DOC2

2025-05-20

```r
#PREREQUISITES:
#factors are properly labelled and reading data makes R to directly recognize them
#Numerical variables do not contain missing values anymore. They have been imputed in preprocessing ste

#  READING CREDSCO_BIN
dd <- read.table("credscoClean.csv",header=T, sep=";");



#alternatively
#dd<- <your-data-frame>

objects()
```

```
## [1] "dd"
```

```r
attributes(dd)
```

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##  [3] "Vivienda"              "Plazo"
##  [5] "Edad"                  "Estado.civil"
##  [7] "Registros"             "Tipo.trabajo"
##  [9] "Gastos"                "Ingresos"
## [11] "Patrimonio"            "Cargas.patrimoniales"
## [13] "Importe.solicitado"    "Precio.del.bien.financiado"
## [15] "Estalvi"               "RatiFin"
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##
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## [3333] 3333 3334 3335 3336 3337 3338 3339 3340 3341 3342 3343 3344 3345 3346
## [3347] 3347 3348 3349 3350 3351 3352 3353 3354 3355 3356 3357 3358 3359 3360
## [3361] 3361 3362 3363 3364 3365 3366 3367 3368 3369 3370 3371 3372 3373 3374
## [3375] 3375 3376 3377 3378 3379 3380 3381 3382 3383 3384 3385 3386 3387 3388
## [3389] 3389 3390 3391 3392 3393 3394 3395 3396 3397 3398 3399 3400 3401 3402
## [3403] 3403 3404 3405 3406 3407 3408 3409 3410 3411 3412 3413 3414 3415 3416
## [3417] 3417 3418 3419 3420 3421 3422 3423 3424 3425 3426 3427 3428 3429 3430
## [3431] 3431 3432 3433 3434 3435 3436 3437 3438 3439 3440 3441 3442 3443 3444
## [3445] 3445 3446 3447 3448 3449 3450 3451 3452 3453 3454 3455 3456 3457 3458
## [3459] 3459 3460 3461 3462 3463 3464 3465 3466 3467 3468 3469 3470 3471 3472
## [3473] 3473 3474 3475 3476 3477 3478 3479 3480 3481 3482 3483 3484 3485 3486
## [3487] 3487 3488 3489 3490 3491 3492 3493 3494 3495 3496 3497 3498 3499 3500
## [3501] 3501 3502 3503 3504 3505 3506 3507 3508 3509 3510 3511 3512 3513 3514
## [3515] 3515 3516 3517 3518 3519 3520 3521 3522 3523 3524 3525 3526 3527 3528
## [3529] 3529 3530 3531 3532 3533 3534 3535 3536 3537 3538 3539 3540 3541 3542
## [3543] 3543 3544 3545 3546 3547 3548 3549 3550 3551 3552 3553 3554 3555 3556
## [3557] 3557 3558 3559 3560 3561 3562 3563 3564 3565 3566 3567 3568 3569 3570
## [3571] 3571 3572 3573 3574 3575 3576 3577 3578 3579 3580 3581 3582 3583 3584
## [3585] 3585 3586 3587 3588 3589 3590 3591 3592 3593 3594 3595 3596 3597 3598
## [3599] 3599 3600 3601 3602 3603 3604 3605 3606 3607 3608 3609 3610 3611 3612
## [3613] 3613 3614 3615 3616 3617 3618 3619 3620 3621 3622 3623 3624 3625 3626
## [3627] 3627 3628 3629 3630 3631 3632 3633 3634 3635 3636 3637 3638 3639 3640
## [3641] 3641 3642 3643 3644 3645 3646 3647 3648 3649 3650 3651 3652 3653 3654
## [3655] 3655 3656 3657 3658 3659 3660 3661 3662 3663 3664 3665 3666 3667 3668
## [3669] 3669 3670 3671 3672 3673 3674 3675 3676 3677 3678 3679 3680 3681 3682
## [3683] 3683 3684 3685 3686 3687 3688 3689 3690 3691 3692 3693 3694 3695 3696
## [3697] 3697 3698 3699 3700 3701 3702 3703 3704 3705 3706 3707 3708 3709 3710
## [3711] 3711 3712 3713 3714 3715 3716 3717 3718 3719 3720 3721 3722 3723 3724
## [3725] 3725 3726 3727 3728 3729 3730 3731 3732 3733 3734 3735 3736 3737 3738
## [3739] 3739 3740 3741 3742 3743 3744 3745 3746 3747 3748 3749 3750 3751 3752
## [3753] 3753 3754 3755 3756 3757 3758 3759 3760 3761 3762 3763 3764 3765 3766
## [3767] 3767 3768 3769 3770 3771 3772 3773 3774 3775 3776 3777 3778 3779 3780
## [3781] 3781 3782 3783 3784 3785 3786 3787 3788 3789 3790 3791 3792 3793 3794
## [3795] 3795 3796 3797 3798 3799 3800 3801 3802 3803 3804 3805 3806 3807 3808
## [3809] 3809 3810 3811 3812 3813 3814 3815 3816 3817 3818 3819 3820 3821 3822
## [3823] 3823 3824 3825 3826 3827 3828 3829 3830 3831 3832 3833 3834 3835 3836
## [3837] 3837 3838 3839 3840 3841 3842 3843 3844 3845 3846 3847 3848 3849 3850
## [3851] 3851 3852 3853 3854 3855 3856 3857 3858 3859 3860 3861 3862 3863 3864
## [3865] 3865 3866 3867 3868 3869 3870 3871 3872 3873 3874 3875 3876 3877 3878
## [3879] 3879 3880 3881 3882 3883 3884 3885 3886 3887 3888 3889 3890 3891 3892
## [3893] 3893 3894 3895 3896 3897 3898 3899 3900 3901 3902 3903 3904 3905 3906
## [3907] 3907 3908 3909 3910 3911 3912 3913 3914 3915 3916 3917 3918 3919 3920
## [3921] 3921 3922 3923 3924 3925 3926 3927 3928 3929 3930 3931 3932 3933 3934
```

```
## [3935] 3935 3936 3937 3938 3939 3940 3941 3942 3943 3944 3945 3946 3947 3948
## [3949] 3949 3950 3951 3952 3953 3954 3955 3956 3957 3958 3959 3960 3961 3962
## [3963] 3963 3964 3965 3966 3967 3968 3969 3970 3971 3972 3973 3974 3975 3976
## [3977] 3977 3978 3979 3980 3981 3982 3983 3984 3985 3986 3987 3988 3989 3990
## [3991] 3991 3992 3993 3994 3995 3996 3997 3998 3999 4000 4001 4002 4003 4004
## [4005] 4005 4006 4007 4008 4009 4010 4011 4012 4013 4014 4015 4016 4017 4018
## [4019] 4019 4020 4021 4022 4023 4024 4025 4026 4027 4028 4029 4030 4031 4032
## [4033] 4033 4034 4035 4036 4037 4038 4039 4040 4041 4042 4043 4044 4045 4046
## [4047] 4047 4048 4049 4050 4051 4052 4053 4054 4055 4056 4057 4058 4059 4060
## [4061] 4061 4062 4063 4064 4065 4066 4067 4068 4069 4070 4071 4072 4073 4074
## [4075] 4075 4076 4077 4078 4079 4080 4081 4082 4083 4084 4085 4086 4087 4088
## [4089] 4089 4090 4091 4092 4093 4094 4095 4096 4097 4098 4099 4100 4101 4102
## [4103] 4103 4104 4105 4106 4107 4108 4109 4110 4111 4112 4113 4114 4115 4116
## [4117] 4117 4118 4119 4120 4121 4122 4123 4124 4125 4126 4127 4128 4129 4130
## [4131] 4131 4132 4133 4134 4135 4136 4137 4138 4139 4140 4141 4142 4143 4144
## [4145] 4145 4146 4147 4148 4149 4150 4151 4152 4153 4154 4155 4156 4157 4158
## [4159] 4159 4160 4161 4162 4163 4164 4165 4166 4167 4168 4169 4170 4171 4172
## [4173] 4173 4174 4175 4176 4177 4178 4179 4180 4181 4182 4183 4184 4185 4186
## [4187] 4187 4188 4189 4190 4191 4192 4193 4194 4195 4196 4197 4198 4199 4200
## [4201] 4201 4202 4203 4204 4205 4206 4207 4208 4209 4210 4211 4212 4213 4214
## [4215] 4215 4216 4217 4218 4219 4220 4221 4222 4223 4224 4225 4226 4227 4228
## [4229] 4229 4230 4231 4232 4233 4234 4235 4236 4237 4238 4239 4240 4241 4242
## [4243] 4243 4244 4245 4246 4247 4248 4249 4250 4251 4252 4253 4254 4255 4256
## [4257] 4257 4258 4259 4260 4261 4262 4263 4264 4265 4266 4267 4268 4269 4270
## [4271] 4271 4272 4273 4274 4275 4276 4277 4278 4279 4280 4281 4282 4283 4284
## [4285] 4285 4286 4287 4288 4289 4290 4291 4292 4293 4294 4295 4296 4297 4298
## [4299] 4299 4300 4301 4302 4303 4304 4305 4306 4307 4308 4309 4310 4311 4312
## [4313] 4313 4314 4315 4316 4317 4318 4319 4320 4321 4322 4323 4324 4325 4326
## [4327] 4327 4328 4329 4330 4331 4332 4333 4334 4335 4336 4337 4338 4339 4340
## [4341] 4341 4342 4343 4344 4345 4346 4347 4348 4349 4350 4351 4352 4353 4354
## [4355] 4355 4356 4357 4358 4359 4360 4361 4362 4363 4364 4365 4366 4367 4368
## [4369] 4369 4370 4371 4372 4373 4374 4375 4376 4377 4378 4379 4380 4381 4382
## [4383] 4383 4384 4385 4386 4387 4388 4389 4390 4391 4392 4393 4394 4395 4396
## [4397] 4397 4398 4399 4400 4401 4402 4403 4404 4405 4406 4407 4408 4409 4410
## [4411] 4411 4412 4413 4414 4415 4416 4417 4418 4419 4420 4421 4422 4423 4424
## [4425] 4425 4426 4427 4428 4429 4430 4431 4432 4433 4434 4435 4436 4437 4438
## [4439] 4439 4440 4441 4442 4443 4444 4445 4446 4447 4448 4449 4450 4451 4452
## [4453] 4453 4454 4455
```

