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Reliability

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Measurement

- Measure is composed of truth and error
- Our work here is to figure out how much is truth and how much is error.
- Observed score, true score, measurement error
 - $X = t + e$, where
 - X is the observed score
 - t is the true score
 - e is the error

Reliability

- “A measure is reliable to the extent that it gives the same result again and again if the measurement is repeated.”

(Shively, p. 43)

Several common strategies to assess reliability

- Repeated measures at more than one point in time
- Or, more commonly, use multiple indicators.
- We are going to focus, here, on multiple indicators.

What might multiple indicators look like?

E14. On your last visit to the Museum of Islamic Art, how satisfied were you with the []?

	1. Very satisfied								
	2. Somewhat satisfied								
	3. Somewhat dissatisfied								
	4. Very dissatisfied								
	7. NOT APPLICABLE								
	8. DON'T KNOW								
	9. REFUSED								
a. Contents of displays/exhibitions	1	2	3	4	7	8	9		
b. Ease of reading exhibit labels/descriptions	1	2	3	4	7	8	9		
c. Directions and signs	1	2	3	4	7	8	9		
d. Guidebook and leaflet	1	2	3	4	7	8	9		
e. Helpfulness of staff	1	2	3	4	7	8	9		
f. Parking facilities	1	2	3	4	7	8	9		
g. Cleanliness of toilets	1	2	3	4	7	8	9		
h.									
i. Gift shop	1	2	3	4	7	8	9		
j. Facilities and activities for the children	1	2	3	4	7	8	9		

E15. To what extent do you agree/disagree with the following statements regarding your last visit to the Museum of Islamic Art.

	1. Strongly agree								
	2. Somewhat agree								
	3. Somewhat disagree								
	4. Strongly disagree								
	8. DON'T KNOW								
	9. REFUSED								
a. I had an enjoyable visit to the museum	1	2	3	4	8	9			
b. My visit to this museum inspired me to learn more about Islamic heritage	1	2	3	4	8	9			
c. I learned many new things about Islamic heritage from visiting this museum	1	2	3	4	8	9			
d. Museum hours suit my schedule	1	2	3	4	8	9			
e. I would recommend this museum to others	1	2	3	4	8	9			

Or they might look like this...

F6. How many bedrooms are there in this house?

-8: DON'T KNOW

-9: REFUSED

F7. Does this house have any indoor or outdoor swimming pool (do not count shared pool in a housing compound)?

1 YES

2 NO

3 DON'T KNOW

F13. What is the current total monthly income of all household members? Is it less than or greater than QR 25,000?

1 Less than 25,000

2 25,000 or more

3 DON'T KNOW

4 REFUSE

F13a. You said the total household monthly income is less than 25,000, is it ...

1 Less than 10,000

2 10,000 to less than 15,000

3 15,000 to less than 20,000

4 20,000 to less than 25,000

5 DK/REF

F13b. You said the total household monthly income is 25,000 or more, is it ...

1 Less than 30,000

2 30,000 to less than 35,000

3 35,000 to less than 40,000

4 40,000 to less than 50,000

5 50,000 or more

6 DK/REF

Additive scales

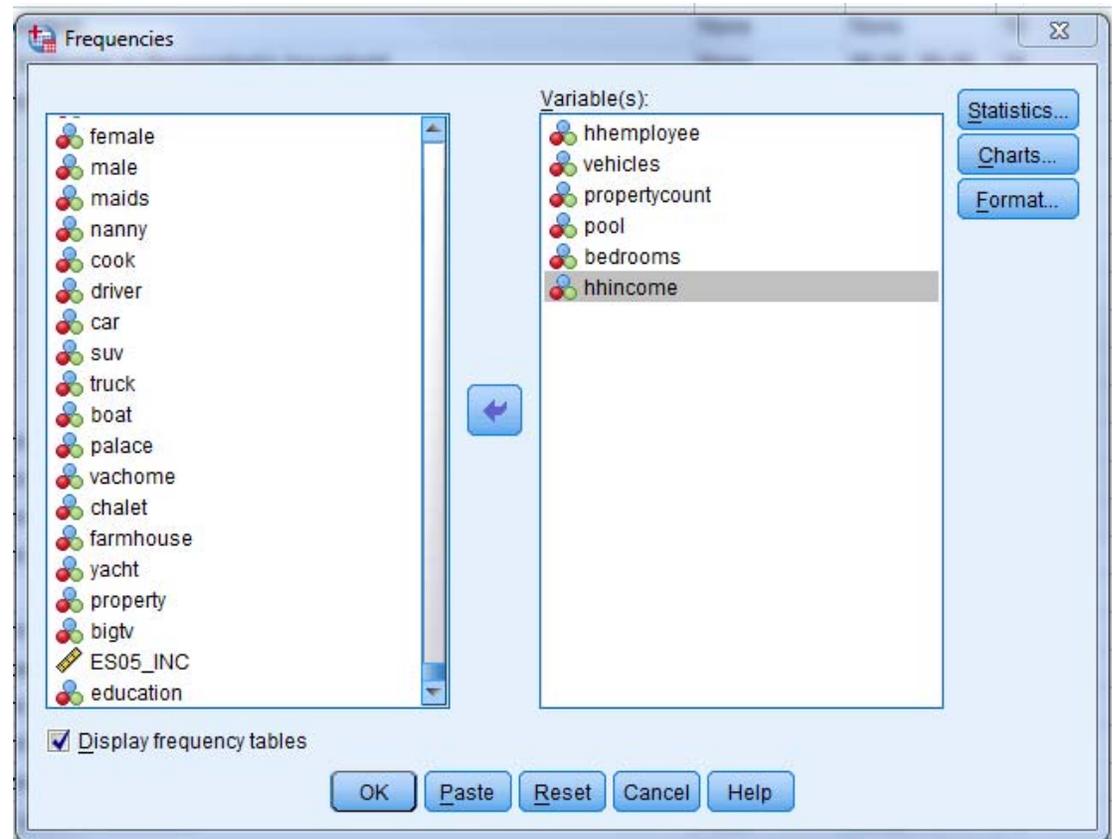
- Rescale each variable 0-1.
- Make sure all variables are running in the same direction, that is “high” means the same thing on all of the variables and “low” means the same thing on all of the variables.
- Add them up and divide by the number of items.

What if we wanted to create a measure of wealth using the 2011 SESRI Omnibus Survey?

- We could explore creating a scale consisting of several variables:
 - The total number of household employees (hhemployee)
 - The total number of household vehicles (vehicles)
 - The total number of properties / living quarters owned by a respondent's household (propertycount)
 - Whether the respondent's household has a pool (pool)
 - The number of bedrooms in household (bedrooms)
 - Total household income (hhincome)
- These variables do not range in value from 0 to 1.

