

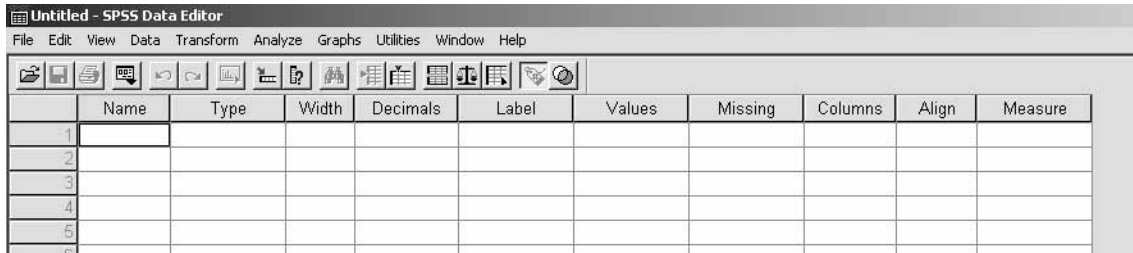
7.2. t test (Student's t test) for unmatched samples

EXAMPLE 7.2. The evolution of *Littorina littoralis* at Porthcawl, 2002

BOX 7.3. How to carry out a t test for unmatched data

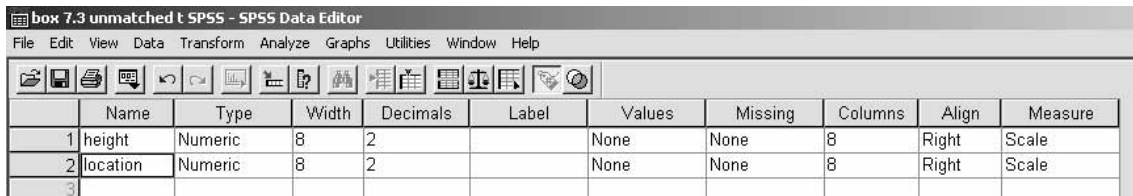
Step 1. Set up the variables.

When SPSS starts up, select 'Variable View' using the tabs at the bottom left. You should get something like this:



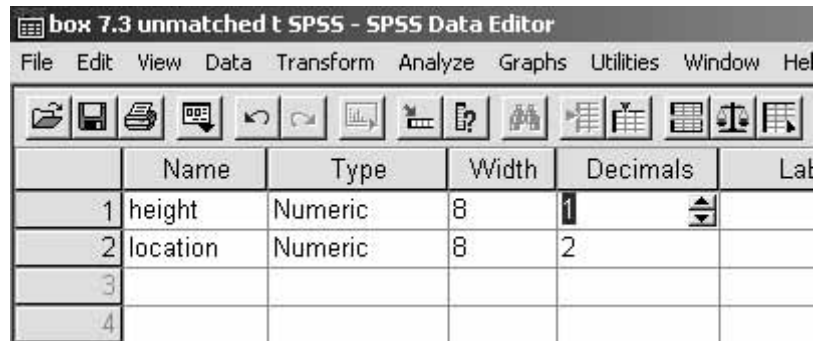
	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure
1										
2										
3										
4										
5										

For the first variable name, type in 'height', and for the second 'location'. Default properties are set for each variable.



	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure
1	height	Numeric	8	2		None	None	8	Right	Scale
2	location	Numeric	8	2		None	None	8	Right	Scale
3										

