TP 2 estimation des effectifs en populations fermées

On charge le package `RMark` qui appelle le logiciel Mark depuis `R`. On charge aussi le package `secr` qui permet d'implémenter le test de `closure`.

```
library(RMark)
library(secr)
```

Exercice 1 : souris sylvestre

Lecture et formatage des données

On commence par lire les données qui se trouvent dans le répertoire dat/

```
mouse <- convert.inp("dat/deer-mouse-nogroup.inp",
                     group.df = NULL,
                     covariates = NULL)
```

On regarde les 10 premières lignes du fichier.

```
head(mouse)
```

```
##       ch freq
## 1 111111    1
## 2 100111    1
## 3 110011    1
## 4 110111    1
## 5 111111    1
## 6 110111    1
```

Les 10 dernières lignes.

```
tail(mouse)
```

```
##        ch freq
## 33 000010    1
## 34 000010    1
## 35 000010    1
## 36 000001    1
## 37 000001    1
## 38 000001    1
```

On fait les tests de fermeture. Pour cela, il nous faut d'abord convertir les données au format requis pour utiliser le package secr qui fait ces tests. Le formatage consiste à mettre un espace entre les colonnes de capture.

```
mouse_secr <- unRMarkInput(mouse)
```

On peut utiliser la fonction summary de R pour obtenir un résumé des données.

```
summary(mouse_secr)
```

```
## Object class       capthist
##
## Counts by occasion
##             1  2  3  4  5  6 Total
## n          15 20 16 19 25 25   120
## u          15  8  6  3  3  3    38
## f           9  6  7  6  6  4    38
## M(t+1)     15 23 29 32 35 38    38
## losses      0  0  0  0  0  0     0
## detections 15 20 16 19 25 25   120
```

Test de l'hypothèse de fermeture

On fait enfin les tests. Par défaut, seul le test d'Otis est fait. En rajoutant l'option "SB = TRUE", on fait aussi le test de Stanley et Burnham.

```
closure.test(mouse_secr, SB = TRUE)
```

```
## $Otis
##  statistic         p
##  0.7649179 0.7778398
##
## $Xc
##  statistic df         p
##     11.668  7 0.1120193
##
## $NRvsJS
##  statistic df          p
##    9.31129  3 0.02542603
##
## $NMvsJS
##   statistic df         p
##  0.04895105  1 0.8248987
##
## $MtvsNR
##  statistic df        p
##   2.356705  4 0.670465
##
## $MtvsNM
##  statistic df          p
##   11.61904  6 0.07102745
##
## $compNRvsJS
##   Occasion  Chisquare df           p
## 1        2 7.44579710  1 0.006358475
```

```
## 2        3 0.04505929  1 0.831895047
## 3        4 1.82043344  1 0.177261692
## 4        5         NA NA          NA
##
## $compNMvsJS
##   Occasion  Chisquare df         p
## 1        2         NA NA        NA
## 2        3         NA NA        NA
## 3        4         NA NA        NA
## 4        5 0.04895105  1 0.8248987
```

Une première série de modèles

Pour utiliser RMark, on passe par 3 étapes : la préparation des données, la définition des modèles et l'ajustement à proprement parler.

On commence par préparer les données.

```
mouse.proc <- process.data(mouse,
                           begin.time = 1,
                           model = "FullHet")
mouse.ddl <- make.design.data(mouse.proc)
```