Creating a Scale

- Rescale variables to range from 0 to 1.
- Use the frequencies command (under *Analyze/Descriptive Statistics* menu) to see how variables are currently coded & how they need to be transformed.

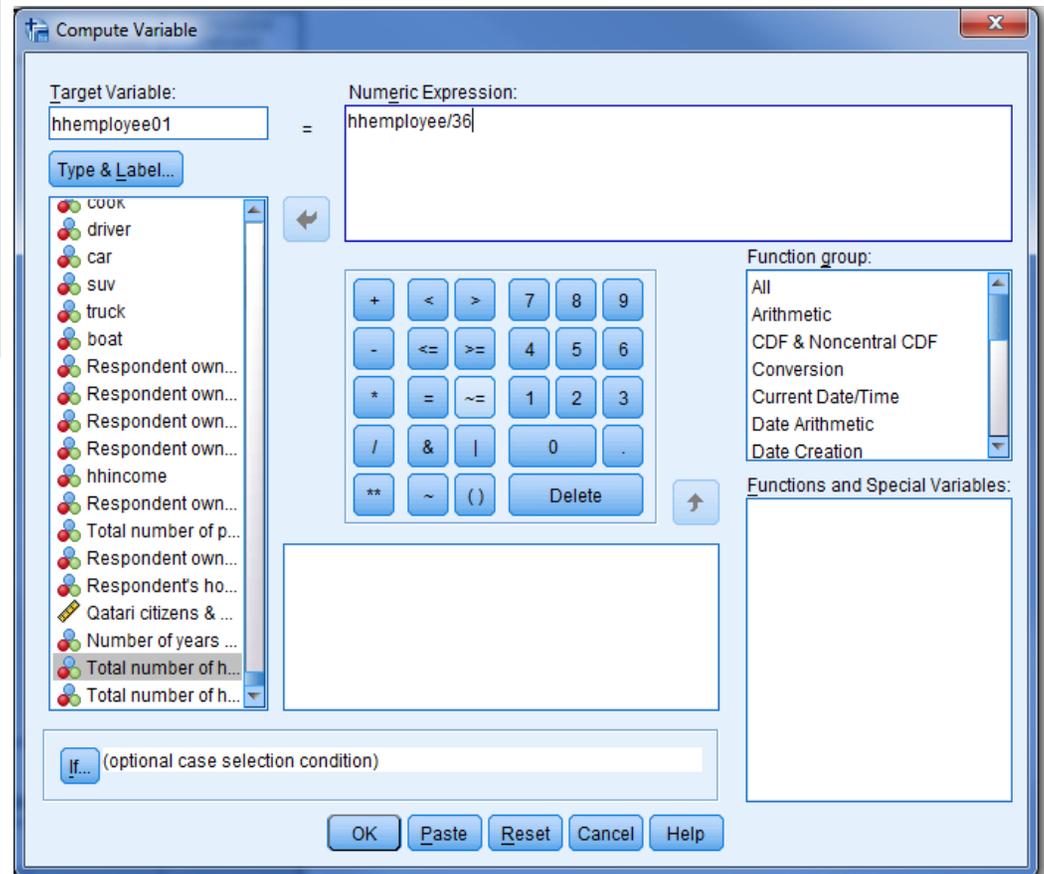


Total number of household employees

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	816	28.6	40.9
	1.00	387	13.6	60.3
	2.00	247	8.7	72.7
	3.00	238	8.3	84.6
	4.00	119	4.2	90.6
	5.00	57	2.0	93.4
	6.00	34	1.2	95.1
	7.00	32	1.1	96.7
	8.00	40	1.4	98.7
	9.00	8	.3	99.1
	10.00	5	.2	99.4
	11.00	3	.1	99.5
	12.00	4	.1	99.7
	16.00	1	.0	99.8
	17.00	1	.0	99.8
	22.00	1	.0	99.9
	30.00	1	.0	99.9
	36.00	1	.0	100.0
Total	1995	69.9	100.0	
Missing	System	859	30.1	
Total		2854	100.0	

Recoding

We can see that the variable “hmployee” (the total number of household employees a respondent has) ranges from 0 to 36. We can create a new variable that transforms hmployee to range from 0 to 1.



Use the *Transform/Compute Variable* menu to create a new variable called “hmployee01”, which divides “hmployee” by 36.

Frequencies for Recoded Wealth Variables

Total number of household employees recoded 0 to 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	816	28.6	40.9	40.9
	.03	387	13.6	19.4	60.3
	.06	247	8.7	12.4	72.7
	.08	238	8.3	11.9	84.6
	.11	119	4.2	6.0	90.6
	.14	57	2.0	2.9	93.4
	.17	34	1.2	1.7	95.1
	.19	32	1.1	1.6	96.7
	.22	40	1.4	2.0	98.7
	.25	8	.3	.4	99.1
	.28	5	.2	.3	99.4
	.31	3	.1	.2	99.5
	.33	4	.1	.2	99.7
	.44	1	.0	.1	99.8
	.47	1	.0	.1	99.8
	.61	1	.0	.1	99.9
	.83	1	.0	.1	99.9
	1.00	1	.0	.1	100.0
Total		1995	69.9	100.0	
Missing	System	859	30.1		
Total		2854	100.0		

Hmployee01

Total number of household vehicles recoded 0 to 1.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	106	3.7	5.3	5.3
	.03	606	21.2	30.5	35.8
	.06	431	15.1	21.7	57.5
	.09	297	10.4	14.9	72.5
	.12	201	7.0	10.1	82.6
	.15	128	4.5	6.4	89.0
	.18	70	2.5	3.5	92.6
	.21	63	2.2	3.2	95.7
	.24	39	1.4	2.0	97.7
	.26	18	.6	.9	98.6
	.29	11	.4	.6	99.1
	.32	3	.1	.2	99.3
	.35	6	.2	.3	99.6
	.38	3	.1	.2	99.7
	.41	2	.1	.1	99.8
	.44	1	.0	.1	99.9
	.74	1	.0	.1	99.9
	1.00	1	.0	.1	100.0
Total		1987	69.6	100.0	
Missing	System	867	30.4		
Total		2854	100.0		

vehicles01

Frequencies for Recoded Wealth Variables

Total number of property / living quarters owned by respondent's household recoded 0 to 1.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid .00	2319	81.3	81.3	81.3
.25	422	14.8	14.8	96.0
.50	96	3.4	3.4	99.4
.75	14	.5	.5	99.9
1.00	3	.1	.1	100.0
Total	2854	100.0	100.0	

