As part of an assessment for a health psychology unit, a psychology student developed a scale to assess various coping strategies. Ten forms of coping were included in the scale. The scale was completed by 91 of her fellow psychology students.   As well as developing the scale, the student was required to conduct some psychometric analysis of the scale she had developed, beginning with an exploratory factor analysis.

The ten coping strategies included in the student's coping scale are:

- Discuss feelings
- Develop plan
- Express emotions to family
- Attend workshops
- Honest with myself
- Advice from others
- Explore emotions
- Direct action
- Talk to someone I trust
- Work on problem

Step 1 – Taking a look at the data.

Step 2 – Navigating to the Independent Samples *t*-test analysis menu.
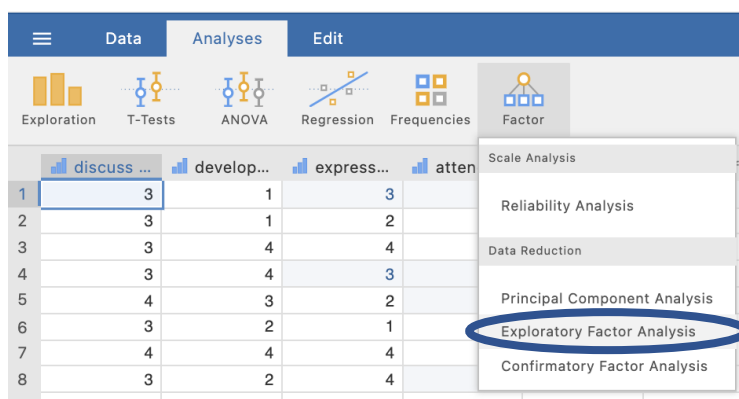
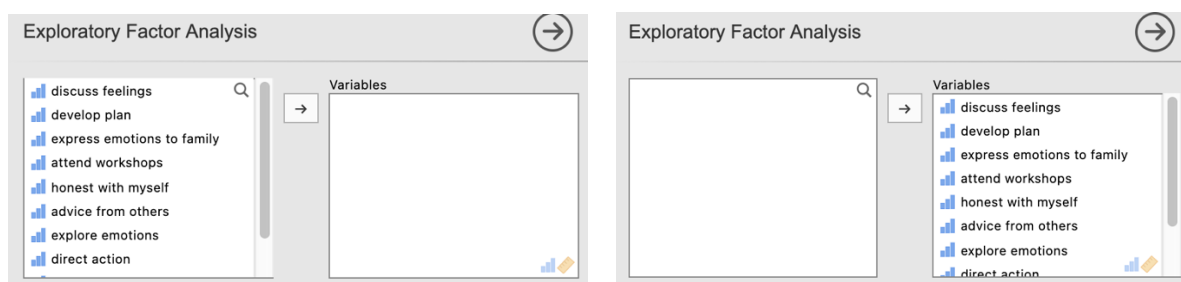On the Analyses tab select the Factor menu, then select Exploratory Factor Analysis.

Step 3 – Selecting analysis options

The first step is to move all the variables in your data set that you are wanting to include in the factor analysis. For us this means moving all ten of our variables/scale items across

Under the "Method" heading we want to choose Principal axis as our Extraction method (the full name of this approach is Principal Axis Factoring). The rotation method we will choose is Oblimin. This is what is known as an oblique rotation method which means that our factor analysis will run allowing any derived factors to correlate. We expect this will be the case here (and in fact mostly do in psychology research).
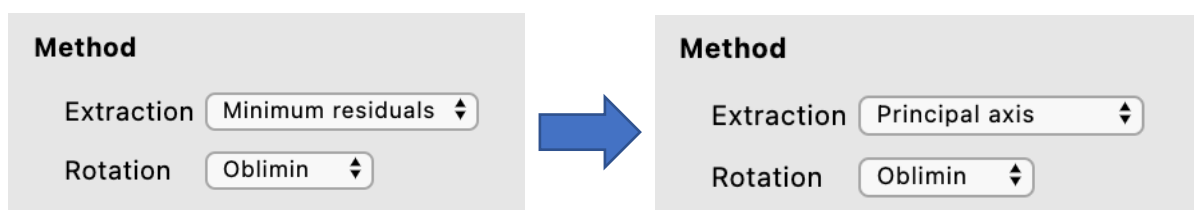
Number of Factors