On définit les modèles que l'on souhaite ajuster grâce à une fonction R qui fait 3 choses : spéficication des effets, création d'une liste des modèles à ajuster et préparation pour envoi à Mark. Par défaut, Mark considère un effet comportement et distingue une probabilité de capture c et une autre de recapture p. On utilise "share = TRUE" pour fusionner ces deux paramètres en une seule probabilité de capture.

```
run.mouse <- function() {

## On specifie les effets

  # M0 : p constant dans le temps
  p.dot <- list(formula =  ~ 1, share = TRUE)
  # Mb : p (recapture) different de c (premiere capture) et constants dans le temps
  p.dot.behav <- list(p = list(formula =  ~ 1),
                      c = list(formula =  ~ 1))
  # Mt : p varie selon la session (dans le temps)
  p.time <- list(formula =  ~ time, share = TRUE)
  # Mh : p est heterogene entre individu
  p.h <- list(formula = ~ mixture, share = TRUE)
  # Mtb
  p.time.behav <- list(p = list(formula =  ~ time),
                       c = list(formula =  ~ time))
  # Mbh
  p.h.behav <- list(p = list(formula =  ~ mixture),
                    c = list(formula =  ~ mixture))
  # Mth
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  # Mtbh
  p.h.time.behav <- list(p = list(formula =  ~ mixture + time),
                         c = list(formula =  ~ mixture + time))
```

```
## On construit la liste des modeles
  mouse.model.list <- create.model.list("FullHet")

## On prépare le tout pour envoi a Mark
  mouse.results <- mark.wrapper(mouse.model.list,
                                data = mouse.proc,
                                ddl = mouse.ddl)

## On retourne les resultats
  return(mouse.results)
}
```

