

# Análisis Factorial Bechtoldt

Melissa Ortega Galarza

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## Descargar Librerías

```
install.packages("psych")
```

```
library(psych)
```

```
install.packages("polycor")
```

```
library("polycor")
```

```
install.packages("ggcorrplot")
```

```
library("ggcorrplot")
```

## Extracción de datos

```
O<-data.frame(psych::Bechtoldt)
```

```
O<-Bechtoldt
```

## Exploración de la matriz

Dimensión

```
dim(O)
```

```
## [1] 17 17
```

## Tipo de variables

```
str(O)
```

```
##  num [1:17, 1:17] 1 0.472 0.29 0.401 0.299 0.234 0.254 0.296 0.086 0.061 ...
##  - attr(*, "dimnames")=List of 2
##    ..$ : chr [1:17] "First_Names" "Word_Number" "Sentences" "Vocabulary" ...
##    ..$ : chr [1:17] "First_Names" "Word_Number" "Sentences" "Vocabulary" ...
```

## Nombre de las variables

```
colnames(0)
```

```
## [1] "First_Names"      "Word_Number"      "Sentences"
## [4] "Vocabulary"       "Completion"       "First_Letters"
## [7] "Four_letter_words" "Suffixes"         "Flags"
## [10] "Figures"          "Cards"           "Addition"
## [13] "Multiplication"   "Three_Higher"    "Letter_Series"
## [16] "Pedigrees"        "Letter_Grouping"
```

Creacion de la matriz de datos se incluten las variables 1 a la 25 y las primeras 200 observaciones

