Analyse Factorielle Multiple (AFM) avec FactoMineR sur la description sensorielle de vins

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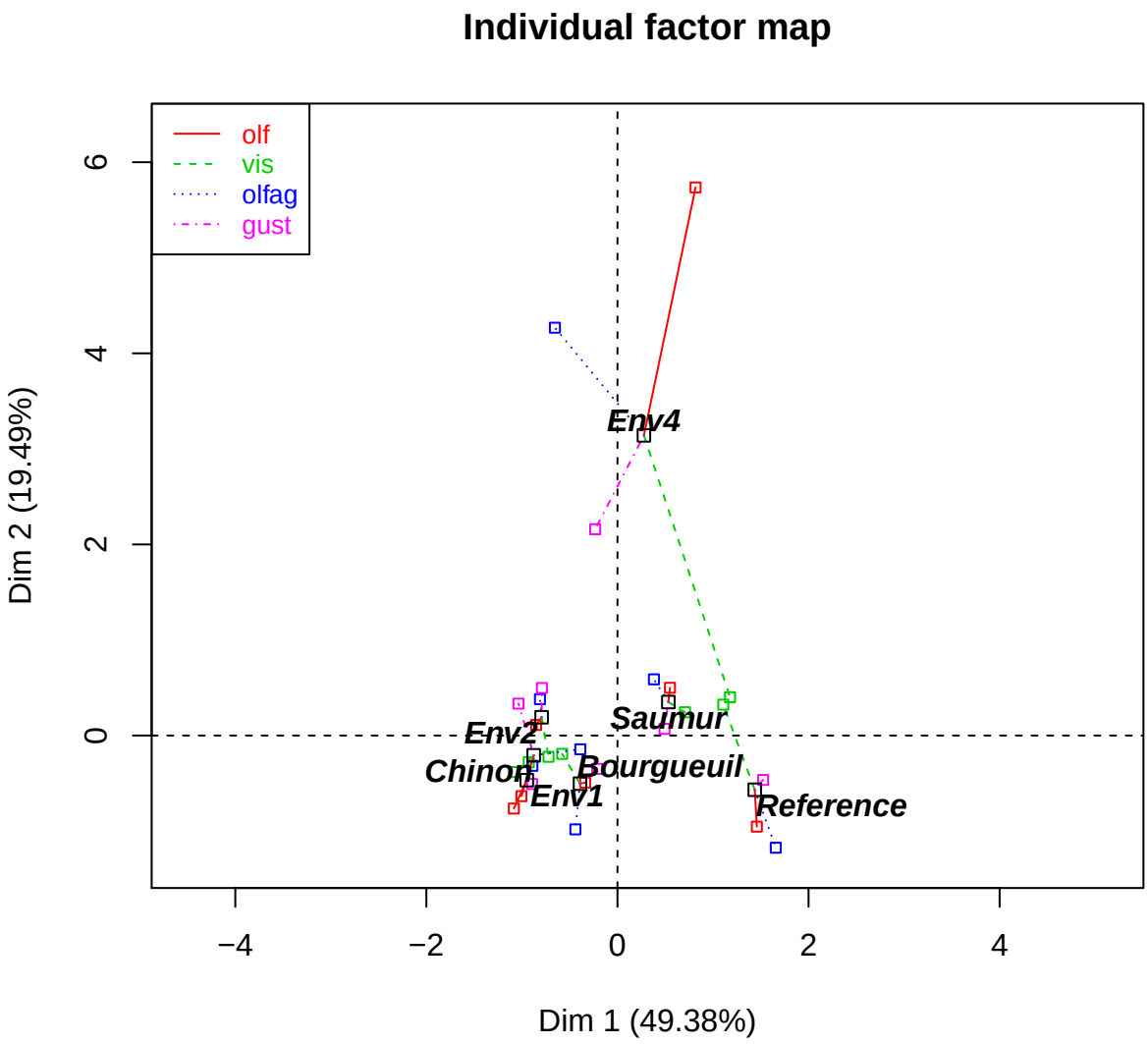
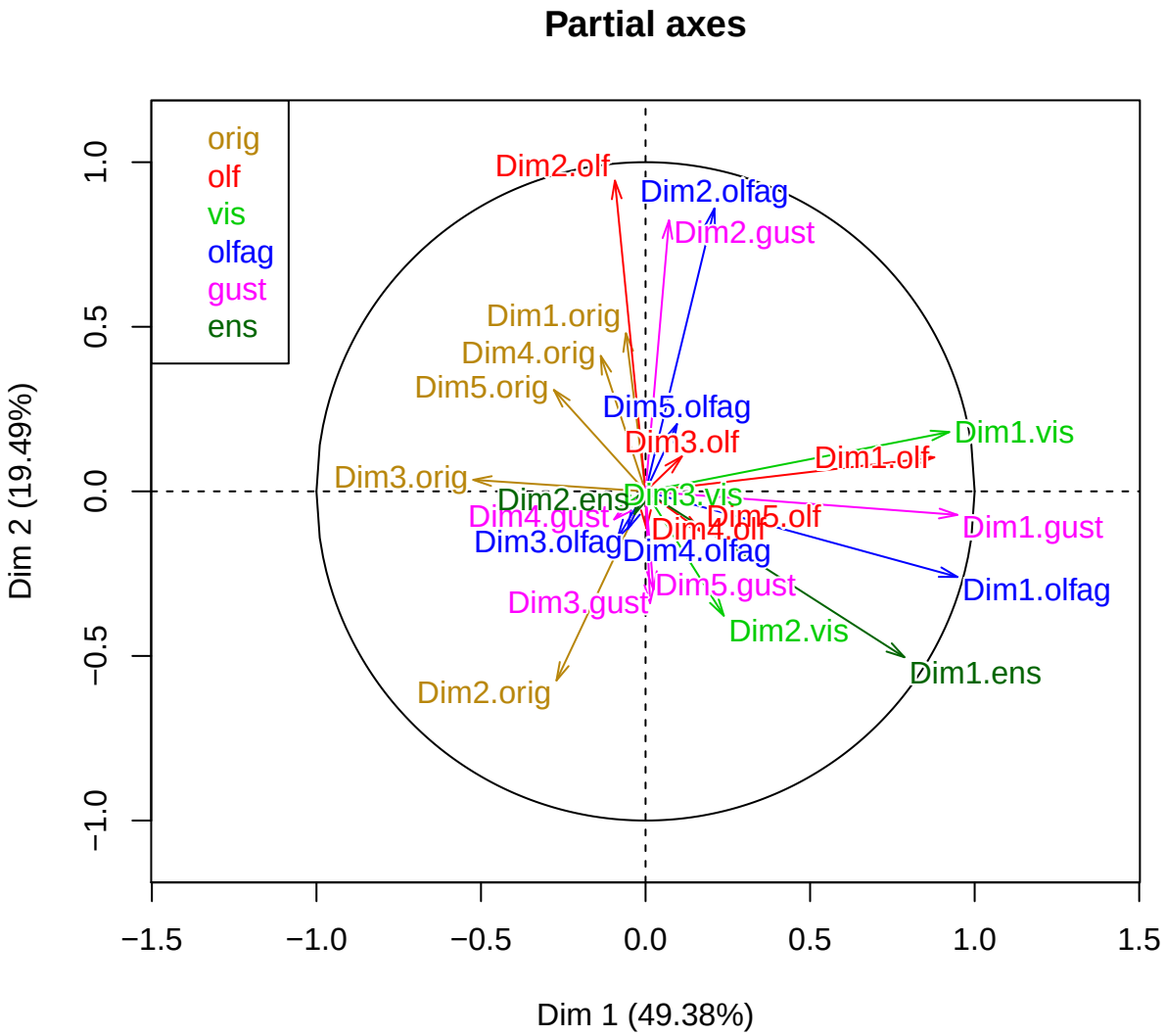
Chargement de FactoMineR