```r
#
# VISUALISATION OF DATA
#
# PRINCIPAL COMPONENT ANALYSIS OF CONTINcUOUS VARIABLES, WITH Dictamen PROJECTED AS ILLUSTRATIVE
#

# CREATION OF THE DATA FRAME OF CONTINUOUS VARIABLES

attach(dd)
names(dd)
```

```
## [1] "Dictamen"            "Antiguedad.Trabajo"
## [3] "Vivienda"            "Plazo"
## [5] "Edad"                "Estado.civil"
## [7] "Registros"           "Tipo.trabajo"
```

```
##  [9] "Gastos"                  "Ingresos"
## [11] "Patrimonio"              "Cargas.patrimoniales"
## [13] "Importe.solicitado"      "Precio.del.bien.financiado"
## [15] "Estalvi"                 "RatiFin"
```

```
#is R understanding well my factor variables?
sapply(dd,class)
```

```
##                  Dictamen        Antiguedad.Trabajo
##                 "character"               "integer"
##                  Vivienda                     Plazo
##                 "character"               "integer"
##                      Edad               Estado.civil
##                 "integer"               "character"
##                 Registros              Tipo.trabajo
##                 "character"               "character"
##                    Gastos                  Ingresos
##                 "integer"                 "integer"
##                 Patrimonio      Cargas.patrimoniales
##                 "integer"                 "integer"
##         Importe.solicitado Precio.del.bien.financiado
##                 "integer"                 "integer"
##                    Estalvi                    RatiFin
##                 "numeric"                 "numeric"
```

```
#set a list of numerical variables (with no missing values)
```

```
numeriques<-which(sapply(dd,is.numeric))
numeriques
```

```
##          Antiguedad.Trabajo                       Plazo
##                           2                           4
##                        Edad                      Gastos
##                           5                           9
##                    Ingresos                  Patrimonio
##                          10                          11
##        Cargas.patrimoniales          Importe.solicitado
##                          12                          13
## Precio.del.bien.financiado                     Estalvi
##                          14                          15
##                     RatiFin
##                          16
```

```
dcon<-dd[,numeriques]
sapply(dcon,class)
```

```
##          Antiguedad.Trabajo                       Plazo
##                 "integer"                 "integer"
##                        Edad                      Gastos
##                 "integer"                 "integer"
##                    Ingresos                  Patrimonio
```

8

```
##                     "integer"                        "integer"
##         Cargas.patrimoniales      Importe.solicitado
##                     "integer"                        "integer"
## Precio.del.bien.financiado                    Estalvi
##                     "integer"                        "numeric"
##                       RatiFin
##                     "numeric"
```

```
#dcon <- data.frame (Antiguedad.Trabajo,Plazo,Edad,Gastos,Ingresos,Patrimonio,Cargas.patrimoniales,Impo

#alternatively
#dim(dd)
#indexCon<-c(2,4:5,9:16)
#dcon<-dd[,indexCon]
#names(dcon)

#be sure you don't have missing data in your numerical variables.

#in case of having missing data, select complete rows JUST TO FOLLOW THE CLASS
#dd<-dd[!is.na(dd[,indecCon[1]])& !is.na(dd[,indecCon[2]]) & !is.na(dd[,indecCon[3]])& !is.na(dd[,indec
#then preprocess your complete data set to IMPUTE all missing data, and reproduce
#the whole analysis again
# PRINCIPAL COMPONENT ANALYSIS OF dcon

pc1 <- prcomp(dcon, scale=TRUE)
class(pc1)
```

```
## [1] "prcomp"
```

```
attributes(pc1)
```

```
## $names
## [1] "sdev"     "rotation" "center"   "scale"     "x"
##
## $class
## [1] "prcomp"
```

```
print(pc1)
```

```
## Standard deviations (1, .., p=11):
##  [1] 1.4744109 1.4171431 1.2335157 1.1541179 1.0424195 0.9760376 0.8770617
##  [8] 0.7307046 0.6822867 0.3352657 0.2095152
##
## Rotation (n x k) = (11 x 11):
##                                PC1         PC2          PC3          PC4
## Antiguedad.Trabajo      -0.1378355  0.36466844 -0.328141308  0.32821818
## Plazo                   -0.3709036 -0.26967410  0.248757347  0.29401290
## Edad                    -0.1615495  0.35252148 -0.407822855  0.36306630
## Gastos                  -0.1564237  0.21112393 -0.144862280  0.25795585
## Ingresos                -0.2929562  0.47012915  0.409051415 -0.10564515
## Patrimonio              -0.2075899  0.16214212 -0.271671179 -0.27887813
## Cargas.patrimoniales    -0.1122824  0.01184096 -0.001967503 -0.25957051
```

```
## Importe.solicitado              -0.5916964 -0.25583119 -0.071489310 -0.09663841
## Precio.del.bien.financiado -0.4501156 -0.04295842 -0.227003917 -0.46854005
## Estalvi                        -0.1170106  0.45191568  0.552859370 -0.03618873
## RatiFin                        -0.2914461 -0.32630293  0.199277093  0.47008696
##                                         PC5          PC6          PC7          PC8
## Antiguedad.Trabajo            -0.0154458878 -0.347912673  0.3154381807  0.08429712
## Plazo                          0.0555631804 -0.145848654  0.2618110240 -0.69942555
## Edad                          -0.0001774573 -0.127096070  0.0302064178  0.06577229
## Gastos                         0.0077267363  0.848916855 -0.0812709932 -0.22702246
## Ingresos                      -0.0136818417  0.127516266 -0.0887121379  0.23428803
## Patrimonio                     0.4370176193 -0.220246721 -0.6415115751 -0.33729641
## Cargas.patrimoniales           0.7628131810  0.137279849  0.5290663068  0.15288957
## Importe.solicitado            -0.1569815544  0.001572679 -0.0338483076  0.26557584
## Precio.del.bien.financiado -0.3645714125  0.033801089  0.1707257678 -0.01957819
## Estalvi                       -0.0643341088 -0.185767988 -0.0005869002 -0.10844964
## RatiFin                        0.2487257152 -0.040027484 -0.3079365168  0.41608002
##                                        PC9          PC10          PC11
## Antiguedad.Trabajo            0.636160283 -0.005017236  0.0005254345
## Plazo                        -0.062865851  0.234904119  0.0122598914
## Edad                         -0.727855434  0.015052793  0.0100885451
## Gastos                        0.170637641 -0.187915622 -0.0117819769
## Ingresos                      0.020056749  0.659041785  0.0269192147
## Patrimonio                    0.118767409 -0.001932685 -0.0113892643
## Cargas.patrimoniales         -0.087918577 -0.090075713  0.0035116581
## Importe.solicitado            0.009632619 -0.126838449 -0.6763825551
## Precio.del.bien.financiado -0.022046034 -0.111245653  0.5899515965
## Estalvi                      -0.074133704 -0.646786055 -0.0296534483
## RatiFin                       0.064381474 -0.141445336  0.4385505215
```

