Multiple Correspondence Analysis (MCA) with FactoMineR (hobbies dataset)

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Import data

```
setwd("C:/users/houee/Downloads") # select the working directory
hobbies = read.table("data_MCA_Hobbies.csv", header=TRUE, sep=";")
```

`header=TRUE` : indicates that the file contains the names of the variables

`sep=";"` : indicates the fields separator (usually ";" or "," for csv files)

It is important to check that the import is well done

```
summary(hobbies)
```

```
##  Reading  Listening.music Cinema   Show     Exhibition Computer Sport
##  n:2757   n:2456          n:5044   n:5978   n:5808     n:5245   n:5308
##  y:5646   y:5947          y:3359   y:2425   y:2595     y:3158   y:3095
##
##
##
##
##
##  Walking  Travelling Playing.music Collecting Volunteering Mechanic
##  n:4228   n:5040     n:6943        n:7541     n:7118       n:4864
##  y:4175   y:3363     y:1460        y: 862     y:1285       y:3539
##
##
##
##
##
##  Gardening Knitting Cooking  Fishing        TV        Sex
##  n:5047    n:6990   n:4717   n:7458   Min.   :0.000   F:4616
##  y:3356    y:1413   y:3686   y: 945   1st Qu.:1.000   M:3787
##                                       Median :2.000
##                                       Mean   :2.355
##                                       3rd Qu.:4.000
##                                       Max.   :4.000
##
##       Age         Marital.status            Profession   nb.activitees
##  (45,55]:1837   Divorcee : 792   Employee        :2552   Min.   : 0.000
##  (35,45]:1646   Married  :4333   Manual labourer :1161   1st Qu.: 4.000
##  (25,35]:1302   Remarried: 404   Management      :1052   Median : 7.000
##  (55,65]:1257   Single   :2140   Unskilled worker: 792   Mean   : 6.866
##  (65,75]: 937   Widower  : 734   Foreman         : 735   3rd Qu.: 9.000
##  [15,25]: 857                   (Other)         : 613   Max.   :16.000
##  (Other): 567                   NA's            :1498
```

Transform the TV variable as factor

```
hobbies[,"TV"] = as.factor(hobbies[,"TV"])
summary(hobbies[,"TV"])
```

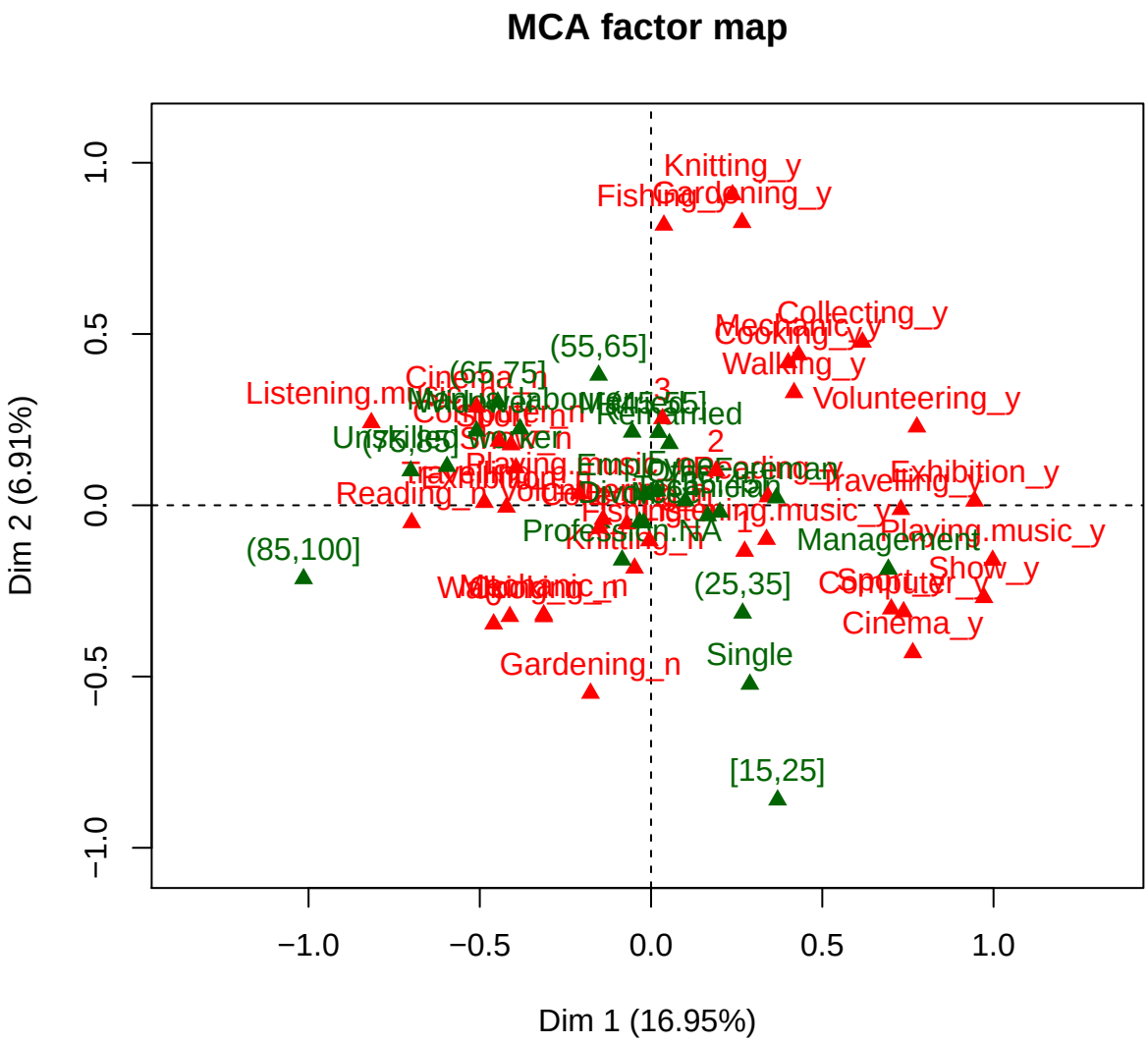
```
##    0    1    2    3    4
## 1017 1223 2156 1775 2232
```