propertycount01

Respondents household has a private swimming pool

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Respondents household doesnt have a private pool	1907	66.8	95.5	95.5
Respondents household has a private swimming pool	90	3.2	4.5	100.0
Total	1997	70.0	100.0	
Missing 99.00	857	30.0		
Total	2854	100.0		

pool

Frequencies for Recoded Wealth Variables

Total number of bedrooms in household recoded 0 to 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	8	.3	.4	.4
	.05	98	3.4	4.9	5.3
	.10	463	16.2	23.2	28.5
	.15	453	15.9	22.7	51.3
	.20	352	12.3	17.7	68.9
	.25	259	9.1	13.0	81.9
	.30	151	5.3	7.6	89.5
	.35	105	3.7	5.3	94.7
	.40	50	1.8	2.5	97.2
	.45	22	.8	1.1	98.3
	.50	14	.5	.7	99.0
	.55	3	.1	.2	99.2
	.60	1	.0	.1	99.2
	.65	4	.1	.2	99.4
	.70	3	.1	.2	99.6
	.75	5	.2	.3	99.8
	.80	1	.0	.1	99.9
	.90	1	.0	.1	99.9
	1.00	1	.0	.1	100.0
	Total	1994	69.9	100.0	
Missing	System	860	30.1		
Total		2854	100.0		

bedrooms01

Household income recoded 0 to 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	377	13.2	20.7	20.7
	.13	402	14.1	22.1	42.8
	.25	254	8.9	14.0	56.8
	.38	123	4.3	6.8	63.6
	.50	128	4.5	7.0	70.6
	.63	173	6.1	9.5	80.1
	.75	154	5.4	8.5	88.6
	.88	115	4.0	6.3	94.9
	1.00	93	3.3	5.1	100.0
	Total	1819	63.7	100.0	
Missing	System	1035	36.3		
Total		2854	100.0		

hhincome01

We can follow the same procedure to recode variables measuring “museum satisfaction”.

E14. On your last visit to the Museum of Islamic Art, how satisfied were you with the []?

	1. Very satisfied							
	2. Somewhat satisfied							
	3. Somewhat dissatisfied							
	4. Very dissatisfied							
	7. NOT APPLICABLE							
	8. DON'T KNOW							
	9. REFUSED							
e. Helpfulness of staff	1	2	3	4	7	8	9	
f. Parking facilities	1	2	3	4	7	8	9	
h. Gift shop	1	2	3	4	7	8	9	
i. Facilities and activities for the children	1	2	3	4	7	8	9	

E15. To what extent do you agree/disagree with the following statements regarding your last visit to the Museum of Islamic Art.

	1. Strongly agree							
	2. Somewhat agree							
	3. Somewhat disagree							
	4. Strongly disagree							
	8. DON'T KNOW							
	9. REFUSED							
b. My visit to this museum inspired me to learn more about Islamic heritage	1	2	3	4	8	9		
d. Museum hours suit my schedule	1	2	3	4	8	9		

E19. Overall, how satisfied were you with your last visit to the Museum of Islamic Art?

1. Very satisfied
2. Somewhat satisfied
3. Somewhat dissatisfied
4. Very dissatisfied
5. DON'T KNOW
6. REFUSED

The items listed here correspond to variables e14e, e14f, e14h, e14i, e15b, e15d, and e19 in your dataset. SPSS knows to treat values 5, 6, 7, 8, and 9 as missing, so we might expect that all of the variables just listed range from 1 to 4.

Frequencies for Museum Satisfaction Variables

Helpfulness of staff

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 very satisfied	488	17.1	73.2	73.2
	2 somewhat satisfied	152	5.3	22.8	96.0
	3 neutral	12	.4	1.8	97.8
	4 somewhat dissatisfied	12	.4	1.8	99.6
	5 very dissatisfied	3	.1	.4	100.0
	Total	667	23.4	100.0	
Missing	9 refused	8	.3		
	System	2179	76.3		
	Total	2187	76.6		
Total	2854	100.0			

We see that the values of the museum satisfaction variables actually range from 1 to 5, which is why it is always good practice to check the frequencies of your variables before recoding.