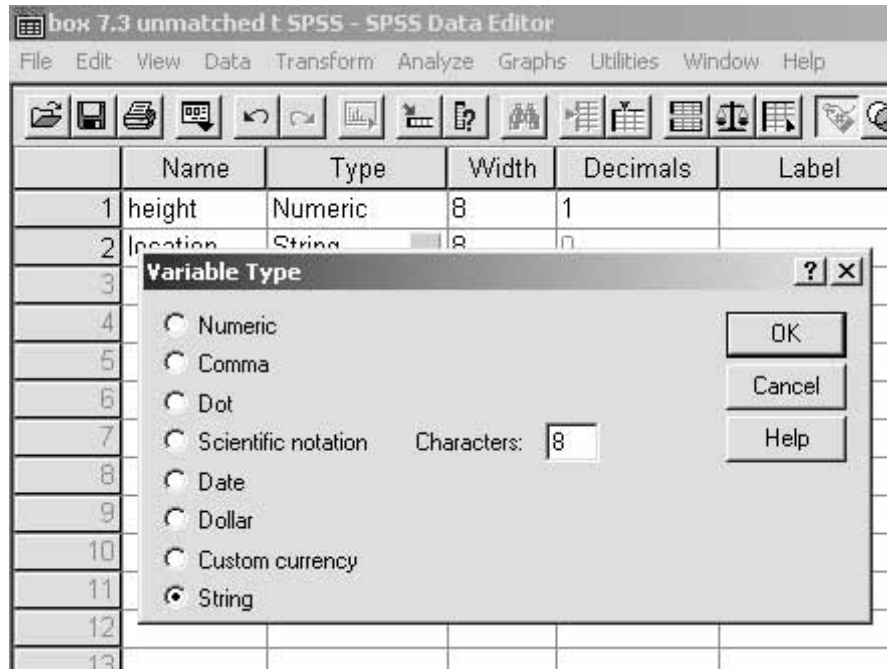
Height is measured in mm to the nearest 0.1 mm, so we need to change the 'Decimals' to '1'. Click in the 'Decimals' cell in row 1, and a set of 'up' and 'down' arrows should appear. Use the down arrow to change the setting to '1'.



The screenshot shows the SPSS Data Editor window titled 'box 7.3 unmatched t SPSS - SPSS Data Editor'. The menu bar includes File, Edit, View, Data, Transform, Analyze, Graphs, Utilities, Window, and Help. Below the menu bar is a toolbar with various icons. The main area is a table with the following columns: Name, Type, Width, Decimals, and Label. The table contains two rows of data:

	Name	Type	Width	Decimals	Label
1	height	Numeric	8	1	
2	location	Numeric	8	2	
3					
4					

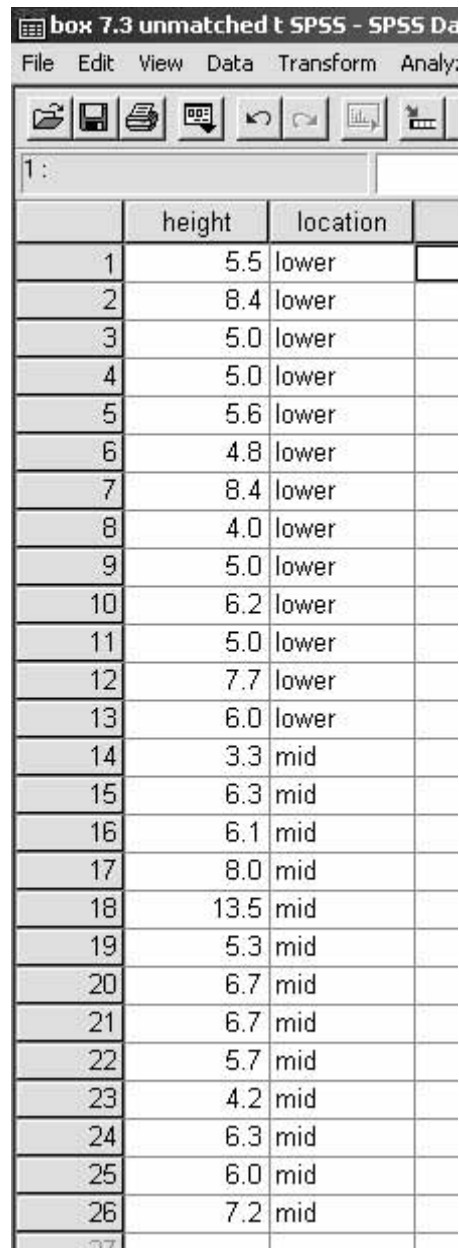
Location is going to be either 'lower shore' or 'mid shore', so it needs to be a 'String' variable. Click in the 'Type' cell in row 2, and a grey area should appear at the right-hand side of the cell. Clicking on this gives a dialogue box, in which you should click on the 'String' radio button.