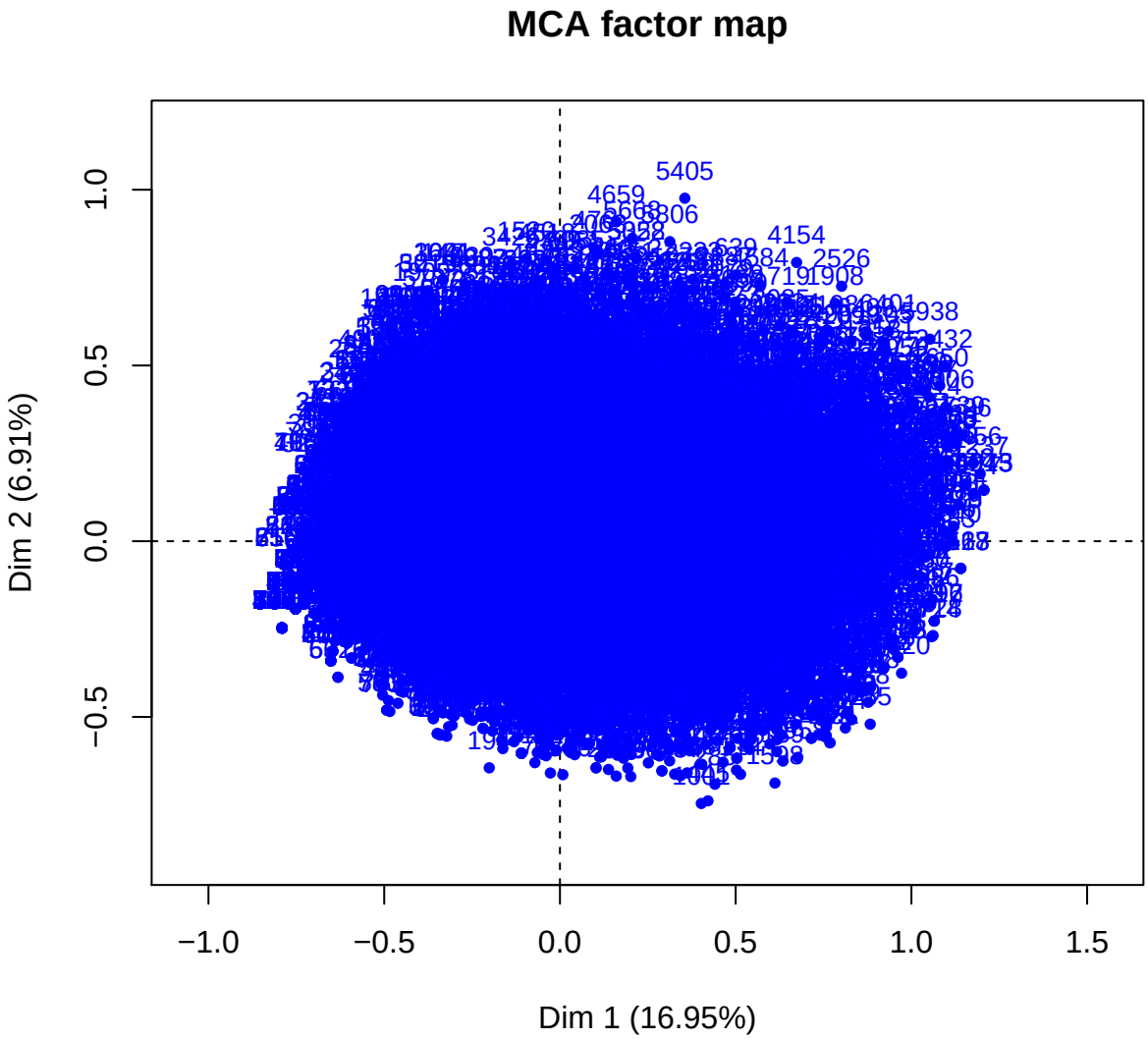
Loading FactoMineR

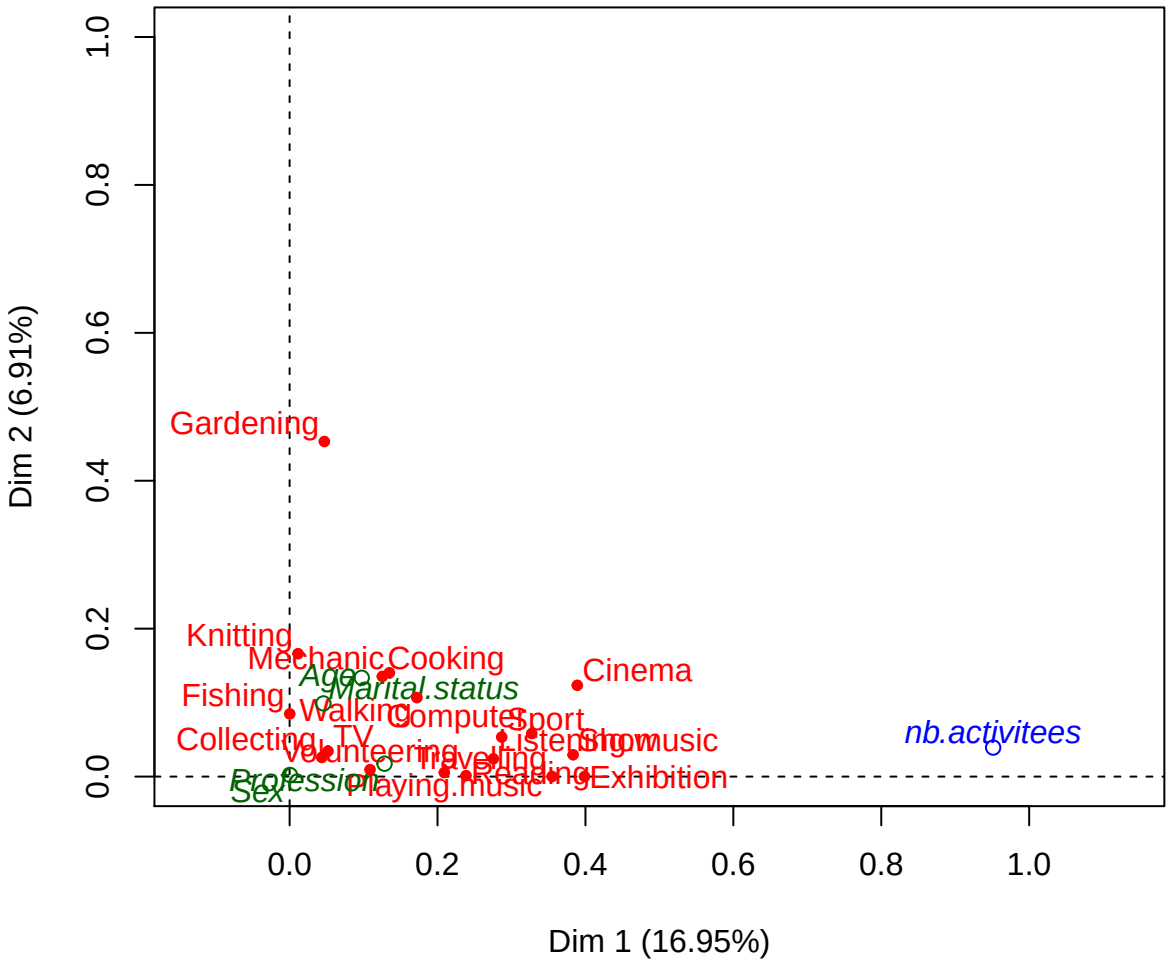
```
library(FactoMineR)
```

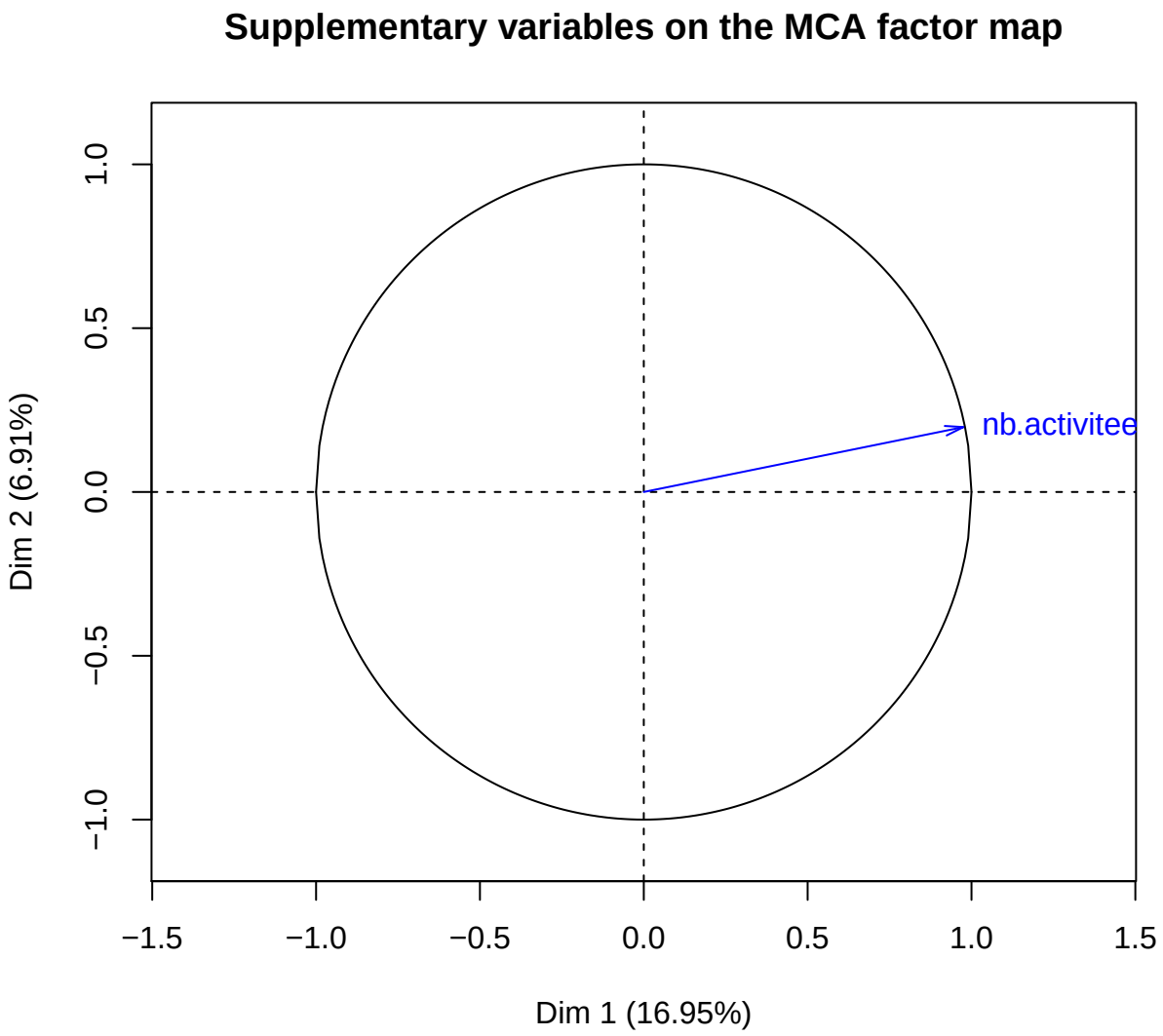
MCA

```
res.mca <- MCA(hobbies,quali.sup=19:22,quanti.sup=23)
```