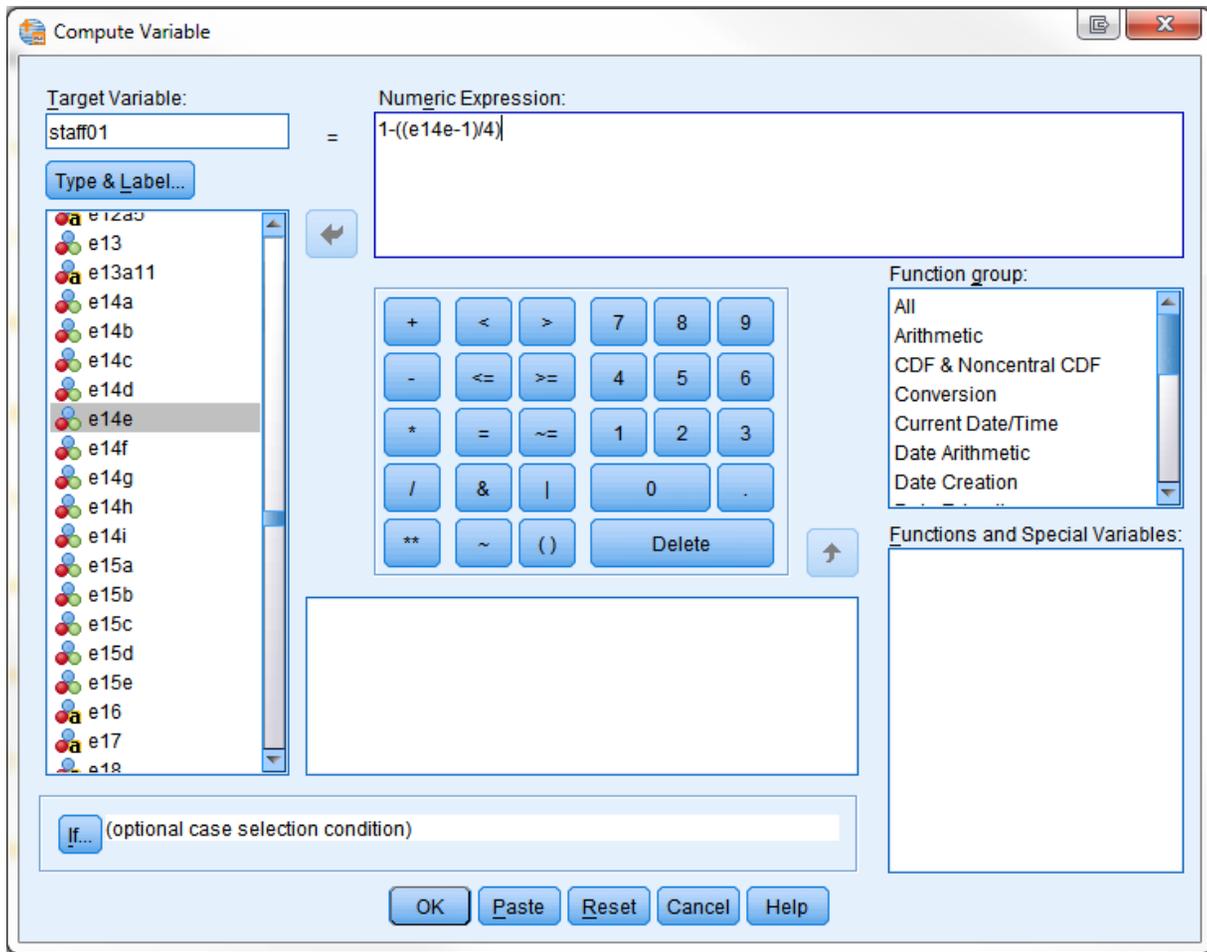
respondent hours suits the schedule

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 strongly agree	430	15.1	64.1	64.1
	2 somewhat agree	191	6.7	28.5	92.5
	3 neither agree nor disagree	19	.7	2.8	95.4
	4 somewhat disagree	17	.6	2.5	97.9
	5 strongly disagree	14	.5	2.1	100.0
	Total	671	23.5	100.0	
Missing	9 refused	4	.1		
	System	2179	76.3		
	Total	2183	76.5		
Total	2854	100.0			

We can also notice that these variables are coded such that higher values indicate *dissatisfaction*. We may want to reverse the order of coding so that higher values indicate *satisfaction*.

Note: By default, SPSS only displays the labels associated with each value of a variable, not the values and the label, as we do above. To get SPSS to show both, open the *Edit / Options* menu and choose the "Output Labels" tab. Under "Variable value in item labels shown as" choose "Values and labels."

Recoding Museum Satisfaction Variables



We can use the *Transform/Compute Variable* menu to create a new variable called “staff01”, which will be the name for the recoded variable about helpfulness of museum staff.

We will transform the original variable (e14e) so that it ranges from 0 to 1, rather than 1 to 5.

To do so, we subtract 1 from the variable and then divide by the highest number in the scale, which will be 4. We can also reverse the direction of the coding so that higher values indicate “very satisfied” rather than “very dissatisfied.” To do this, we subtract the variable from 1.

Our transformation will look as follows:
 $staff01 = 1 - ((e14e - 1) / 4)$.

Frequencies for Recoded Museum Satisfaction Variables

Very satisfied with museum staff 0 to 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	3	.1	.4	.4
	.25	12	.4	1.8	2.2
	.50	12	.4	1.8	4.0
	.75	152	5.3	22.8	26.8
	1.00	488	17.1	73.2	100.0
	Total	667	23.4	100.0	
Missing	System	2187	76.6		
Total		2854	100.0		

Very satisfied with museum parking 0 to 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	11	.4	1.6	1.6
	.25	20	.7	3.0	4.6
	.50	14	.5	2.1	6.7
	.75	137	4.8	20.4	27.0
	1.00	491	17.2	73.0	100.0
	Total	673	23.6	100.0	
Missing	System	2181	76.4		
Total		2854	100.0		

Frequencies for Recoded Museum Satisfaction Variables

Very satisfied with museum gift shop 0 to 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	4	.1	.6	.6
	.25	19	.7	3.0	3.7
	.50	63	2.2	10.1	13.7
	.75	185	6.5	29.6	43.3
	1.00	355	12.4	56.7	100.0
	Total	626	21.9	100.0	
Missing	System	2228	78.1		
Total		2854	100.0		

Very satisfied with museum activities for children 0 to 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	13	.5	2.2	2.2
	.25	21	.7	3.5	5.6
	.50	77	2.7	12.8	18.4
	.75	159	5.6	26.4	44.8
	1.00	333	11.7	55.2	100.0
	Total	603	21.1	100.0	
Missing	System	2251	78.9		
Total		2854	100.0		

Frequencies for Recoded Museum Satisfaction Variables

Strongly agree was inspired to learn more about Islamic heritage 0 to 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	6	.2	.9	.9
	.25	11	.4	1.6	2.5
	.50	23	.8	3.4	6.0
	.75	138	4.8	20.5	26.5
	1.00	494	17.3	73.5	100.0
	Total	672	23.5	100.0	
Missing	System	2182	76.5		
Total		2854	100.0		

Strongly agree museum hours fit schedule 0 to 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	14	.5	2.1	2.1
	.25	17	.6	2.5	4.6
	.50	19	.7	2.8	7.5
	.75	191	6.7	28.5	35.9
	1.00	430	15.1	64.1	100.0
	Total	671	23.5	100.0	
Missing	System	2183	76.5		
Total		2854	100.0		

Frequencies for Recoded Museum Satisfaction Variables

Very satisfied with last visit to museum 0 to 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	5	.2	.7	.7
	.33	8	.3	1.2	1.9
	.67	156	5.5	23.2	25.1
	1.00	504	17.7	74.9	100.0
	Total	673	23.6	100.0	
Missing	System	2181	76.4		
Total		2854	100.0		

But how can we tell whether the resulting measure is a good measure?

Internal Consistency Reliability

- Our measure: **Cronbach's Alpha**
- The idea behind our measure:

Random error varies over items. If items are measuring the same construct, and if they each contain some different bit of random error, then, if the items correlate weakly, we might come to believe they contain a lot of random error.

Cronbach's Alpha

Alpha = (the number of items*the mean correlation between the items) / [1+ the mean correlation between the items *(the number of items – 1)]

$$\alpha = k\bar{r}/[1 + \bar{r}(k - 1)]$$

Where \bar{r} is the mean inter-item correlation and k is the number of items in the scale.

What would alpha be if we just used 6 identical items?

- $(6 * 1.0) / (1 + 1 * (6 - 1)) = 6 / (1 + 5) = 6 / 6 = 1.$

$$\alpha = k\bar{r} / [1 + \bar{r}(k - 1)]$$

Where \bar{r} is the mean inter-item correlation and k is the number of items in the scale.

What difference does the number of items make?

What if we have 6 items with a mean inter-item correlation of .5? What is the alpha?

$$(6 \cdot .5) / (1 + .5 \cdot (6 - 1)) = 3 / (1 + .5 \cdot 5) = 3 / (1 + 2.5) = 3 / 3.5 = .86$$

What if we had 3 items with the same inter-item correlation?

