subtracting the responses to *im_extr* and *say_extr*. *Compute Variable* can also be used to create a scale of total masculinity, *TOT_MASC*.

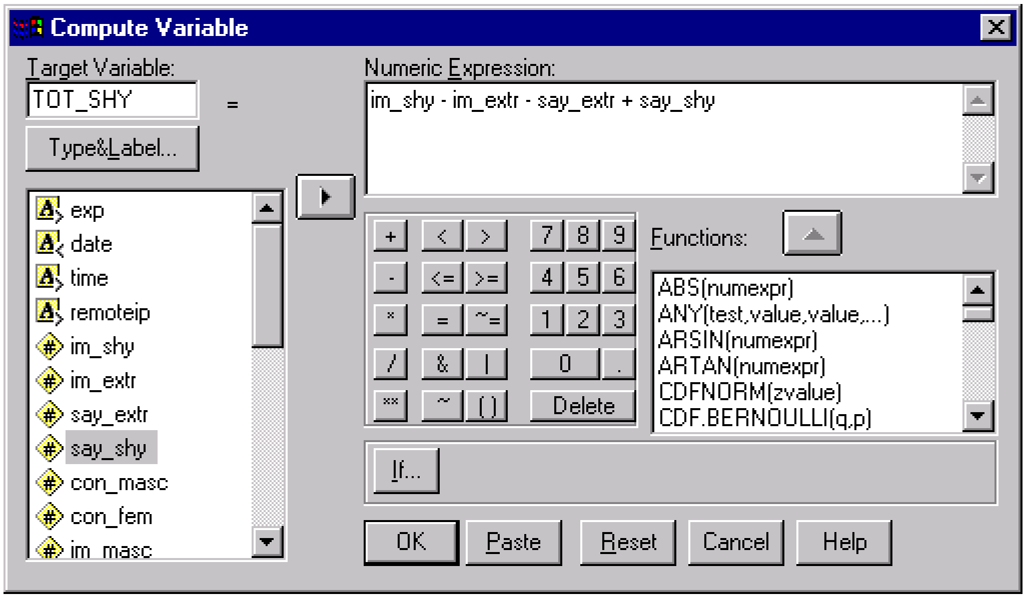
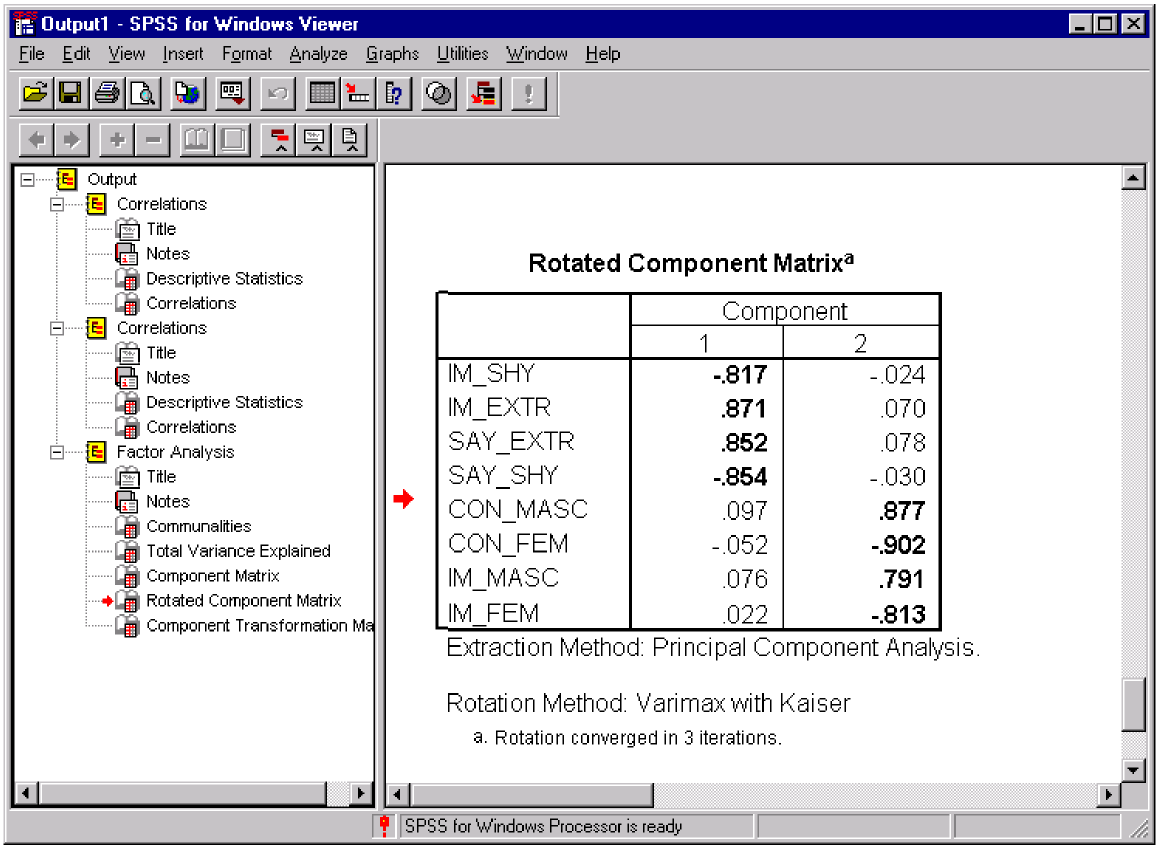