MCA factor map
Knitting_y
Gardening_y
Collecting_y
Cooking_y
Walking_y
(55,65]
Volunteering_y
Exhibition_y
Management
Playing.music_y
Show_y
Computer_y
Cinema_y
(25,35]
Single
Gardening_n
[15,25]
(85,100]
Dim 1 (16.95%)
Dim 2 (6.91%)
1.0
0.5
0.0
−0.5
−1.0


MCA factor map
Dim 2 (6.91%)
Dim 1 (16.95%)
1.0
0.5
0.0
−0.5
−1.0
−0.5
0.0
0.5
1.0
1.5
5405
4659
4154
2526


Dim 2 (6.91%)
Dim 1 (16.95%)
0.0
0.2
0.4
0.6
0.8
1.0
Gardening
Knitting
Mechanic
Cooking
Cinema
Age
Marital.status
Fishing
Walking
Computer
Sport
Collecting
TV
Volunteering
Travelling
Reading
Exhibition
Playing.music
Profession
Sex
nb.activitees



Outputs can be summarized with the function `summary`.

```
summary(res.mca)
```

Outputs are given for the first 2 dimensions (by default 3 dimensions are given).

```
summary(res.mca, ncp=2)
```

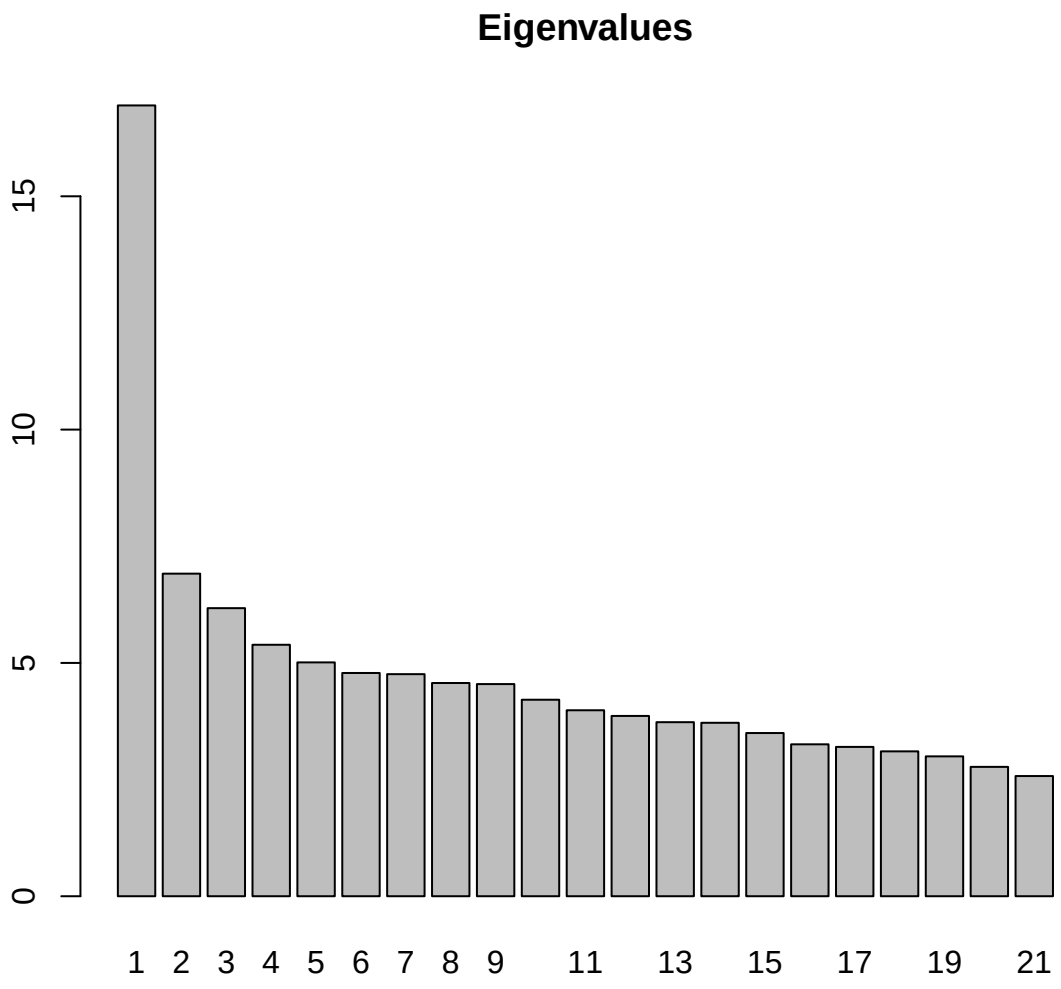
```
##
## Call:
## MCA(X = hobbies, quanti.sup = 23, quali.sup = 19:22)
##
##
## Eigenvalues
##                        Dim.1   Dim.2   Dim.3   Dim.4   Dim.5   Dim.6
## Variance               0.198   0.081   0.072   0.063   0.058   0.056
```

```
## % of var.             16.947   6.913   6.173   5.389   5.011   4.784
## Cumulative % of var.  16.947  23.859  30.033  35.422  40.433  45.217
##                        Dim.7   Dim.8   Dim.9  Dim.10  Dim.11  Dim.12
## Variance               0.056   0.053   0.053   0.049   0.046   0.045
## % of var.              4.759   4.569   4.547   4.211   3.985   3.864
## Cumulative % of var.  49.976  54.545  59.092  63.303  67.288  71.152
##                       Dim.13  Dim.14  Dim.15  Dim.16  Dim.17  Dim.18
## Variance               0.044   0.043   0.041   0.038   0.037   0.036
## % of var.              3.730   3.717   3.497   3.256   3.200   3.105
## Cumulative % of var.  74.881  78.598  82.095  85.351  88.551  91.655
##                       Dim.19  Dim.20  Dim.21
## Variance               0.035   0.032   0.030
## % of var.              2.997   2.772   2.575
## Cumulative % of var.  94.652  97.425 100.000
##
## Individuals (the 10 first)
##                      Dim.1    ctr   cos2    Dim.2    ctr   cos2
## 1                  |  0.667  0.027  0.336 | -0.191  0.005  0.027 |
## 2                  |  0.140  0.001  0.011 |  0.434  0.028  0.108 |
## 3                  | -0.155  0.001  0.032 | -0.244  0.009  0.079 |
## 4                  | -0.108  0.001  0.011 | -0.285  0.012  0.073 |
## 5                  | -0.022  0.000  0.001 | -0.268  0.011  0.087 |
## 6                  | -0.636  0.024  0.449 |  0.019  0.000  0.000 |
## 7                  | -0.206  0.003  0.046 | -0.239  0.008  0.063 |
## 8                  |  0.284  0.005  0.065 | -0.611  0.055  0.304 |
## 9                  |  0.598  0.021  0.261 | -0.577  0.049  0.243 |
## 10                 |  0.204  0.003  0.033 | -0.015  0.000  0.000 |
##
## Categories (the 10 first)
##                       Dim.1     ctr    cos2  v.test     Dim.2     ctr
## Reading_n           |  -0.699   4.503   0.239 -44.766 |  -0.051   0.058
## Reading_y           |   0.341   2.199   0.239  44.766 |   0.025   0.028
## Listening.music_n   |  -0.817   5.478   0.275 -48.111 |   0.241   1.170
## Listening.music_y   |   0.337   2.262   0.275  48.111 |  -0.100   0.483
## Cinema_n            |  -0.509   4.369   0.389 -57.170 |   0.287   3.398
## Cinema_y            |   0.764   6.561   0.389  57.170 |  -0.430   5.103
## Show_n              |  -0.394   3.109   0.383 -56.753 |   0.109   0.586
## Show_y              |   0.972   7.663   0.383  56.753 |  -0.270   1.444
## Exhibition_n        |  -0.422   3.461   0.399 -57.885 |  -0.005   0.001
## Exhibition_y        |   0.945   7.745   0.399  57.885 |   0.012   0.003
##                       cos2  v.test
## Reading_n           0.001  -3.255 |
## Reading_y           0.001   3.255 |
## Listening.music_n   0.024  14.202 |
## Listening.music_y   0.024 -14.202 |
## Cinema_n            0.123  32.200 |
## Cinema_y            0.123 -32.200 |
## Show_n              0.029  15.735 |
## Show_y              0.029 -15.735 |
## Exhibition_n        0.000  -0.748 |
## Exhibition_y        0.000   0.748 |
##
## Categorical variables (eta2)
##                     Dim.1 Dim.2
```

```
## Reading           | 0.239 0.001 |
## Listening.music   | 0.275 0.024 |
## Cinema            | 0.389 0.123 |
## Show              | 0.383 0.029 |
## Exhibition        | 0.399 0.000 |
## Computer          | 0.327 0.058 |
## Sport             | 0.287 0.053 |
## Walking           | 0.172 0.107 |
## Travelling        | 0.355 0.000 |
## Playing.music     | 0.209 0.005 |
##
## Supplementary categories (the 10 first)
##                      Dim.1    cos2  v.test     Dim.2    cos2  v.test
## F                  |   0.018   0.000   1.779 |   0.042   0.002   4.253 |
## M                  |  -0.021   0.000  -1.779 |  -0.051   0.002  -4.253 |
## (25,35]            |   0.267   0.013  10.495 |  -0.315   0.018 -12.358 |
## (35,45]            |   0.201   0.010   9.092 |  -0.020   0.000  -0.916 |
## (45,55]            |   0.022   0.000   1.064 |   0.213   0.013  10.309 |
## (55,65]            |  -0.153   0.004  -5.885 |   0.380   0.025  14.599 |
## (65,75]            |  -0.447   0.025 -14.526 |   0.301   0.011   9.789 |
## (75,85]            |  -0.701   0.030 -15.862 |   0.101   0.001   2.276 |
## (85,100]           |  -1.015   0.011  -9.400 |  -0.214   0.000  -1.986 |
## [15,25]            |   0.370   0.016  11.416 |  -0.860   0.084 -26.580 |
##
## Supplementary categorical variables (eta2)
##                     Dim.1 Dim.2
## Sex               | 0.000 0.002 |
## Age               | 0.097 0.134 |
## Marital.status    | 0.046 0.099 |
## Profession        | 0.128 0.017 |
##
## Supplementary continuous variable
##                     Dim.1   Dim.2
## nb.activitees     | 0.975 | 0.198 |
```