The screenshot shows the SPSS Data Editor window with the 'Variable Type' dialog box open for the 'location' variable. The dialog box has a title bar with a question mark and a close button. It contains several radio buttons for different variable types: Numeric, Comma, Dot, Scientific notation, Date, Dollar, Custom currency, and String. The 'String' radio button is selected. There is a 'Characters' field with the value '8'. There are three buttons on the right: OK, Cancel, and Help. The background table shows the 'location' variable's type changed to 'String'.

	Name	Type	Width	Decimals	Label
1	height	Numeric	8	1	
2	location	String	8	0	
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

Click on 'OK'. Change to data view using the tabs at the bottom left, and enter the data.

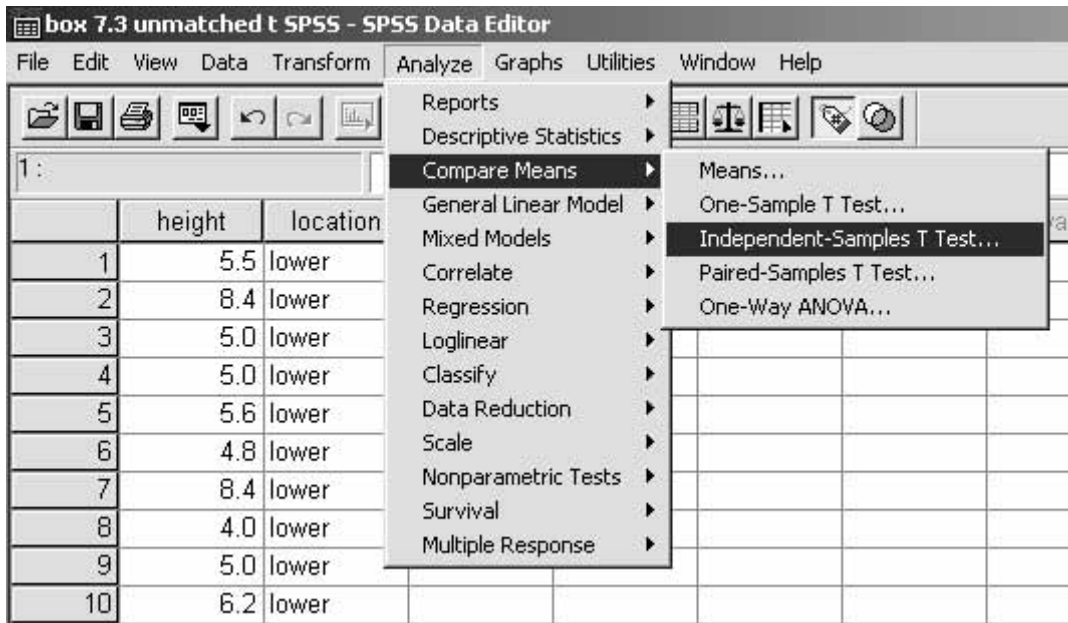


The image shows a screenshot of the SPSS software interface. The title bar reads 'box 7.3 unmatched t SPSS - SPSS Da'. The menu bar includes 'File', 'Edit', 'View', 'Data', 'Transform', and 'Analy:'. Below the menu bar is a toolbar with various icons. The main window displays a data table with the following columns: 'height' and 'location'. The data is organized into 26 rows, numbered 1 through 26. The 'height' column contains numerical values, and the 'location' column contains categorical values: 'lower' for rows 1-13 and 'mid' for rows 14-26.

	height	location
1	5.5	lower
2	8.4	lower
3	5.0	lower
4	5.0	lower
5	5.6	lower
6	4.8	lower
7	8.4	lower
8	4.0	lower
9	5.0	lower
10	6.2	lower
11	5.0	lower
12	7.7	lower
13	6.0	lower
14	3.3	mid
15	6.3	mid
16	6.1	mid
17	8.0	mid
18	13.5	mid
19	5.3	mid
20	6.7	mid
21	6.7	mid
22	5.7	mid
23	4.2	mid
24	6.3	mid
25	6.0	mid
26	7.2	mid

Step 2. Perform the test.