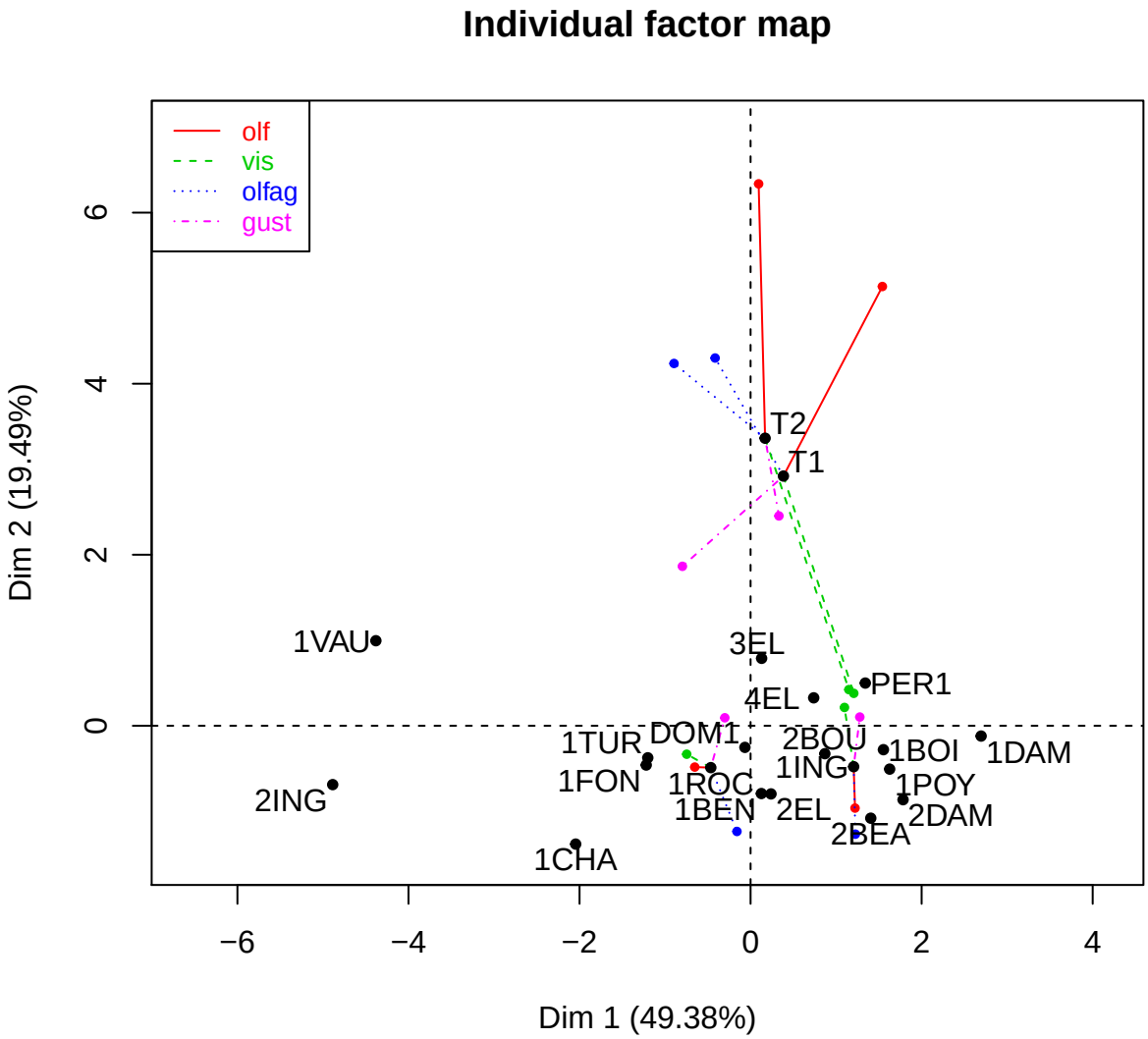
```
library(FactoMineR)
data(wine)
```

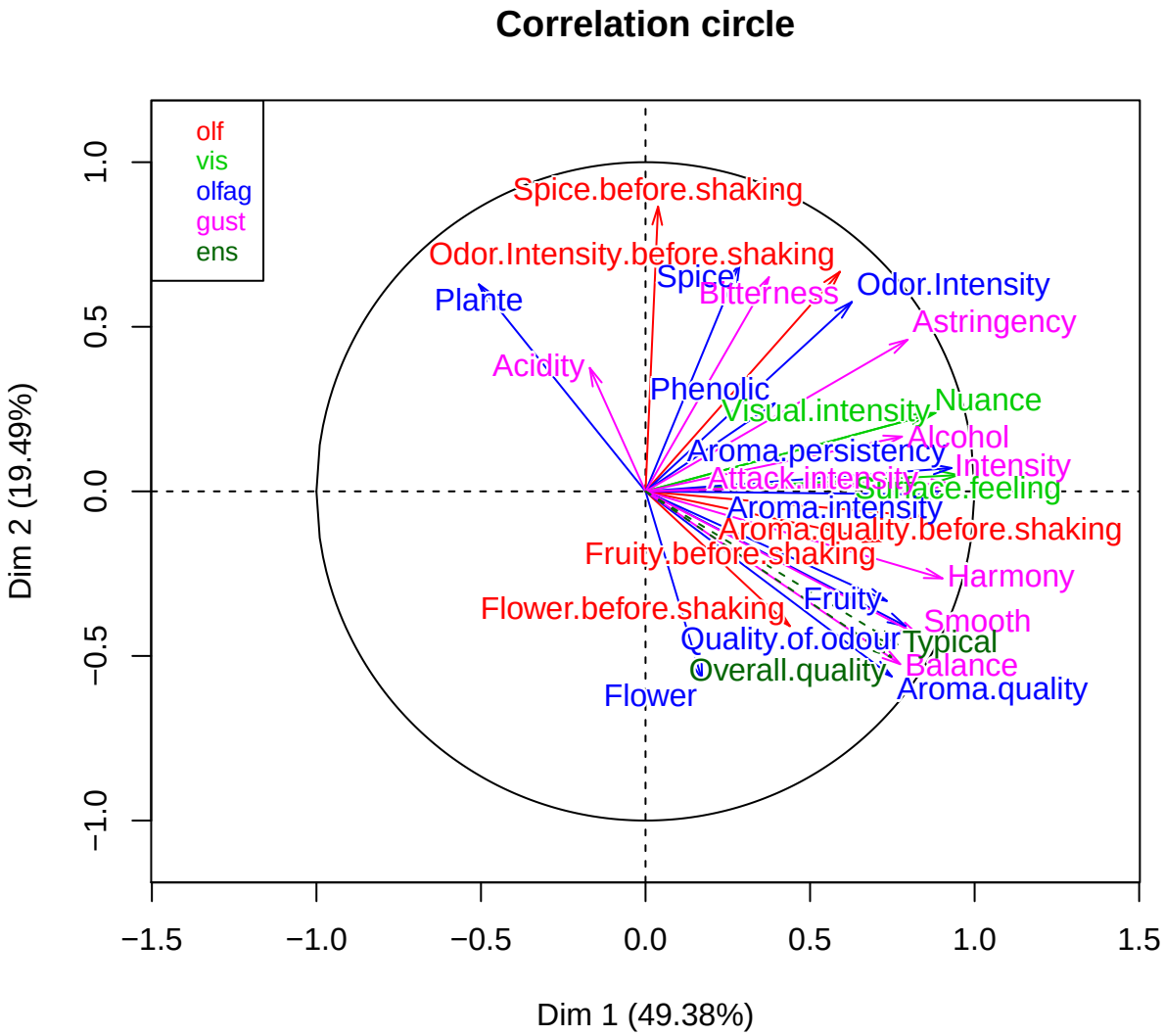
L'AFM

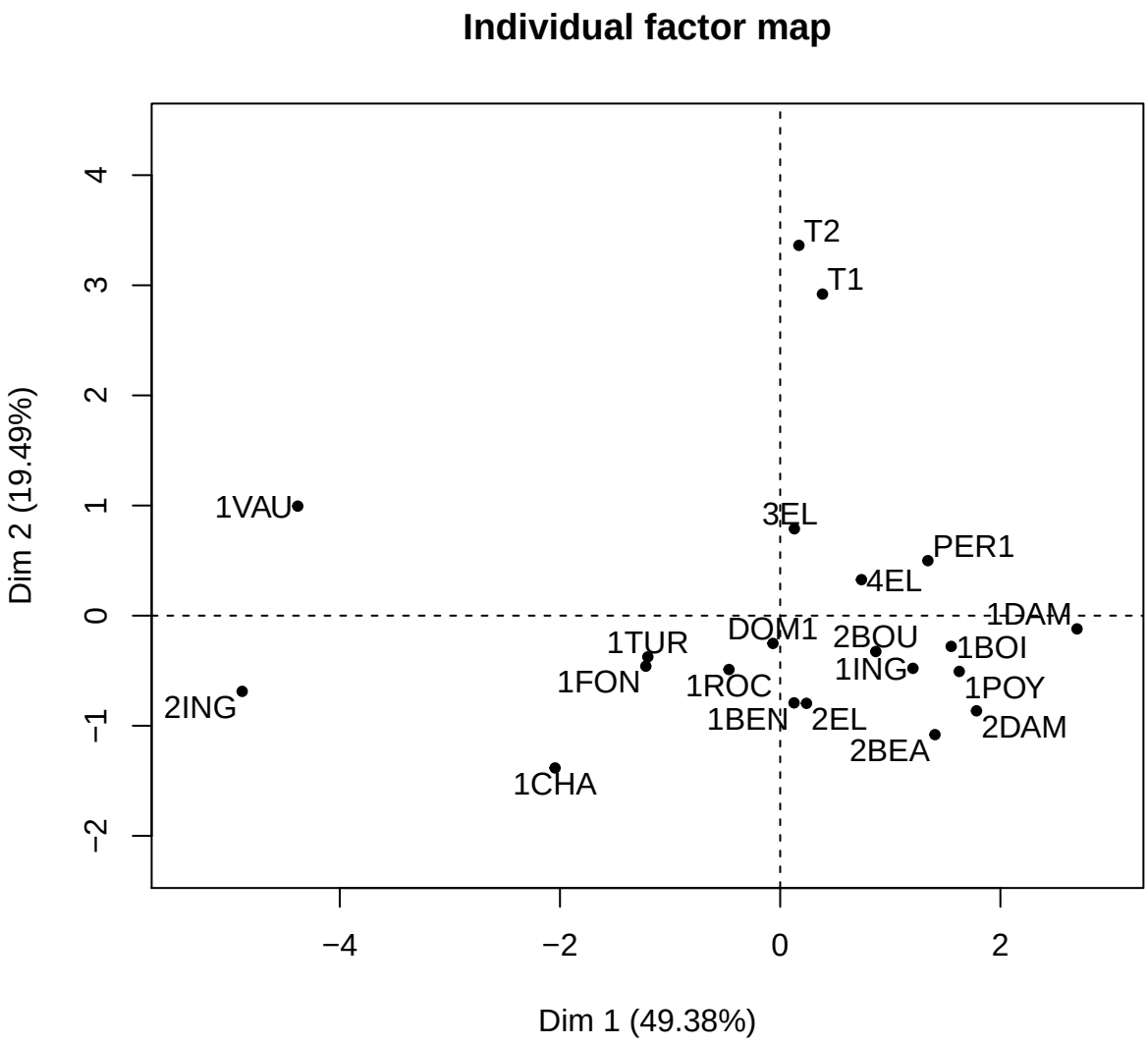
```
res <- MFA(wine, group=c(2,5,3,10,9,2), type=c("n",rep("s",5)),
    ncp=5, name.group=c("orig","olf","vis","olfag","gust","ens"),
    num.group.sup=c(1,6))
```

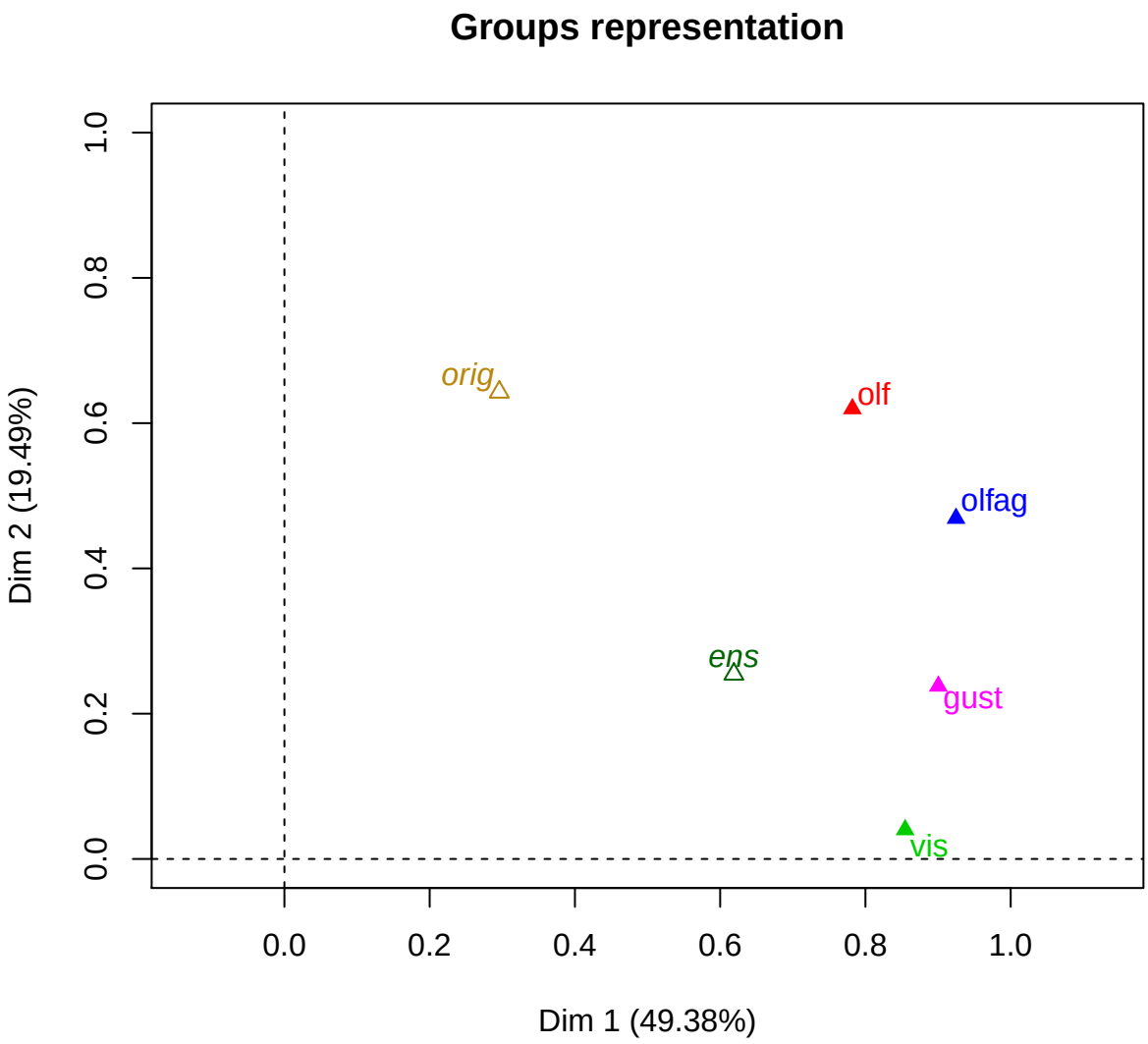

Individual factor map
olf
vis
olfag
gust
Env4
Saumur
Env2
Chinon
Bourgueuil
Env1
Reference
Dim 2 (19.49%)
Dim 1 (49.38%)
6
4
2
0
−4
−2
0
2
4


Partial axes
orig
olf
vis
olfag
gust
ens
Dim2.olf
Dim2.olfag
Dim2.gust
Dim1.orig
Dim4.orig
Dim5.orig
Dim5.olfag
Dim3.olf
Dim1.vis
Dim1.olf
Dim3.orig
Dim2.ens
Dim3.vis
Dim4.gust
Dim5.olf
Dim4.olf
Dim1.gust
Dim3.olfag
Dim4.olfag
Dim1.olfag
Dim5.gust
Dim3.gust
Dim2.vis
Dim1.ens
Dim2.orig
Dim 2 (19.49%)
Dim 1 (49.38%)
1.0
0.5
0.0
−0.5
−1.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5


Individual factor map
olf
vis
olfag
gust
T2
T1
1VAU
3EL
PER1
4EL
DOM1
1TUR
2BOU
1BOI
1DAM
1ING
1FON
1ROC
1POY
2ING
1BEN
2EL
2DAM
2BEA
1CHA
Dim 2 (19.49%)
Dim 1 (49.38%)
6
4
2
0
−6
−4
−2
0
2
4


Correlation circle
olf
vis
olfag
gust
ens
Spice.before.shaking
Odor.Intensity.before.shaking
Spice
Bitterness
Odor.Intensity
Plante
Astringency
Acidity
Phenolic
Visual.intensity
Nuance
Alcohol
Aroma.persistency
Intensity
Attack.intensity
Surface.feeling
Aroma.intensity
Aroma.quality.before.shaking
Fruity.before.shaking
Harmony
Fruity
Flower.before.shaking
Smooth
Quality.of.odour
Typical
Balance
Overall.quality
Aroma.quality
Flower
Dim 2 (19.49%)
Dim 1 (49.38%)
1.0
0.5
0.0
−0.5
−1.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5


Individual factor map
Dim 2 (19.49%)
Dim 1 (49.38%)
T2
T1
1VAU
3EL
PER1
4EL
1DAM
DOM1
2BOU
1BOI
1TUR
1ING
1FON
1ROC
1POY
2ING
1BEN
2EL
2DAM
2BEA
1CHA



Résumé des résultats

On peut obtenir un résumé des principaux résultats en utilisant la fonction `summary`.

```
summary(res)
```

Nous demandons ici à avoir les résultats sur les 2 premières dimensions pour éviter d'avoir des tableaux trop grands (par défaut, la fonction retourne les résultats des 3 premières dimensions).

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

```
##
## Call:
## MFA(base = wine, group = c(2, 5, 3, 10, 9, 2), type = c("n",
```

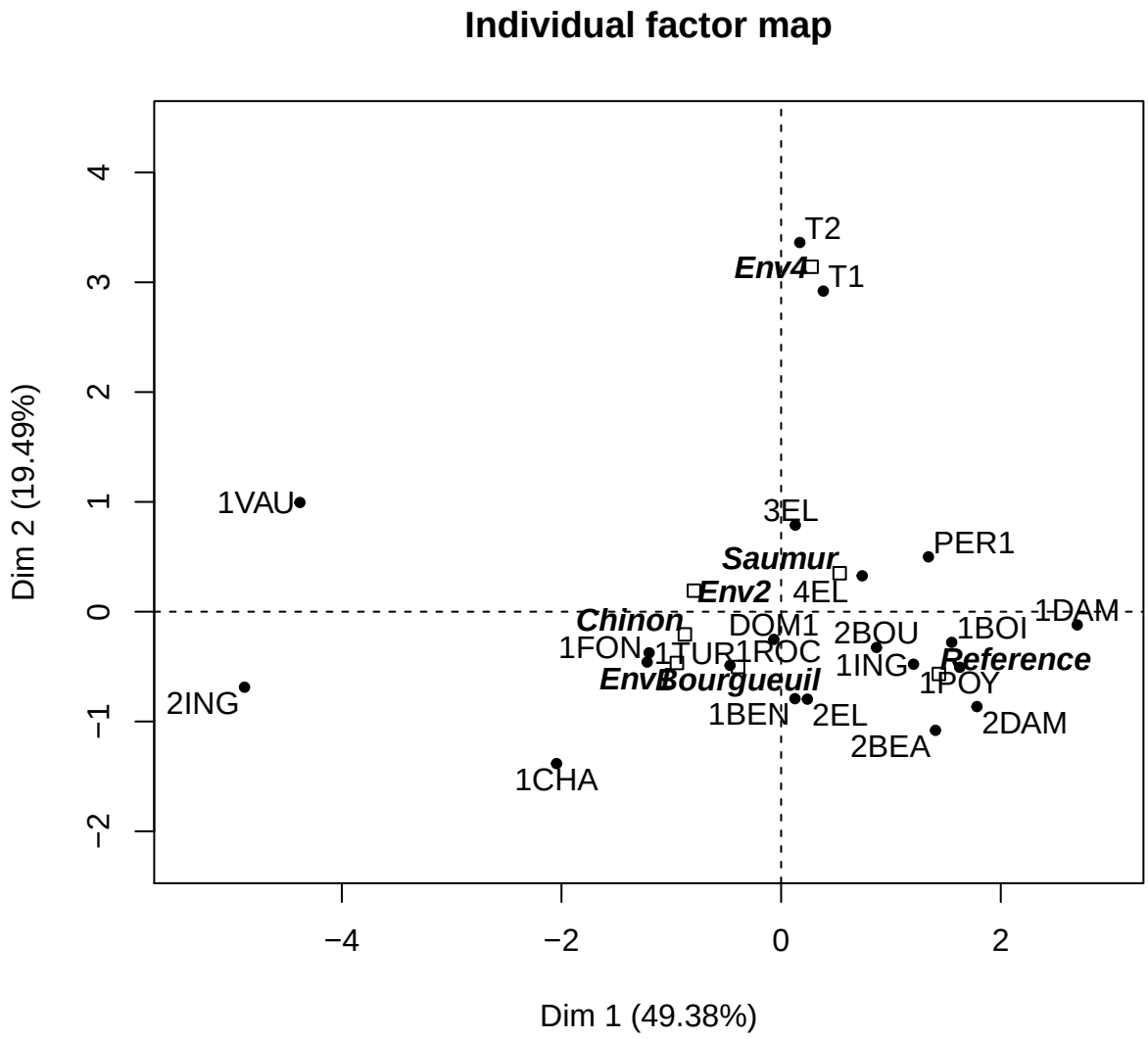
```
##      rep("s", 5)), ncp = 5, name.group = c("orig", "olf", "vis",
##      "olfag", "gust", "ens"), num.group.sup = c(1, 6))
##
##
## Eigenvalues
##                        Dim.1   Dim.2   Dim.3   Dim.4   Dim.5   Dim.6
## Variance               3.462   1.367   0.615   0.372   0.270   0.202
## % of var.             49.378  19.494   8.778   5.309   3.857   2.887
## Cumulative % of var.  49.378  68.873  77.651  82.960  86.816  89.703
##                        Dim.7   Dim.8   Dim.9  Dim.10  Dim.11  Dim.12
## Variance               0.176   0.126   0.105   0.079   0.074   0.060
## % of var.              2.506   1.796   1.502   1.124   1.054   0.861
## Cumulative % of var.  92.209  94.005  95.506  96.630  97.684  98.545
##                       Dim.13  Dim.14  Dim.15  Dim.16  Dim.17  Dim.18
## Variance               0.029   0.022   0.019   0.011   0.009   0.006
## % of var.              0.409   0.313   0.273   0.156   0.131   0.091
## Cumulative % of var.  98.954  99.268  99.541  99.697  99.827  99.918
##                       Dim.19  Dim.20
## Variance               0.003   0.002
## % of var.              0.047   0.035
## Cumulative % of var.  99.965 100.000
##
## Groups
##                              Dim.1    ctr   cos2    Dim.2    ctr
## olf                        |  0.782 22.591  0.380 |  0.620 45.346
## vis                        |  0.855 24.688  0.728 |  0.040  2.937
## olfag                      |  0.925 26.712  0.625 |  0.469 34.309
## gust                       |  0.900 26.009  0.722 |  0.238 17.408
##                              cos2
## olf                        0.239 |
## vis                        0.002 |
## olfag                      0.161 |
## gust                       0.050 |
##
## Supplementary groups
##                              Dim.1  cos2   Dim.2  cos2
## orig                       | 0.296 0.033 | 0.643 0.156 |
## ens                        | 0.619 0.380 | 0.254 0.064 |
##
## Individuals (the 10 first)
##                              Dim.1    ctr   cos2    Dim.2    ctr
## 2EL                        |  0.239  0.078  0.009 | -0.797  2.211
## 1CHA                       | -2.045  5.751  0.257 | -1.383  6.667
## 1FON                       | -1.220  2.048  0.187 | -0.459  0.734
## 1VAU                       | -4.381 26.404  0.426 |  0.995  3.446
## 1DAM                       |  2.696  9.996  0.462 | -0.120  0.050
## 2BOU                       |  0.869  1.038  0.116 | -0.326  0.371
## 1BOI                       |  1.553  3.318  0.294 | -0.280  0.272
## 3EL                        |  0.129  0.023  0.001 |  0.789  2.167
## DOM1                       | -0.066  0.006  0.001 | -0.253  0.222
## 1TUR                       | -1.202  1.987  0.184 | -0.375  0.489
##                              cos2
## 2EL                        0.098 |
## 1CHA                       0.118 |
```

```
## 1FON                            0.026 |
## 1VAU                            0.022 |
## 1DAM                            0.001 |
## 2BOU                            0.016 |
## 1BOI                            0.010 |
## 3EL                             0.052 |
## DOM1                            0.017 |
## 1TUR                            0.018 |
##
## Continuous variables (the 10 first)
##                                    Dim.1    ctr   cos2    Dim.2    ctr
## Odor.Intensity.before.shaking |  0.591  4.497  0.349 |  0.667 14.530
## Aroma.quality.before.shaking  |  0.835  8.989  0.698 | -0.075  0.186
## Fruity.before.shaking         |  0.716  6.606  0.513 | -0.151  0.741
## Flower.before.shaking         |  0.439  2.480  0.192 | -0.409  5.469
## Spice.before.shaking          |  0.038  0.019  0.001 |  0.865 24.420
## Visual.intensity              |  0.881  7.912  0.776 |  0.238  1.466
## Nuance                        |  0.862  7.577  0.744 |  0.234  1.408
## Surface.feeling               |  0.950  9.198  0.903 |  0.049  0.063
## Odor.Intensity                |  0.627  2.416  0.393 |  0.576  5.155
## Quality.of.odour              |  0.791  3.844  0.626 | -0.410  2.612
##                                  cos2
## Odor.Intensity.before.shaking  0.445 |
## Aroma.quality.before.shaking   0.006 |
## Fruity.before.shaking          0.023 |
## Flower.before.shaking          0.168 |
## Spice.before.shaking           0.748 |
## Visual.intensity               0.057 |
## Nuance                         0.055 |
## Surface.feeling                0.002 |
## Odor.Intensity                 0.331 |
## Quality.of.odour               0.168 |
##
## Supplementary continuous variables
##                                    Dim.1   cos2    Dim.2   cos2
## Overall.quality               |  0.747  0.558 | -0.504  0.254 |
## Typical                       |  0.766  0.586 | -0.466  0.217 |
##
## Supplementary categories
##                                    Dim.1   cos2 v.test    Dim.2   cos2
## Saumur                        |  0.533  0.483  1.343 |  0.350  0.209
## Bourgueuil                    | -0.392  0.176 -0.596 | -0.504  0.291
## Chinon                        | -0.877  0.537 -1.022 | -0.207  0.030
## Reference                     |  1.437  0.823  2.442 | -0.567  0.128
## Env1                          | -0.949  0.614 -1.613 | -0.467  0.149
## Env2                          | -0.794  0.554 -1.067 |  0.191  0.032
## Env4                          |  0.277  0.008  0.216 |  3.141  0.971
##                                 v.test
## Saumur                           1.405 |
## Bourgueuil                      -1.219 |
## Chinon                          -0.384 |
## Reference                       -1.534 |
## Env1                            -1.263 |
## Env2                             0.409 |
```