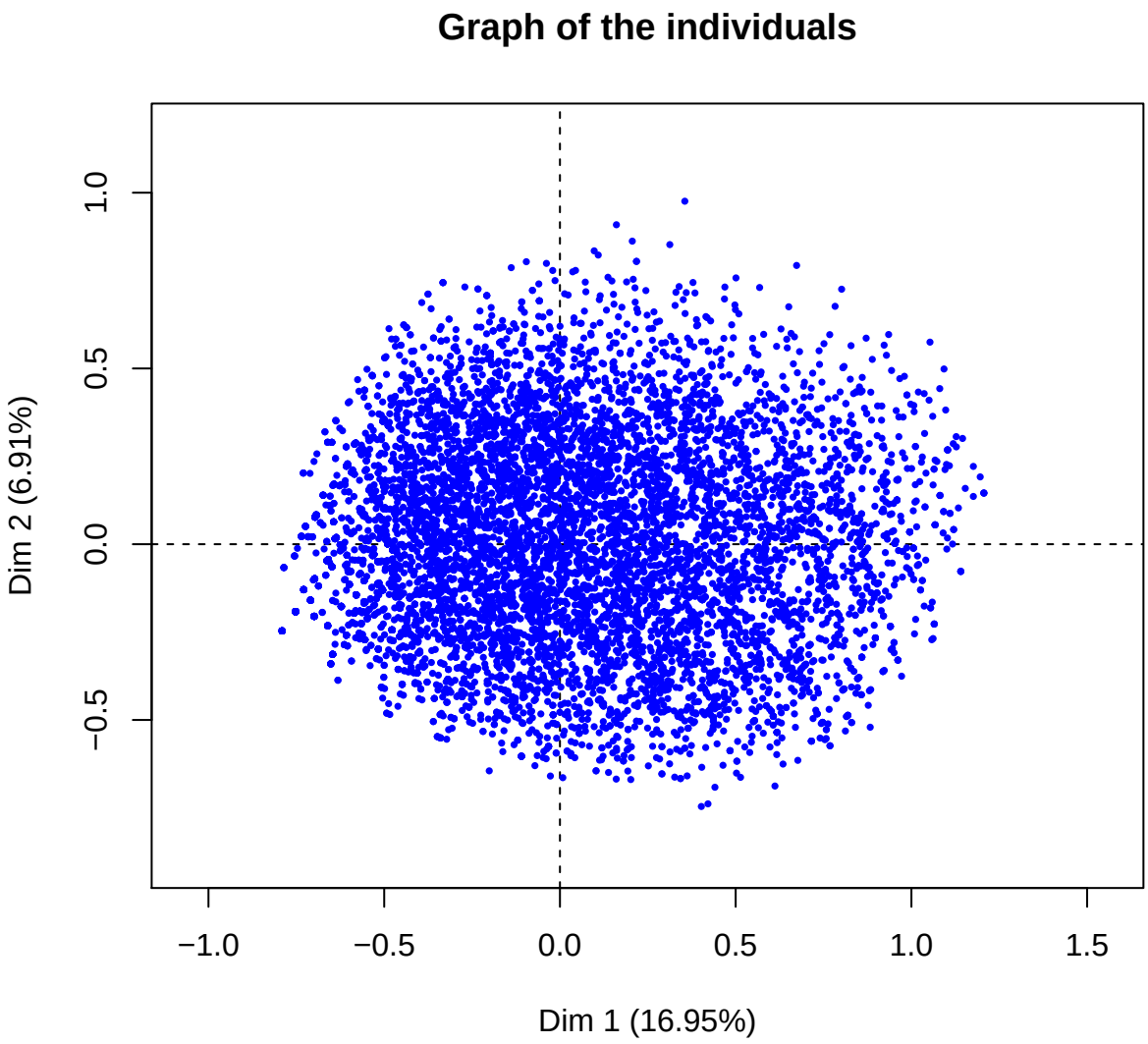
Graph of the eigenvalues

```
barplot(res.mca$eig[,2],main="Eigenvalues", names.arg=1:nrow(res.mca$eig))
```