```
str(pc1)
```

```
## List of 5
##  $ sdev    : num [1:11] 1.47 1.42 1.23 1.15 1.04 ...
##  $ rotation: num [1:11, 1:11] -0.138 -0.371 -0.162 -0.156 -0.293 ...
##   ..- attr(*, "dimnames")=List of 2
##   .. ..$ : chr [1:11] "Antiguedad.Trabajo" "Plazo" "Edad" "Gastos" ...
##   .. ..$ : chr [1:11] "PC1" "PC2" "PC3" "PC4" ...
##  $ center  : Named num [1:11] 7.99 46.44 37.08 55.57 130.48 ...
##   ..- attr(*, "names")= chr [1:11] "Antiguedad.Trabajo" "Plazo" "Edad" "Gastos" ...
##  $ scale   : Named num [1:11] 8.17 14.66 10.98 19.52 86.35 ...
##   ..- attr(*, "names")= chr [1:11] "Antiguedad.Trabajo" "Plazo" "Edad" "Gastos" ...
##  $ x       : num [1:4455, 1:11] 0.1399 -0.5773 -2.507 0.0404 2.5959 ...
##   ..- attr(*, "dimnames")=List of 2
##   .. ..$ : NULL
##   .. ..$ : chr [1:11] "PC1" "PC2" "PC3" "PC4" ...
##  - attr(*, "class")= chr "prcomp"
```

```
# WHICH PERCENTAGE OF THE TOTAL INERTIA IS REPRESENTED IN SUBSPACES?

pc1$sdev
```

```
##  [1] 1.4744109 1.4171431 1.2335157 1.1541179 1.0424195 0.9760376 0.8770617
##  [8] 0.7307046 0.6822867 0.3352657 0.2095152
```

```
inerProj<- pc1$sdev^2
inerProj
```

```
##   [1] 2.17388738 2.00829448 1.52156090 1.33198822 1.08663833 0.95264946
##   [7] 0.76923718 0.53392924 0.46551512 0.11240307 0.04389661
```
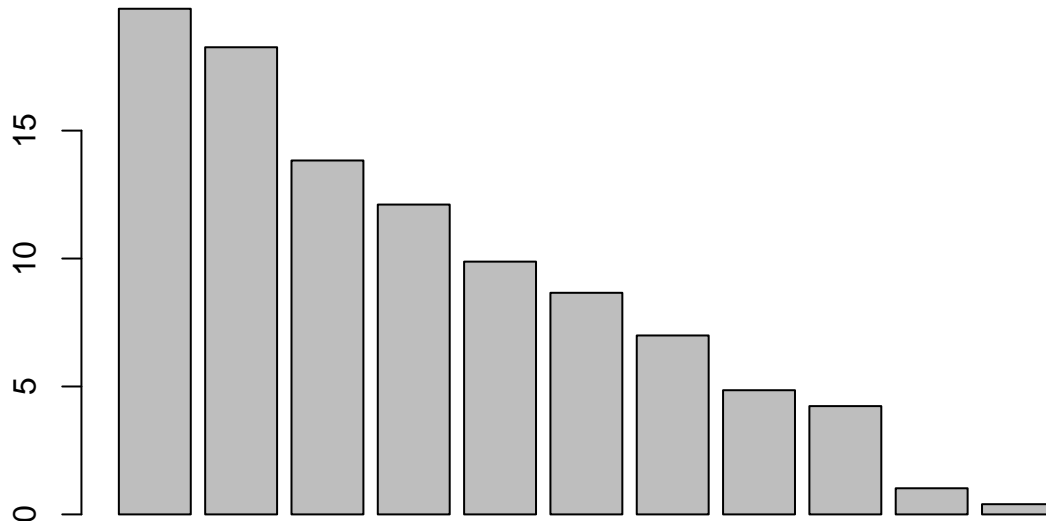
```
totalIner<- sum(inerProj)
totalIner
```
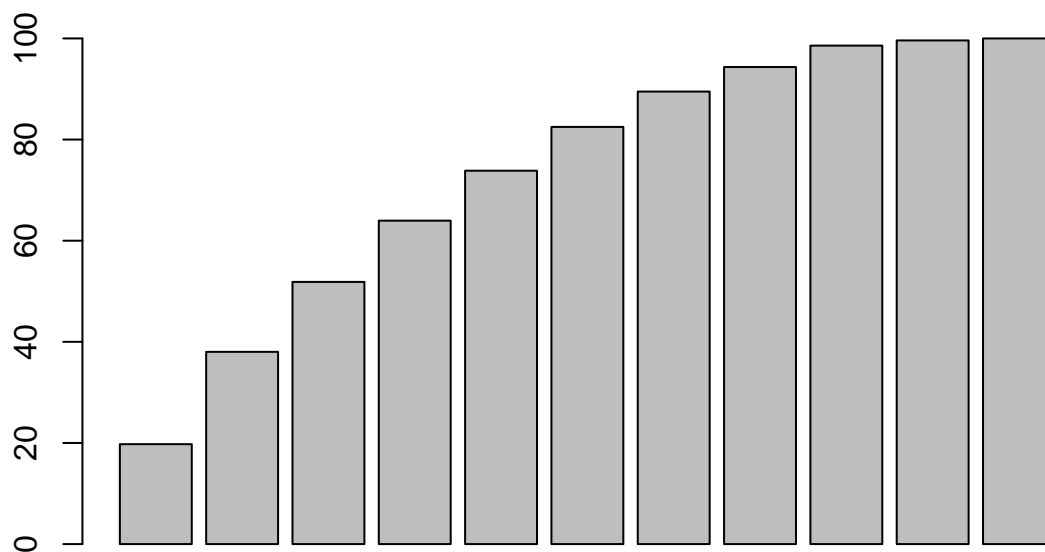
```
## [1] 11
```

```
pinerEix<- 100*inerProj/totalIner
pinerEix
```

```
##   [1] 19.7626125 18.2572225 13.8323718 12.1089838  9.8785303  8.6604497
##   [7]  6.9930653  4.8539022  4.2319557  1.0218461  0.3990601
```

```
barplot(pinerEix)
```



```
#Cummulated Inertia in subspaces, from first principal component to the 11th dimension subspace
barplot(100*cumsum(pc1$sdev[1:dim(dcon)[2]]^2)/dim(dcon)[2])
```

```
percInerAccum<-100*cumsum(pc1$sdev[1:dim(dcon)[2]]^2)/dim(dcon)[2]
percInerAccum
```

```
## [1]  19.76261  38.01984  51.85221  63.96119  73.83972  82.50017  89.49324
## [8]  94.34714  98.57909  99.60094 100.00000
```

```
# SELECTION OF THE SINGIFICNT DIMENSIONS (keep 80% of total inertia)
```

```
nd = 6
```

```
print(pc1)
```

```
## Standard deviations (1, .., p=11):
##  [1] 1.4744109 1.4171431 1.2335157 1.1541179 1.0424195 0.9760376 0.8770617
##  [8] 0.7307046 0.6822867 0.3352657 0.2095152
##
## Rotation (n x k) = (11 x 11):
##                          PC1         PC2          PC3         PC4
## Antiguedad.Trabajo -0.1378355  0.36466844 -0.328141308  0.32821818
## Plazo              -0.3709036 -0.26967410  0.248757347  0.29401290
## Edad               -0.1615495  0.35252148 -0.407822855  0.36306630
## Gastos             -0.1564237  0.21112393 -0.144862280  0.25795585
## Ingresos           -0.2929562  0.47012915  0.409051415 -0.10564515
## Patrimonio         -0.2075899  0.16214212 -0.271671179 -0.27887813
```

```
## Cargas.patrimoniales         -0.1122824  0.01184096 -0.001967503 -0.25957051
## Importe.solicitado           -0.5916964 -0.25583119 -0.071489310 -0.09663841
## Precio.del.bien.financiado   -0.4501156 -0.04295842 -0.227003917 -0.46854005
## Estalvi                      -0.1170106  0.45191568  0.552859370 -0.03618873
## RatiFin                      -0.2914461 -0.32630293  0.199277093  0.47008696
##                                      PC5          PC6          PC7          PC8
## Antiguedad.Trabajo           -0.0154458878 -0.347912673  0.3154381807  0.08429712
## Plazo                         0.0555631804 -0.145848654  0.2618110240 -0.69942555
## Edad                         -0.0001774573 -0.127096070  0.0302064178  0.06577229
## Gastos                        0.0077267363  0.848916855 -0.0812709932 -0.22702246
## Ingresos                     -0.0136818417  0.127516266 -0.0887121379  0.23428803
## Patrimonio                    0.4370176193 -0.220246721 -0.6415115751 -0.33729641
## Cargas.patrimoniales          0.7628131810  0.137279849  0.5290663068  0.15288957
## Importe.solicitado           -0.1569815544  0.001572679 -0.0338483076  0.26557584
## Precio.del.bien.financiado   -0.3645714125  0.033801089  0.1707257678 -0.01957819
## Estalvi                      -0.0643341088 -0.185767988 -0.0005869002 -0.10844964
## RatiFin                       0.2487257152 -0.040027484 -0.3079365168  0.41608002
##                                      PC9         PC10         PC11
## Antiguedad.Trabajo            0.636160283 -0.005017236  0.0005254345
## Plazo                        -0.062865851  0.234904119  0.0122598914
## Edad                         -0.727855434  0.015052793  0.0100885451
## Gastos                        0.170637641 -0.187915622 -0.0117819769
## Ingresos                      0.020056749  0.659041785  0.0269192147
## Patrimonio                    0.118767409 -0.001932685 -0.0113892643
## Cargas.patrimoniales         -0.087918577 -0.090075713  0.0035116581
## Importe.solicitado            0.009632619 -0.126838449 -0.6763825551
## Precio.del.bien.financiado   -0.022046034 -0.111245653  0.5899515965
## Estalvi                      -0.074133704 -0.646786055 -0.0296534483
## RatiFin                       0.064381474 -0.141445336  0.4385505215
```

attributes(pc1)