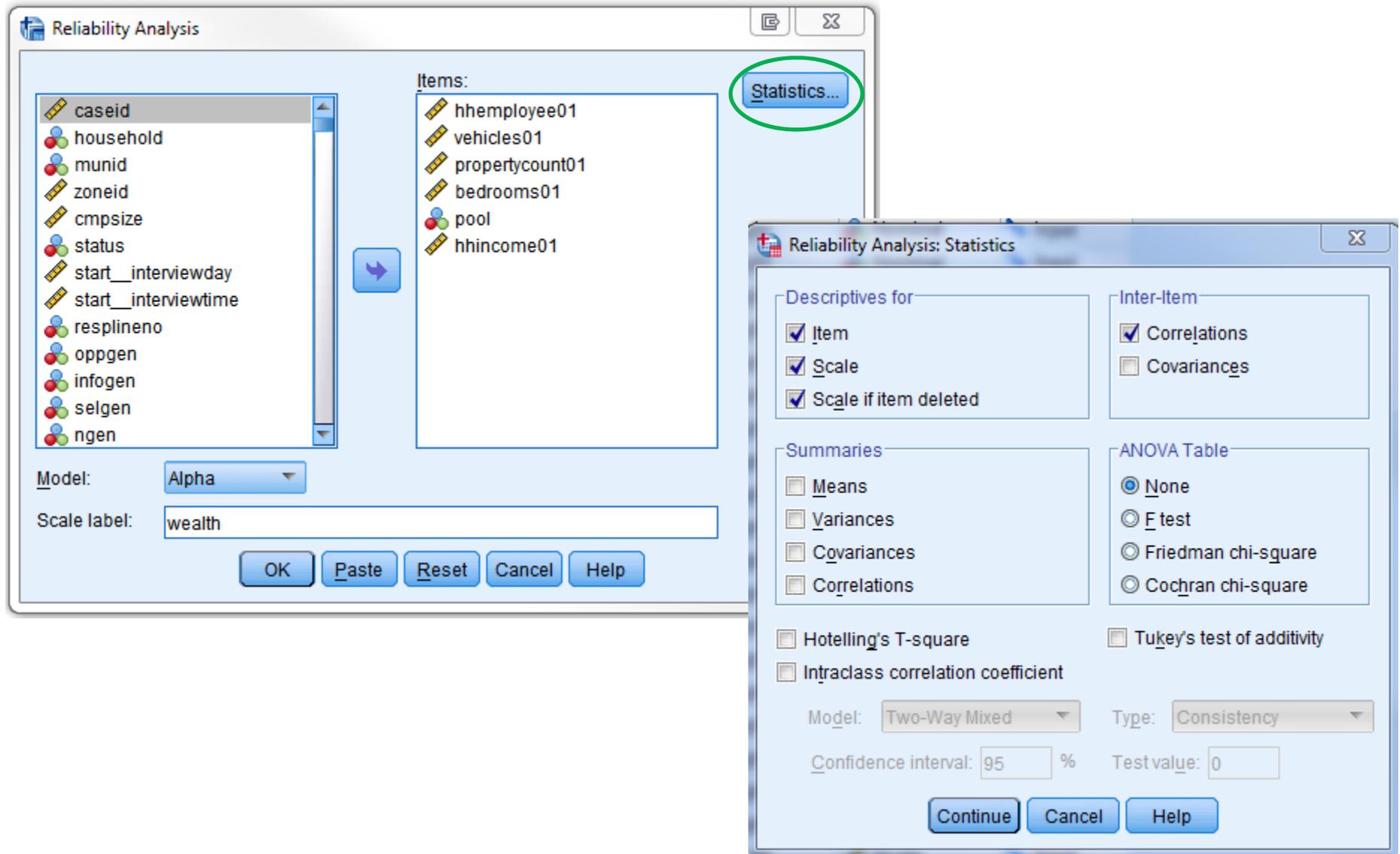
$$(3 \cdot .5) / (1 + .5(3 - 1)) = (1.5) / (1 + .5 \cdot 2) = (1.5) / 2 = .75$$

Some Tips for Using Alpha

- High doesn't mean best. Interpret it in context.
- Ways to Increase Alpha:
 - Precise questions, with little space for interpretation
 - Clear instructions
 - Standard conditions for the interview
- Ways to (perhaps *artificially*) inflate or deflate alpha
 - Single or heterogeneous method
 - More or fewer indicators

Using SPSS to Calculate Cronbach's Alpha

- Menu: *Analyze / Scale / Reliability Analysis*



Case Processing Summary

		N	%
Cases	Valid	1811	63.5
	Excluded ^a	1043	36.5
	Total	2854	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.511	.673	6

Inter-Item Correlation Matrix

	Total number of household employees recoded 0 to 1	Total number of household vehicles recoded 0 to 1.	Total number of property / living quarters owned by respondent's household recoded 0 to 1.	Respondents household has a private swimming pool	Total number of bedrooms in household recoded 0 to 1	Household income recoded 0 to 1
Total number of household employees recoded 0 to 1	1.000	.608	.057	.069	.497	.382
Total number of household vehicles recoded 0 to 1.	.608	1.000	.105	.109	.609	.460
Total number of property / living quarters owned by respondent's household recoded 0 to 1.	.057	.105	1.000	.102	.019	.106
Respondents household has a private swimming pool	.069	.109	.102	1.000	.099	.153
Total number of bedrooms in household recoded 0 to 1	.497	.609	.019	.099	1.000	.458
Household income recoded 0 to 1	.382	.460	.106	.153	.458	1.000

Notice that the “Cronbach’s Alpha if item Deleted” column shows you what the value of the resulting alpha would be if you eliminated any of the variables from your scale.