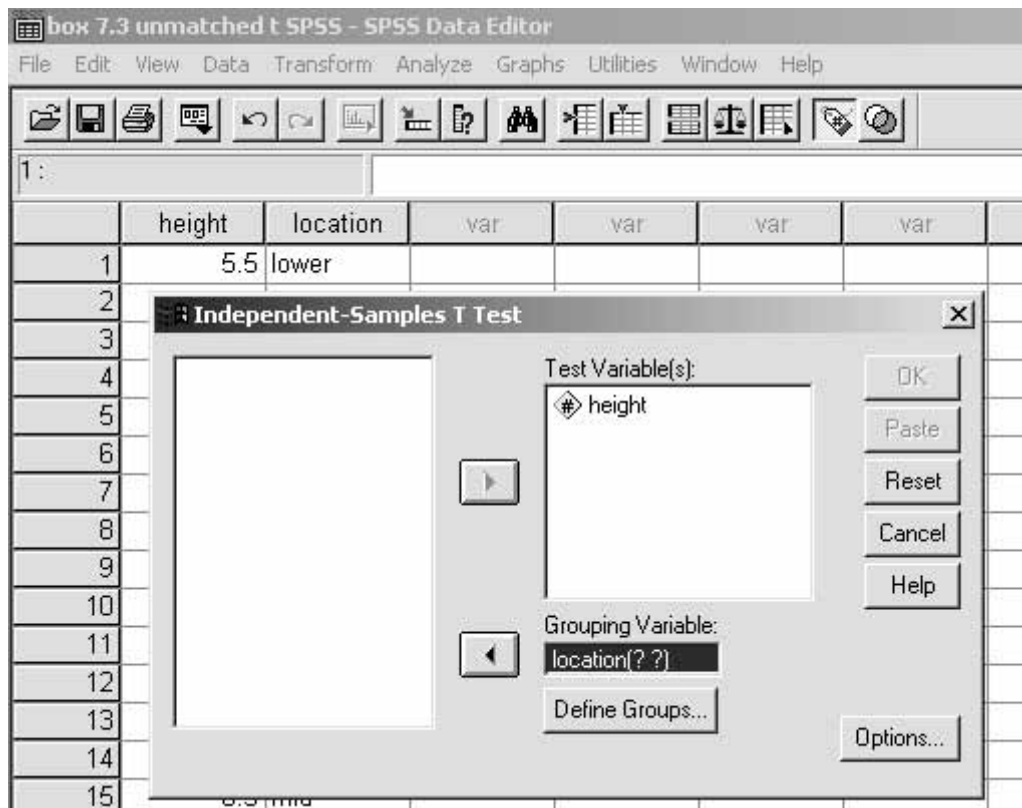
Go to 'Analyze', 'Compare Means', 'Independent-Samples T Test'.