```
## $names
## [1] "sdev"     "rotation" "center"   "scale"     "x"
##
## $class
## [1] "prcomp"
```

pc1**$**rotation

```
##                                      PC1          PC2          PC3          PC4
## Antiguedad.Trabajo           -0.1378355  0.36466844 -0.328141308  0.32821818
## Plazo                        -0.3709036 -0.26967410  0.248757347  0.29401290
## Edad                         -0.1615495  0.35252148 -0.407822855  0.36306630
## Gastos                       -0.1564237  0.21112393 -0.144862280  0.25795585
## Ingresos                     -0.2929562  0.47012915  0.409051415 -0.10564515
## Patrimonio                   -0.2075899  0.16214212 -0.271671179 -0.27887813
## Cargas.patrimoniales         -0.1122824  0.01184096 -0.001967503 -0.25957051
## Importe.solicitado           -0.5916964 -0.25583119 -0.071489310 -0.09663841
## Precio.del.bien.financiado   -0.4501156 -0.04295842 -0.227003917 -0.46854005
## Estalvi                      -0.1170106  0.45191568  0.552859370 -0.03618873
## RatiFin                      -0.2914461 -0.32630293  0.199277093  0.47008696
##                                      PC5          PC6          PC7          PC8
```

```
## Antiguedad.Trabajo          -0.0154458878 -0.347912673  0.3154381807  0.08429712
## Plazo                        0.0555631804 -0.145848654  0.2618110240 -0.69942555
## Edad                        -0.0001774573 -0.127096070  0.0302064178  0.06577229
## Gastos                       0.0077267363  0.848916855 -0.0812709932 -0.22702246
## Ingresos                    -0.0136818417  0.127516266 -0.0887121379  0.23428803
## Patrimonio                   0.4370176193 -0.220246721 -0.6415115751 -0.33729641
## Cargas.patrimoniales         0.7628131810  0.137279849  0.5290663068  0.15288957
## Importe.solicitado          -0.1569815544  0.001572679 -0.0338483076  0.26557584
## Precio.del.bien.financiado  -0.3645714125  0.033801089  0.1707257678 -0.01957819
## Estalvi                     -0.0643341088 -0.185767988 -0.0005869002 -0.10844964
## RatiFin                      0.2487257152 -0.040027484 -0.3079365168  0.41608002
##                                      PC9         PC10          PC11
## Antiguedad.Trabajo           0.636160283 -0.005017236  0.0005254345
## Plazo                       -0.062865851  0.234904119  0.0122598914
## Edad                        -0.727855434  0.015052793  0.0100885451
## Gastos                       0.170637641 -0.187915622 -0.0117819769
## Ingresos                     0.020056749  0.659041785  0.0269192147
## Patrimonio                   0.118767409 -0.001932685 -0.0113892643
## Cargas.patrimoniales        -0.087918577 -0.090075713  0.0035116581
## Importe.solicitado           0.009632619 -0.126838449 -0.6763825551
## Precio.del.bien.financiado  -0.022046034 -0.111245653  0.5899515965
## Estalvi                     -0.074133704 -0.646786055 -0.0296534483
## RatiFin                      0.064381474 -0.141445336  0.4385505215
```

```r
# STORAGE OF THE EIGENVALUES, EIGENVECTORS AND PROJECTIONS IN THE nd DIMENSIONS
View(pc1$x)
dim(pc1$x)
```

```
## [1] 4455   11
```

```r
dim(dcon)
```

```
## [1] 4455   11
```

```r
dcon[2000,]
```

```
##      Antiguedad.Trabajo Plazo Edad Gastos Ingresos Patrimonio
## 2000                  1    48   27     45       90       5000
##      Cargas.patrimoniales Importe.solicitado Precio.del.bien.financiado
## 2000                    0                350                       1680
##       Estalvi  RatiFin
## 2000 6.171429 20.83333
```