On fait tourner tous les modèles d'un coup.

```
mouse.results <- run.mouse()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=1)
## -2lnL:  109.5069
## AICc :  115.614  (unadjusted=111.52455)
##
## Beta
##                       estimate           se           lcl          ucl
## pi:(Intercept) -1.404355e-04 2.508630e+03 -4.916914e+03 4.916914e+03
## p:(Intercept)   1.053594e-01 1.326371e-01 -1.546092e-01 3.653281e-01
## f0:(Intercept) -1.788026e+01 1.857492e+04 -3.642473e+04 3.638897e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999649
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.5263155 0.5263155 0.5263155 0.5263155 0.5263155 0.5263155
## mixture:2 0.5263155 0.5263155 0.5263155 0.5263155 0.5263155 0.5263155
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.5263155 0.5263155 0.5263155 0.5263155 0.5263155
## mixture:2 0.5263155 0.5263155 0.5263155 0.5263155 0.5263155
##
##
## Real Parameter f0
##
```

```
##             1
##  1.716722e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  97.98748
## AICc :  106.1668  (unadjusted=104.09462)
##
## Beta
##                     estimate          se          lcl         ucl
## pi:(Intercept)  4.002810e-06 439.9827500 -862.3662000 862.3662100
## p:(Intercept)  -6.525620e-01   0.3230647   -1.2857688  -0.0193553
## c:(Intercept)   4.554756e-01   0.1772735    0.1080195   0.8029316
## f0:(Intercept)  1.040117e+00   1.0904376   -1.0971410   3.1773746
##
##
## Real Parameter pi
##
##
## mixture:1 0.500001
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.3424124 0.3424124 0.3424124 0.3424124 0.3424124 0.3424124
## mixture:2 0.3424124 0.3424124 0.3424124 0.3424124 0.3424124 0.3424124
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
## Real Parameter f0
##
##         1
##  2.829547
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=1)
## -2lnL:  1
## AICc :  NA  (unadjusted=Not a Number                )
##
## Beta
##                estimate se lcl ucl
## pi:(Intercept)      Inf  0 Inf Inf
## p:(Intercept)       Inf  0 Inf Inf
```

```
## p:mixture2          Inf  0 Inf Inf
## f0:(Intercept)      Inf  0 Inf Inf
##
##
## Real Parameter pi
##
##
## mixture:1 5.562685e-309
##
##
## Real Parameter p
##
##                         1             2             3             4             5
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
##                         6
## mixture:1 5.562685e-309
## mixture:2 5.562685e-309
##
##
## Real Parameter c
##
##                         2             3             4             5             6
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
##
##
## Real Parameter f0
##
##   1
##  NA
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6  (unadjusted=5)
## -2lnL:  85.72969
## AICc :  98.10978  (unadjusted=95.999961)
##
## Beta
##                   estimate           se           lcl           ucl
## pi:(Intercept)  1.2784179 4.930487e-01  3.120424e-01     2.2447933
## p:(Intercept)  -1.5107145 7.093411e-01 -2.901023e+00    -0.1204059
## p:mixture2     25.3541470 1.150715e+04 -2.252865e+04 22579.3590000
## c:(Intercept)  -0.1529383 2.659579e-01 -6.742158e-01     0.3683393
## c:mixture2      1.7873844 4.787058e-01  8.491210e-01     2.7256478
## f0:(Intercept)  2.4209144 1.175624e+00  1.166918e-01     4.7251371
##
##
## Real Parameter pi
##
##
## mixture:1 0.7821803
##
```

```
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.1808329 0.1808329 0.1808329 0.1808329 0.1808329 0.1808329
## mixture:2 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.4618398 0.4618398 0.4618398 0.4618398 0.4618398
## mixture:2 0.8367778 0.8367778 0.8367778 0.8367778 0.8367778
##
##
## Real Parameter f0
##
##         1
##  11.25615
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  9
## -2lnL:  80.75912
## AICc :  99.58481
##
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept) -0.3007796 0.5739910 -1.4258019  0.8242428
## p:(Intercept)   0.6308275 0.5695646 -0.4855190  1.7471741
## p:time2         0.6813488 0.5269155 -0.3514056  1.7141032
## p:time3         0.1400699 0.5295154 -0.8977803  1.1779201
## p:time4         0.5482069 0.5267872 -0.4842960  1.5807099
## p:time5         1.3410903 0.5353025  0.2918975  2.3902832
## p:time6         1.3410903 0.5353024  0.2918976  2.3902831
## p:mixture2     -2.2472086 0.3887932 -3.0092433 -1.4851738
## f0:(Intercept)  0.8024619 1.2065481 -1.5623723  3.1672962
##
##
## Real Parameter pi
##
##
## mixture:1 0.4253669
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.6526771 0.7878771 0.6837150 0.7647742 0.8778170 0.8778170
## mixture:2 0.1657046 0.2819049 0.1859852 0.2557505 0.4316087 0.4316087
##
##
## Real Parameter c
```

```
##
##                   2         3         4         5         6
## mixture:1 0.7878771 0.6837150 0.7647742 0.8778170 0.8778170
## mixture:2 0.2819049 0.1859852 0.2557505 0.4316087 0.4316087
##
##
## Real Parameter f0
##
##         1
##  2.231027
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  15  (unadjusted=12)