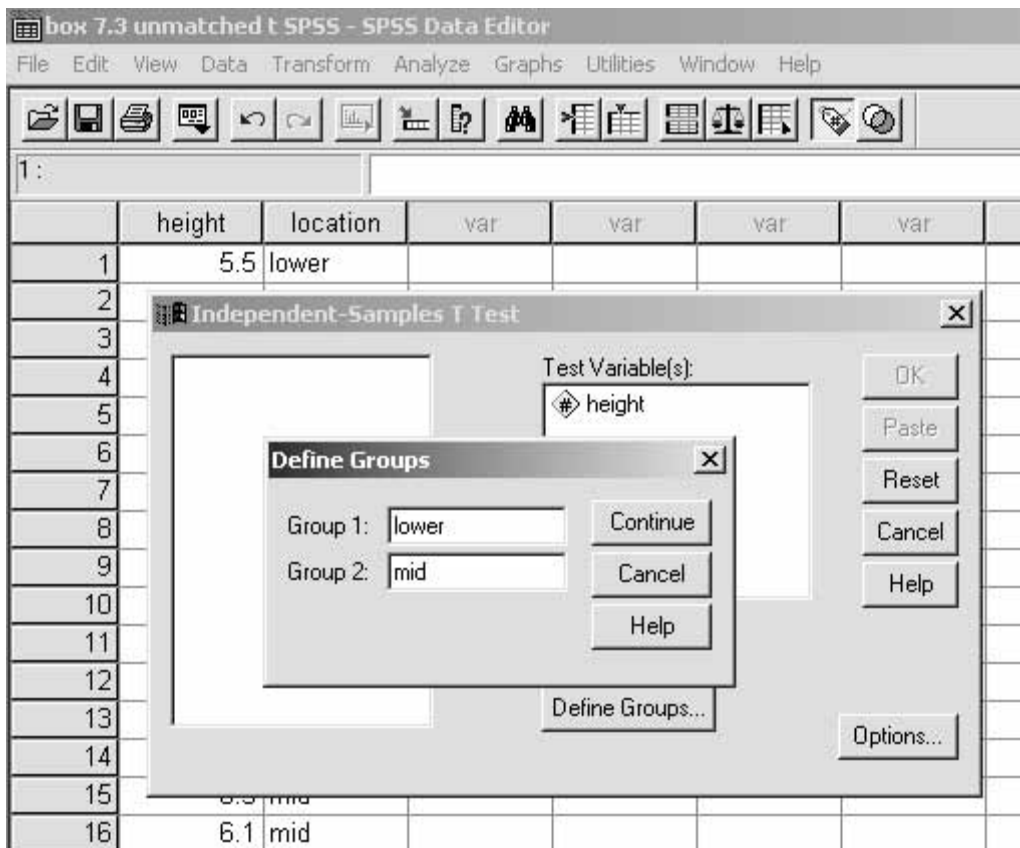
The screenshot shows the SPSS Data Editor window titled 'box 7.3 unmatched t SPSS - SPSS Data Editor'. The 'Analyze' menu is open, and the path 'Analyze > Compare Means > Independent-Samples T Test...' is highlighted. The data table below shows the variables 'height' and 'location'.

	height	location
1	5.5	lower
2	8.4	lower
3	5.0	lower
4	5.0	lower
5	5.6	lower
6	4.8	lower
7	8.4	lower
8	4.0	lower
9	5.0	lower
10	6.2	lower

Click on 'height' to highlight it, then click on the appropriate arrow to transfer it to the 'Test Variable(s)' window. Similarly, transfer 'location' to the 'Grouping Variable' window.



Click on 'Define Groups', and enter 'lower' in group 1, and 'mid' in group 2.



Click on 'Continue'. Click on 'OK'. The results will appear in a separate window.

Group Statistics

	LOCATION	N	Mean	Std. Deviation	Std. Error Mean
HEIGHT	lower	13	5.892	1.4186	.3934
	mid	13	6.562	2.4130	.6692

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
HEIGHT	Equal variances assumed	.303	.587	-.862	24	.397	-.669	.7763	-2.2715	.9330
	Equal variances not assumed			-.862	19.410	.399	-.669	.7763	-2.2918	.9533

Step 3. Decide what the results mean.

The test calculates two values of *t*, one assuming equal variances, and the other not making this assumption. In both cases, the result is -0.862 . We ignore the negative sign here.

The column headed 'Sig. (2-tailed)' gives the *p* value for this result. Both values, when rounded to two decimal places, come to 0.40. Since this is greater than 0.05, we accept the null hypothesis, and conclude that there is no significant difference ($t=0.862$, $p=0.05$) in the mean shell height (mm) between the periwinkles on the lower and mid shores of Porthcawl.