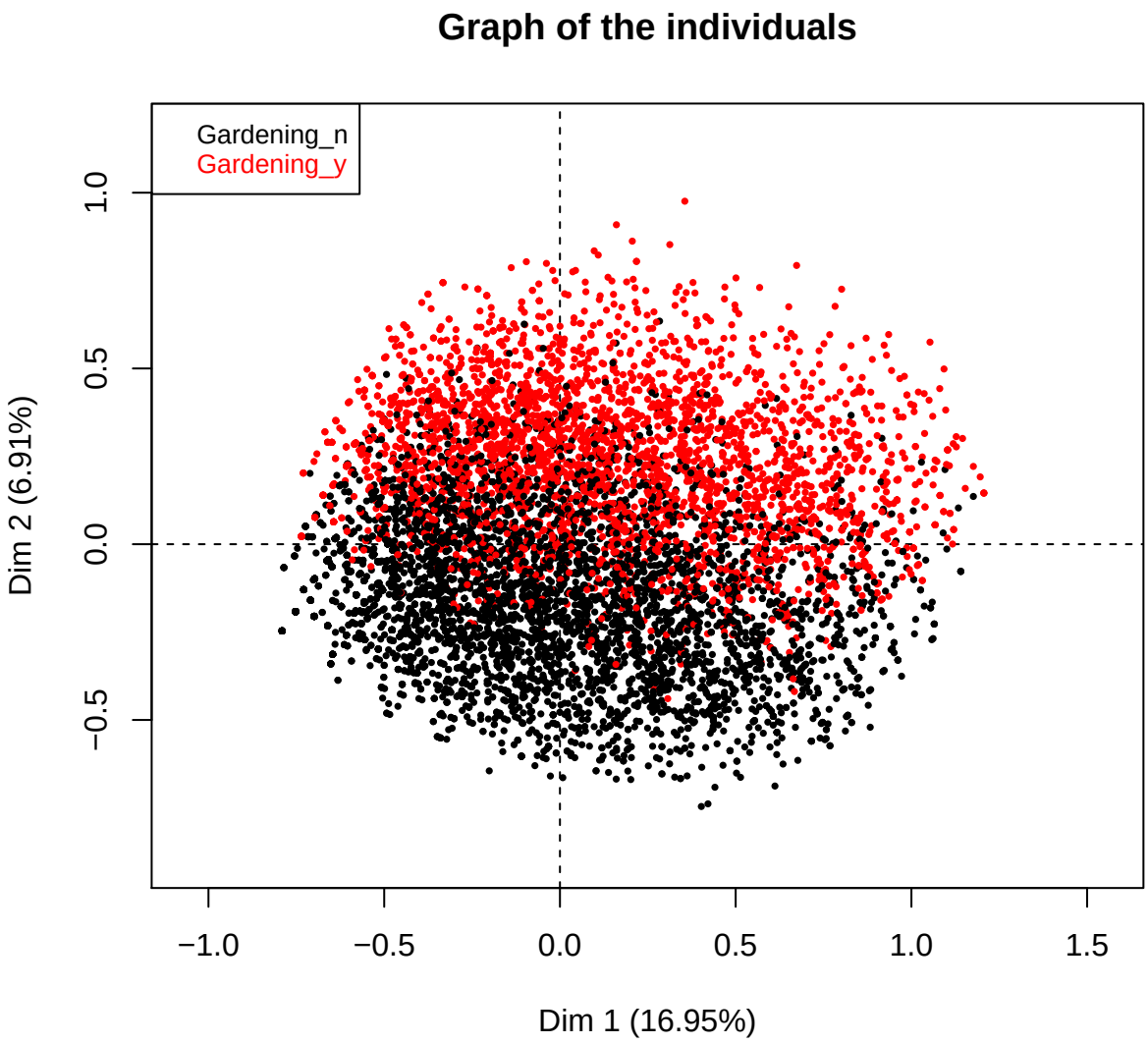


Graphs of the individuals

```
plot(res.mca,invisible=c("var","quali.sup"),cex=.5,label="none",
     title="Graph of the individuals")
```

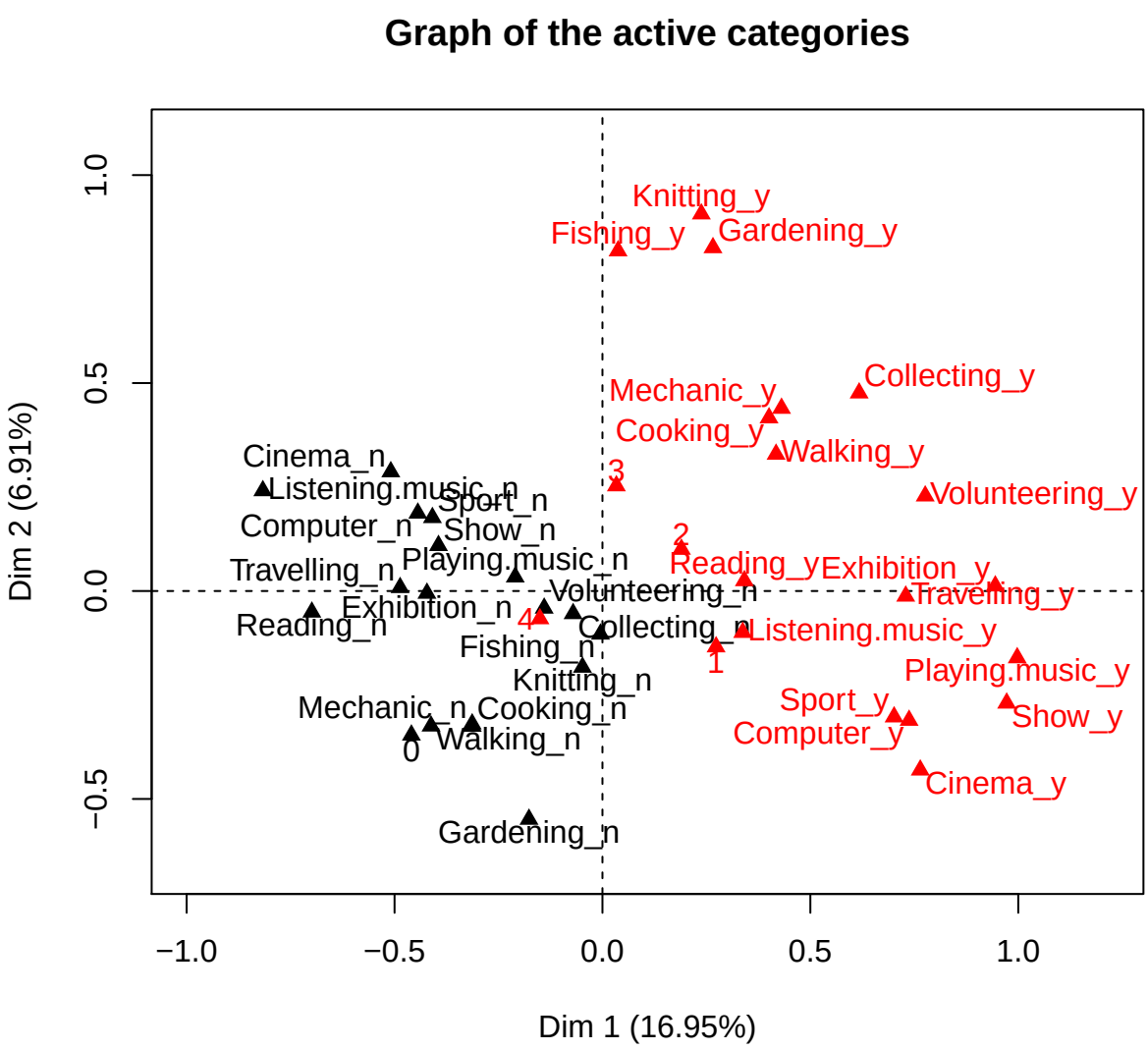



```
plot(res.mca,invisible=c("var","quali.sup"),cex=.5,label="none",
     title="Graph of the individuals", habillage="Gardening")
```