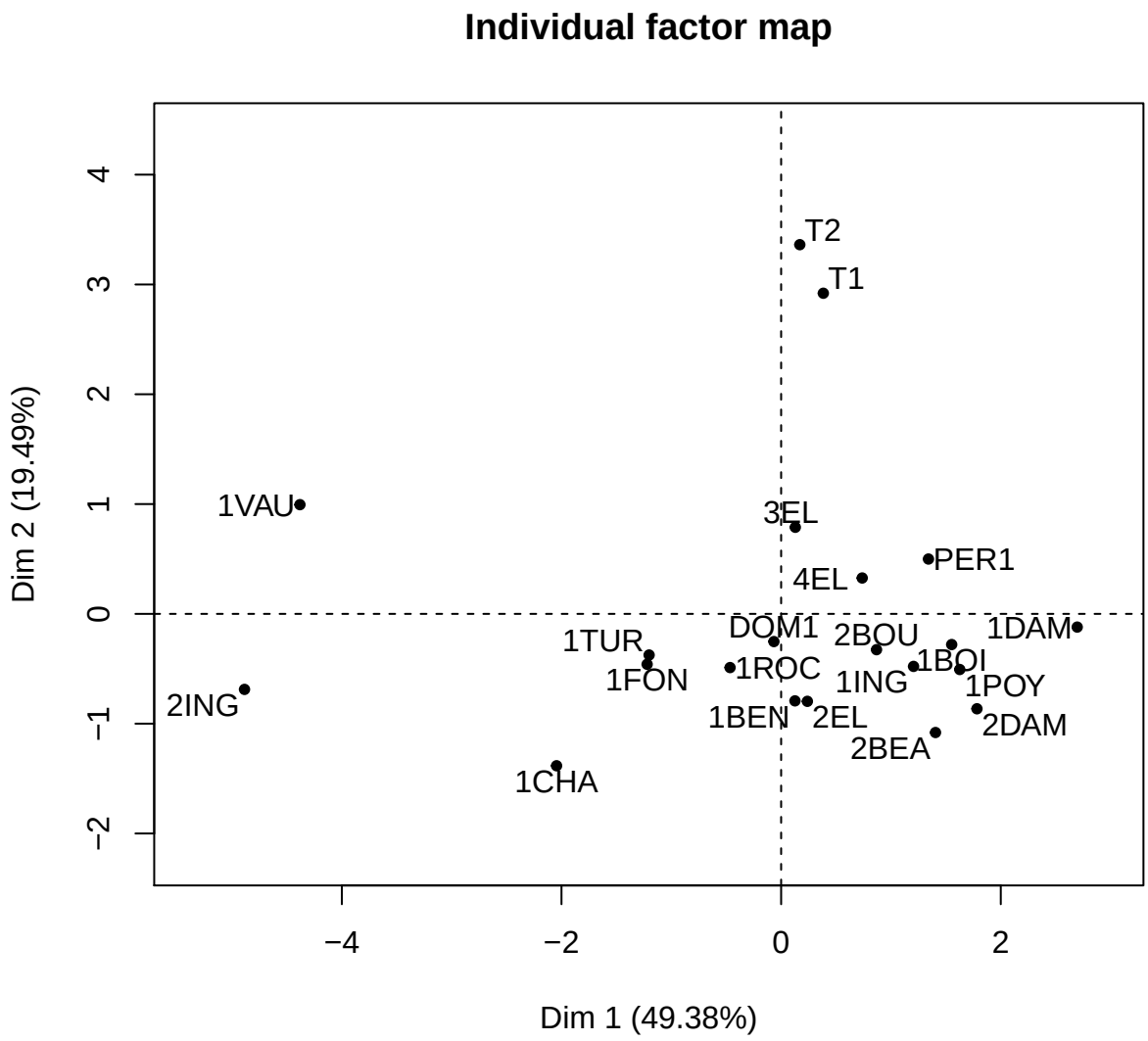
```
## Env4                          3.899 |
```

Graphe des individus et des modalités

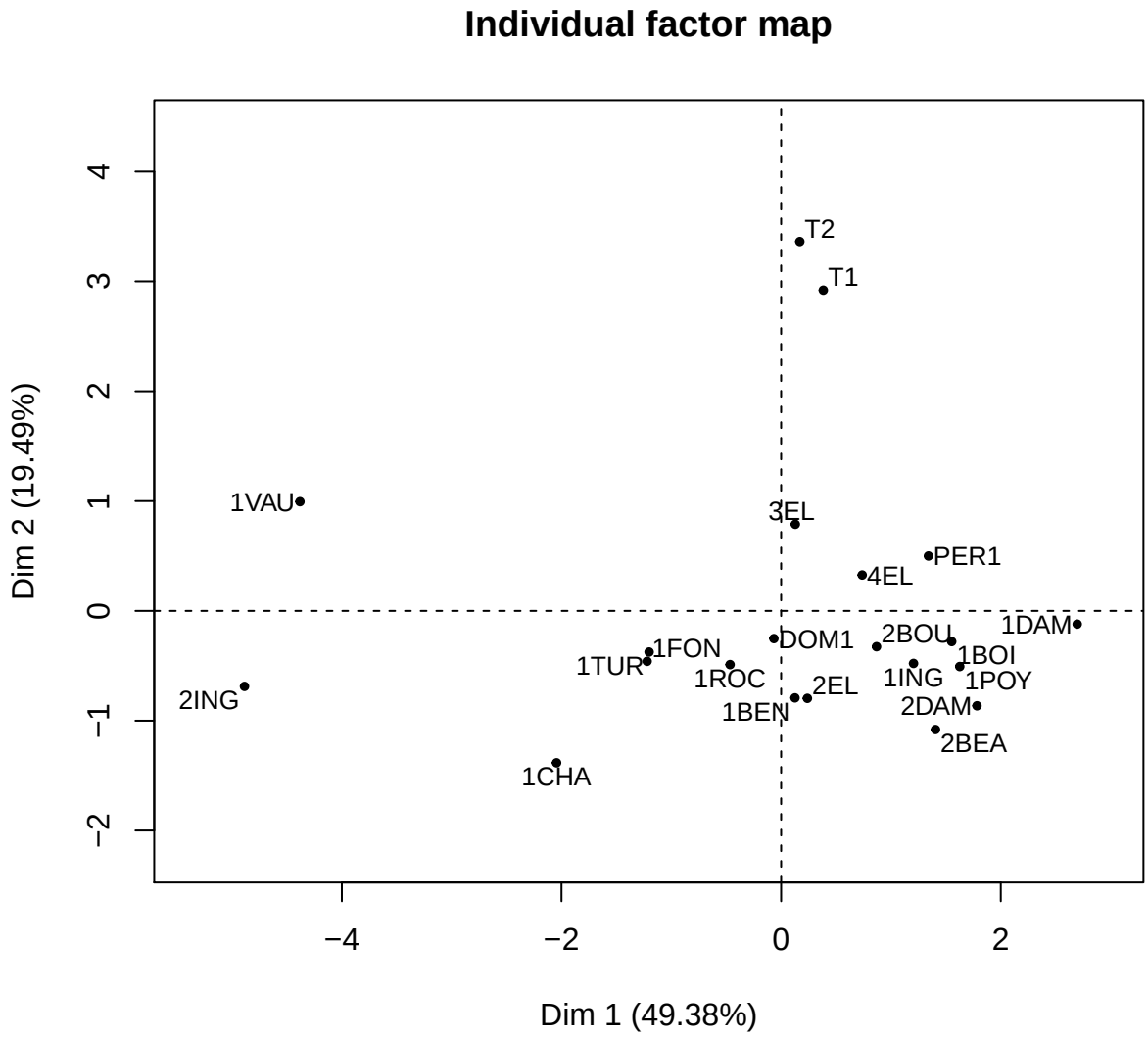
```
plot(res)
```



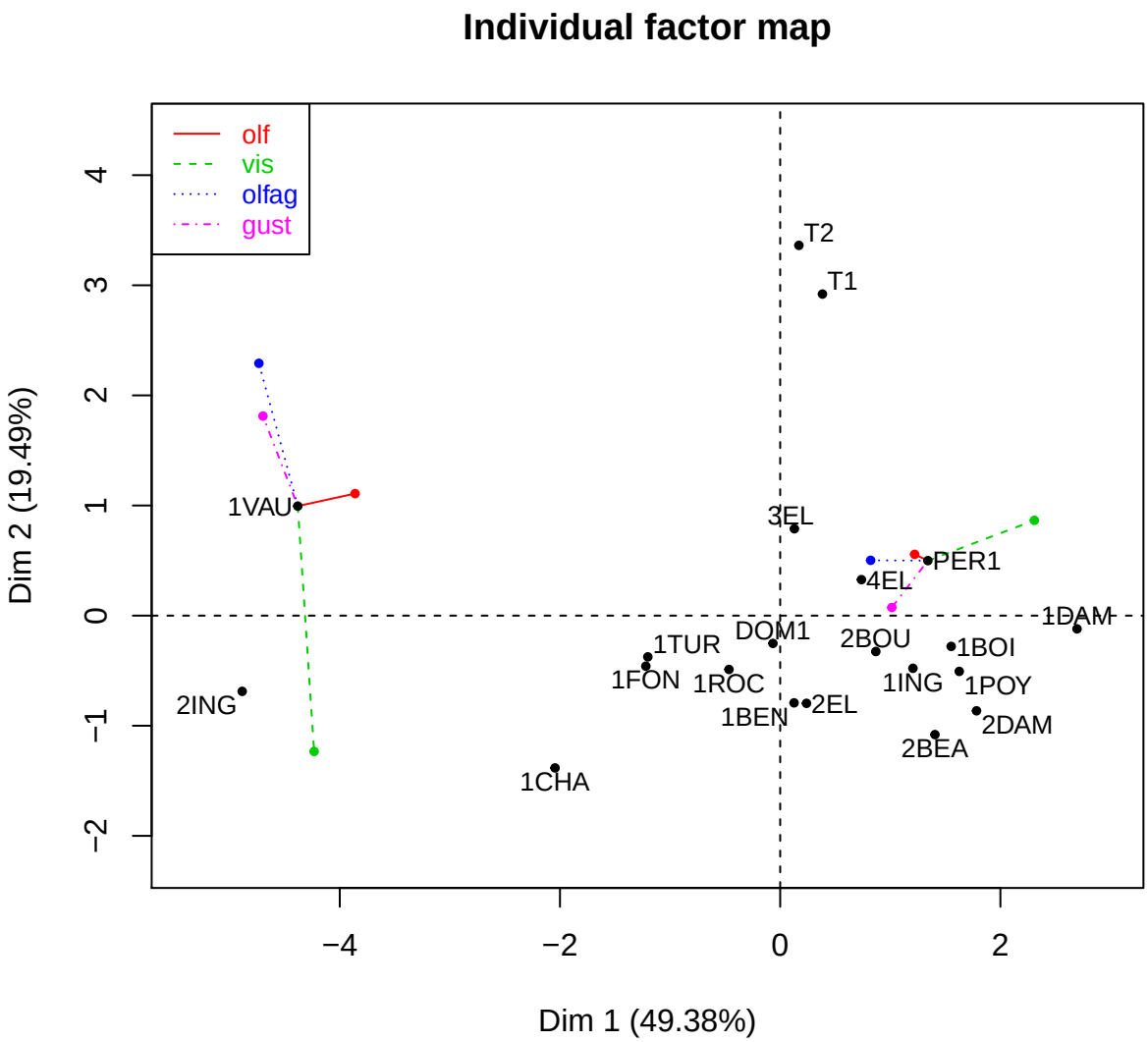

```
plot(res, invisible="quali")
```




```
plot(res, invisible="quali", cex=0.8)
```

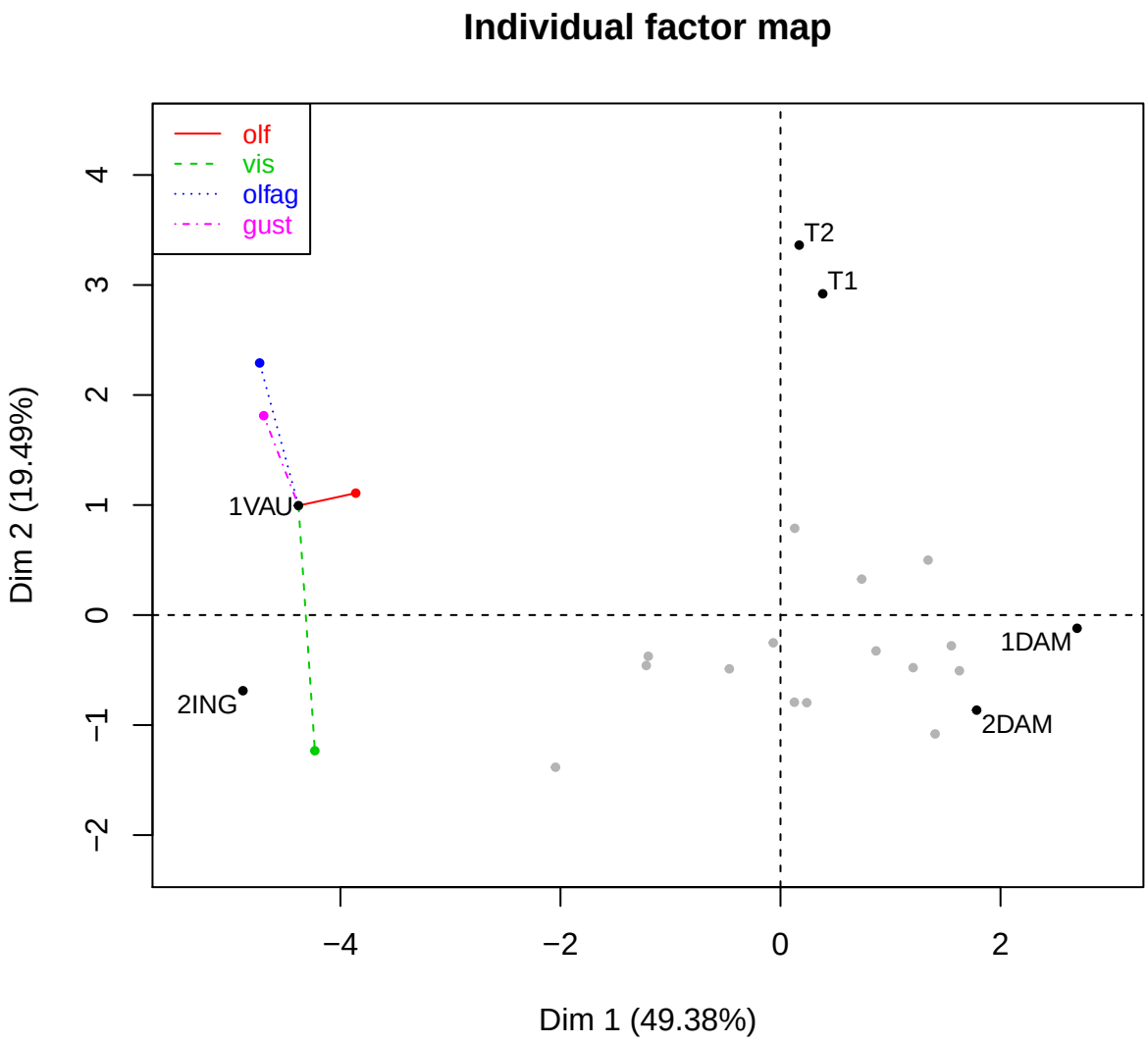



```
plot(res, invisible="quali", cex=0.8, partial=c("1VAU","PER1"))
```