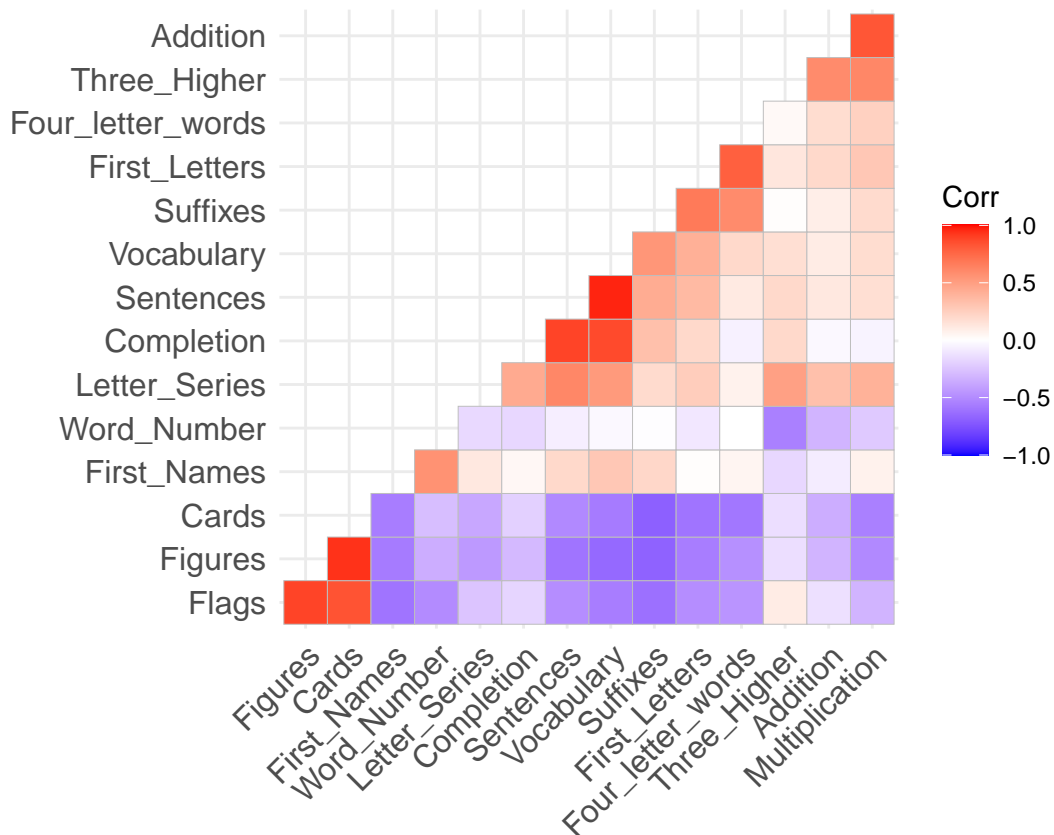
```
x1<-Bechtoldt[1:17,1:15]
```

## Matriz de correlaciones

```
R<-hetcor(x1)$correlations
```

## Grafico de correlaciones

```
ggcorrplot(R,type="lower",hc.order=TRUE)
```



## Factorizacion de la matriz de correlaciones

Se utiliza la prueba de esfericidad de Bartlett

```
p_Bartlett<-cortest.bartlett(R)
```

```
## Warning in cortest.bartlett(R): n not specified, 100 used
```

## Vizualizar del p-valor

```
p_Bartlett$p.value
```

```
## [1] 0
```

H0:Las variables estan correlacionadas Ha:Las variables no estan correlacionadas

```
KMO (R)
```

```
## Kaiser-Meyer-Olkin factor adequacy
```

```
## Call: KMO(r = R)
```

```
## Overall MSA = 0.25
```

```
## MSA for each item =
```

##	First_Names	Word_Number	Sentences	Vocabulary
##	0.14	0.11	0.25	0.41
##	Completion	First_Letters	Four_letter_words	Suffixes
##	0.19	0.47	0.18	0.22
##	Flags	Figures	Cards	Addition
##	0.29	0.33	0.31	0.94
##	Multiplication	Three_Higher	Letter_Series	
##	0.18	0.16	0.21	

## Extracion de factores

minres: minimo de residuos mle: max de verosimilitudes paf: ejes principales alpha: alfa minchi: minimos cuadrados mirank: rango minimo

```
modelo1<-fa(R,nfactor=3,rotate = "none",fm="mle")
```

```
modelo2<-fa(R,nfactor=3,rotate = "none",fm="minres")
```

```
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
```

```
## The estimated weights for the factor scores are probably incorrect. Try a
```

```
## different factor score estimation method.
```

## Extraer el resultados de las comunidalidades

Encontrar la proporcion varianza explicada. Se interpreta de tal forma que el numero cercanos a 1, el factor explica mejor la variable.

```
C1<-sort(modelo1$communality,decreasing = TRUE)
```

```
C2<-sort(modelo2$communality,decreasing = TRUE)
```

```
head(cbind(C1,C2))
```

```
##              C1      C2
## Vocabulary    0.9673461 0.9730792
## Sentences     0.9584128 0.9676126
## Figures       0.9558632 0.9633833
## Completion    0.9244580 0.9627860
## Cards         0.9126491 0.9209740
## Multiplication 0.8927945 0.8860139
```

## Extracción de Unicidades

La unicidad es el cuadrado del coeficiente del factor unico y se expresa como la porcion de la varianza explicada por el factor unico. Quiere decir que no se puede explicar por otros.

```
u1<-sort(modelo1$uniquenesses,decreasing = TRUE)
```

```
u2<-sort(modelo2$uniquenesses,decreasing = TRUE)
```

```
head(cbind(u1,u2))
```

```
##              u1      u2
## Four_letter_words 0.6905647 0.6295458
## First_Letters     0.6599320 0.6184858
## Letter_Series     0.5481960 0.5846903
## First_Names       0.5289519 0.5634604
## Suffixes          0.5156407 0.5008660
## Word_Number       0.3744904 0.4102245
```