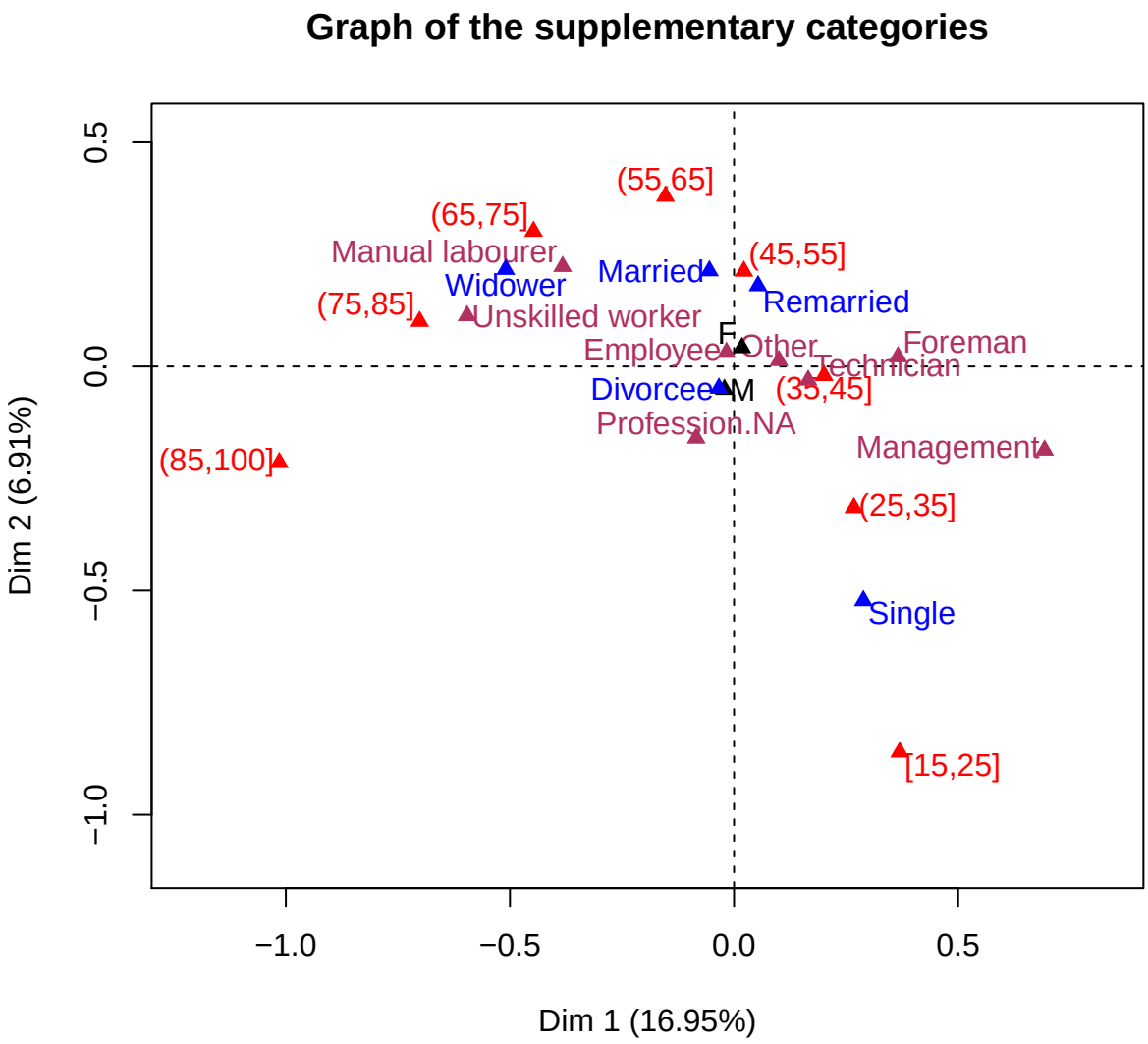


Graphs of the categories

```
plot(res.mca,invis=c("ind","quali.sup"),col.var=c(rep(c("black","red"),17),"black",rep("red",4)),
     title="Graph of the active categories")
```

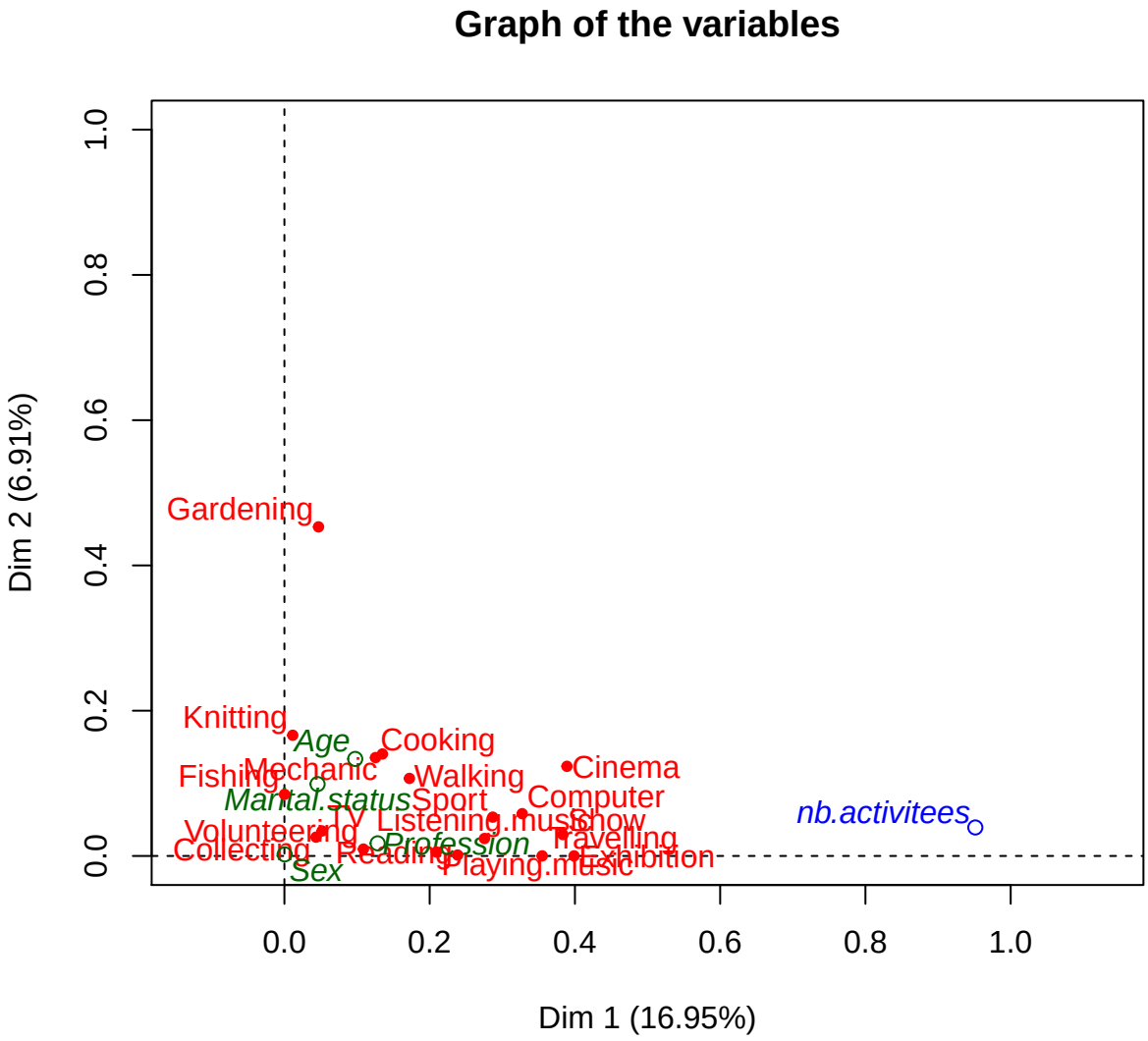



```
plot(res.mca,invisible=c("ind","var"),hab="quali",
     palette=palette(c("blue","maroon","darkgreen","black","red")),
     title="Graph of the supplementary categories")
```

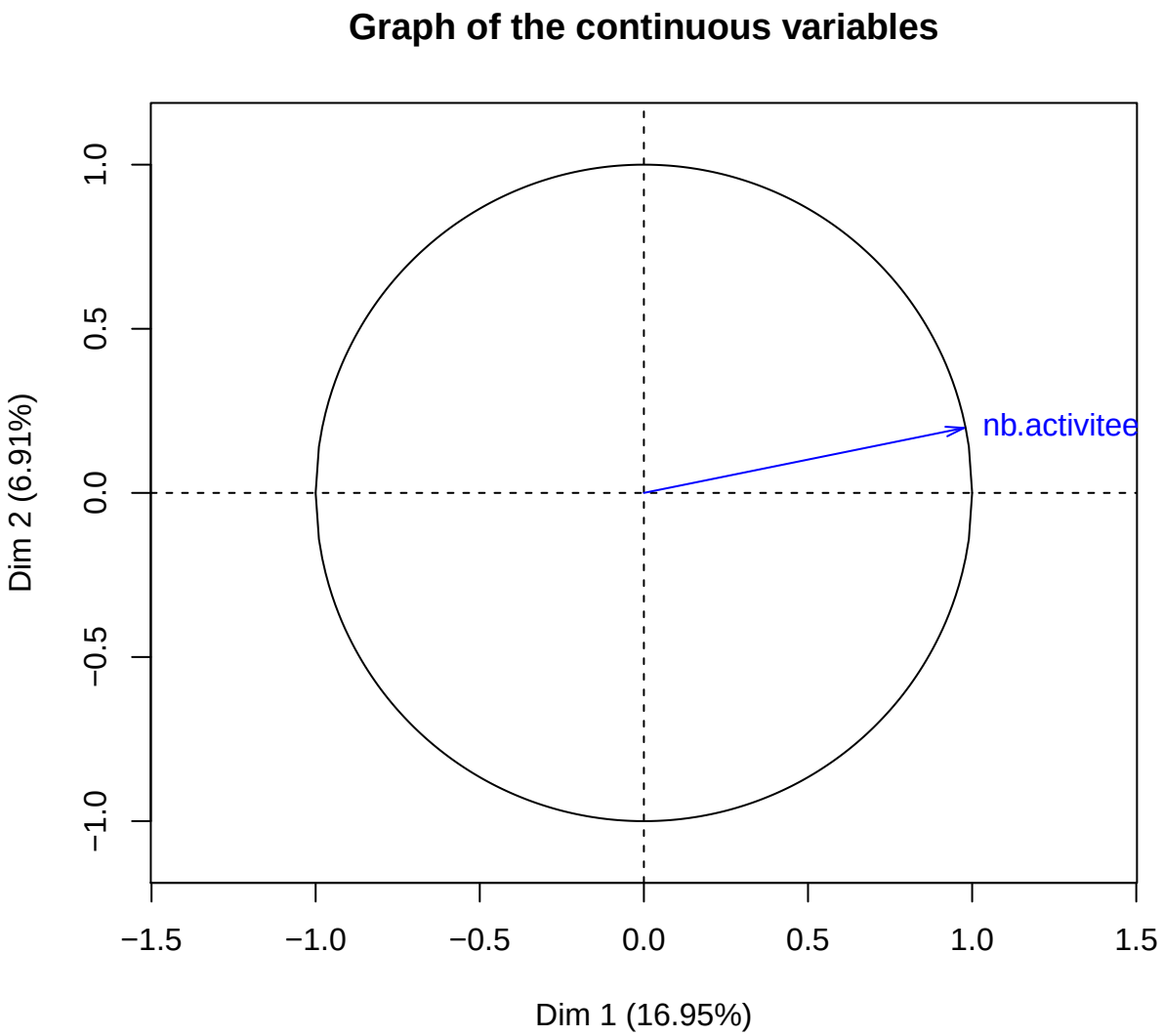


Graphs of the variables

```
plot(res.mca,choix="var",title="Graph of the variables")
```




```
plot(res.mca,choix="quanti.sup",title="Graph of the continuous variables")
```