## -2lnL:  68.98024
## AICc :  101.2444  (unadjusted=94.431404)
##
## Beta
##                     estimate           se           lcl           ucl
## pi:(Intercept)   0.5724609 3.633269e-01 -1.396598e-01  1.284582e+00
## p:(Intercept)   -2.8773033 1.278706e+00 -5.383568e+00 -3.710388e-01
## p:mixture2      22.2535410 5.280326e+03 -1.032719e+04  1.037169e+04
## p:time2          2.2486884 1.351576e+00 -4.003999e-01  4.897777e+00
## p:time3          2.4718452 1.383064e+00 -2.389610e-01  5.182652e+00
## p:time4          2.1841545 1.461195e+00 -6.797870e-01  5.048096e+00
## p:time5          2.8773044 1.517154e+00 -9.631740e-02  5.850926e+00
## p:time6         29.4075200 1.776785e+04 -3.479557e+04  3.485439e+04
## c:(Intercept)   -0.3391201 8.083497e-01 -1.923485e+00  1.245245e+00
## c:mixture2       1.9698574 4.916154e-01  1.006291e+00  2.933423e+00
## c:time3         -1.1887938 8.298536e-01 -2.815307e+00  4.377193e-01
## c:time4         -0.3216366 8.302089e-01 -1.948846e+00  1.305573e+00
## c:time5          0.4774461 8.549637e-01 -1.198283e+00  2.153175e+00
## c:time6          0.2405251 8.399631e-01 -1.405803e+00  1.886853e+00
## f0:(Intercept) -40.4660650 8.492251e+04 -1.664886e+05  1.664076e+05
##
##
## Real Parameter pi
##
##
## mixture:1 0.6393308
##
##
## Real Parameter p
##
##                   1         2         3         4         5 6
## mixture:1 0.053287 0.3478247 0.4000017 0.333333 0.5000003 1
## mixture:2 1.000000 1.0000000 1.0000000 1.000000 1.0000000 1
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.4160232 0.1782991 0.3405696 0.5345265 0.4753712
```

```
## mixture:2 0.8362706 0.6087220 0.7873626 0.8916960 0.8666043
##
##
## Real Parameter f0
##
##           1
##  2.6657e-18
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  8  (unadjusted=6)
## -2lnL:  99.67496
## AICc :  116.3325  (unadjusted=112.05505)
##
## Beta
##                       estimate           se           lcl          ucl
## pi:(Intercept) -2.515238e-04 3.548134e+03 -6.954342e+03 6.954342e+03
## p:(Intercept)  -4.274439e-01 3.318808e-01 -1.077930e+00 2.230425e-01
## p:time2         5.328045e-01 4.644356e-01 -3.774893e-01 1.443098e+00
## p:time3         1.089902e-01 4.670111e-01 -8.063515e-01 1.024332e+00
## p:time4         4.274439e-01 4.641206e-01 -4.822326e-01 1.337120e+00
## p:time5         1.081370e+00 4.765164e-01  1.473982e-01 2.015343e+00
## p:time6         1.081371e+00 4.765166e-01  1.473980e-01 2.015343e+00
## f0:(Intercept) -1.902876e+01 1.450237e+04 -2.844368e+04 2.840562e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999371
##
##
## Real Parameter p
##
##                   1         2         3   4         5         6
## mixture:1 0.3947369 0.5263158 0.4210526 0.5 0.6578947 0.6578947
## mixture:2 0.3947369 0.5263158 0.4210526 0.5 0.6578947 0.6578947
##
##
## Real Parameter c
##
##                   2         3   4         5         6
## mixture:1 0.5263158 0.4210526 0.5 0.6578947 0.6578947
## mixture:2 0.5263158 0.4210526 0.5 0.6578947 0.6578947
##
##
## Real Parameter f0
##
##             1
##  5.443949e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~time)f0(~1)
```

```
##
## Npar :  13  (unadjusted=10)
## -2lnL:  87.05684
## AICc :  114.7578  (unadjusted=108.07067)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept) -6.276846e-05    0.0000000 -6.276846e-05 -6.276846e-05
## p:(Intercept)  -4.274438e-01    0.3318811 -1.077931e+00  2.230432e-01
## p:time2        -2.011652e-01    0.5493741 -1.277939e+00  8.756081e-01
## p:time3         2.197890e-02    0.6228348 -1.198777e+00  1.242735e+00
## p:time4        -2.657039e-01    0.7811186 -1.796696e+00  1.265289e+00
## p:time5         4.274434e-01    0.8813700 -1.300042e+00  2.154929e+00
## p:time6         2.005979e+01 9924.1114000 -1.943120e+04  1.947132e+04
## c:(Intercept)   1.386295e+00    0.6454975  1.211199e-01  2.651470e+00
## c:time3        -1.648659e+00    0.7704480 -3.158737e+00 -1.385814e-01
## c:time4        -1.178656e+00    0.7457145 -2.640256e+00  2.829445e-01
## c:time5        -5.978379e-01    0.7497477 -2.067343e+00  8.716676e-01
## c:time6        -8.602021e-01    0.7341966 -2.299228e+00  5.788233e-01
## f0:(Intercept) -2.053579e+01 6084.0415000 -1.194526e+04  1.190419e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999843
##
##
## Real Parameter p
##
##                   1        2   3         4         5 6
## mixture:1 0.3947369 0.347826 0.4 0.3333332 0.4999999 1
## mixture:2 0.3947369 0.347826 0.4 0.3333332 0.4999999 1
##
##
## Real Parameter c
##
##                   2         3         4      5         6
## mixture:1 0.8000001 0.4347826 0.5517241 0.6875 0.6285714
## mixture:2 0.8000001 0.4347826 0.5517241 0.6875 0.6285714
##
##
## Real Parameter f0
##
##             1
##  1.206206e-09
```