○ Based on parallel analysis

◉ Based on eigenvalue

    Eigenvalues greater than 1

○ Fixed number

    1   factor(s)

There are various ways we can decide how many factors to "extract". We can allow the analysis to determine this based on parallel analysis (a bootstrapping approach) or with Kaiser's criterion retaining all factors with an eigenvalue over 1. Alternatively we could also choose to dictate a fixed number of factors to extract. We'll go with Kaiser's criterion here based on eigenvalues over 1.

Factor Loadings

Hide loadings below 0.3

☑ Sort loadings by size

We can ease our interpretation of our derived factors by organising our output a little. Here we have chosen to hide factor loadings under .3 so that we can more readily see which factor an item predominantly loads on. Asking to sort the loadings by size will mean the items that load together on a factor are ordered in the table together.

Additional Output

☑ Factor summary

☑ Factor correlations

☐ Model fit measures

☐ Initial eigenvalues

☑ Scree plot

Finally in Additional Output we'll ask for a Factor summary (which will tell us the % of variance accounted for by our factors), Factor correlations (a correlation matrix of our derived factors) and a Scree plot (a visual aid to help us clarify how many factors we should extract).

The output we obtain from these options selections is shown below:

Exploratory Factor Analysis

Factor Loadings

	Factor 1	Factor 2	Uniqueness
talk to someone I trust	0.79321		0.36999
discuss feelings	0.74750		0.40111
advice from others	0.73135		0.48234
express emotions to family	0.55109		0.70272
develop plan		0.66086	0.51890
direct action		0.51905	0.72552
work on problem		0.48057	0.78220
honest with myself		0.46600	0.75383
attend workshops		0.39030	0.81554
explore emotions		0.36516	0.72551

Note. 'Principal axis factoring' extraction method was used in combination with a 'oblimin' rotation

[3]

Here we can see that two factors have been extracted. The items on the scale have been sorted by their loadings on the two extracted factors. The column "Uniqueness" refers to the amount of variance in that item unexplained by the factors. The mirror of these values are what is more commonly/conventionally reported and they are known as communalities. Communality is the amount of variance in an item that is explained by the factors derived. For example the communality for "talk to someone I trust" would be 1 - .36999 = .63001.

Factor Statistics

Summary

Factor	SS Loadings	% of Variance	Cumulative %
1	2.25012	22.50115	22.50115
2	1.47223	14.72229	37.22344

The Factor Statistics table tells us the % of variance in the item set that is captured by the derived factors. Factor 1 captures 22.5% while Factor 2 captures an additional 14.72%. The column SS loadings are the eigenvalues for each factor post rotation.
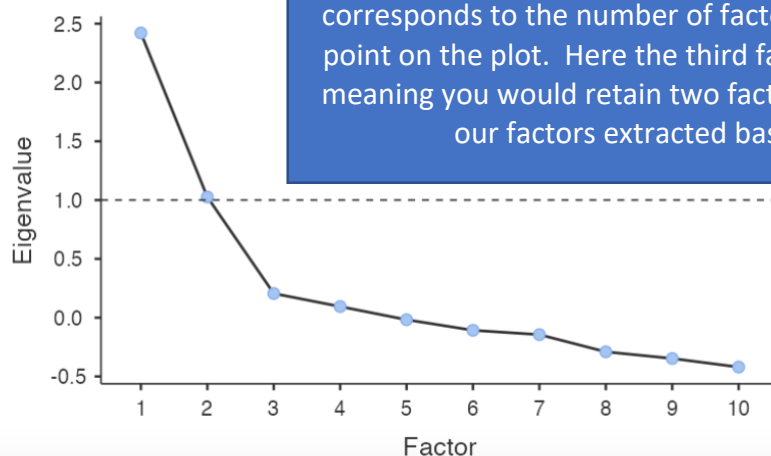
Correlation Matrix

	1	2
1	—	0.31078
2		—

The correlation matrix here tells us that the two factors created from our items are correlated with each other positively at r = .31

Eigenvalues

Scree Plot

Finally, the scree plot is an additional visual aid often used to help decide how many factors to extract. The number of factors to keep corresponds to the number of factors prior to the elbow or inflection point on the plot. Here the third factor would be the inflection point meaning you would retain two factors. This decision marries up with our factors extracted based on Kaiser's criterion.