Figure 10.6. The rotated factor loading matrix. Note that this exploratory factor analysis yielded two factors, which when rotated can be interpreted as extroversion and masculinity. (Note that shyness items load negatively on the first component and that femininity items load negatively on the second component.) These results confirm the hypothesized structure.



Rotated Component Matrix[a]

	Component	
	1	2
IM_SHY	**-.817**	-.024
IM_EXTR	**.871**	.070
SAY_EXTR	**.852**	.078
SAY_SHY	**-.854**	-.030
CON_MASC	.097	**.877**
CON_FEM	-.052	**-.902**
IM_MASC	.076	**.791**
IM_FEM	.022	**-.813**

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser

a. Rotation converged in 3 iterations.

Factor analysis is a method for exploring correlations among variables. A more general method that includes factor analysis as a special case is the approach known as linear structural equations analysis. Personality test developers use such methods to investigate how many factors of personality might underlie a set of items and to explore the dimensions of individual differences among people.

In the little personality test used here, there were eight items designed to assess two personality factors. Factor analysis indicated that shyness and masculinity are nearly independent factors. To check this in another way, perform another correlation analysis in which the total scores for shyness and masculinity are included with the other numerical variables. If the two scales were independent, then they would have a correlation of zero. The two total scores correlate only –.107, indicating that the two dimensions are nearly independent.

In larger studies of personality, other factors, or dimensions of personality, have been developed and measured. The real challenge to personality testing is to develop tests that have high validity when used to predict interesting behavioral criteria. Intelligence tests can predict success in school (as measured by grades or scholastic achievement tests) with correlations of about .5. Personality tests have not yet achieved validity coefficients as high as those reported for IQ tests.

Some social psychologists dispute the basic premise of personality testing; they argue that people are not very different in personality, and behavior is determined more by the social situation than by individual differences. This debate is long from settled.

E. Summary and Discussion

In this chapter, you learned to use surveyWiz to construct a simple personality test. You also learned how to use SPSS to compute correlations, to make computations with the data (find total scores), and to conduct a simple factor analysis. You also learned that evidence of correlation and causation are not necessarily related in any simple manner, and that one should not confuse the results of correlational surveys as evidence of causation.

A number of recent articles discuss individual differences testing via the Internet. For discussions of on-line personality testing, see Buchanan (in press), Buchanan and Smith (1999), and Pasveer and Ellard (1998). Bailey, Foote, and Throckmorton (in press) present the results of a comparison of on-line and in-class tests of sexual attitudes, knowledge, and behaviors. Mueller, Jacobson, and Schwarzer (in press) present a study that correlates a personality test of self-efficacy with experience in computer programming. Perhaps people who learned to control a computer also learn to control other aspects of their lives. Pagani and Lombardi (in press) examine individual differences in the communication of emotions in pictorial stimuli that are correlated with cultural differences.

F. Exercises

1. For the data included, what is the correlation between height and sex? What does this correlation mean? What is the correlation between the total masculinity score (*TOT_MASC*) and sex? Would you consider this correlation evidence of validity of the scale? What is the correlation between *TOT_MASC* and height? How would you interpret this correlation?

2. Suppose you wanted to predict GPA. Can you predict GPA from shyness or masculinity? (Hint: look at the correlation matrix to see what variables are most highly correlated with GPA). What can you predict GPA from? How would you interpret the correlations with GPA? What personality scales should correlate with GPA?
3. What happens if you include sex, height, and GPA as well as the 8 personality items in the factor analysis? Can you interpret the factors?
4. Use surveyWiz to construct a personality test designed to measure two of the following personality dimensions: social conformity, neuroticism, order, depression, extroversion, and locus of control.
5. Project idea: Have everyone in a class take a personality test twice. Compute the test-retest reliability of each scale on the test.
6. Project idea: Devise a personality test to measure Authoritarian personality. Devise a procedure to validate the test. Construct your questionnaire using surveyWiz or by writing your own HTML.
7. Project idea: Have everyone in a class take the personality test. Also ask each person if they would like to give a speech to the class. Correlate the test scores to see if you can predict how much a person would like to give a speech from their measure on the test of shyness.