On examine les résultats.

```
mouse.results
```

```
##                                          model npar      AICc DeltaAICc
## 1                          pi(~1)p(~1)c()f0(~1)    3 115.61399        NA
## 2                        pi(~1)p(~1)c(~1)f0(~1)    4 106.16685        NA
```

```
## 3                      pi(~1)p(~mixture)c()f0(~1)    4        NA        NA
## 4               pi(~1)p(~mixture)c(~mixture)f0(~1)    6  98.10978        NA
## 5                pi(~1)p(~time + mixture)c()f0(~1)    9  99.58481        NA
## 6 pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   15 101.24439        NA
## 7                         pi(~1)p(~time)c()f0(~1)    8 116.33249        NA
## 8                    pi(~1)p(~time)c(~time)f0(~1)   13 114.75778        NA
##   weight Deviance
## 1     NA 85.44111
## 2     NA 73.92174
## 3     NA  2.00000
## 4     NA 61.66395
## 5     NA 56.69338
## 6     NA 44.91450
## 7     NA 75.60922
## 8     NA 62.99110
```

Le nom des modèles n'est pas limpide. On fait le lien entre la première colonne qui donne le numéro du modèle, et la liste des modèles qu'on a définie au-dessus.

```
names(mouse.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

Par exemple, si l'on veut afficher les résultats du modèle M_0, il s'agit du modèle 1 "p.dot". On peut afficher la probabilité de détection avec l'intervalle de confiance associé.

```
mouse.results$p.dot$results$real
```

```
##                 estimate           se           lcl          ucl fixed note
## pi g1 m1    4.999649e-01 6.271574e+02 5.561904e-309 1.0000000000
## p g1 t1 m1  5.263155e-01 3.306740e-02  4.614245e-01 0.5903296000
## f0 g1 a0 t1 1.716722e-08 3.188797e-04  2.887487e-12 0.0001020657
```

On obtient aussi une estimation de l'effectif.

```
mouse.results$p.dot$results$derived
```

```
## $`N Population Size`
##   estimate lcl     ucl
## 1       38  38 38.0001
```

Le meilleur modèle selon l'AIC est le modèle numéroté 4 qui correspond à "p.h.behav". On affiche les résults pour ce modèle.

```
mouse.results$p.h.behav$results$real
```

```
##               estimate           se       lcl        ucl fixed note
## pi g1 m1     0.7821803 8.400280e-02 0.5773837  0.9042005
## p g1 t1 m1   0.1808329 1.050764e-01 0.0521030  0.4699348
```

```
## p g1 t1 m2   1.0000000 5.080381e-07 0.9999990  1.0000010
## c g1 t2 m1   0.4618398 6.610220e-02 0.3375535  0.5910576
## c g1 t2 m2   0.8367778 6.128250e-02 0.6802697  0.9251092
## f0 g1 a0 t1 11.2561480 1.323300e+01 1.8128006 69.8923310
```

```
mouse.results$p.h.behav$results$derived
```

```
## $`N Population Size`
##   estimate     lcl      ucl
## 1 49.25615 39.8128 107.8923
```

Analyses séparées, mâles vs. femelles

Ici on sépare mâles et femelles et on reproduit l'analyse ci-dessus.On commence par lire les données. On spécifie le groupe, ici les mâles d'abord, puis les femelles.

```
mouse <- convert.inp("dat/deer-mouse-sex2G-MF.inp",
                     group.df = data.frame(sex = c("M","F")),
                     covariates = NULL)
```

On inspecte les données.

```
head(mouse)
```

```
##         ch freq sex
## 1:1 111111    1   M
## 1:3 110011    1   M
## 1:4 110111    1   M
## 1:5 111111    1   M
## 1:6 110111    1   M
## 1:7 111110    1   M
```

```
tail(mouse)
```

```
##          ch freq sex
## 2:28 001010    1   F
## 2:29 001000    1   F
## 2:30 000100    1   F
## 2:32 000110    1   F
## 2:34 000010    1   F
## 2:38 000001    1   F
```

On sépare mâles et femelles en deux jeux de données.

```
mouseM <- mouse[mouse$sex == "M", ]
mouseF <- mouse[mouse$sex == "F", ]
```

On formate les données pour effectuer les tests de l'hypothèse de fermeture.