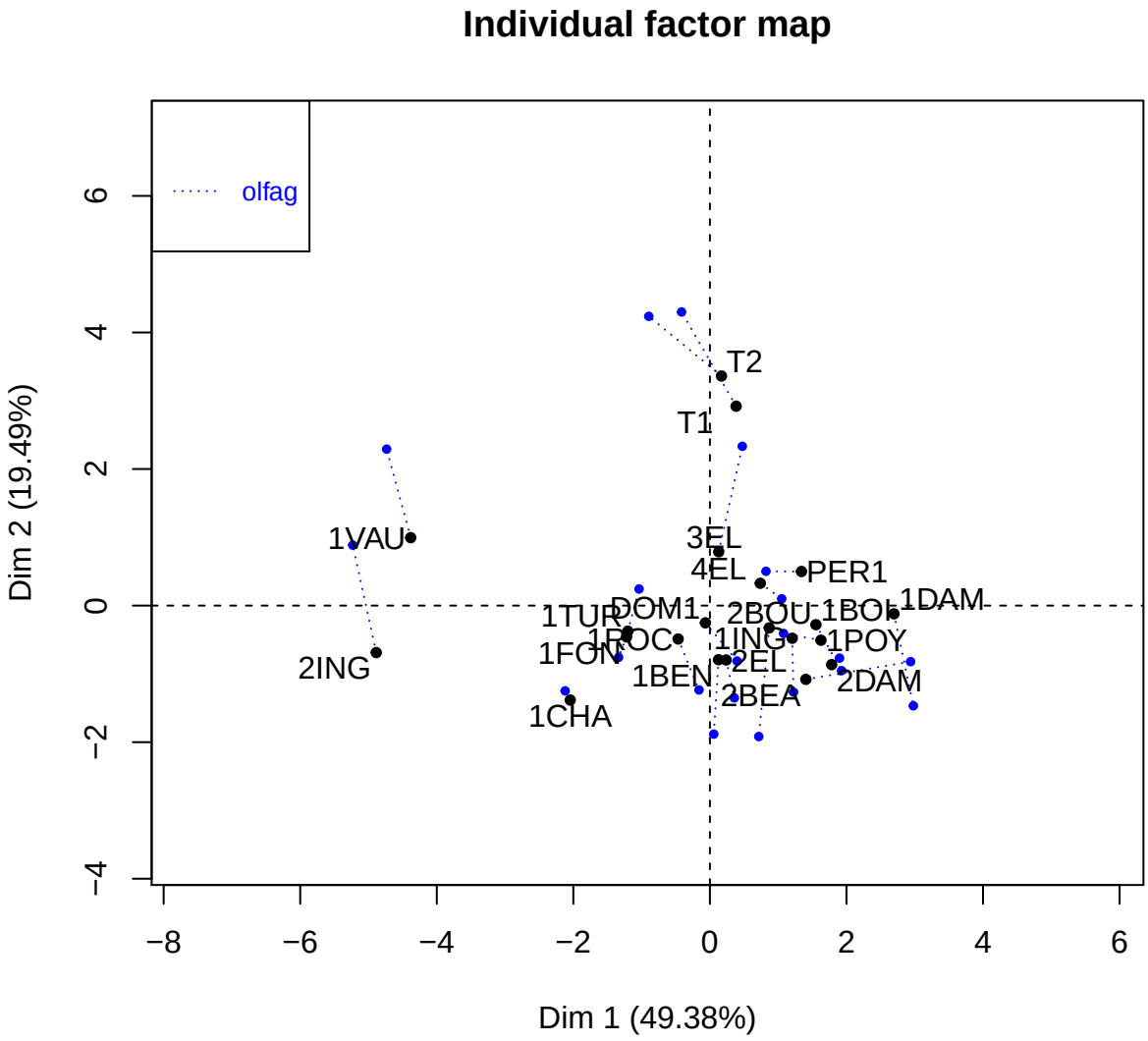


Graphe des individus avec sélection

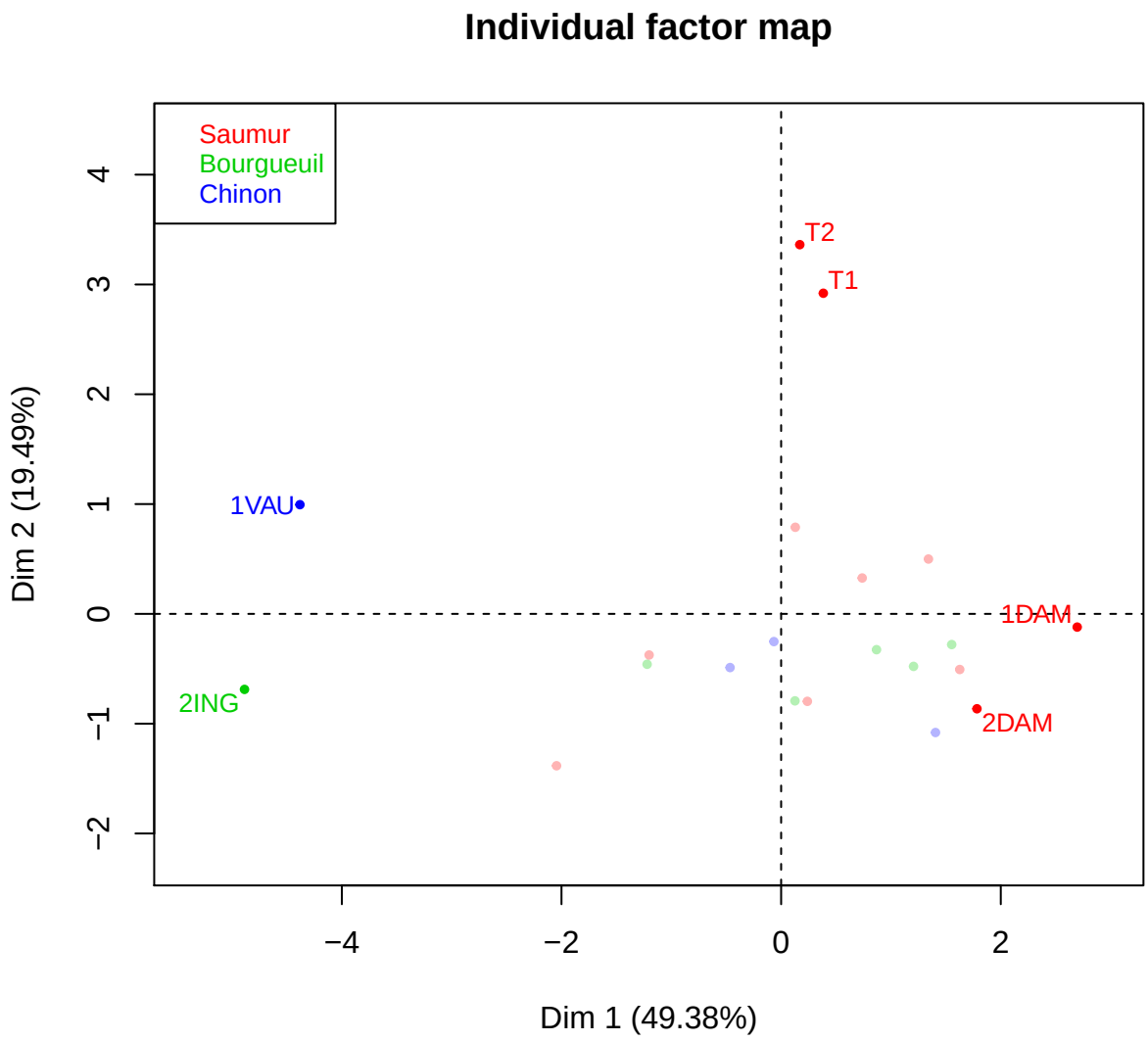
```
plot(res, invisible="quali", cex=0.8, partial=c("1VAU","PER1"), select="cos2 0.4")
```



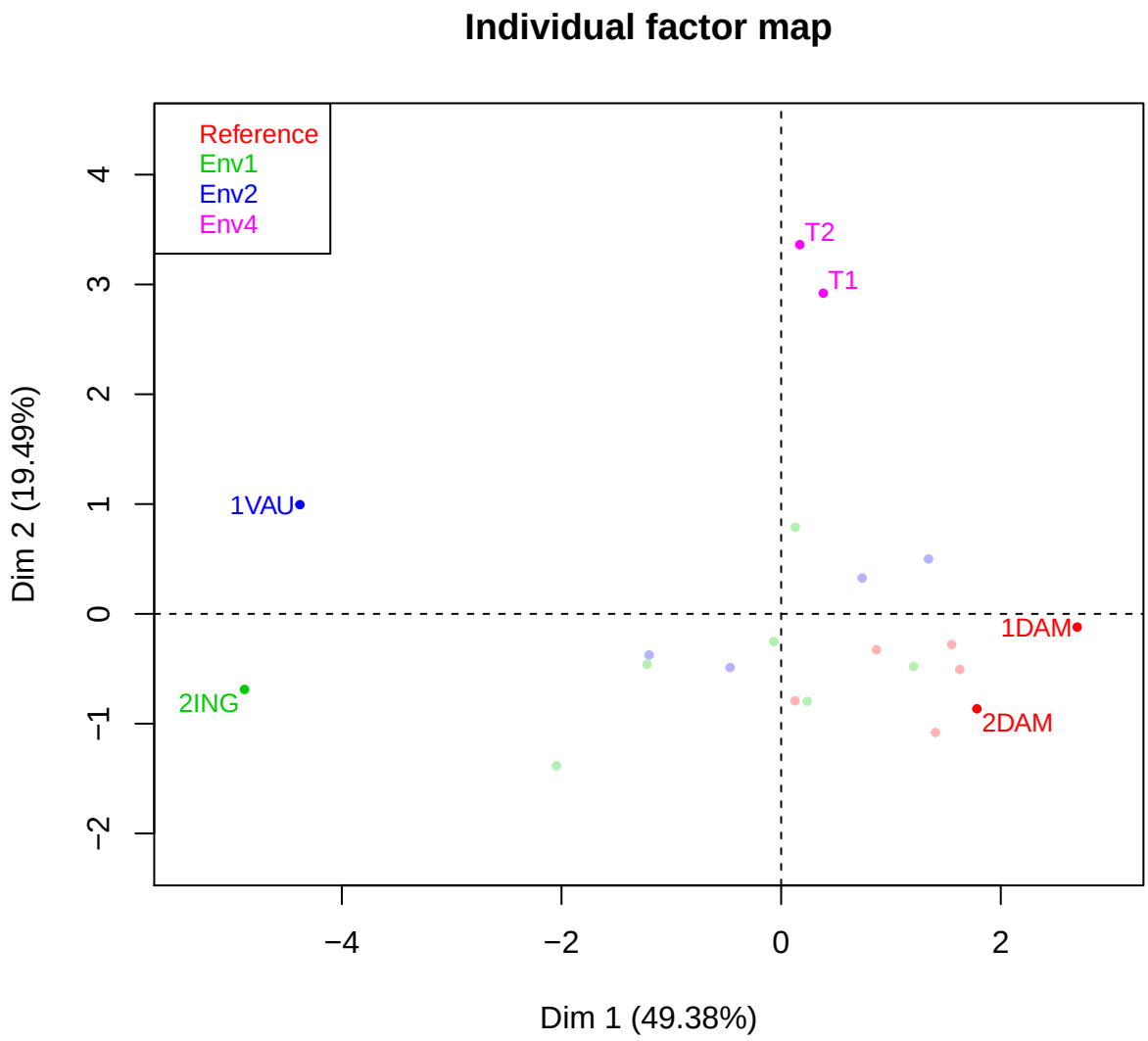

```
plot(res, ,invisible="quali", partial="all",
     palette=palette(c("black","transparent","transparent","blue","transparent")))
```



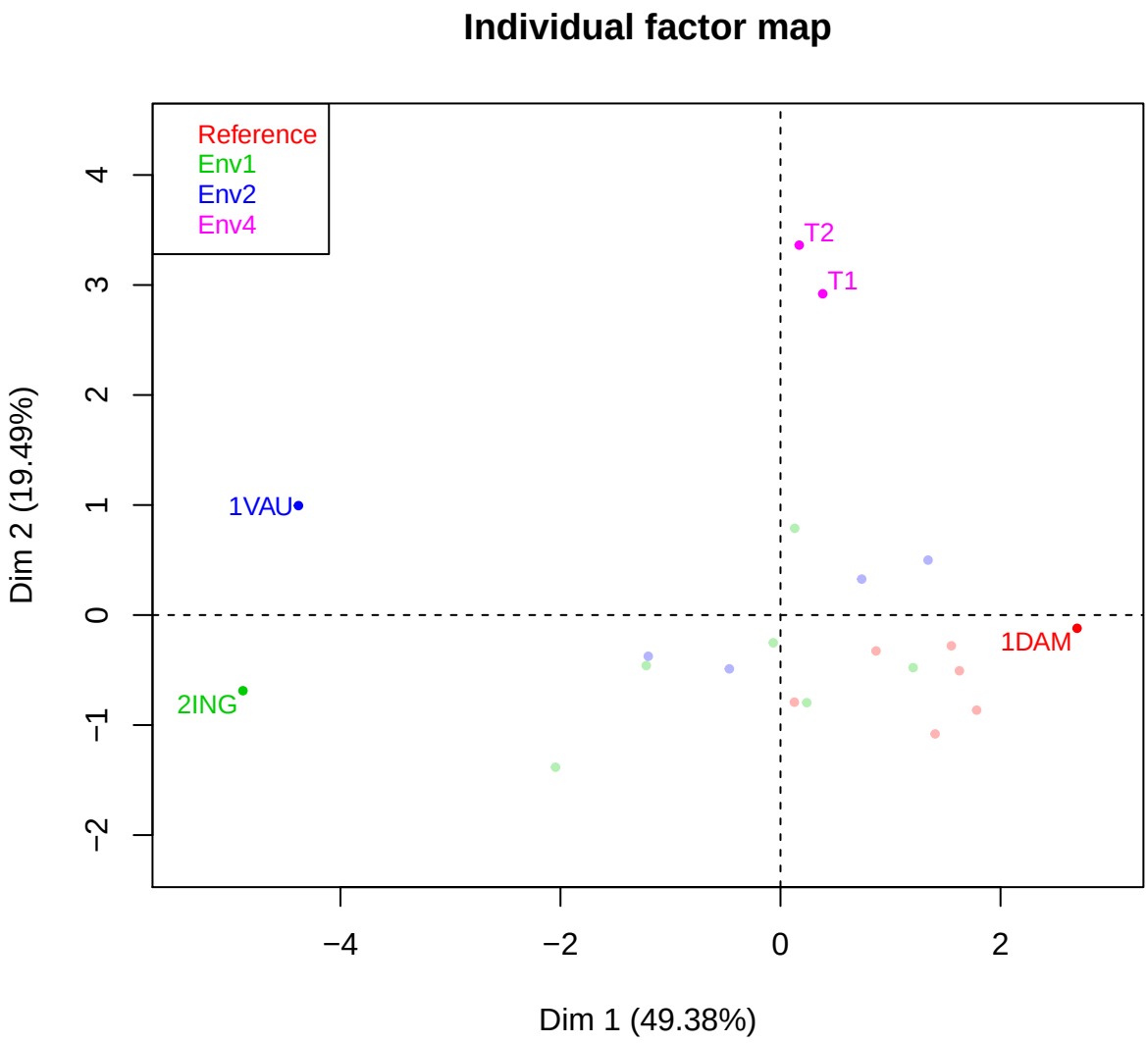

```
plot(res, invisible="quali", habillage=1, cex=0.8, select="cos2 0.4")
```