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Total number of household employees recoded 0 to 1	.7497	.287	.443	.401	.461
Total number of household vehicles recoded 0 to 1.	.7162	.279	.547	.518	.440
Total number of property / living quarters owned by respondent's household recoded 0 to 1.	.7104	.278	.128	.028	.525
Respondents household has a private swimming pool	.7525	.247	.175	.033	.519
Total number of bedrooms in household recoded 0 to 1	.6060	.261	.475	.432	.415
Household income recoded 0 to 1	.4431	.127	.430	.282	.405

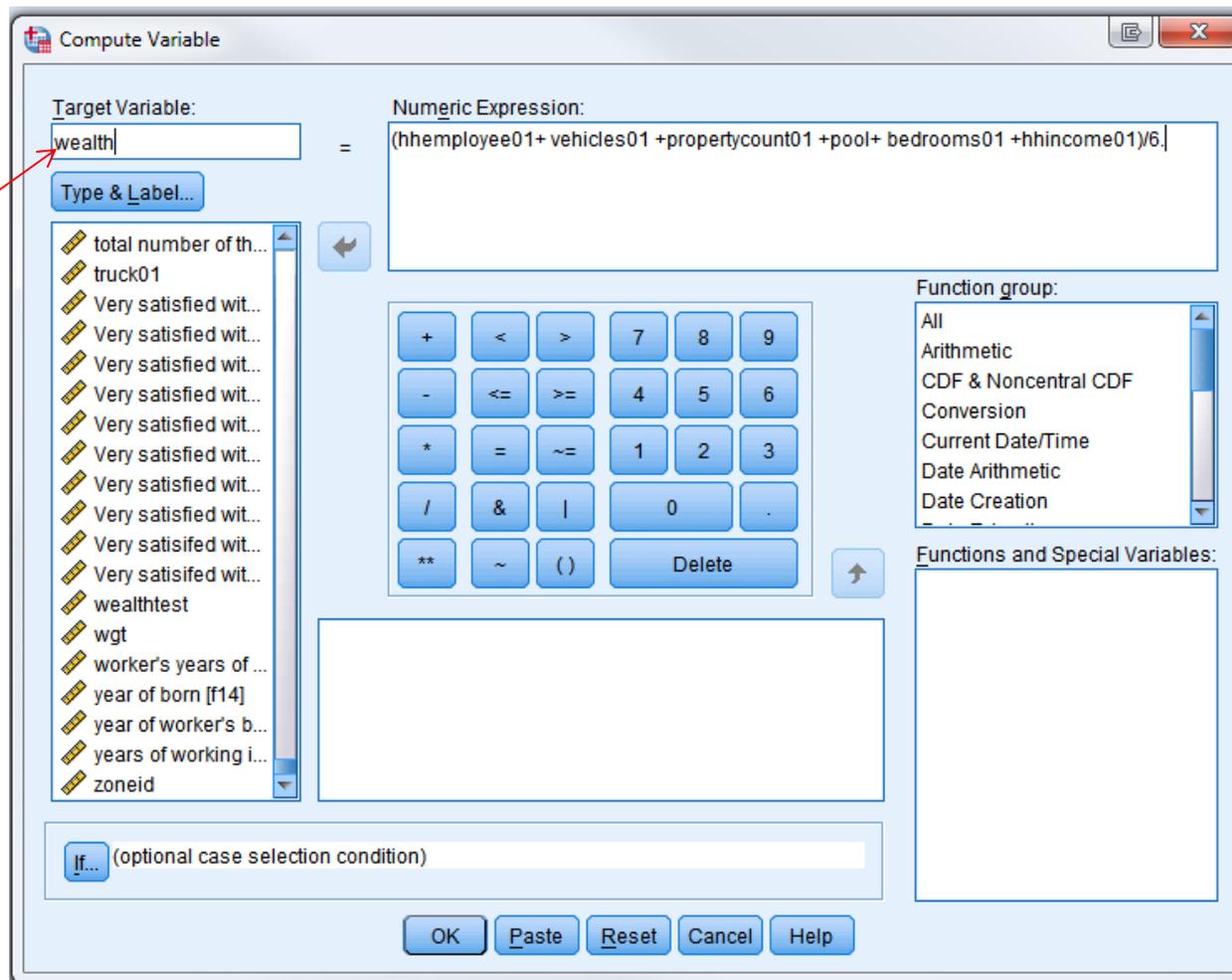
Scale Statistics

Mean	Variance	Std. Deviation	N of Items
.7956	.323	.56838	6

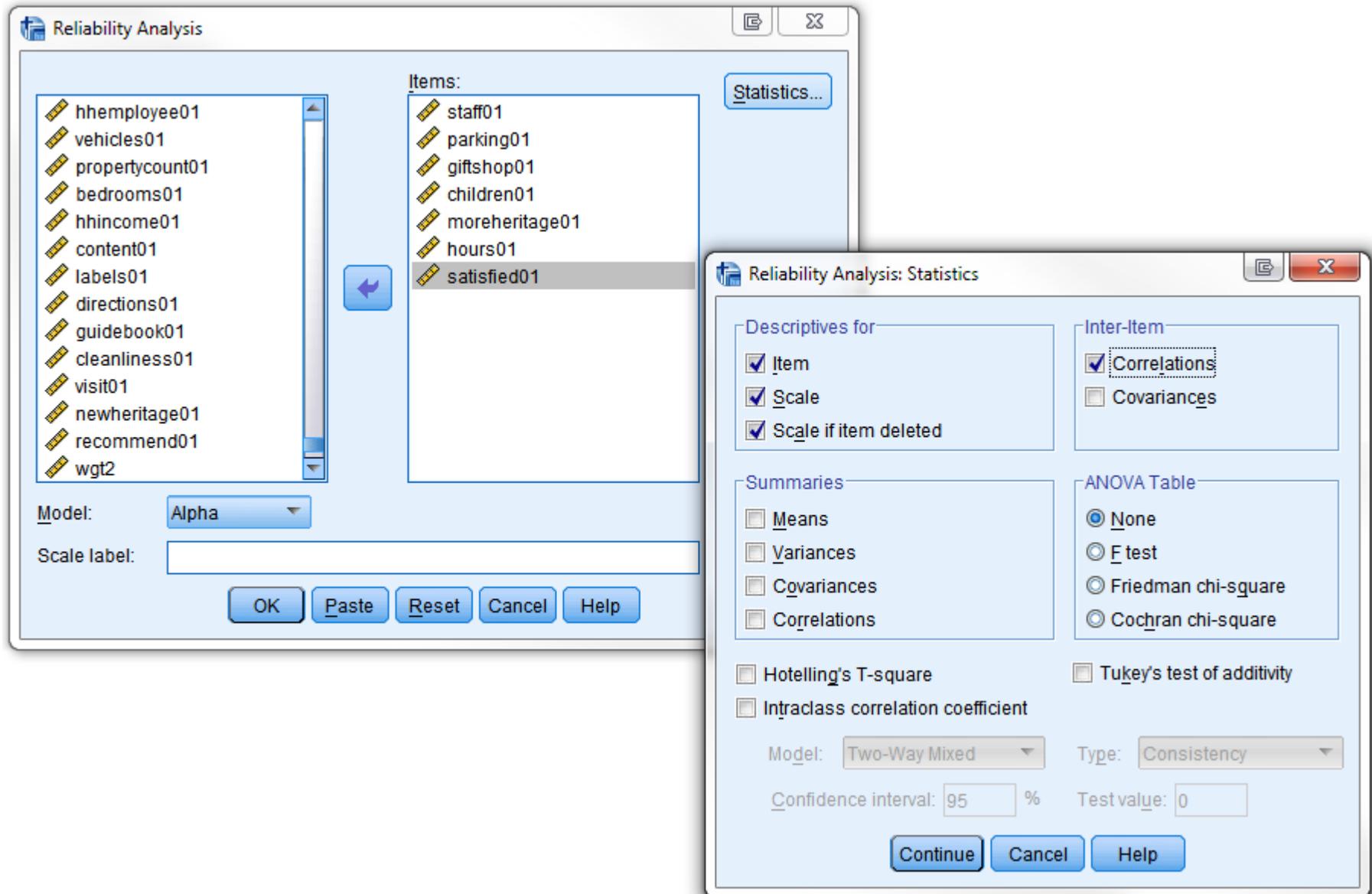
Generating the New Scale Variable

- Once we decide which variables should go into our scale, we can use the *Transform / Compute Variable* menu option to generate the scale variable.
- Calculate your scale variable by adding each variable completing your scale and dividing by the total number of variables.

Name your new variable in the “Target Variable” box.



We can follow the same procedure to create a measure of “museum satisfaction.”



Case Processing Summary

		N	%
Cases	Valid	575	20.1
	Excluded ^a	2279	79.9
	Total	2854	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.775	.778	7

Inter-Item Correlation Matrix

	Very satisfied with museum staff 0 to 1	Very satisfied with museum parking 0 to 1	Very satisfied with museum gift shop 0 to 1	Very satisfied with museum activities for children 0 to 1	Strongly agree was inspired to learn more about Islamic heritage 0 to 1	Strongly agree museum hours fit schedule 0 to 1	Very satisfied with last visit to museum 0 to 1