```r
pc1$x[2000,]
```

```
##        PC1       PC2       PC3       PC4       PC5       PC6       PC7
##  1.8500730 0.4860563 0.4714612 -1.8332931 -0.7748730 -0.1672763 0.5800451
##        PC8       PC9      PC10      PC11
## -1.7485676 -0.1995542 -0.1015557 0.0365578
```

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```
Psi = pc1$x[,1:nd]
dim(Psi)
```

```
## [1] 4455     6
```

```
Psi[2000,]
```

```
##        PC1        PC2        PC3        PC4        PC5        PC6
##  1.8500730  0.4860563  0.4714612 -1.8332931 -0.7748730 -0.1672763
```

```
# STORAGE OF LABELS FOR INDIVIDUALS AND VARIABLES

iden = row.names(dcon)
etiq = names(dcon)
ze = rep(0,length(etiq)) # WE WILL NEED THIS VECTOR AFTERWARDS FOR THE GRAPHICS

# PLOT OF INDIVIDUALS

#select your axis
#eje1<-2
eje1<-1
#eje2<-3
eje2<-2

plot(Psi[,eje1],Psi[,eje2])
text(Psi[,eje1],Psi[,eje2],labels=iden, cex=0.5)
axis(side=1, pos= 0, labels = F, col="cyan")
axis(side=3, pos= 0, labels = F, col="cyan")
axis(side=2, pos= 0, labels = F, col="cyan")
axis(side=4, pos= 0, labels = F, col="cyan")
```
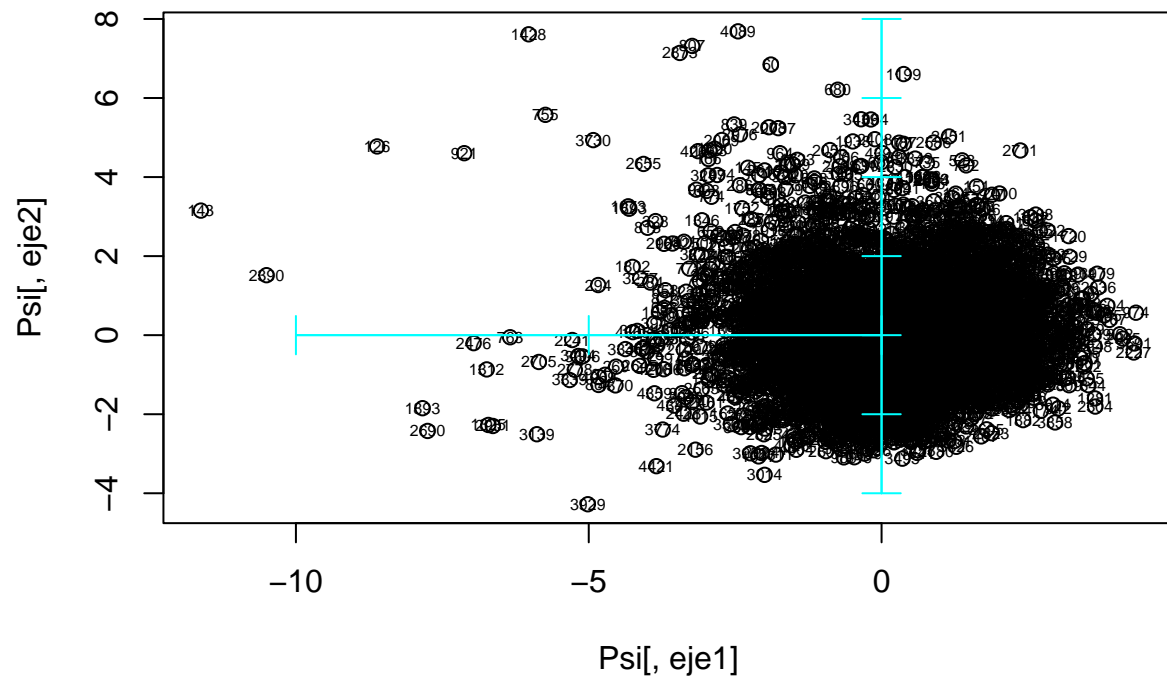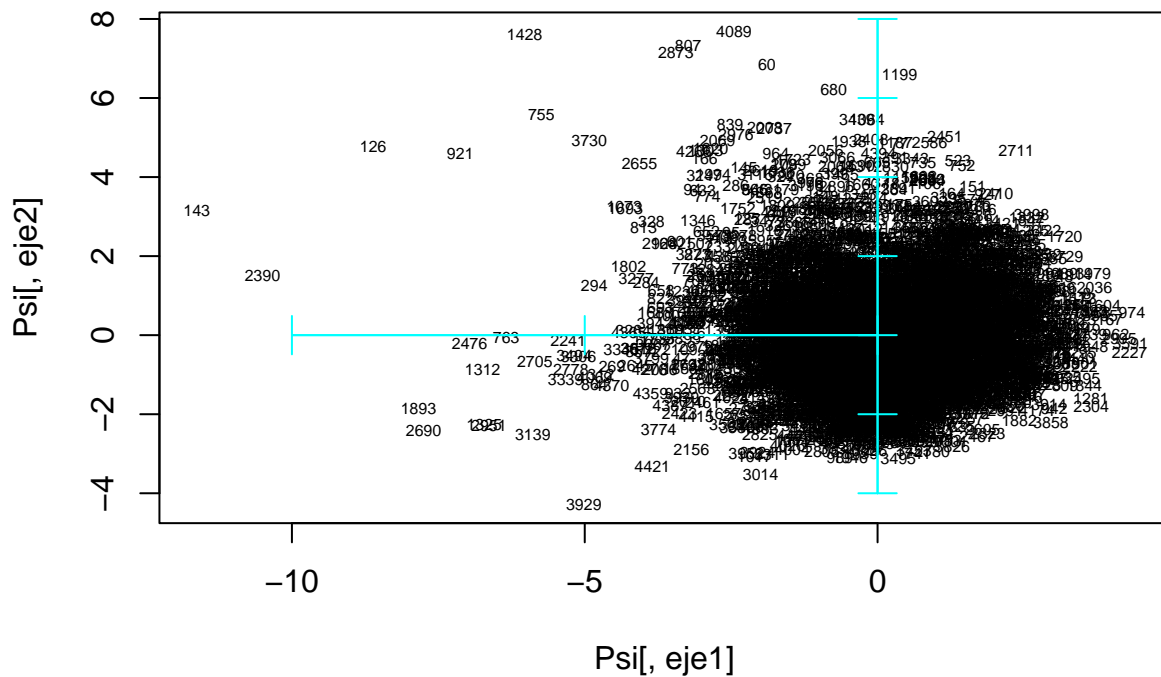
```r
plot(Psi[,eje1],Psi[,eje2], type="n")
text(Psi[,eje1],Psi[,eje2],labels=iden, cex=0.5)
axis(side=1, pos= 0, labels = F, col="cyan")
axis(side=3, pos= 0, labels = F, col="cyan")
axis(side=2, pos= 0, labels = F, col="cyan")
axis(side=4, pos= 0, labels = F, col="cyan")
```

```r
#library(rgl)
#plot3d(Psi[,1],Psi[,2],Psi[,3])

#Projection of variables

Phi = cor(dcon,Psi)
View(Phi)

#select your axis

X<-Phi[,eje1]
Y<-Phi[,eje2]

plot(Psi[,eje1],Psi[,eje2],type="n")
axis(side=1, pos= 0, labels = F)
axis(side=3, pos= 0, labels = F)
axis(side=2, pos= 0, labels = F)
axis(side=4, pos= 0, labels = F)
arrows(ze, ze, X, Y, length = 0.07,col="blue")
text(X,Y,labels=etiq,col="darkblue", cex=0.7)
```
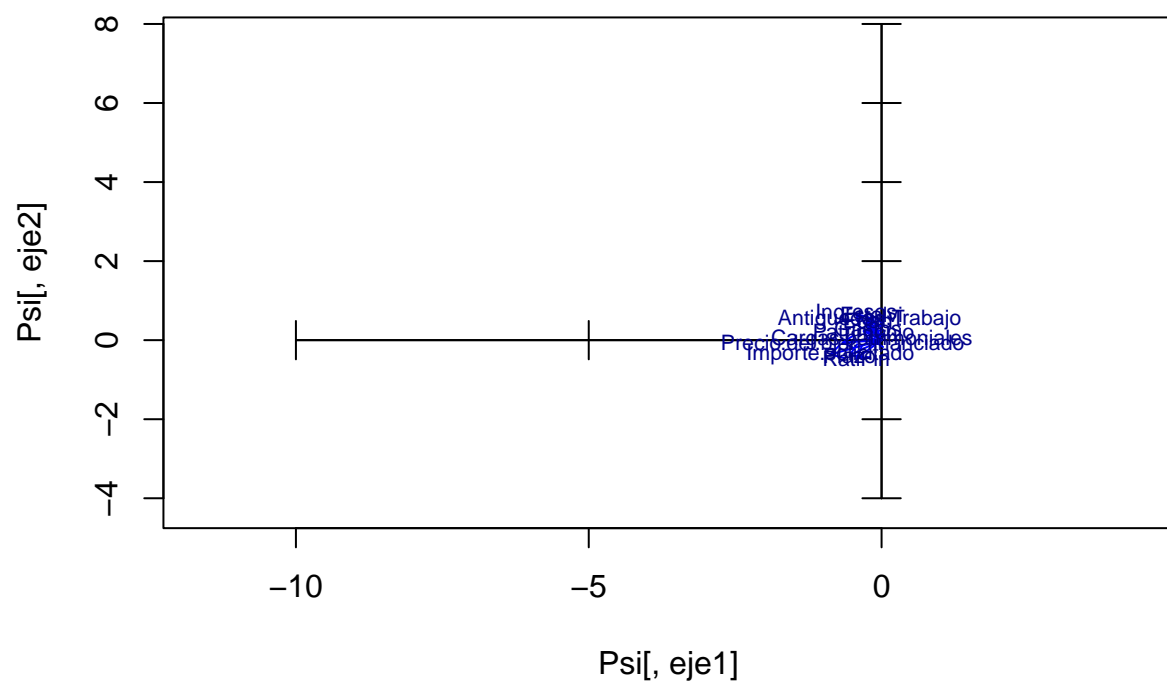
```
#zooms
plot(Psi[,eje1],Psi[,eje2],type="n",xlim=c(min(X,0),max(X,0)), ylim=c(-1,1))
axis(side=1, pos= 0, labels = F)
axis(side=3, pos= 0, labels = F)
axis(side=2, pos= 0, labels = F)
axis(side=4, pos= 0, labels = F)
arrows(ze, ze, X, Y, length = 0.07,col="blue")
text(X,Y,labels=etiq,col="darkblue", cex=0.7)
```

```r
# PROJECTION OF ILLUSTRATIVE qualitative variables on individuals' map
# PROJECCI? OF INDIVIDUALS DIFFERENTIATING THE Dictamen
# (we need a numeric Dictamen to color)


varcat=factor(dd[,1])
plot(Psi[,1],Psi[,2],col=varcat)
axis(side=1, pos= 0, labels = F, col="darkgray")
axis(side=3, pos= 0, labels = F, col="darkgray")
axis(side=2, pos= 0, labels = F, col="darkgray")
axis(side=4, pos= 0, labels = F, col="darkgray")
legend("bottomleft",levels(factor(varcat)),pch=1,col=c(1,2), cex=0.6)

#select your qualitative variable
k<-1 #dictamen in credsco

varcat<-factor(dd[,k])
fdic1 = tapply(Psi[,eje1],varcat,mean)
fdic2 = tapply(Psi[,eje2],varcat,mean)
#points(fdic1,fdic2,pch=16,col="blue", labels=levels(varcat))
text(fdic1,fdic2,labels=levels(varcat),col="yellow", cex=0.7)
```
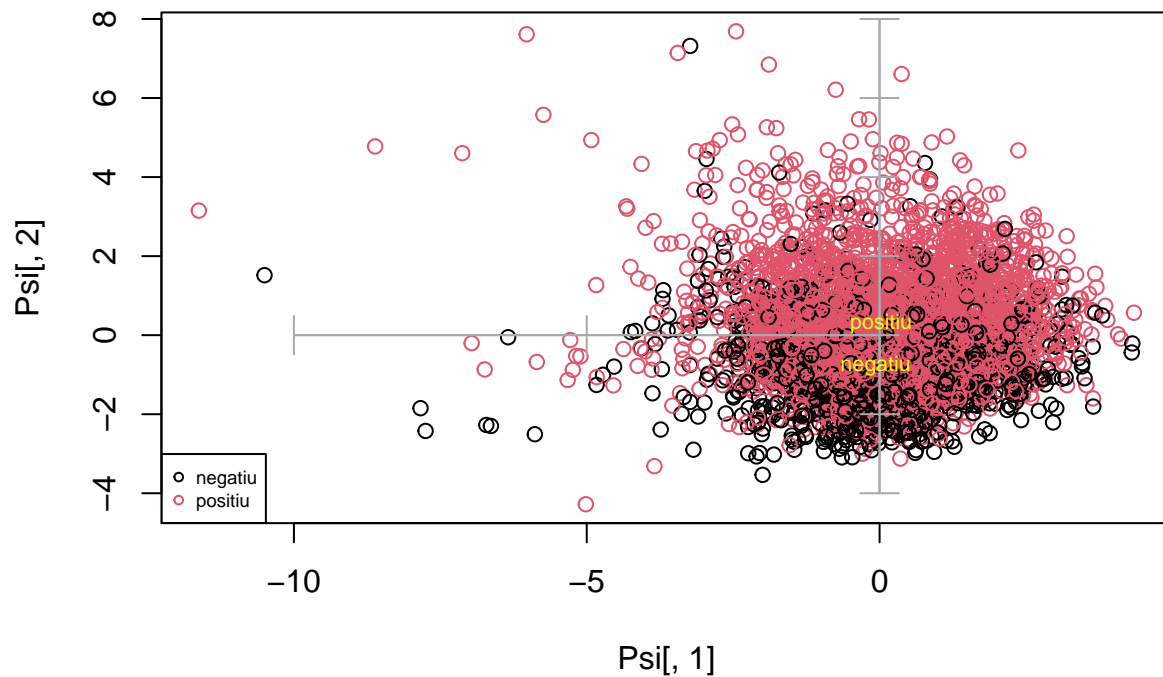