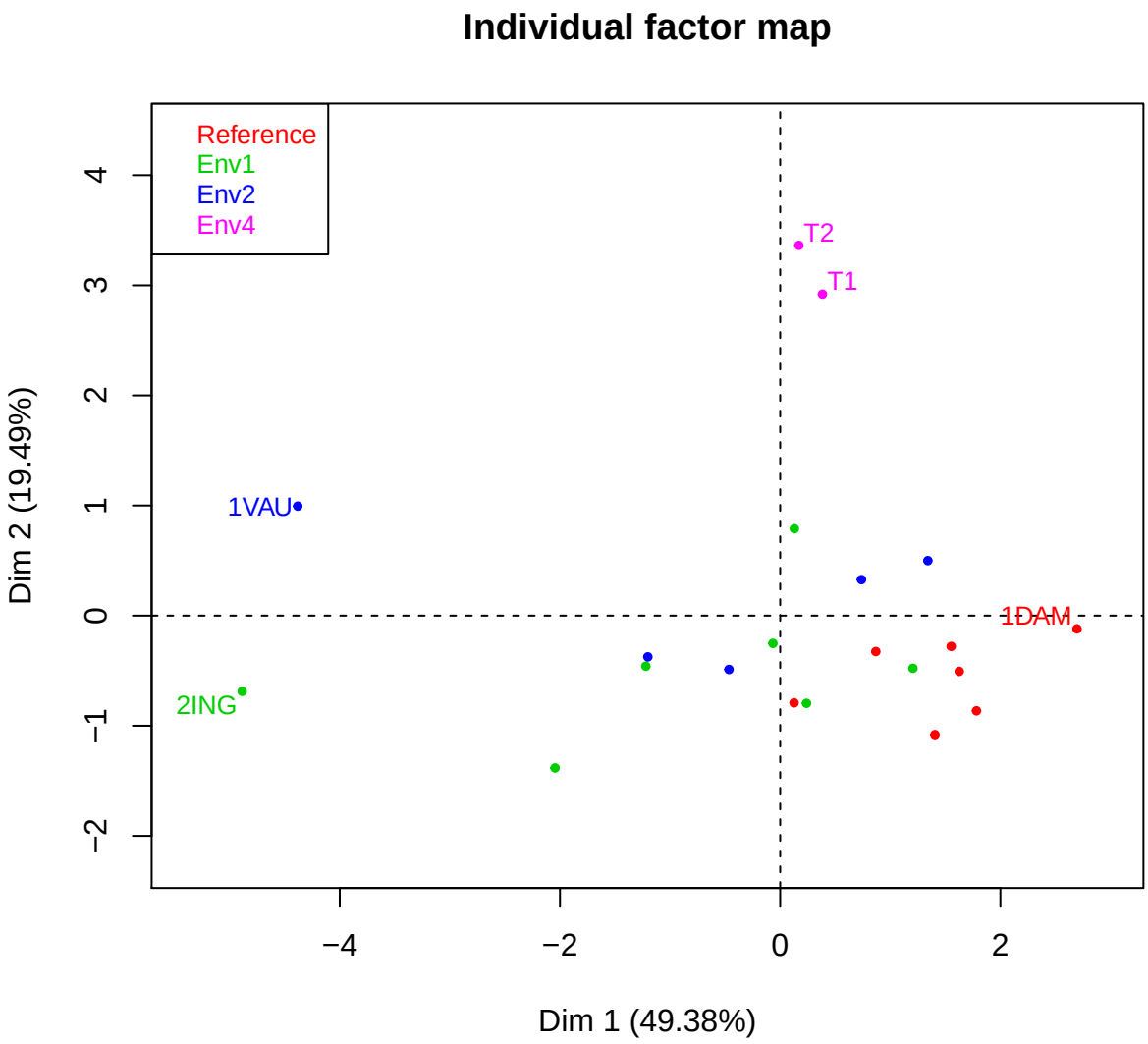

```
plot(res, invisible="quali", habillage="Soil", cex=0.8, select="cos2 0.4")
```



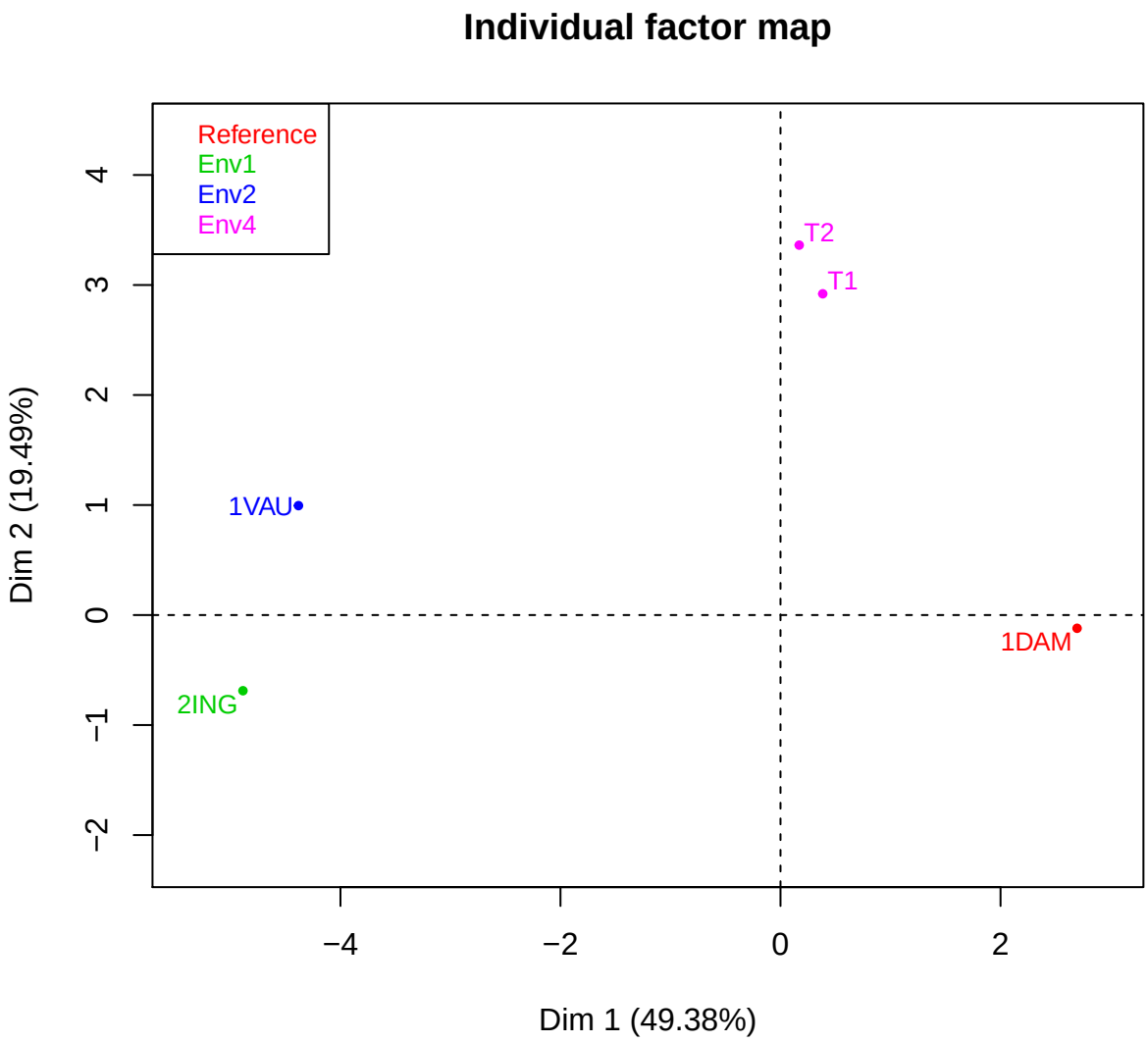

```
plot(res, invisible="quali", habillage="Soil", cex=0.8, select="contrib 5")
```



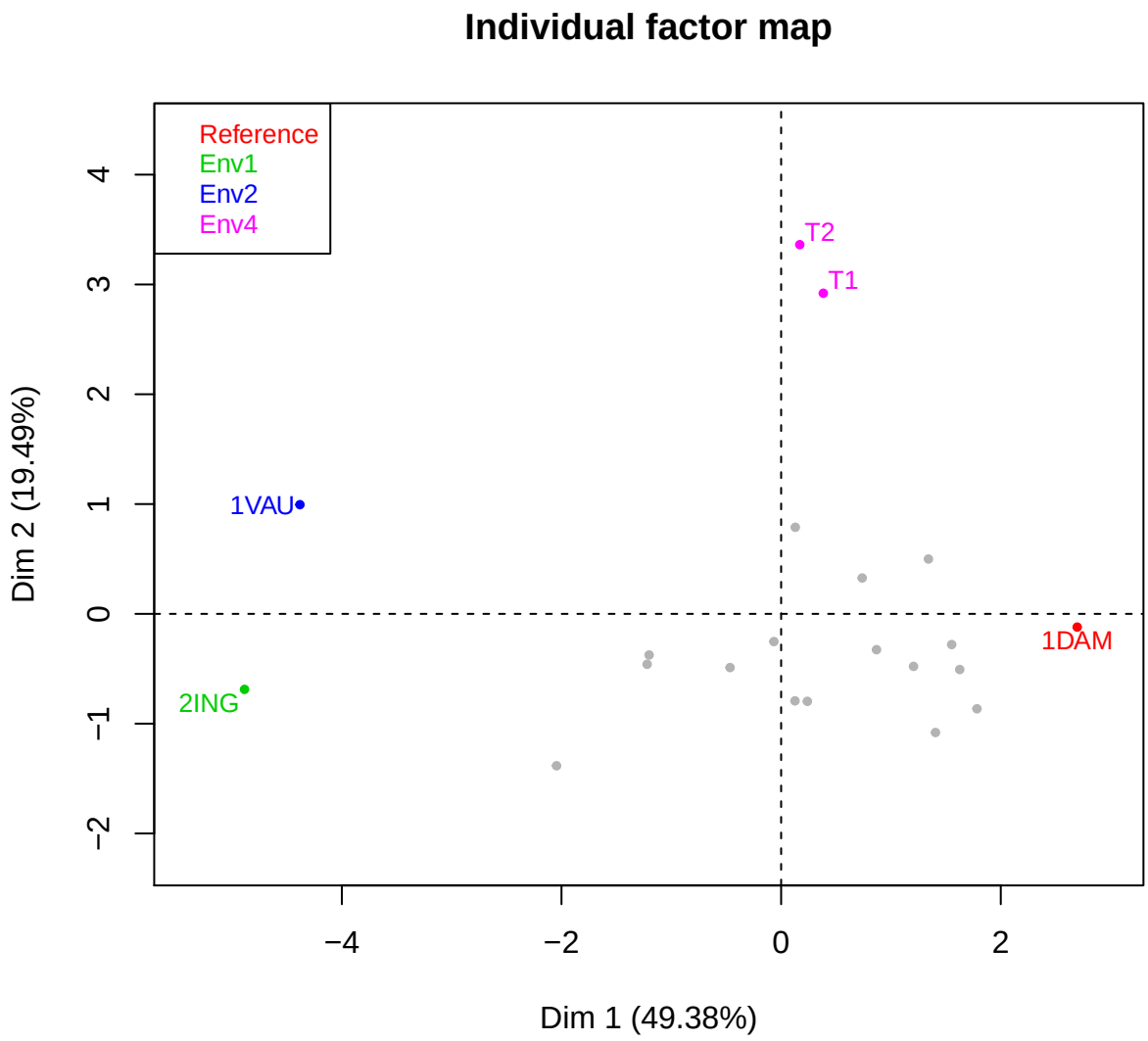

```
plot(res, invisible="quali", habillage="Soil", cex=0.8, select="contrib 5", unselect=0)
```



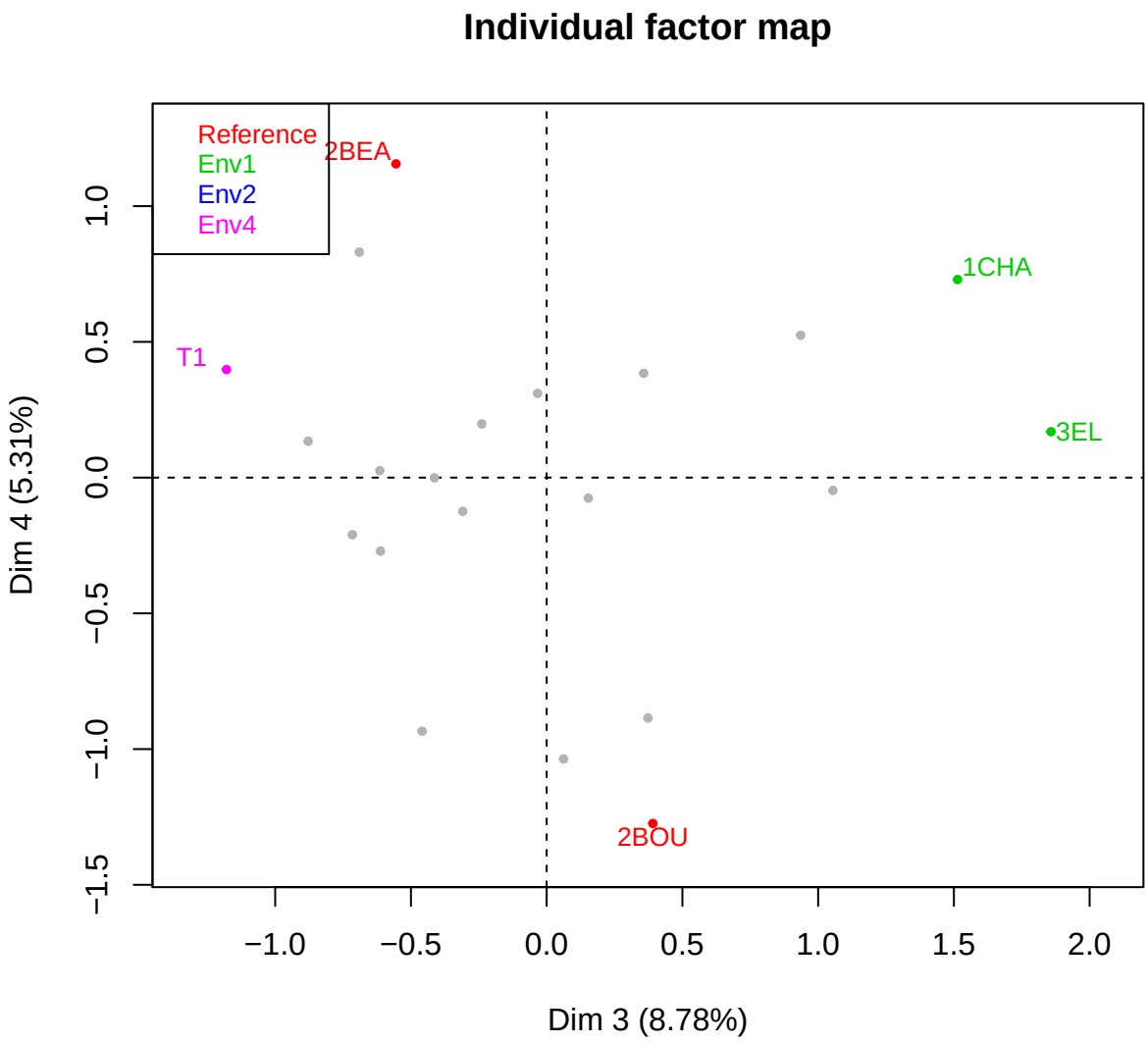

```
plot(res, invisible="quali", habillage="Soil", cex=0.8, select="contrib 5", unselect=1)
```