Very satisfied with museum staff 0 to 1	1.000	.379	.250	.333	.322	.216	.436
Very satisfied with museum parking 0 to 1	.379	1.000	.343	.325	.227	.308	.282
Very satisfied with museum gift shop 0 to 1	.250	.343	1.000	.573	.233	.369	.266
Very satisfied with museum activities for children 0 to 1	.333	.325	.573	1.000	.343	.299	.325
Strongly agree was inspired to learn more about Islamic heritage 0 to 1	.322	.227	.233	.343	1.000	.316	.556
Strongly agree museum hours fit schedule 0 to 1	.216	.308	.369	.299	.316	1.000	.313
Very satisfied with last visit to museum 0 to 1	.436	.282	.266	.325	.556	.313	1.000

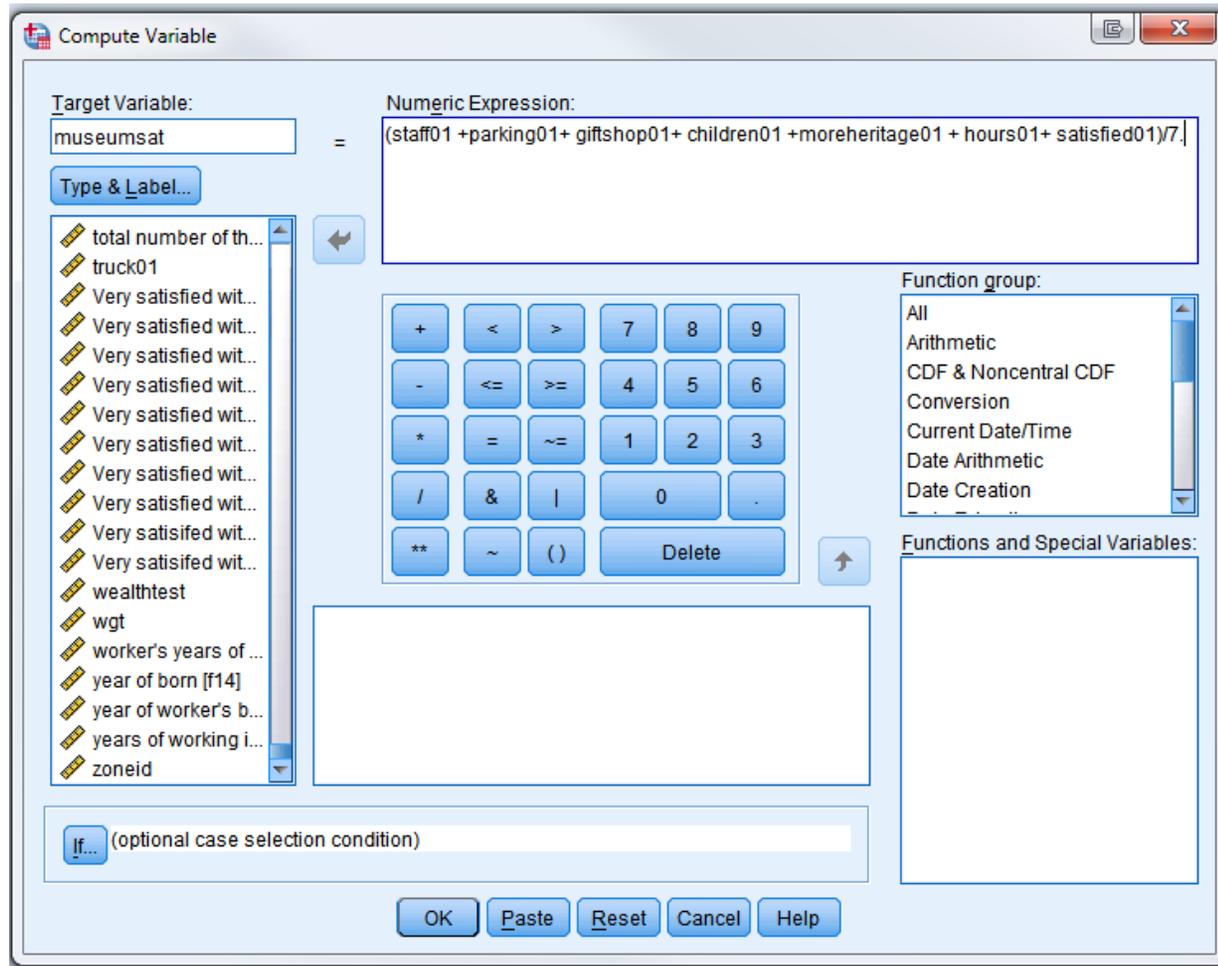
Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Very satisfied with museum staff 0 to 1	5.2855	.621	.477	.283	.752
Very satisfied with museum parking 0 to 1	5.3029	.584	.461	.241	.754
Very satisfied with museum gift shop 0 to 1	5.3533	.562	.534	.387	.739
Very satisfied with museum activities for children 0 to 1	5.3794	.515	.563	.400	.734
Strongly agree was inspired to learn more about Islamic heritage 0 to 1	5.2886	.610	.488	.355	.749
Strongly agree museum hours fit schedule 0 to 1	5.3199	.594	.452	.226	.755
Very satisfied with last visit to museum 0 to 1	5.2930	.597	.531	.401	.741

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
6.2038	.765	.87460	7

Creating a Museum Satisfaction Variable



Again, to create our scale variable, we add together the relevant variables and divide by the total number.