```r
#Now we project both cdgs of levels of a selected qualitative variable without
#representing the individual anymore

plot(Psi[,eje1],Psi[,eje2],type="n")
axis(side=1, pos= 0, labels = F, col="cyan")
axis(side=3, pos= 0, labels = F, col="cyan")
axis(side=2, pos= 0, labels = F, col="cyan")
axis(side=4, pos= 0, labels = F, col="cyan")

#select your qualitative variable
k<-1 #dictamen in credsco

#varcat<-dd[,k]
#fdic1 = tapply(Psi[,eje1],varcat,mean)
#fdic2 = tapply(Psi[,eje2],varcat,mean)

#points(fdic1,fdic2,pch=16,col="blue", labels=levels(varcat))
text(fdic1,fdic2,labels=levels(varcat),col="blue", cex=0.7)
```
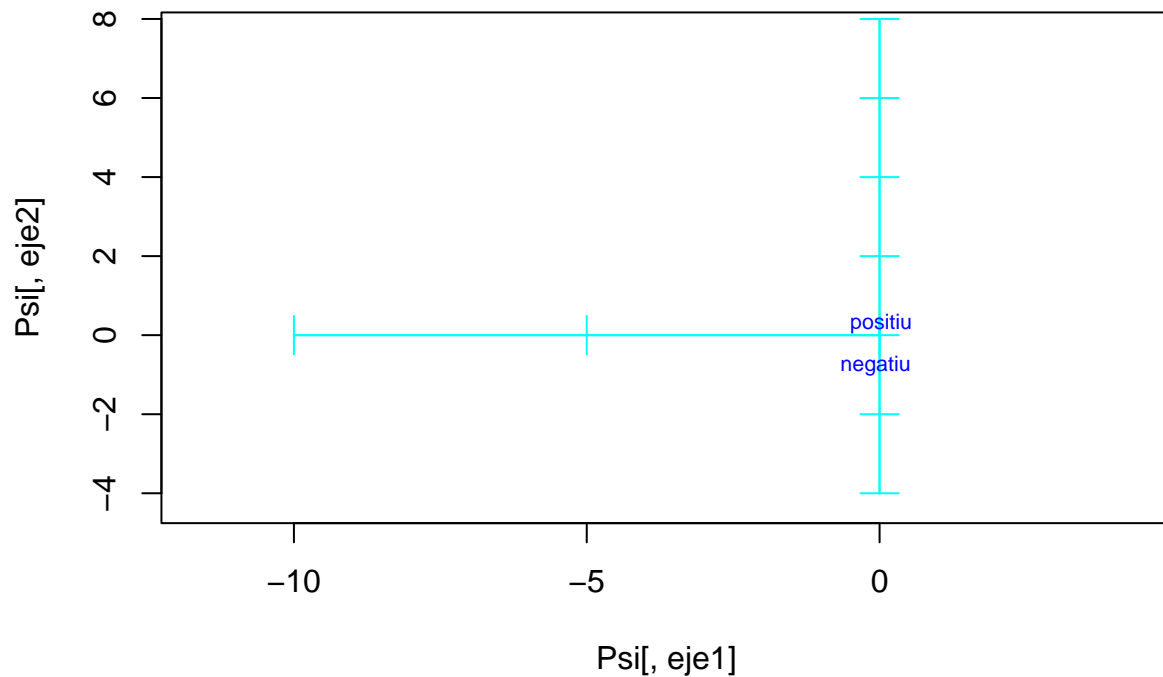
```
#all qualitative together
plot(Psi[,eje1],Psi[,eje2],type="n")
axis(side=1, pos= 0, labels = F, col="cyan")
axis(side=3, pos= 0, labels = F, col="cyan")
axis(side=2, pos= 0, labels = F, col="cyan")
axis(side=4, pos= 0, labels = F, col="cyan")

#nominal qualitative variables

dcat<-c(1,3,6:7)
#divide categoricals in several graphs if joint representation saturates

#build a palette with as much colors as qualitative variables

#colors<-c("blue","red","green","orange","darkgreen")
#alternative
colors<-rainbow(length(dcat))

c<-1
for(k in dcat){
  seguentColor<-colors[c]
fdic1 = tapply(Psi[,eje1],dd[,k],mean)
fdic2 = tapply(Psi[,eje2],dd[,k],mean)

text(fdic1,fdic2,labels=levels(factor(dd[,k])),col=seguentColor, cex=0.6)
c<-c+1
```
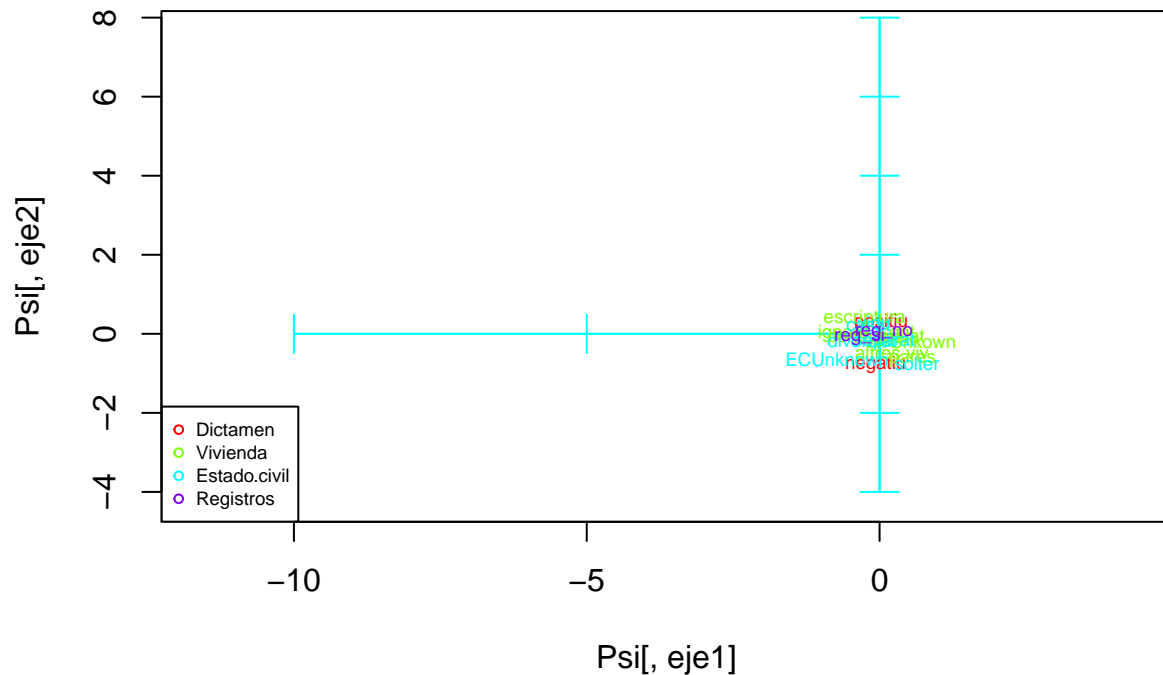
```
}
legend("bottomleft",names(dd)[dcat],pch=1,col=colors, cex=0.6)
```



```
#determine zoom level
#use the scale factor or not depending on the position of centroids
# ES UN FACTOR D'ESCALA PER DIBUIXAR LES FLETXES MES VISIBLES EN EL GRAFIC
#fm = round(max(abs(Psi[,1])))
fm=20

#scale the projected variables
#X<-fm*U[,eje1]
#Y<-fm*U[,eje2]

#represent numerical variables in background
plot(Psi[,eje1],Psi[,eje2],type="n",xlim=c(-1,1), ylim=c(-3,1))
#plot(X,Y,type="none",xlim=c(min(X,0),max(X,0)))
axis(side=1, pos= 0, labels = F, col="cyan")
axis(side=3, pos= 0, labels = F, col="cyan")
axis(side=2, pos= 0, labels = F, col="cyan")
axis(side=4, pos= 0, labels = F, col="cyan")

#add projections of numerical variables in background
arrows(ze, ze, X, Y, length = 0.07,col="lightgray")
text(X,Y,labels=etiq,col="gray", cex=0.7)
```

```r
#add centroids
c<-1
for(k in dcat){
  seguentColor<-colors[c]

  fdic1 = tapply(Psi[,eje1],dd[,k],mean)
  fdic2 = tapply(Psi[,eje2],dd[,k],mean)

  #points(fdic1,fdic2,pch=16,col=seguentColor, labels=levels(dd[,k]))
  text(fdic1,fdic2,labels=levels(factor(dd[,k])),col=seguentColor, cex=0.6)
  c<-c+1
}
legend("bottomleft",names(dd)[dcat],pch=1,col=colors, cex=0.6)


#add ordinal qualitative variables. Ensure ordering is the correct

dordi<-c(8)


levels(factor(dd[,dordi[1]]))
```

```
## [1] "altres sit"         "autonom"              "fixe"
## [4] "temporal"           "WorkingTypeUnknown"
```

```r
#reorder modalities: when required
dd[,dordi[1]] <- factor(dd[,dordi[1]], ordered=TRUE,  levels= c("WorkingTypeUnknown","altres sit","tempo