## Rotación de la matriz

```
install.packages("GPArotation")
```

```
library(GPArotation)
```

```
rot<-c("None","Varimax","Quartimax","Promax")
```

```
bi_mod<-function(tipo){
```

```
  biplot.psych(fa(x1,nfactors = 2,fm="minres",rotate = tipo),col = c(2,3,4),pch = c(21,18),group = bfi[
```

```
  })
```

```
## Specified rotation not found, rotate='none' used
```

```
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
```

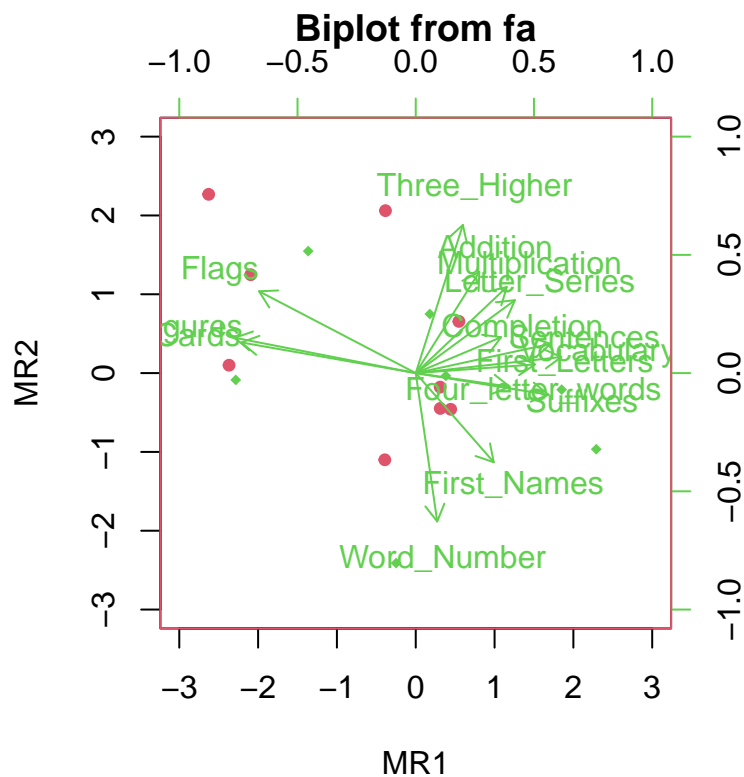
```
## The estimated weights for the factor scores are probably incorrect. Try a
```

```
## different factor score estimation method.
```

```
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
```

```
## The estimated weights for the factor scores are probably incorrect. Try a
```

```
## different factor score estimation method.
```

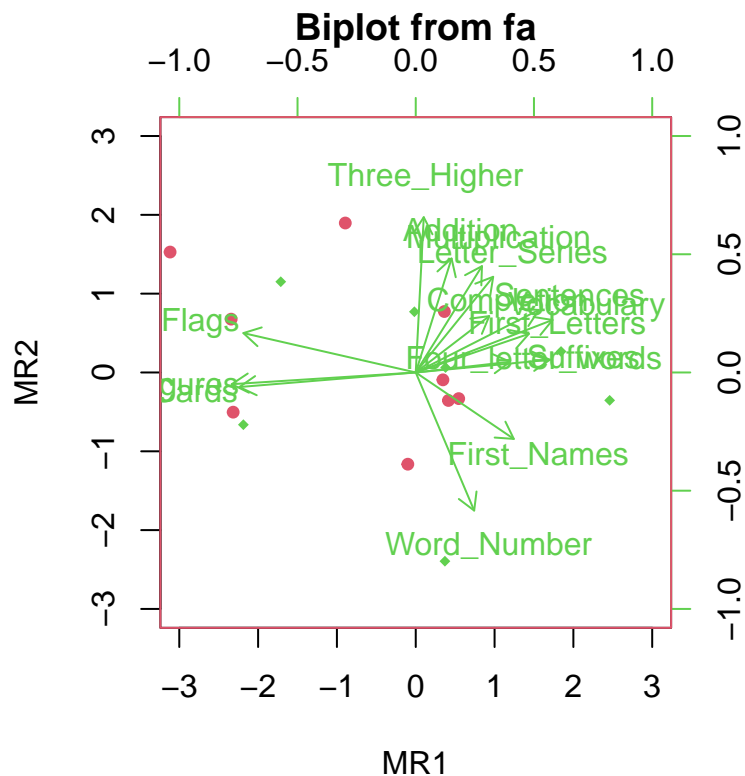


```
## Specified rotation not found, rotate='none' used
```