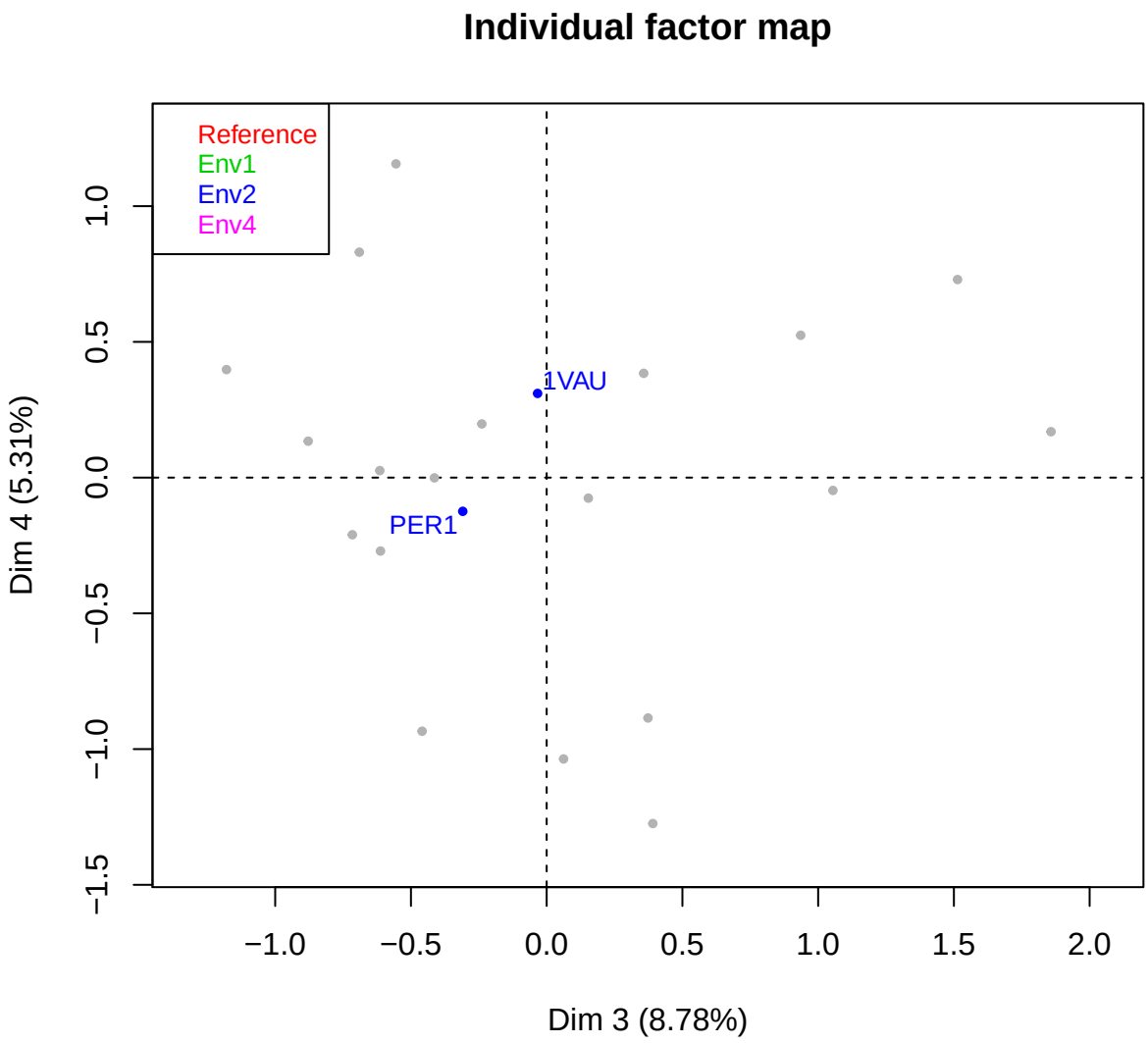

```
plot(res, invisible="quali", habillage="Soil", cex=0.8, select="contrib 5", unselect="grey70")
```




```
plot(res, invisible="quali", habillage="Soil", cex=0.8, select="contrib 5",
     unselect="grey70", axes=3:4)
```

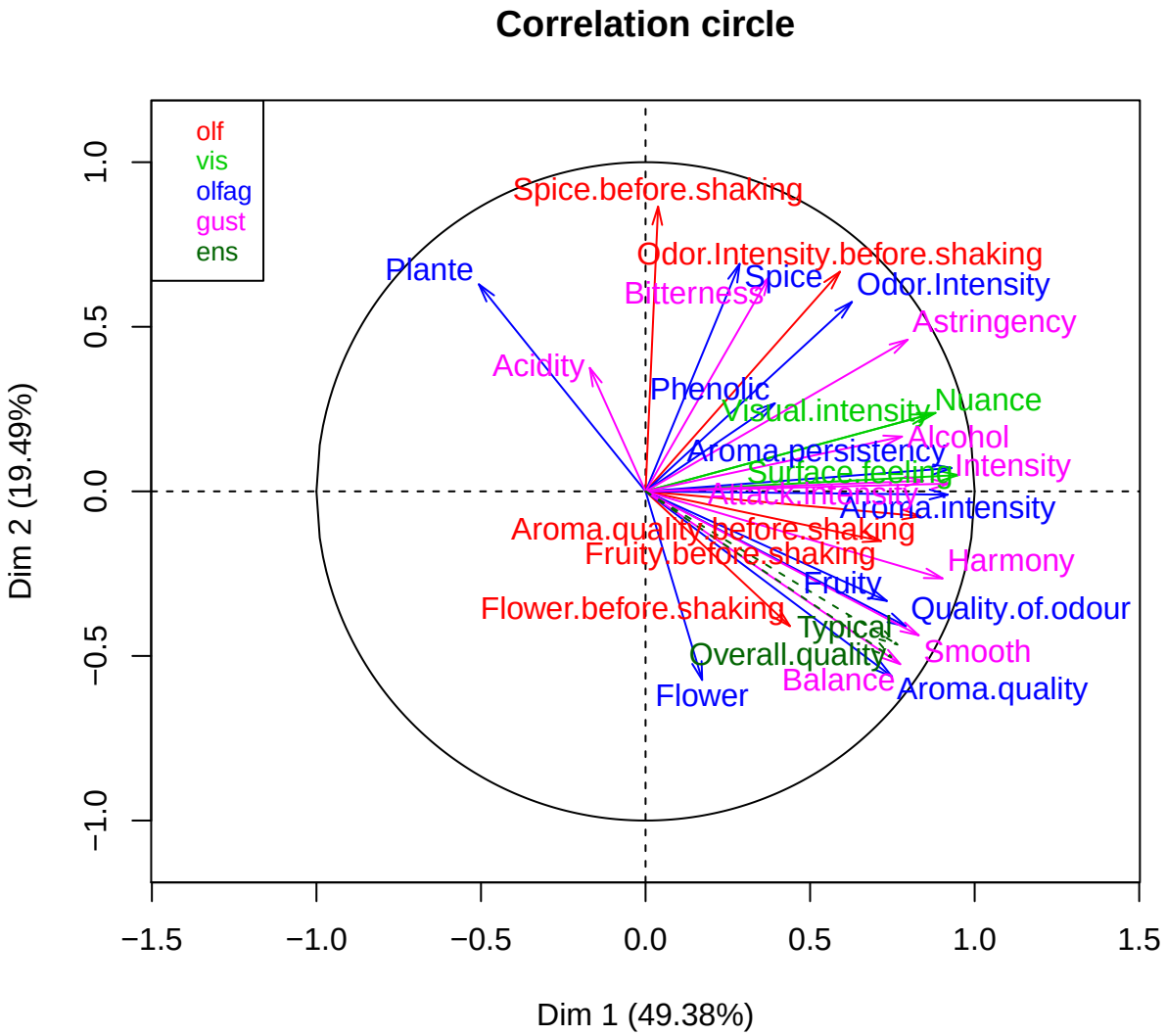



```
plot(res, invisible="quali", habillage="Soil", cex=0.8, select=c("1VAU","PER1"),
     unselect="grey70", axes=3:4)
```

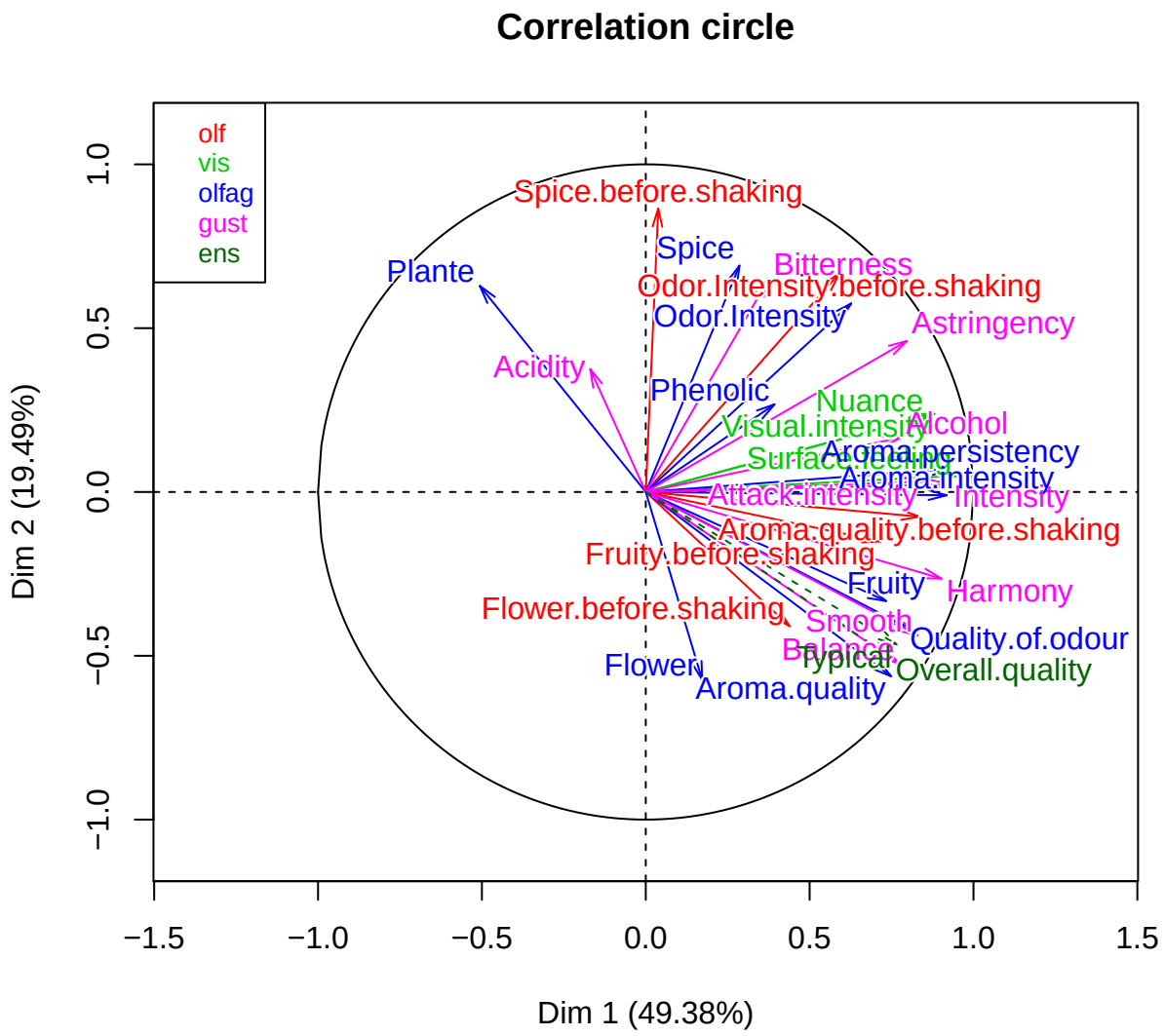


Graphe des variables

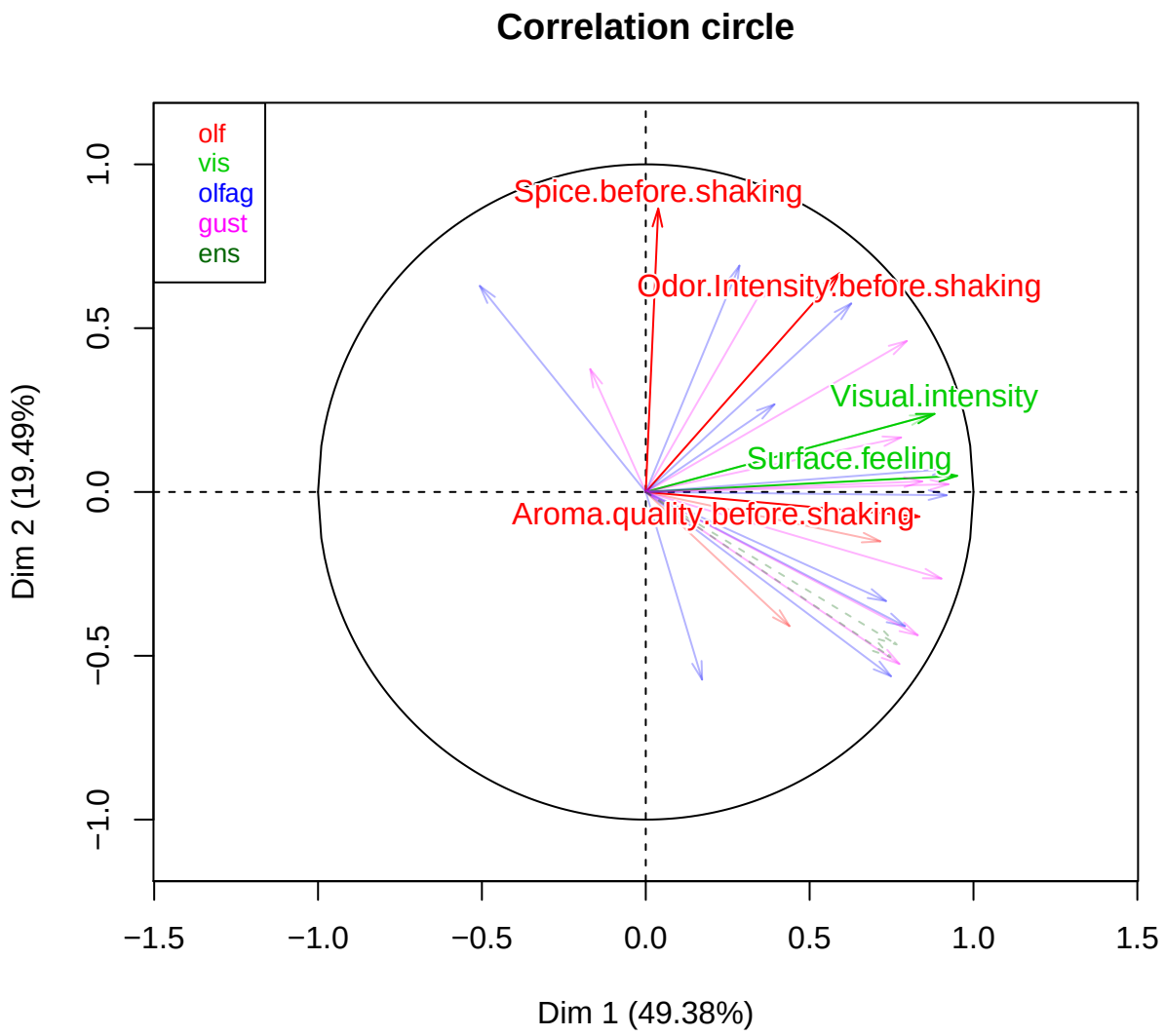
```
plot(res, choix="var")
```



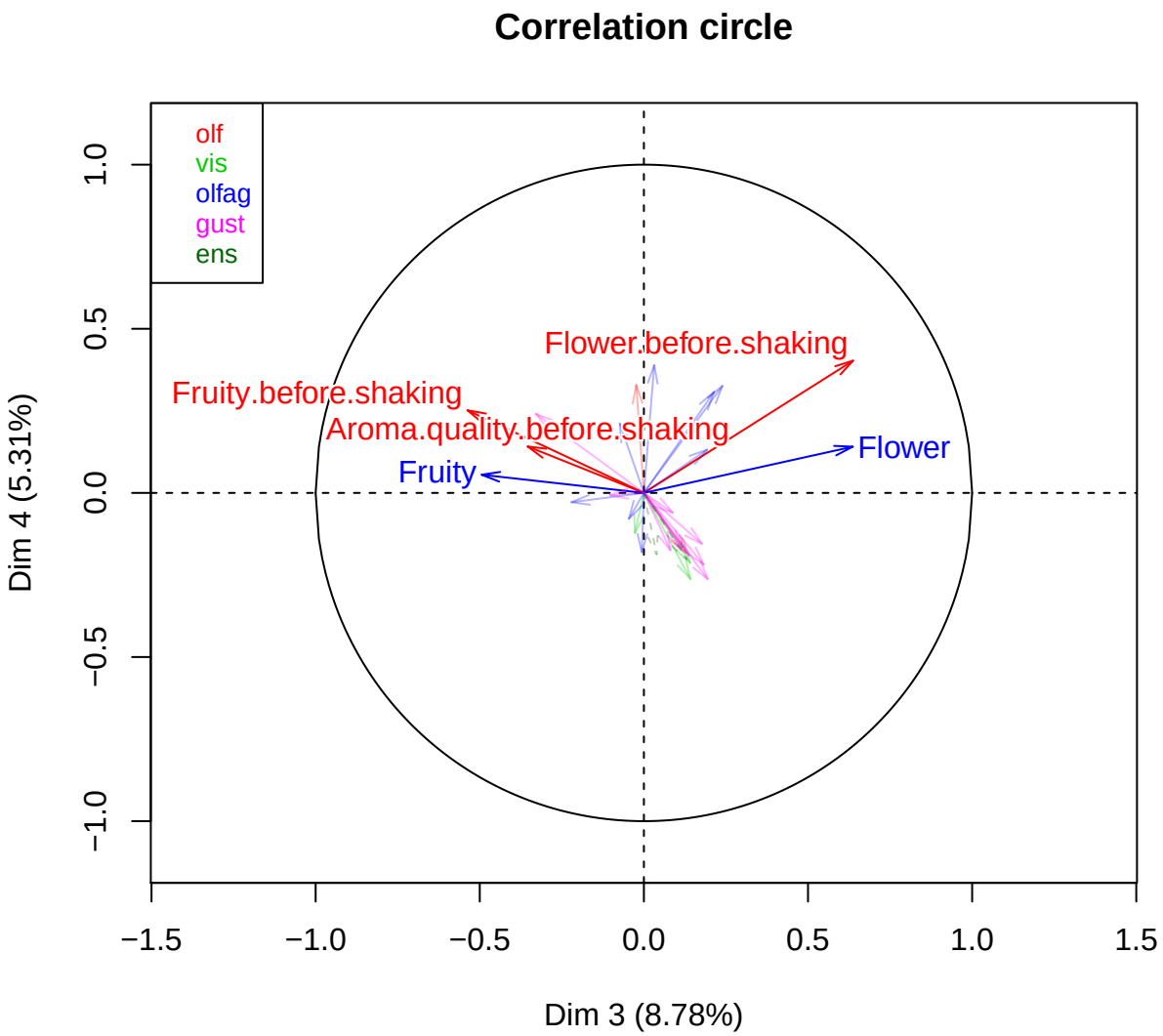

```
plot(res, choix="var", shadow=TRUE)
```




```
plot(res, choix="var", shadow=TRUE, select="contrib 5")
```