levels(dd[,dordi[1]])
```

```
## [1] "WorkingTypeUnknown" "altres sit"           "temporal"
## [4] "fixe"               "autonom"
```

```r
c<-1
col<-1
for(k in dordi){
  seguentColor<-colors[col]
  fdic1 = tapply(Psi[,eje1],dd[,k],mean)
  fdic2 = tapply(Psi[,eje2],dd[,k],mean)

  #points(fdic1,fdic2,pch=16,col=seguentColor, labels=levels(dd[,k]))
  #connect modalities of qualitative variables
  lines(fdic1,fdic2,pch=16,col=seguentColor)
 text(fdic1,fdic2,labels=levels(dd[,k]),col=seguentColor, cex=0.6)
  c<-c+1
  col<-col+1
}
legend("topleft",names(dd)[dordi],pch=1,col=colors[1:length(dordi)], cex=0.6)
```
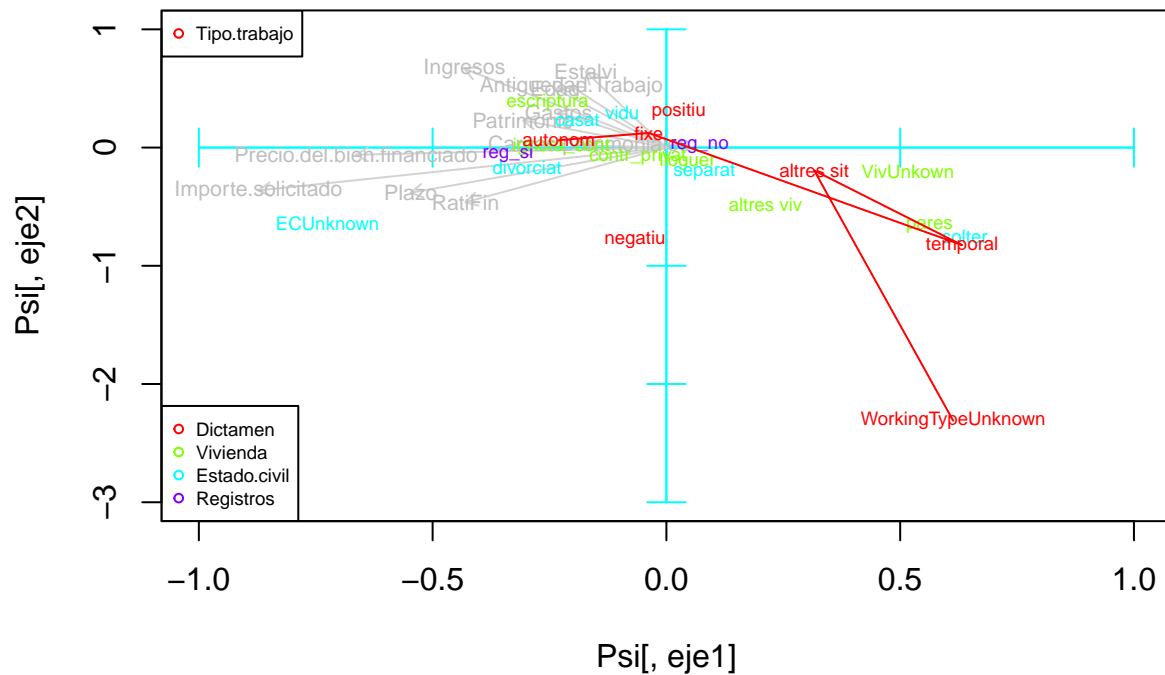
```r
#using our own colors palette
# search palettes in internet. One might be https://r-charts.com/es/colores/

colors<-c("red", "blue", "darkgreen", "orange", "violet", "magenta", "pink")

#represent numerical variables in background
plot(Psi[,eje1],Psi[,eje2],type="n",xlim=c(-1,1), ylim=c(-3,1))
#plot(X,Y,type="none",xlim=c(min(X,0),max(X,0)))
axis(side=1, pos= 0, labels = F, col="cyan")
axis(side=3, pos= 0, labels = F, col="cyan")
axis(side=2, pos= 0, labels = F, col="cyan")
axis(side=4, pos= 0, labels = F, col="cyan")

#add projections of numerical variables in background
arrows(ze, ze, X, Y, length = 0.07,col="lightgray")
text(X,Y,labels=etiq,col="gray", cex=0.7)

#add centroids
c<-1
for(k in dcat){
  seguentColor<-colors[c]

  fdic1 = tapply(Psi[,eje1],dd[,k],mean)
  fdic2 = tapply(Psi[,eje2],dd[,k],mean)

  #points(fdic1,fdic2,pch=16,col=seguentColor, labels=levels(dd[,k]))
```

```
  text(fdic1,fdic2,labels=levels(factor(dd[,k])),col=seguentColor, cex=0.6)
  c<-c+1
}
legend("bottomleft",names(dd)[dcat],pch=19,col=colors, cex=0.6)


#add ordinal qualitative variables. Ensure ordering is the correct

dordi<-c(8)


levels(factor(dd[,dordi[1]]))
```

```
## [1] "WorkingTypeUnknown" "altres sit"          "temporal"
## [4] "fixe"                "autonom"
```

```
#reorder modalities: when required
dd[,dordi[1]] <- factor(dd[,dordi[1]], ordered=TRUE,  levels= c("WorkingTypeUnknown","altres sit","tempo
levels(dd[,dordi[1]])
```

```
## [1] "WorkingTypeUnknown" "altres sit"          "temporal"
## [4] "fixe"                "autonom"
```

```
c<-1
col<-length(dcat)+1
for(k in dordi){
  seguentColor<-colors[col]
  fdic1 = tapply(Psi[,eje1],dd[,k],mean)
  fdic2 = tapply(Psi[,eje2],dd[,k],mean)

  #points(fdic1,fdic2,pch=16,col=seguentColor, labels=levels(dd[,k]))
  #connect modalities of qualitative variables
  lines(fdic1,fdic2,pch=16,col=seguentColor)
  text(fdic1,fdic2,labels=levels(dd[,k]),col=seguentColor, cex=0.6)
  c<-c+1
  col<-col+1
}
legend("topleft",names(dd)[dordi],pch=19,col=colors[col:col+length(dordi)-1], cex=0.6)
```
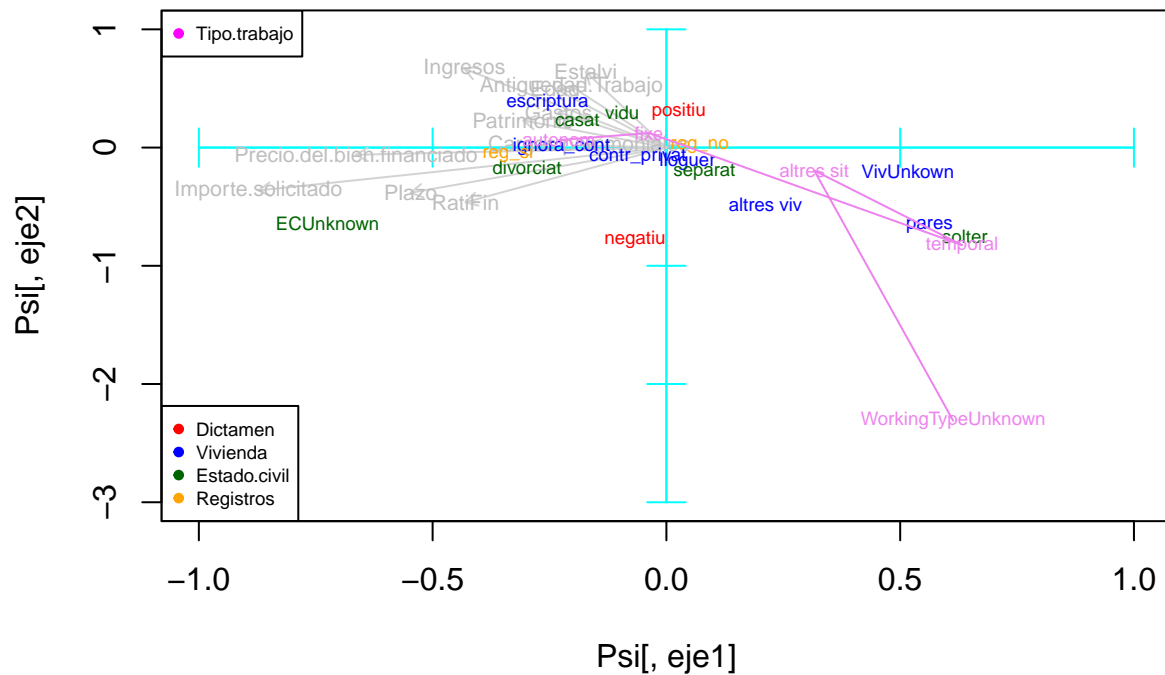
```
#Make two complementary factorial maps

colors<-c("red", "blue", "darkgreen", "orange", "violet", "magenta", "pink")

#represent numerical variables in background
#plot(Psi[,eje1],Psi[,eje2],type="p",xlim=c(-1,1), ylim=c(-3,1), col="lightgray")