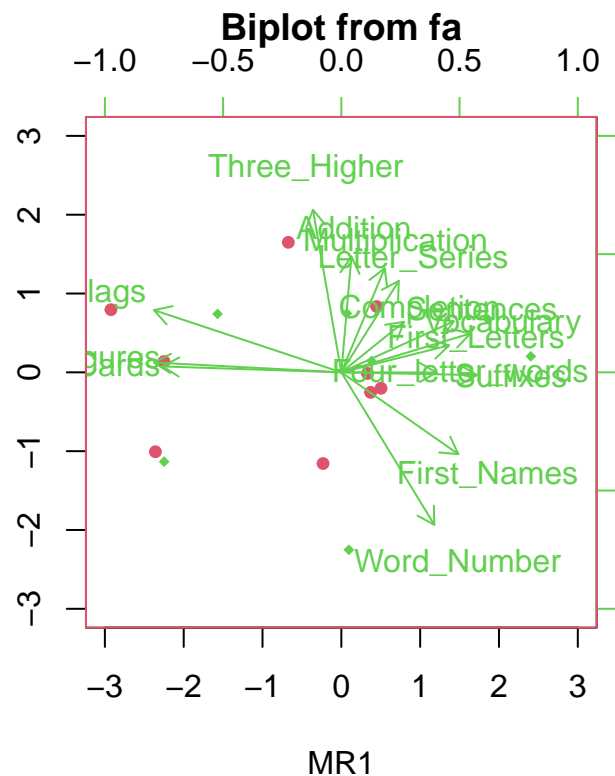
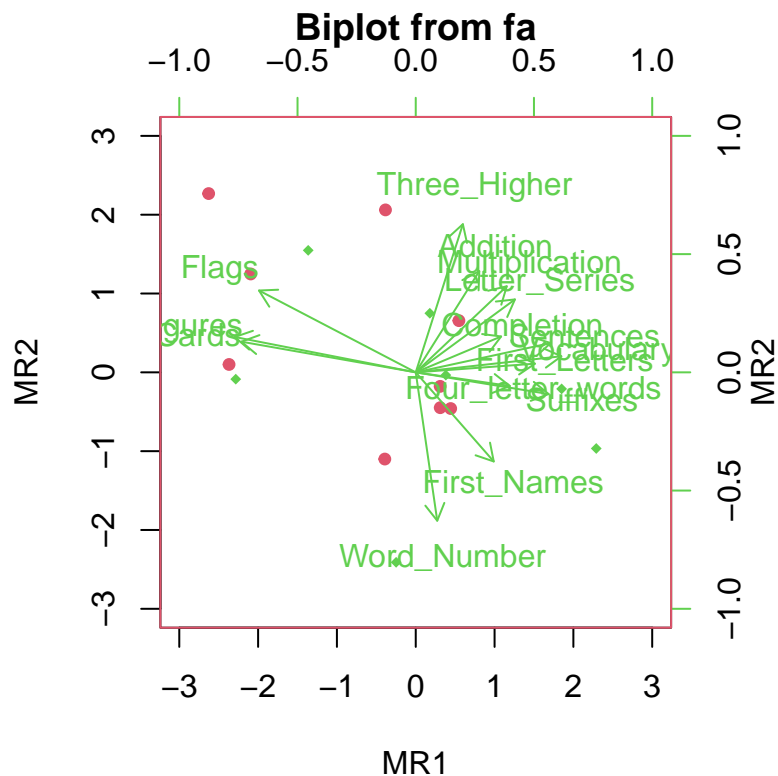
```
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
```

```
## The estimated weights for the factor scores are probably incorrect. Try a
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```
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
## The estimated weights for the factor scores are probably incorrect. Try a
## different factor score estimation method.
```



```
## $None
```

```
## NULL
##
## $Varimax
## NULL
##
## $Quartimax
## NULL
##
## $Promax
## NULL
```