Step 4 – Conducting reliability analysis for the derived factors

An important part of establishing the integrity of factors derived from a factor analysis (which will ultimately be presented as sub-scales of the scale) is to establish their internal consistency as an initial form of reliability analysis.
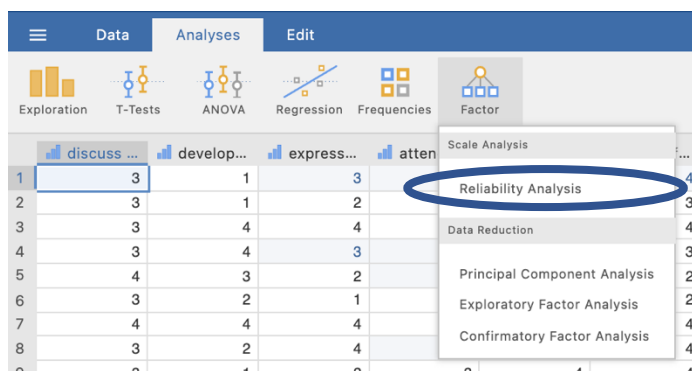

On the Analyses tab select the Factor menu again, then select Reliability Analysis.

We have two derived factors so we will run this twice, using the two subsets of items the factor analysis has grouped into factors.

The Scale Statistics option we want to select here is Cronbach's α which you'll see is selected as a default.

You'll also note that there is a menu option for "Reverse Scaled Items" which is where you would tell *jamovi* if you have any items that need to have their scores reversed (if you have included any items that were worded in the opposing way to minimise response bias). This does not apply to us here so we don't need to use this feature but it is good to know it is there.
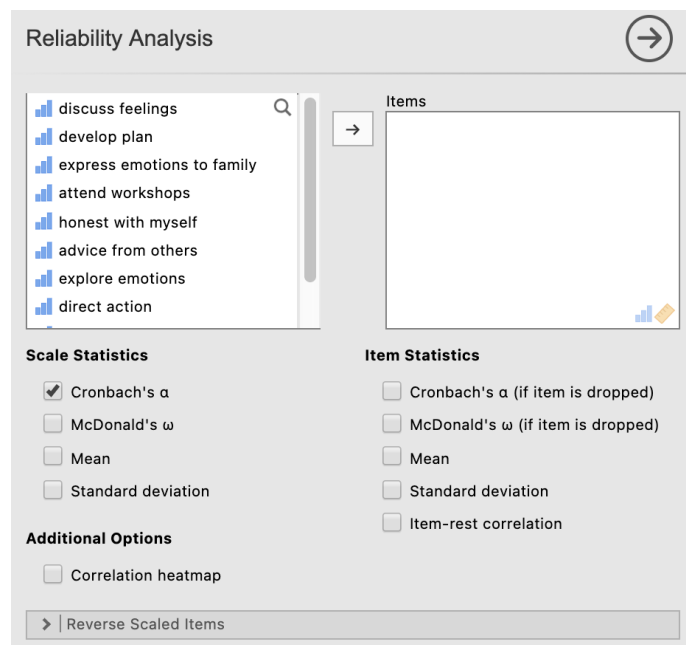
The two reliability analyses we need to run are as follows:
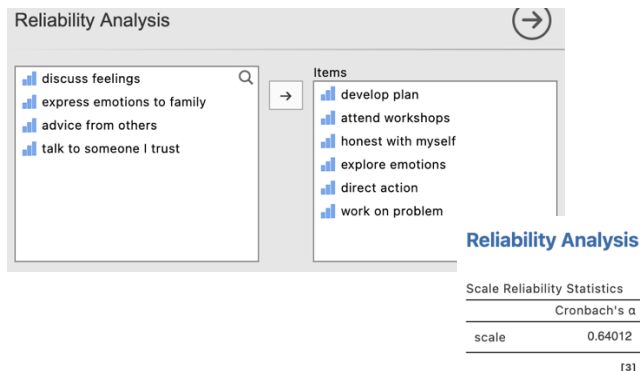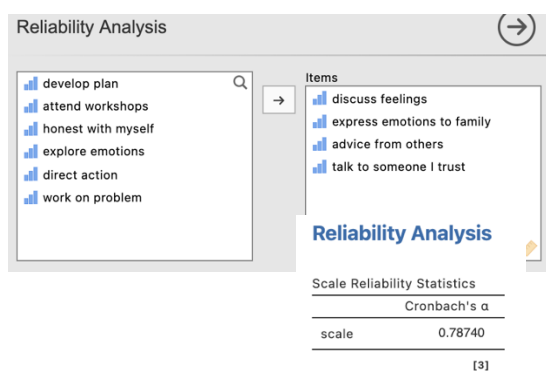
Step 5 – Finding the components for reporting.