```
mouseM_secr <- unRMarkInput(mouseM) # on convertit au bon format
mouseF_secr <- unRMarkInput(mouseF) # on convertit au bon format
```

On fait les tests de fermeture, les mâles d'abord.

```
closure.test(mouseM_secr, SB = TRUE)
```

```
## $Otis
##  statistic        p
##   1.408787 0.920551
##
## $Xc
##  statistic df          p
##   11.31081  6 0.07923259
##
## $NRvsJS
##  statistic df           p
##   9.316319  2 0.009483899
##
## $NMvsJS
##  statistic df p
##          0  0 1
##
## $MtvsNR
##  statistic df         p
##   1.994488  4 0.7367727
##
## $MtvsNM
##  statistic df          p
##   11.31081  6 0.07923259
##
## $compNRvsJS
##   Occasion Chisquare df          p
## 1        2  5.619444  1 0.01776228
## 2        3        NA NA         NA
## 3        4  3.696875  1 0.05451448
## 4        5        NA NA         NA
##
## $compNMvsJS
##   Occasion Chisquare df  p
## 1        2        NA NA NA
## 2        3        NA NA NA
## 3        4        NA NA NA
## 4        5        NA NA NA
```

Les femelles ensuite.

```
closure.test(mouseF_secr, SB = TRUE)
```

```
## $Otis
##  statistic         p
##  0.2255718 0.5892328
```

```
##
## $Xc
##  statistic df         p
##   3.362287  5 0.6443199
##
## $NRvsJS
##  statistic df         p
##    1.63254  1 0.2013521
##
## $NMvsJS
##  statistic df         p
##  0.2539683  1 0.6142947
##
## $MtvsNR
##  statistic df         p
##   1.729747  4 0.7853071
##
## $MtvsNM
##  statistic df        p
##   3.108319  4 0.539865
##
## $compNRvsJS
##   Occasion Chisquare df         p
## 1        2        NA NA        NA
## 2        3   1.63254  1 0.2013521
## 3        4        NA NA        NA
## 4        5        NA NA        NA
##
## $compNMvsJS
##   Occasion Chisquare df         p
## 1        2        NA NA        NA
## 2        3        NA NA        NA
## 3        4        NA NA        NA
## 4        5 0.2539683  1 0.6142947
```

Les modèles maintenant. Commençons par les mâles.

```
mouse.proc <- process.data(mouseM,
                           begin.time = 1,
                           model = "FullHet")
mouse.ddl <- make.design.data(mouse.proc)
```

La liste des modèles.

```
run.mouse <- function() {

  # sans l'effet sexe
  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.dot.behav <- list(p = list(formula =  ~ 1),
                      c = list(formula =  ~ 1))
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(p = list(formula =  ~ time),
```

```
                      c = list(formula =  ~ time))
  p.h.behav <- list(p = list(formula =  ~ mixture),
                    c = list(formula =  ~ mixture))
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  p.h.time.behav <- list(p = list(formula =  ~ mixture + time),
                         c = list(formula =  ~ mixture + time))

  mouse.model.list <- create.model.list("FullHet")

  mouse.results <- mark.wrapper(mouse.model.list,
                                data = mouse.proc,
                                ddl = mouse.ddl)

  return(mouse.results)
}
```

On lance Mark.

```
mouse.results <- run.mouse()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=1)
## -2lnL:  75.69613
## AICc :  81.89285  (unadjusted=77.728386)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  3.727891e-05    0.0000000  3.727891e-05 3.727891e-05
## p:(Intercept)   5.193002e-01    0.1842141  1.582406e-01 8.803597e-01
## f0:(Intercept) -1.763875e+01 4716.5688000 -9.262114e+03 9.226836e+03
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000093
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
## mixture:2 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
## mixture:2 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
```

