Testdata Example

PCA using Correlation - `princomp(testdata,cor=T)$loadings`
`summary(princomp(testdata,cor=T))`

```
             Comp.1 Comp.2 Comp.3 Comp.4 Comp.5
Mechanics_C   0.400  0.645  0.621 -0.146 -0.131
Vectors_C     0.431  0.442 -0.705  0.298 -0.182
Algebra_O     0.503 -0.129        -0.109  0.847
Analysis_O    0.457 -0.388 -0.136 -0.666 -0.422
Statistics_O  0.438 -0.470  0.313  0.659 -0.234


                        Comp.1    Comp.2     Comp.3     Comp.4    Comp.5
Standard deviation     1.783530 0.8599836 0.66705706 0.62281006 0.4965788
```

Principal Components Factor Analysis – `lamda<-factpca(testdata)`

```
             Fact.1 Fact.2 Fact.3 Fact.4 Fact.5
Mechanics_C  -0.713  0.555  0.414 -0.091 -0.065
Vectors_C    -0.769  0.380 -0.470  0.186 -0.090
Algebra_O    -0.898 -0.111 -0.025 -0.068  0.420
Analysis_O   -0.815 -0.334 -0.091 -0.415 -0.210
Statistics_O -0.782 -0.405  0.208  0.410 -0.116
```

Diagnostics Using All 5 Factors

Communatlities – `apply(lamda^2,1,sum)`

```
Mechanics_C    Vectors_C    Algebra_O   Analysis_O Statistics_O
          1            1            1            1            1
```

Specificities – `spec<-1-apply(lamda^2,1,sum)`

```
Mechanics_C    Vectors_C    Algebra_O   Analysis_O Statistics_O
          0            0            0            0            0
```

Correlation – `lamda%*%t(lamda)+diag(spec)`
`cor(testdata)`

	Mechanics_C	Vectors_C	Algebra_O	Analysis_O	Statistics_O
Mechanics_C	1.000	0.553	0.547	0.409	0.389
Vectors_C	0.553	1.000	0.610	0.485	0.436
Algebra_O	0.547	0.610	1.000	0.711	0.665
Analysis_O	0.409	0.485	0.711	1.000	0.607
Statistics_O	0.389	0.436	0.665	0.607	1.000

	Mechanics_C	Vectors_C	Algebra_O	Analysis_O	Statistics_O
Mechanics_C	1.000	0.553	0.547	0.409	0.389
Vectors_C	0.553	1.000	0.610	0.485	0.436
Algebra_O	0.547	0.610	1.000	0.711	0.665
Analysis_O	0.409	0.485	0.711	1.000	0.607
Statistics_O	0.389	0.436	0.665	0.607	1.000

Diagnostics Using First 4 Factors

Communatlities – `apply(lamda[,1:4]^2,1,sum)`

```
Mechanics_C    Vectors_C    Algebra_O   Analysis_O Statistics_O
      0.996        0.992        0.823        0.956        0.986
```

Specificities – `spec<-1-apply(lamda[,1:4]^2,1,sum)`

```
Mechanics_C    Vectors_C    Algebra_O   Analysis_O Statistics_O
      0.004        0.008        0.177        0.044        0.014
```

Correlation – `lamda[,1 :4]%*%t(lamda[,1 :4])+diag(spec)`
`cor(testdata)`

	Mechanics_C	Vectors_C	Algebra_O	Analysis_O	Statistics_O
Mechanics_C	1.000	0.548	0.574	0.396	0.382
Vectors_C	0.548	1.000	0.648	0.466	0.426
Algebra_O	0.574	0.648	1.000	0.799	0.714
Analysis_O	0.396	0.466	0.799	1.000	0.583
Statistics_O	0.382	0.426	0.714	0.583	1.000

	Mechanics_C	Vectors_C	Algebra_O	Analysis_O	Statistics_O
Mechanics_C	1.000	0.553	0.547	0.409	0.389
Vectors_C	0.553	1.000	0.610	0.485	0.436
Algebra_O	0.547	0.610	1.000	0.711	0.665
Analysis_O	0.409	0.485	0.711	1.000	0.607
Statistics_O	0.389	0.436	0.665	0.607	1.000

Residual Cor - `cor(testdata)-(lamda[,1 :4]%*%t(lamda[,1 :4])+diag(spec))`

	Mechanics_C	Vectors_C	Algebra_O	Analysis_O	Statistics_O
Mechanics_C	0.000	0.006	-0.027	0.014	0.008
Vectors_C	0.006	0.000	-0.038	0.019	0.010
Algebra_O	-0.027	-0.038	0.000	-0.088	-0.049
Analysis_O	0.014	0.019	-0.088	0.000	0.024
Statistics_O	0.008	0.010	-0.049	0.024	0.000

Principal Factor Factor Analysis

Principal Components Factor Analysis – `lamda<-factpf(testdata)`

```
             Fact.1 Fact.2 Fact.3 Fact.4
Mechanics_C  -0.646  0.354  0.055  0.097
Vectors_C    -0.713  0.303 -0.037 -0.105
Algebra_O    -0.864 -0.051 -0.013  0.001
Analysis_O   -0.786 -0.249 -0.191  0.030
Statistics_O -0.742 -0.276  0.205 -0.017
```

Communatlities – `apply(lamda[,1:4]^2,1,sum)`

```
Mechanics_C    Vectors_C    Algebra_O   Analysis_O Statistics_O
      0.555        0.612        0.749        0.718        0.669
```

Specificities – `spec<-1-apply(lamda[,1:4]^2,1,sum)`

```
Mechanics_C    Vectors_C    Algebra_O   Analysis_O Statistics_O
      0.445        0.388        0.251        0.282        0.331
```

Residual Cor - `cor(testdata)-(lamda[,1 :4]%*%t(lamda[,1 :4])+diag(spec))`

```
             Mechanics_C Vectors_C Algebra_O Analysis_O Statistics_O
Mechanics_C        0.000    -0.002     0.007     -0.003       -0.002
Vectors_C         -0.002     0.000     0.009     -0.004       -0.003
Algebra_O          0.007     0.009     0.000      0.016        0.012
Analysis_O        -0.003    -0.004     0.016      0.000       -0.005
Statistics_O      -0.002    -0.003     0.012     -0.005        0.000
```

Versus Before....

```
Mechanics_C    Vectors_C    Algebra_O   Analysis_O Statistics_O
      0.004        0.008        0.177        0.044        0.014

             Mechanics_C Vectors_C Algebra_O Analysis_O Statistics_O
Mechanics_C        0.000     0.006    -0.027      0.014        0.008
Vectors_C          0.006     0.000    -0.038      0.019        0.010
Algebra_O         -0.027    -0.038     0.000     -0.088       -0.049
Analysis_O         0.014     0.019    -0.088      0.000        0.024
Statistics_O       0.008     0.010    -0.049      0.024        0.000
```