plot(Psi[,eje1],Psi[,eje2],type="n",xlim=c(-1,1), ylim=c(-3,1))
#plot(X,Y,type="none",xlim=c(min(X,0),max(X,0)))
axis(side=1, pos= 0, labels = F, col="cyan")
axis(side=3, pos= 0, labels = F, col="cyan")
axis(side=2, pos= 0, labels = F, col="cyan")
axis(side=4, pos= 0, labels = F, col="cyan")

#add projections of numerical variables in background
arrows(ze, ze, X, Y, length = 0.07,col="lightgray")
text(X,Y,labels=etiq,col="gray", cex=0.7)

#numerical variables of financial situation

seleccio<-c(4:7,10)
dconMapa1<-dcon[,seleccio]

#referencia general comu a tots els mapes
arrows(ze, ze, X, Y, length = 0.07,col="lightgray")
text(X,Y,labels=etiq,col="gray", cex=0.7)
```

```r
#represent in the map1
XMapa1<-Phi[seleccio,eje1]
YMapa1<-Phi[seleccio,eje2]

arrows(ze, ze, XMapa1, YMapa1, length = 0.07,col="green")
text(XMapa1,YMapa1,labels=names(dconMapa1),col="green", cex=0.7)


#add centroids
dcatMapa1<-c(7)

c<-1
for(k in dcatMapa1){
  seguentColor<-colors[c]

  fdic1 = tapply(Psi[,eje1],dd[,k],mean)
  fdic2 = tapply(Psi[,eje2],dd[,k],mean)

  #points(fdic1,fdic2,pch=16,col=seguentColor, labels=levels(dd[,k]))
  text(fdic1,fdic2,labels=levels(factor(dd[,k])),col=seguentColor, cex=0.6)
  c<-c+1
}
legend("bottomleft",names(dd)[dcatMapa1],pch=19,col=colors, cex=0.6)


#add ordinal qualitative variables. Ensure ordering is the correct

dordi<-c(8)


levels(factor(dd[,dordi[1]]))
```

```
## [1] "WorkingTypeUnknown" "altres sit"         "temporal"
## [4] "fixe"               "autonom"
```

```r
#reorder modalities: when required
dd[,dordi[1]] <- factor(dd[,dordi[1]], ordered=TRUE,  levels= c("WorkingTypeUnknown","altres sit","tempo
levels(dd[,dordi[1]])
```

```
## [1] "WorkingTypeUnknown" "altres sit"         "temporal"
## [4] "fixe"               "autonom"
```

```r
c<-1
col<-length(dcat)+1
for(k in dordi){
  seguentColor<-colors[col]
  fdic1 = tapply(Psi[,eje1],dd[,k],mean)
  fdic2 = tapply(Psi[,eje2],dd[,k],mean)

  #points(fdic1,fdic2,pch=16,col=seguentColor, labels=levels(dd[,k]))
  #connect modalities of qualitative variables
  lines(fdic1,fdic2,pch=16,col=seguentColor)
```
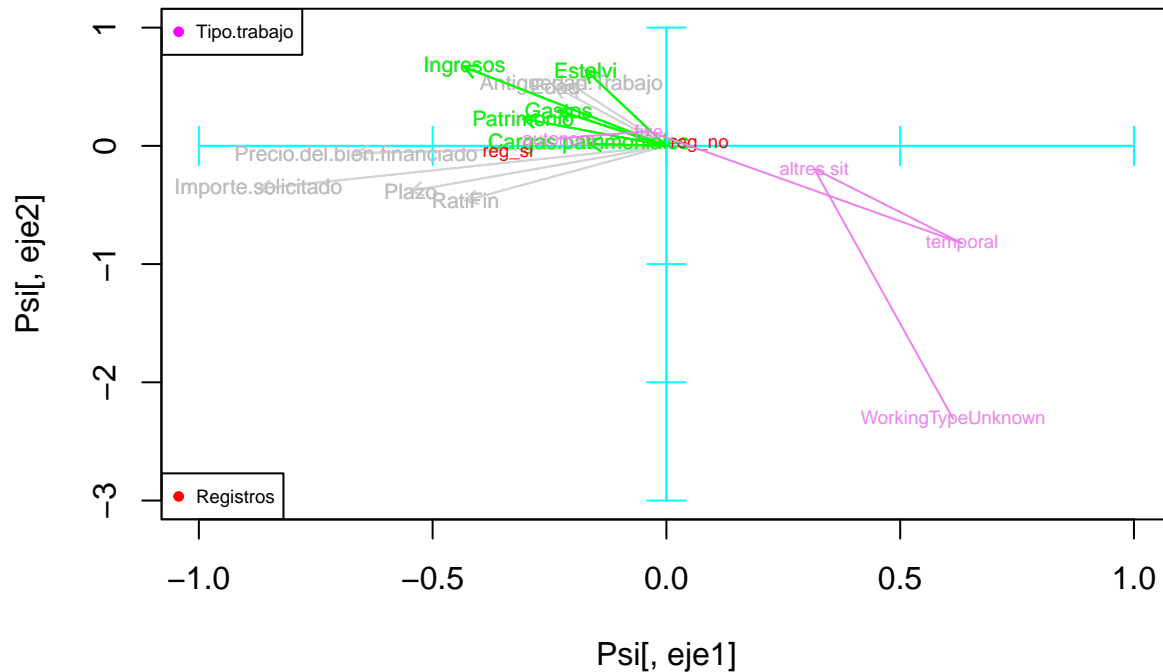
```
    text(fdic1,fdic2,labels=levels(dd[,k]),col=seguentColor, cex=0.6)
    c<-c+1
    col<-col+1
}
legend("topleft",names(dd)[dordi],pch=19,col=colors[col:col+length(dordi)-1], cex=0.6)
```



```
# PROJECTION OF ILLUSTRATIVE qualitative variables on individuals' map
# PROJECCI? OF INDIVIDUALS DIFFERENTIATING THE Dictamen
# (we need a numeric Dictamen to color)

varcat=factor(dd[,1])
plot(Psi[,1],Psi[,2],col=varcat)
axis(side=1, pos= 0, labels = F, col="darkgray")
axis(side=3, pos= 0, labels = F, col="darkgray")
axis(side=2, pos= 0, labels = F, col="darkgray")
axis(side=4, pos= 0, labels = F, col="darkgray")
legend("bottomleft",levels(varcat),pch=1,col=c(1,2), cex=0.6)


# Overproject THE CDG OF  LEVELS OF varcat
fdic1 = tapply(Psi[,1],varcat,mean)
fdic2 = tapply(Psi[,2],varcat,mean)

text(fdic1,fdic2,labels=levels(factor(varcat)),col="cyan", cex=0.75)
```