When reporting a factor analysis we explain firstly the method of factor analysis and rotation used and the resultant number of factors we decide to extract based on this process.

The Write-up Part 1:

Principal axis factoring was conducted to uncover the underlying factor structure of a ten-item coping strategy measure. An oblique rotation method (direct oblimin) was used to allow the derived factors to correlate. Both Kaiser's criterion and an examination of the scree plot suggested that two factors should be extracted. The two factors jointly captured 37.22% of the variance in the set of items, and were positively correlated with each other (*r* = .31).

The second part of the write-up outlines the nature of the factors derived and provides factor labels that capture the general theme of the collection of items that load on them. Traditionally, the loadings are reported in a table. Loading reporting can be approached in two ways. One way is to only include loadings above a threshold of .3. The other is to report all loadings but to bold the ones that demonstrate the factor each item predominantly loads on. Communalities are often reported in these tables as well.

Let's have a go at coming up with some factor labels first before we proceed any further.

Factor Loadings

	Factor		Uniqueness
	1	2	
talk to someone I trust	0.79321		0.36999
discuss feelings	0.74750		0.40111
advice from others	0.73135		0.48234
express emotions to family	0.55109		0.70272
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Note. 'Principal axis factoring' extraction method was used in combination with a 'oblimin' rotation

[3]

Factor 1 seems to contain items that all relate to seeking support from others, either to discuss the impact of the stressor or to seek advice in handling it. We could label this as "Support from others".

Factor 2 seems to reflect coping strategies that are more self-directed or conducted. These involve both active strategizing as well as a focus on emotional responses, but seem to be as managed by the individual. The workshop attendance item is conceptually a little different but perhaps could also be argued as self-directed if the decision to take part in these comes from the self rather than others. We could label this factor as "Self-reflective coping" perhaps.

The Write-up Part 2:

An examination of the factor loadings suggest one factor that reflects the seeking of support from others as a coping approach, while the second factor seems to reflect more self-reflective coping strategies. Reliability analysis suggested that the Support from Others factor has adequate internal consistency (α = .79). The internal consistency for the Self-Reflective Coping factor was just under the acceptable level (α = .64), suggesting this factor warrants further examination and development. Table 1 provides factor loadings as well as communalities for each of the ten items of the Coping Strategy Scale.

Table 1

Factor Loadings and Communalities for the Ten Items of the Coping Strategy Scale

Coping Strategy Scale Item	Factor 1 Support from Others	Factor 2 Self-reflective Coping	Communality
Talk to someone I trust	.79		.63
Discuss feelings	.75		.60
Advice from others	.73		.52
Express emotions to family	.55		.30
Develop plan		.66	.48
Direct action		.52	.27
Work on problem		.48	.22
Honest with myself		.47	.25
Attend workshops		.39	.18
Explore emotions		.37	.27

Note. *N* = 91.