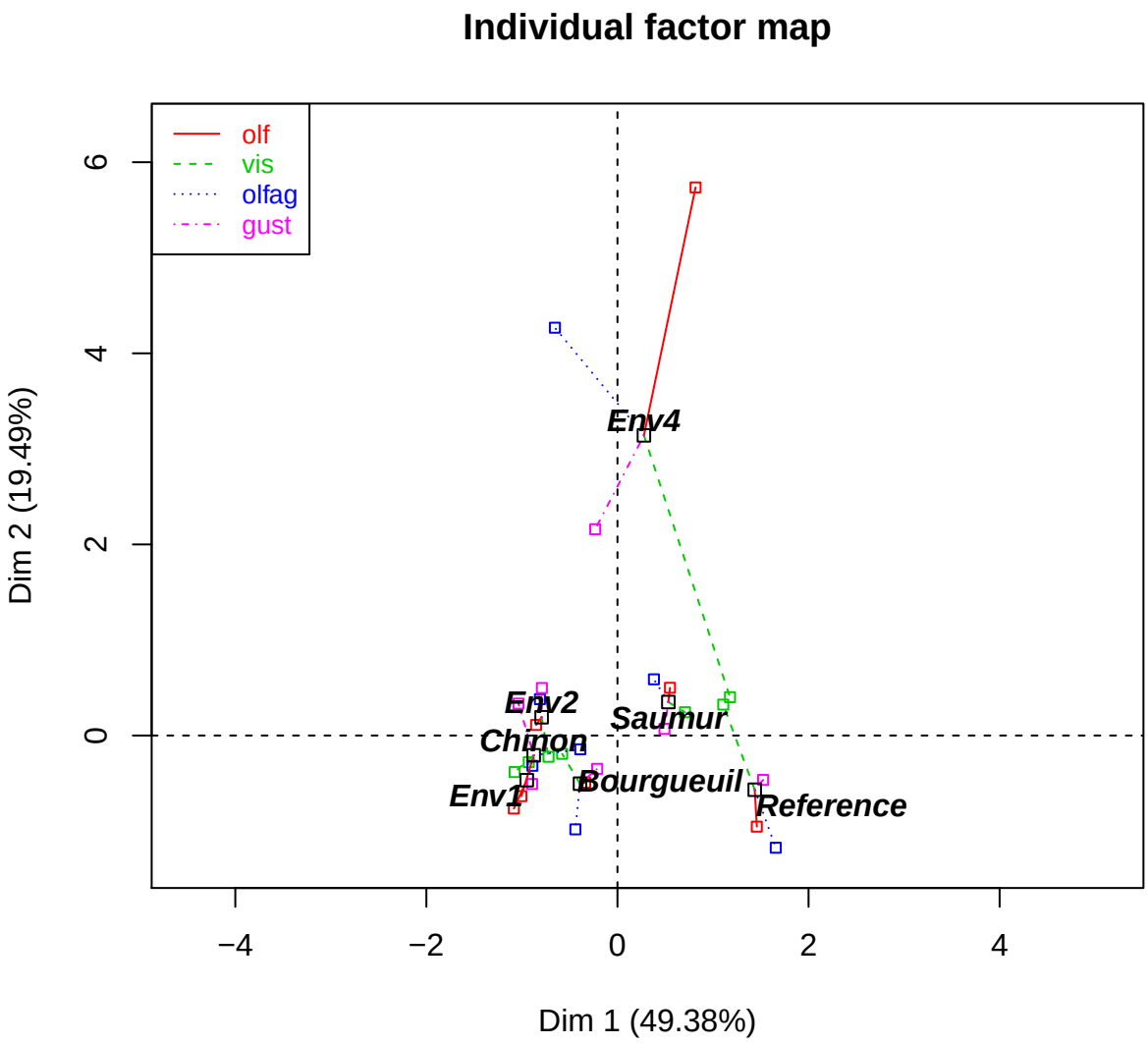


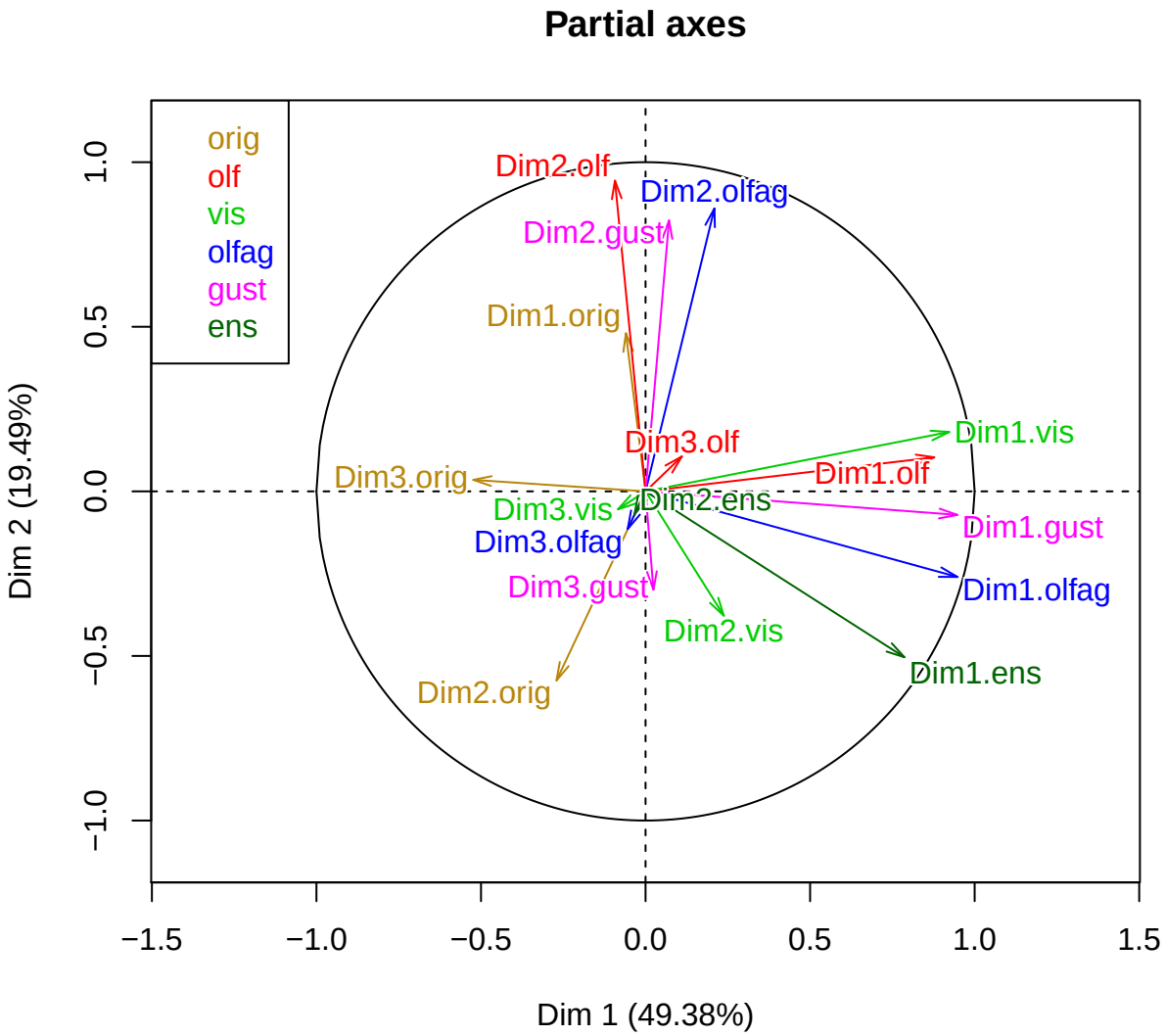

```
plot(res, choix="var", shadow=TRUE, select="contrib 5", axes=3:4)
```