Description of the dimensions

```
dimdesc(res.mca)
```

```
## $`Dim 1`
## $`Dim 1`$quanti
##                correlation p.value
## nb.activitees    0.9753459       0
##
## $`Dim 1`$quali
##                           R2       p.value
## Reading          0.23851813  0.000000e+00
## Listening.music 0.27548544  0.000000e+00
## Cinema           0.38900068  0.000000e+00
```

```
## Show            0.38335191  0.000000e+00
## Exhibition      0.39878925  0.000000e+00
## Computer        0.32739645  0.000000e+00
## Sport           0.28683998  0.000000e+00
## Walking         0.17212148  0.000000e+00
## Travelling      0.35491399  0.000000e+00
## Playing.music   0.20922813  0.000000e+00
## Mechanic        0.13493609 8.816716e-267
## Cooking         0.12539365 9.423346e-247
## Profession      0.12836813 7.201742e-245
## Volunteering    0.10877078 2.247113e-212
## Age             0.09747901 1.104310e-181
## TV              0.05192240  1.282203e-95
## Gardening       0.04696289  7.138377e-90
## Marital.status  0.04566170  1.135400e-83
## Collecting      0.04356310  2.322542e-83
## Knitting        0.01143504  8.427145e-23
##
## $`Dim 1`$category
##                      Estimate       p.value
## Playing.music_y    0.26839870  0.000000e+00
## Travelling_y       0.27033560  0.000000e+00
## Walking_y          0.18447699  0.000000e+00
## Sport_y            0.24685643  0.000000e+00
## Computer_y         0.26265070  0.000000e+00
## Exhibition_y       0.30388560  0.000000e+00
## Show_y             0.30379833  0.000000e+00
## Cinema_y           0.28307598  0.000000e+00
## Listening.music_y  0.25657041  0.000000e+00
## Reading_y          0.23125560  0.000000e+00
## Mechanic_y         0.16540452 8.816716e-267
## Cooking_y          0.15865273 9.423346e-247
## Volunteering_y     0.20372577 2.247113e-212
## Management         0.29445799 4.929397e-132
## Gardening_y        0.09837170  7.138377e-90
## Collecting_y       0.15293668  2.322542e-83
## Single             0.15105015  1.207987e-54
## [15,25]            0.24528149  2.108266e-30
## (25,35]            0.19984888  6.389909e-26
## Foreman            0.14904669  2.149018e-25
## 1                  0.13159677  3.341439e-25
## 2                  0.09449946  1.114616e-24
## Knitting_y         0.06356668  8.427145e-23
## (35,45]            0.17031375  7.998317e-20
## (55,65]            0.01289136  3.849963e-09
## Technician         0.05991778  6.892575e-04
## Profession.NA     -0.05116908  3.088722e-04
## Married           -0.00169137  1.912935e-07
## 4                 -0.05681694  9.650520e-17
## (85,100]          -0.37013968  4.325646e-21
## Knitting_n        -0.06356668  8.427145e-23
## Manual labourer   -0.18364686  2.978737e-45
## Widower           -0.20369965  7.479622e-48
## (65,75]           -0.11794860  2.179375e-48
```

```
## 0                 -0.19424004  7.701514e-56
## (75,85]           -0.23095998  1.734900e-57
## Unskilled worker  -0.27848868  1.030645e-70
## Collecting_n      -0.15293668  2.322542e-83
## Gardening_n       -0.09837170  7.138377e-90
## Volunteering_n    -0.20372577 2.247113e-212
## Cooking_n         -0.15865273 9.423346e-247
## Mechanic_n        -0.16540452 8.816716e-267
## Playing.music_n   -0.26839870  0.000000e+00
## Travelling_n      -0.27033560  0.000000e+00
## Walking_n         -0.18447699  0.000000e+00
## Sport_n           -0.24685643  0.000000e+00
## Computer_n        -0.26265070  0.000000e+00
## Exhibition_n      -0.30388560  0.000000e+00
## Show_n            -0.30379833  0.000000e+00
## Cinema_n          -0.28307598  0.000000e+00
## Listening.music_n -0.25657041  0.000000e+00
## Reading_n         -0.23125560  0.000000e+00
##
##
## $`Dim 2`
## $`Dim 2`$quanti
##                correlation      p.value
## nb.activitees   0.1980007 4.826398e-75
##
## $`Dim 2`$quali
##                            R2       p.value
## Gardening       0.453046316  0.000000e+00
## Knitting        0.166169732  0.000000e+00
## Mechanic        0.140401965 2.363989e-278
## Cooking         0.135420874 8.354586e-268
## Age             0.133583530 9.125004e-256
## Cinema          0.123401798 1.341384e-242
## Walking         0.106756626 2.977082e-208
## Marital.status  0.098904206 5.042868e-188
## Fishing         0.084751244 8.323766e-164
## Computer        0.058202284 1.463850e-111
## Sport           0.053442000 2.406308e-102
## TV              0.034425908  1.895739e-62
## Show            0.029467916  1.375541e-56
## Collecting      0.025914681  6.803897e-50
## Listening.music 0.024006349  2.627936e-46
## Profession      0.017395750  1.450270e-28
## Volunteering    0.009426749  4.666146e-19
## Playing.music   0.005420573  1.407100e-11
## Sex             0.002152884  2.090738e-05
## Reading         0.001260776  1.132204e-03
##
## $`Dim 2`$category
##                       Estimate       p.value
## Knitting_y         0.154764175  0.000000e+00
## Gardening_y        0.195140682  0.000000e+00
## Mechanic_y         0.107759030 2.363989e-278
## Cooking_y          0.105301934 8.354586e-268
```