Thought experiment

- Here are two sets of reliability analyses, one for women and one for men. They use exactly the same wealth-related variables we just used.
- Interpret the differences between the two. Are some measures more central to the measurement of wealth for women than for men? What do you make of the differences between the Alphas across the two groups? Do you see format effects in these results?

Pre-tests for Item selection for a production study

If we only had space for 4 measures of wealth, which would they be?

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Total number of household employees recoded 0 to 1	.7497	.287	.443	.401	.461
Total number of household vehicles recoded 0 to 1.	.7162	.279	.547	.518	.440
Total number of property / living quarters owned by respondent's household recoded 0 to 1.	.7104	.278	.128	.028	.525
Respondents household has a private swimming pool	.7525	.247	.175	.033	.519
Total number of bedrooms in household recoded 0 to 1	.6060	.261	.475	.432	.415
Household income recoded 0 to 1	.4431	.127	.430	.282	.405

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
.7956	.323	.56838	6

Qatari Men

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.610	.669	7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
hhememployee8 Household employees capped at 8	10.3112	12.194	.489	.261	.502
vehicles8 Number of vehicles capped at 8	9.7452	11.350	.502	.259	.496
propertycount Total number of property / living quarters owned by respondent's household	12.8180	17.909	.255	.109	.598
bigtv Respondent's household owns TV larger than 46 inches	12.7004	18.554	.185	.058	.611
pool Respondents household has a private swimming pool	13.0380	19.105	.260	.177	.616
bedrooms8 Number of bedrooms capped at 8	7.9524	10.494	.451	.233	.538
hhincome	11.8763	17.539	.443	.288	.577

Qatari Women

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.559	.532	7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
hhememployee8 Household employees capped at 8	9.7360	11.052	.430	.210	.450
vehicles8 Number of vehicles capped at 8	9.1865	9.679	.555	.388	.374
propertycount Total number of property / living quarters owned by respondent's household	12.0470	16.499	.098	.049	.569
bigtv Respondent's household owns TV larger than 46 inches	11.8529	16.323	.164	.055	.559
pool Respondents household has a private swimming pool	12.1987	17.109	.036	.032	.574
bedrooms8 Number of bedrooms capped at 8	7.3225	8.140	.458	.264	.454
hhincome	11.0981	16.201	.283	.137	.547

Qatari Men

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.542	.669	7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
hhemployee801 Household employees capped at 8 recoded 0 to 1	1.5654	.647	.407	.261	.466
vehicles801 Vehicles capped at 8 recoded 0 to 1	1.4946	.629	.412	.259	.459
propertycount01 Property county recoded 0 to 1	1.8596	.729	.302	.109	.514
bigtv Respondent's household owns TV larger than 46 inches	1.5375	.437	.208	.058	.662
pool Respondents household has a private swimming pool	1.8751	.685	.276	.177	.506
bedrooms801 Number of bedrooms capped at 8 recoded 0 to 1	1.2705	.625	.332	.233	.480
hhincome01 House hold income recoded 0 to 1	1.8613	.702	.437	.288	.489

Qatari Women

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.432	.532	7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
hhemployee801 Household employees capped at 8 recoded 0 to 1	1.4996	.554	.348	.210	.343
vehicles801 Vehicles capped at 8 recoded 0 to 1	1.4310	.546	.347	.388	.339
propertycount01 Property county recoded 0 to 1	1.7740	.641	.157	.049	.421
bigtv Respondent's household owns TV larger than 46 inches	1.4253	.331	.196	.055	.513
pool Respondents household has a private swimming pool	1.7711	.610	.091	.032	.438
bedrooms801 Number of bedrooms capped at 8 recoded 0 to 1	1.1980	.508	.311	.264	.335
hhincome01 House hold income recoded 0 to 1	1.7771	.632	.253	.137	.405

Computer Exercise

Carry out a reliability analysis for the museum assessment items we worked with earlier in this session. What artificially inflates or deflates alpha? What recommendations would you make for inclusion of items on museum assessment in the next survey, if reliability were your only criteria?

Reliability Statistics

Cronbach's Alpha	N of Items
.775	7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Very satisfied with museum staff 0 to 1	5.2855	.621	.477	.752
Very satisfied with museum parking 0 to 1	5.3029	.584	.461	.754
Very satisfied with museum gift shop 0 to 1	5.3533	.562	.534	.739
Very satisfied with museum activities for children 0 to 1	5.3794	.515	.563	.734
Strongly agree was inspired to learn more about Islamic heritage 0 to 1	5.2886	.610	.488	.749
Strongly agree museum hours fit schedule 0 to 1	5.3199	.594	.452	.755
Very satisfied with last visit to museum 0 to 1	5.2930	.597	.531	.741

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.661	.655	3

Inter-Item Correlation Matrix

	giftshop01 Very satisfied with museum gift shop 0 to 1	children01 Very satisfied with museum activities for children 0 to 1	satisfied01 Very satisfied with last visit to museum 0 to 1
giftshop01 Very satisfied with museum gift shop 0 to 1	1.000	.573	.264
children01 Very satisfied with museum activities for children 0 to 1	.573	1.000	.326
satisfied01 Very satisfied with last visit to museum 0 to 1	.264	.326	1.000

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
giftshop01 Very satisfied with museum gift shop 0 to 1	1.7355	.112	.542	.335	.471
children01 Very satisfied with museum activities for children 0 to 1	1.7618	.088	.578	.361	.412
satisfied01 Very satisfied with last visit to museum 0 to 1	1.6757	.153	.335	.115	.722

Additional Sources

- Duane Alwin. 2007. **Margins of Error: A Study of Reliability in Survey Measurement.** Hoboken: John Wiley & Sons.
- Robert F. DeVellis. 2012. **Scale Development: Theory and Applications, 3rd edition.** Los Angeles: Sage.

Additional Sources

- Jennifer Madans et al. 2011. **Question Evaluation Methods**. Hoboken: John Wiley & Sons.
- Edward Carmines and Richard Zeller. 1979. **Reliability and Validity Assessment**. Newbury Park: Sage.