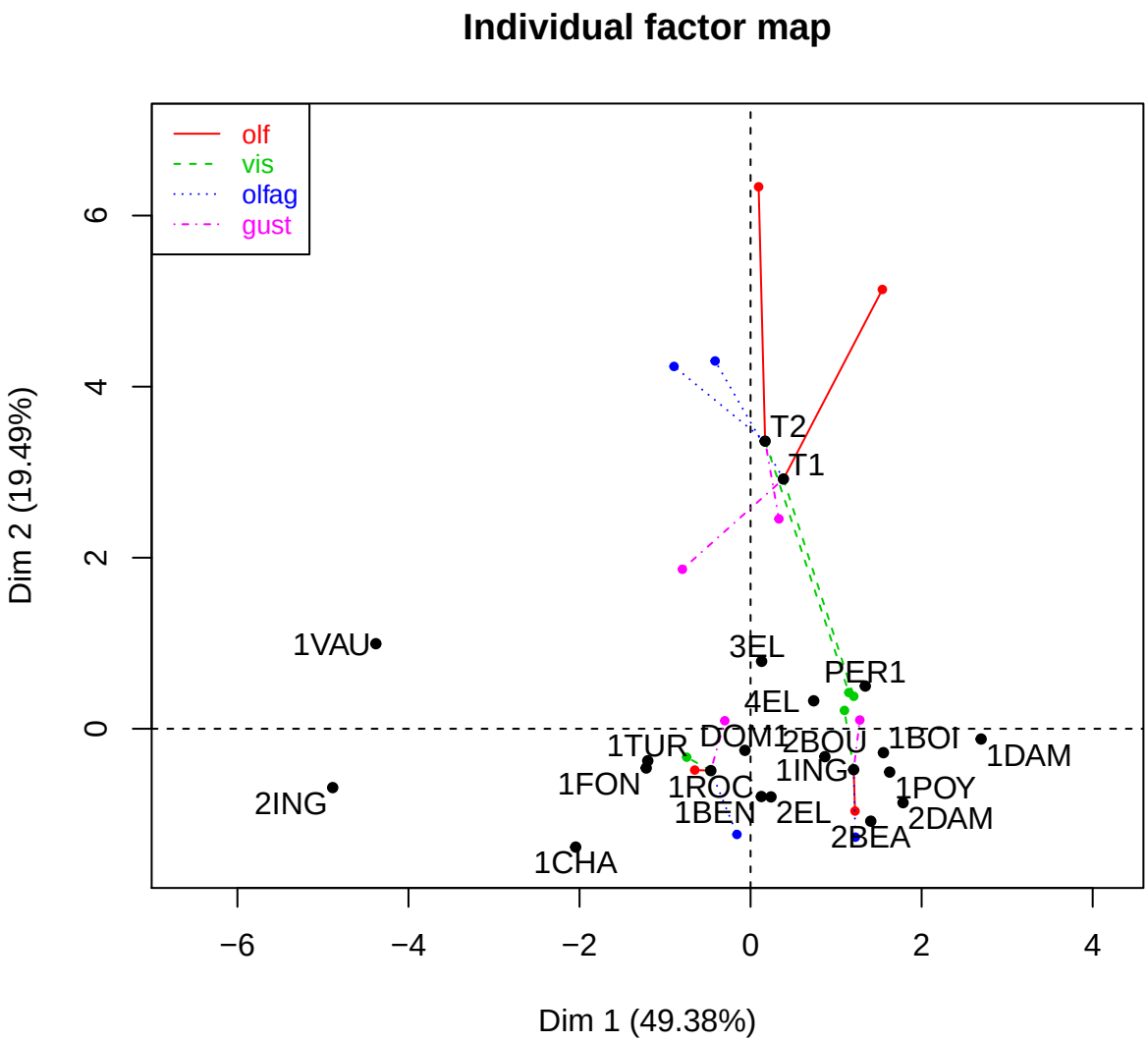


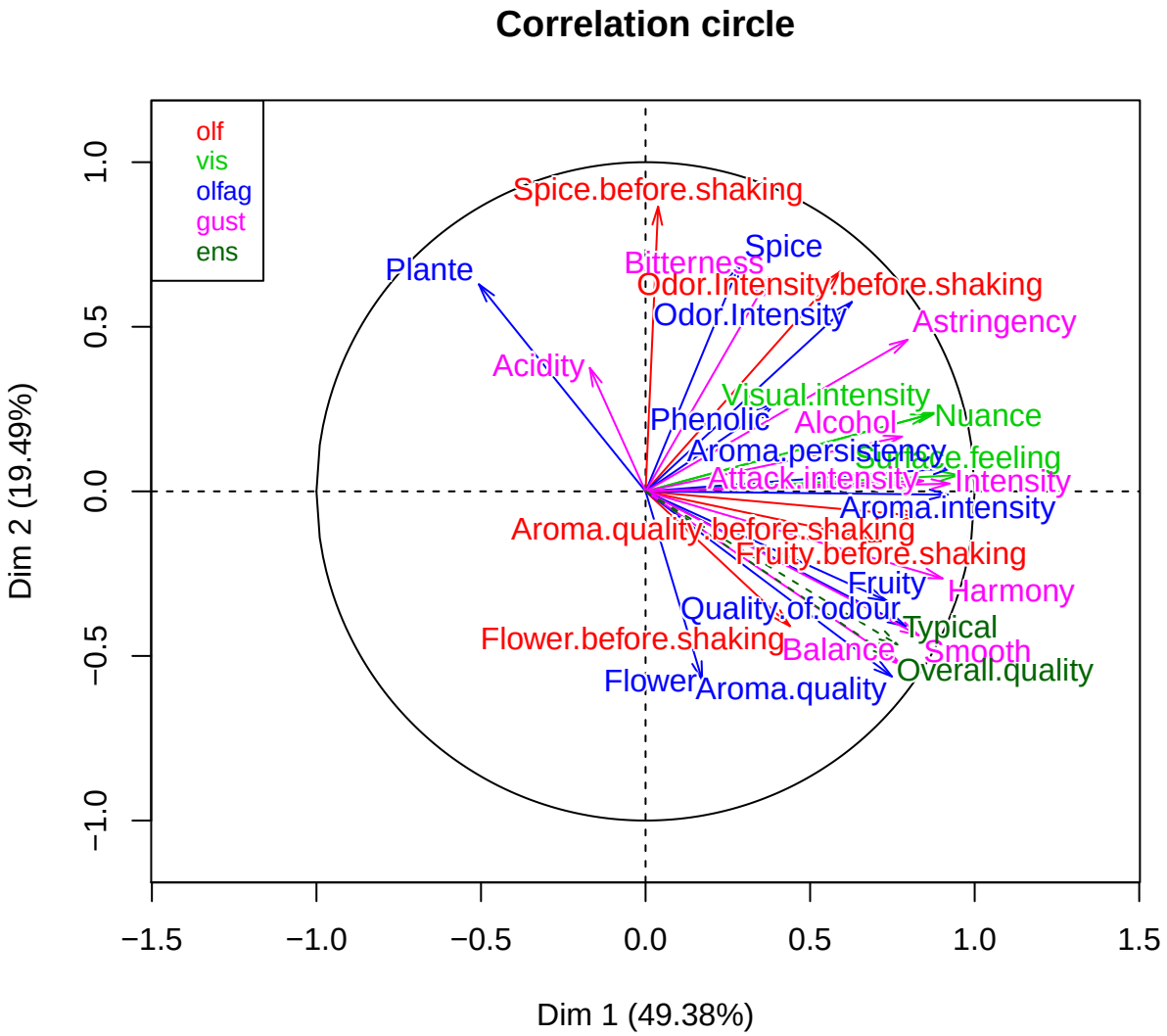
Graphe des axes partiels

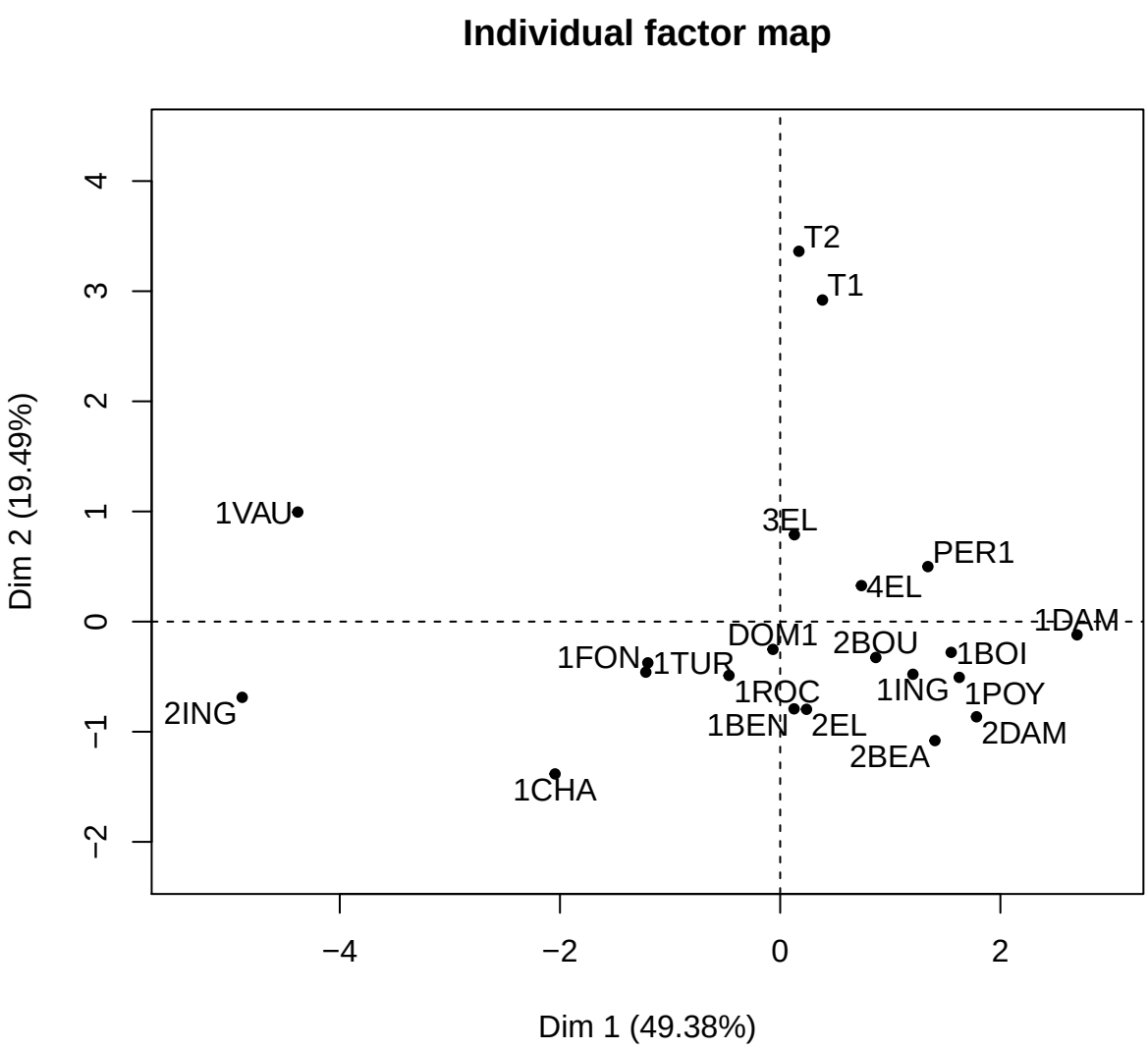
```
res <- MFA(wine, group=c(2,5,3,10,9,2), type=c("n",rep("s",5)),
    ncp=3, name.group=c("orig","olf","vis","olfag","gust","ens"),
    num.group.sup=c(1,6))
```

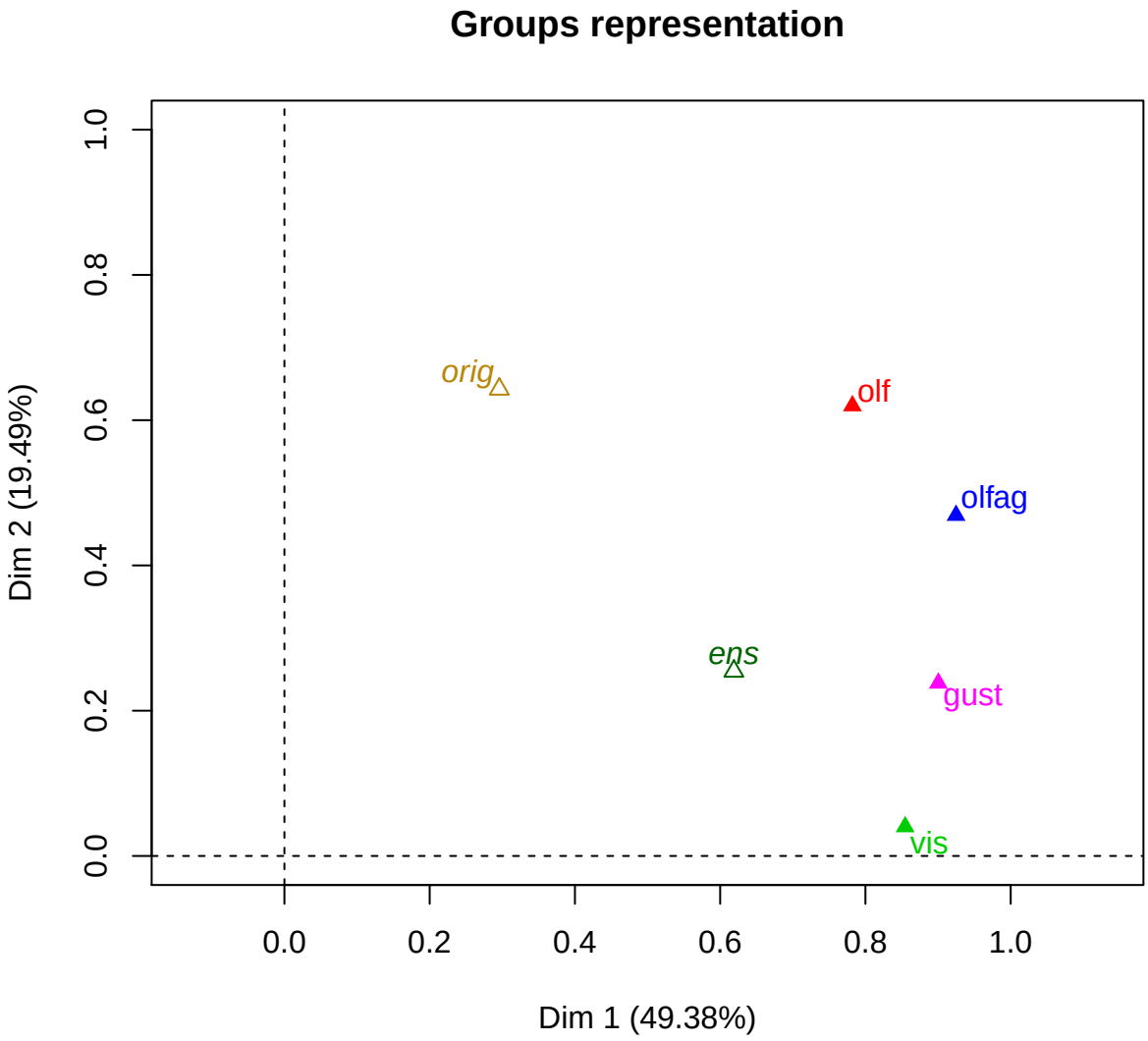

Individual factor map
olf
vis
olfag
gust
Env4
Env2
Chinon
Saumur
Bourgueuil
Env1
Reference
Dim 2 (19.49%)
Dim 1 (49.38%)
6
4
2
0
−4
−2
0
2
4


Partial axes
orig
olf
vis
olfag
gust
ens
Dim2.olf
Dim2.olfag
Dim2.gust
Dim1.orig
Dim3.olf
Dim1.vis
Dim3.orig
Dim1.olf
Dim3.vis
Dim2.ens
Dim1.gust
Dim3.olfag
Dim1.olfag
Dim3.gust
Dim2.vis
Dim1.ens
Dim2.orig
Dim 2 (19.49%)
Dim 1 (49.38%)
1.0
0.5
0.0
−0.5
−1.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5

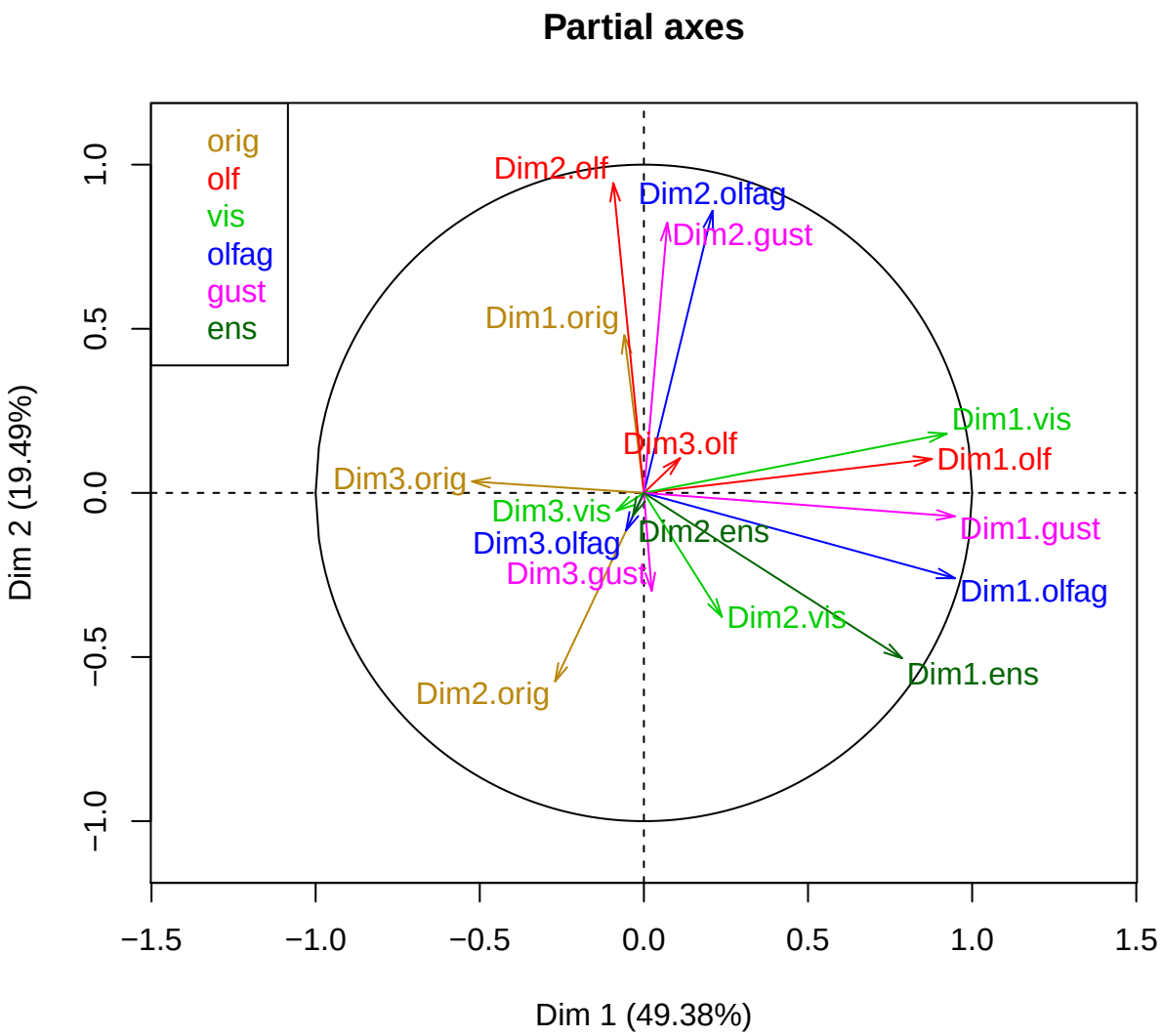

Individual factor map
olf
vis
olfag
gust
T2
T1
1VAU
3EL
PER1
4EL
DOM1
1TUR
2BOU
1BOI
1DAM
1ING
1FON
1ROC
1POY
2ING
1BEN
2EL
2DAM
2BEA
1CHA
Dim 2 (19.49%)
Dim 1 (49.38%)
6
4
2
0
−6
−4
−2
0
2
4


Correlation circle
olf
vis
olfag
gust
ens
Spice.before.shaking
Spice
Bitterness
Plante
Odor.Intensity.before.shaking
Odor.Intensity
Astringency
Acidity
Visual.intensity
Phenolic
Alcohol
Nuance
Aroma.persistency
Surface.feeling
Attack.intensity
Intensity
Aroma.intensity
Aroma.quality.before.shaking
Fruity.before.shaking
Fruity
Harmony
Quality.of.odour
Typical
Flower.before.shaking
Balance
Smooth
Overall.quality
Flower
Aroma.quality
1.0
0.5
0.0
−0.5
−1.0
Dim 2 (19.49%)
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
Dim 1 (49.38%)


Individual factor map
Dim 2 (19.49%)
Dim 1 (49.38%)
T2
T1
1VAU
3EL
PER1
4EL
1DAM
DOM1
2BOU
1BOI
1FON
1TUR
1ROC
1ING
1POY
2ING
1BEN
2EL
2DAM
2BEA
1CHA
4
3
2
1
0
−1
−2
−4
−2
0
2




```
plot(res, choix="axes")
```



Description des dimensions

```
dimdesc(res)
```

```
## $Dim.1
## $Dim.1$quanti
##                              correlation      p.value
## Surface.feeling                0.9501131 4.605897e-11
## Aroma.persistency              0.9298582 1.082737e-09
## Intensity                      0.9241930 2.214222e-09
## Aroma.intensity                0.9183490 4.380472e-09
## Harmony                        0.9024824 2.221510e-08
## Visual.intensity               0.8811873 1.331392e-07
## Nuance                         0.8623373 4.995733e-07
```

```
## Attack.intensity                0.8439524 1.524322e-06
## Aroma.quality.before.shaking    0.8352510 2.462507e-06
## Smooth                          0.8299677 3.251800e-06
## Astringency                     0.7966486 1.549124e-05
## Quality.of.odour                0.7909364 1.967655e-05
## Alcohol                         0.7792689 3.137694e-05
## Balance                         0.7740492 3.832036e-05
## Typical                         0.7656957 5.221396e-05
## Aroma.quality                   0.7484543 9.521647e-05
## Overall.quality                 0.7472814 9.901881e-05
## Fruity                          0.7333860 1.550774e-04
## Fruity.before.shaking           0.7160259 2.618708e-04
## Odor.Intensity                  0.6270975 2.345881e-03
## Odor.Intensity.before.shaking   0.5908036 4.800834e-03
## Flower.before.shaking           0.4387181 4.664182e-02
## Plante                         -0.5064137 1.915100e-02
##
## $Dim.1$category
##           Estimate    p.value
## Reference 1.444131 0.01043873
##
##
## $Dim.2
## $Dim.2$quanti
##                               correlation      p.value
## Spice.before.shaking            0.8650199 4.189450e-07
## Spice                           0.6910122 5.233277e-04
## Odor.Intensity.before.shaking   0.6672378 9.524504e-04
## Bitterness                      0.6506434 1.404051e-03
## Plante                          0.6290859 2.249914e-03
## Odor.Intensity                  0.5755174 6.336628e-03
## Astringency                     0.4608480 3.550587e-02
## Smooth                         -0.4372509 4.746573e-02
## Typical                        -0.4655898 3.341665e-02
## Overall.quality                -0.5036281 1.993378e-02
## Balance                        -0.5249698 1.454356e-02
## Aroma.quality                  -0.5624494 7.951915e-03
## Flower                         -0.5727974 6.648318e-03
##
## $Dim.2$quali
##             R2      p.value
## Soil 0.8255815 1.127917e-06
##
## $Dim.2$category
##      Estimate      p.value
## Env4 2.566606 2.650535e-07
##
##
## $Dim.3
## $Dim.3$quanti
##                        correlation     p.value
## Flower.before.shaking   0.6373128 0.001887133
## Flower                  0.6364710 0.001921831
## Fruity                 -0.4941180 0.022801235
```

```
## Fruity.before.shaking  -0.5374876 0.011976303
```