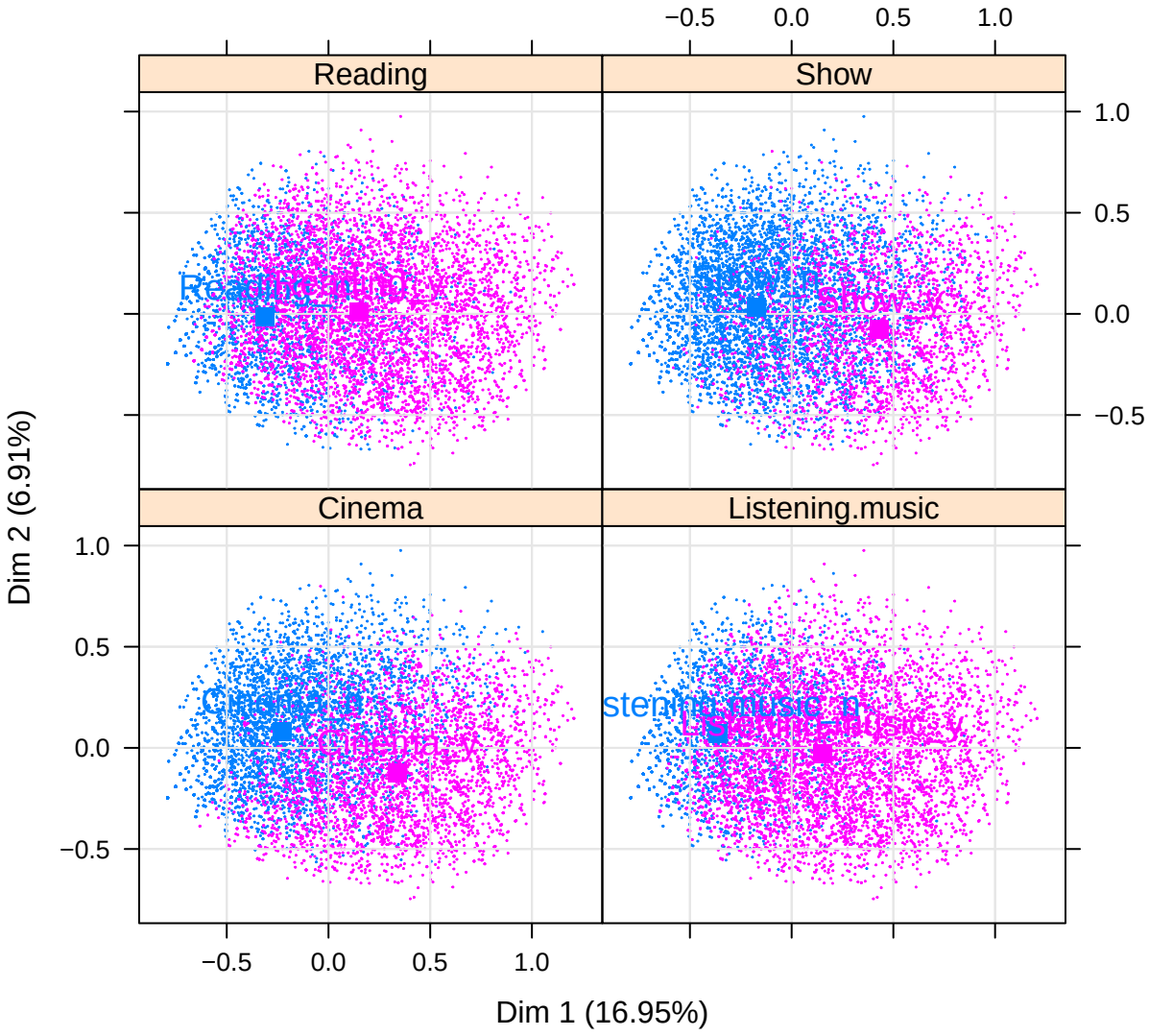
```
## Cinema_n           0.101829204 1.341384e-242
## Walking_y          0.092790996 2.977082e-208
## Fishing_y          0.130842880 8.323766e-164
## Computer_n         0.070728647 1.463850e-111
## Sport_n            0.068053382 2.406308e-102
## Married            0.058392178  7.920392e-93
## Show_n             0.053795386  1.375541e-56
## Collecting_y       0.075337113  6.803897e-50
## (55,65]            0.122588737  7.341769e-49
## Listening.music_n  0.048373115  2.627936e-46
## 3                  0.082847534  1.990737e-33
## (45,55]            0.075130020  4.614026e-25
## (65,75]            0.100358876  9.566953e-23
## Volunteering_y     0.038304920  4.666146e-19
## Manual labourer    0.062446063  2.315841e-16
## Playing.music_n    0.027591591  1.407100e-11
## Widower            0.059301096  7.755244e-10
## 2                  0.039534257  6.282529e-08
## F                  0.013241401  2.090738e-05
## Remarried          0.048925026  2.061549e-04
## Unskilled worker   0.031284323  7.973605e-04
## Reading_y          0.010738269  1.132204e-03
## (75,85]            0.043334701  2.283013e-02
## (85,100]          -0.046130519  4.698967e-02
## Reading_n         -0.010738269  1.132204e-03
## 4                 -0.007916798  2.354582e-04
## M                 -0.013241401  2.090738e-05
## 1                 -0.027119018  3.688650e-07
## Management        -0.053914699  9.259268e-11
## Playing.music_y   -0.027591591  1.407100e-11
## Profession.NA     -0.046307708  8.336614e-12
## Volunteering_n    -0.038304920  4.666146e-19
## 0                 -0.087345976  2.743645e-32
## (25,35]           -0.074668353  2.201473e-35
## Listening.music_y -0.048373115  2.627936e-46
## Collecting_n      -0.075337113  6.803897e-50
## Show_y            -0.053795386  1.375541e-56
## Sport_y           -0.068053382 2.406308e-102
## Computer_y        -0.070728647 1.463850e-111
## [15,25]           -0.229609518 1.782463e-162
## Fishing_n         -0.130842880 8.323766e-164
## Single            -0.150611195 6.342662e-181
## Walking_n         -0.092790996 2.977082e-208
## Cinema_y          -0.101829204 1.341384e-242
## Cooking_n         -0.105301934 8.354586e-268
## Mechanic_n        -0.107759030 2.363989e-278
## Knitting_n        -0.154764175  0.000000e+00
## Gardening_n       -0.195140682  0.000000e+00
##
##
## $`Dim 3`
## $`Dim 3`$quali
##                           R2       p.value
## Mechanic        0.209469073  0.000000e+00
```

```
## Knitting        0.326760742  0.000000e+00
## Fishing         0.331040836  0.000000e+00
## Sex             0.256598886  0.000000e+00
## Reading         0.103546767 1.057035e-201
## TV              0.075506229 2.154507e-141
## Cooking         0.068174772 5.148288e-131
## Sport           0.062202668 2.431680e-119
## Profession      0.062120420 4.080525e-112
## Computer        0.041225998  6.762202e-79
## Age             0.037096503  1.135166e-64
## Gardening       0.030314206  3.475006e-58
## Marital.status  0.030381795  7.010460e-55
## Listening.music 0.022109556  9.532570e-43
## Exhibition      0.012834600  2.072824e-25
## Volunteering    0.003760979  1.842666e-08
## Cinema          0.003011654  4.812422e-07
## Show            0.002498472  4.557774e-06
## Playing.music   0.002317306  1.011746e-05
## Walking         0.001577370  2.709621e-04
##
## $`Dim 3`$category
##                       Estimate       p.value
## M                   0.136610232  0.000000e+00
## Fishing_y           0.244371238  0.000000e+00
## Knitting_n          0.205088669  0.000000e+00
## Mechanic_y          0.124382502  0.000000e+00
## Reading_n           0.091963576 1.057035e-201
## Cooking_n           0.070605355 5.148288e-131
## Sport_y             0.069381729 2.431680e-119
## Computer_y          0.056252675  6.762202e-79
## Gardening_y         0.047701482  3.475006e-58
## Listening.music_n   0.043869558  9.532570e-43
## Manual labourer     0.074927886  2.425621e-41
## 2                   0.051269543  9.688900e-39
## 0                   0.074320988  7.695837e-29
## Exhibition_n        0.032903764  2.072824e-25
## Technician          0.106451165  3.134871e-23
## 1                   0.046966483  1.721087e-17
## [15,25]             0.089295409  2.250144e-13
## (35,45]             0.068211010  6.999672e-13
## Single              0.054243734  1.428671e-10
## Volunteering_y      0.022864214  1.842666e-08
## Cinema_y            0.015033026  4.812422e-07
## Management          0.014062563  1.621277e-06
## (25,35]             0.057570669  3.068950e-06
## Show_n              0.014802663  4.557774e-06
## Foreman             0.018757669  9.818621e-06
## Playing.music_n     0.017048181  1.011746e-05
## Married             0.034417811  1.547920e-05
## Walking_n           0.010658779  2.709621e-04
## Divorcee           -0.010341038  3.409293e-04
## Walking_y          -0.010658779  2.709621e-04
## (55,65]            -0.005079741  1.038252e-05
## Playing.music_y    -0.017048181  1.011746e-05
```

```
## (85,100]          -0.102325499  9.780901e-06
## Show_y            -0.014802663  4.557774e-06
## Cinema_n          -0.015033026  4.812422e-07
## Volunteering_n    -0.022864214  1.842666e-08
## 3                 -0.065496551  2.227645e-20
## (75,85]           -0.085282226  7.049703e-21
## (65,75]           -0.054868462  1.460573e-22
## Exhibition_y      -0.032903764  2.072824e-25
## Listening.music_y -0.043869558  9.532570e-43
## Widower           -0.118694340  9.651417e-51
## Gardening_n       -0.047701482  3.475006e-58
## Employee          -0.103790767  1.329776e-75
## Computer_n        -0.056252675  6.762202e-79
## 4                 -0.107060462  1.674088e-84
## Sport_n           -0.069381729 2.431680e-119
## Cooking_y         -0.070605355 5.148288e-131
## Reading_y         -0.091963576 1.057035e-201
## F                 -0.136610232  0.000000e+00
## Fishing_n         -0.244371238  0.000000e+00
## Knitting_y        -0.205088669  0.000000e+00
## Mechanic_n        -0.124382502  0.000000e+00
```

Confidence ellipses around the categories for the first 4 variables

```
plotellipses(res.mca, cex=0.2, magnify=12, keepvar=1:4)
```


Reading
Show
Cinema
Listening.music
Dim 1 (16.95%)
Dim 2 (6.91%)
−0.5
0.0
0.5
1.0