## Interpretación

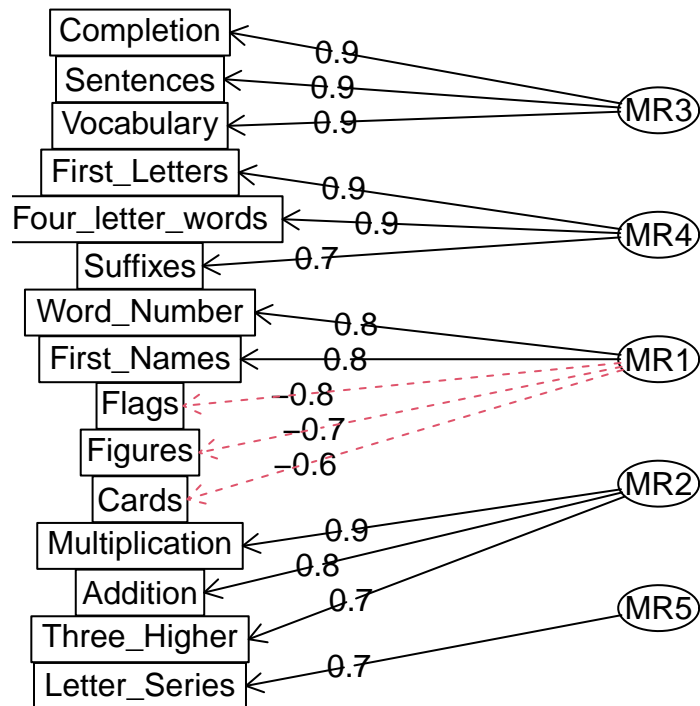
Para esto se utiliza un gráfico de árbol

```
modelo_varimax<-fa(R,nfactors = 5, rotate = "varimax",fm="minres")
```

```
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :  
## The estimated weights for the factor scores are probably incorrect. Try a  
## different factor score estimation method.
```

```
fa.diagram(modelo_varimax)
```

## Factor Analysis





## Visualización de la matriz cargada

```
print(modelo_varimax$loadings, cut=0)
```

```
##
## Loadings:
##           MR3      MR4      MR1      MR2      MR5
## First_Names      0.100  0.009  0.763 -0.037  0.032
## Word_Number     -0.164 -0.058  0.775 -0.379 -0.026
## Sentences        0.920  0.177  0.178  0.106  0.186
## Vocabulary       0.917  0.260  0.238  0.096  0.065
## Completion       0.949  0.025 -0.068 -0.041  0.083
## First_Letters    0.179  0.878  0.009  0.114  0.105
## Four_letter_words -0.076  0.876  0.076  0.085  0.014
## Suffixes         0.342  0.710  0.222  0.050 -0.075
## Flags           -0.263 -0.476 -0.758 -0.098  0.015
## Figures         -0.356 -0.496 -0.700 -0.321 -0.103
## Cards           -0.251 -0.588 -0.640 -0.351 -0.069
## Addition        -0.008  0.117 -0.022  0.835  0.038
## Multiplication   -0.005  0.179  0.166  0.946  0.039
## Three_Higher     0.173  0.001 -0.271  0.697  0.259
## Letter_Series    0.437  0.071  0.088  0.365  0.705
##
##           MR3      MR4      MR1      MR2      MR5
## SS loadings    3.260  3.013  2.914  2.636  0.647
## Proportion Var 0.217  0.201  0.194  0.176  0.043
## Cumulative Var 0.217  0.418  0.612  0.788  0.831
```