```
##
##
## Real Parameter f0
##
##            1
##  2.18568e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  66.768
## AICc :  75.09858  (unadjusted=70.865562)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept)  6.739153e-05    0.0000000  6.739153e-05  6.739153e-05
## p:(Intercept)  -1.743539e-01    0.0000000 -1.743539e-01 -1.743539e-01
## c:(Intercept)   9.694002e-01    0.2503915  4.786328e-01  1.460168e+00
## f0:(Intercept) -1.419264e+01 6535.3577000 -1.282349e+04  1.279511e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000168
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.4565216 0.4565216 0.4565216 0.4565216 0.4565216 0.4565216
## mixture:2 0.4565216 0.4565216 0.4565216 0.4565216 0.4565216 0.4565216
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.7249999 0.7249999 0.7249999 0.7249999 0.7249999
## mixture:2 0.7249999 0.7249999 0.7249999 0.7249999 0.7249999
##
##
## Real Parameter f0
##
##             1
##  6.858275e-07
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4
## -2lnL:  63.91043
## AICc :  72.24101
##
```

```
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept) -0.2917234 0.8369749  -1.932194  1.3487475
## p:(Intercept)  -0.6286003 0.7041750  -2.008783  0.7515827
## p:mixture2      2.1939316 0.5210740   1.172627  3.2152368
## f0:(Intercept) -1.8195800 7.9445867 -17.390970 13.7518100
##
##
## Real Parameter pi
##
##
## mixture:1 0.427582
##
##
## Real Parameter p
##
##                   1        2        3        4        5        6
## mixture:1 0.347828 0.347828 0.347828 0.347828 0.347828 0.347828
## mixture:2 0.827117 0.827117 0.827117 0.827117 0.827117 0.827117
##
##
## Real Parameter c
##
##                   2        3        4        5        6
## mixture:1 0.347828 0.347828 0.347828 0.347828 0.347828
## mixture:2 0.827117 0.827117 0.827117 0.827117 0.827117
##
##
## Real Parameter f0
##
##          1
##  0.1620938
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6  (unadjusted=4)
## -2lnL:  58.68762
## AICc :  71.3935  (unadjusted=67.018194)
##
## Beta
##                    estimate        se         lcl         ucl
## pi:(Intercept)   0.1385538 0.5863577  -1.0107073   1.2878150
## p:(Intercept)   -0.8006214 0.4026088  -1.5897347  -0.0115081
## p:mixture2      20.1919920 2.4617853  15.3668920  25.0170910
## c:(Intercept)    0.1458512 0.4498776  -0.7359090   1.0276114
## c:mixture2       1.5511778 0.5927194   0.3894478   2.7129078
## f0:(Intercept) -38.9194400 0.0000000 -38.9194400 -38.9194400
##
##
## Real Parameter pi
##
##
## mixture:1 0.5345832
```

```
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.3098926 0.3098926 0.3098926 0.3098926 0.3098926 0.3098926
## mixture:2 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.5363983 0.5363983 0.5363983 0.5363983 0.5363983
## mixture:2 0.8451463 0.8451463 0.8451463 0.8451463 0.8451463
##
##
## Real Parameter f0
##
##             1
##  1.251705e-17
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  9  (unadjusted=8)
## -2lnL:  50.46091
## AICc :  70.01264  (unadjusted=67.691682)
##
## Beta
##                       estimate           se           lcl          ucl
## pi:(Intercept) -2.294978e-01 6.798587e-01 -1.562021e+00 1.103025e+00
## p:(Intercept)  -1.054170e+00 7.076182e-01 -2.441101e+00 3.327622e-01
## p:time2         8.890697e-01 7.822782e-01 -6.441956e-01 2.422335e+00
## p:time3        -1.105840e+00 7.670444e-01 -2.609247e+00 3.975668e-01
## p:time4         2.957733e-05 7.551235e-01 -1.480012e+00 1.480072e+00
## p:time5         1.211995e+00 8.018737e-01 -3.596773e-01 2.783668e+00
## p:time6         1.212183e+00 8.018871e-01 -3.595157e-01 2.783882e+00
## p:mixture2      2.572083e+00 5.507324e-01  1.492648e+00 3.651519e+00
## f0:(Intercept) -1.769111e+01 2.965109e+04 -5.813384e+04 5.809845e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.4428761
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.2584252 0.4588185 0.1033995 0.2584309 0.5393747 0.5394214
## mixture:2 0.8202311 0.9173583 0.6015850 0.8202354 0.9387686 0.9387794
##
##
```

```
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.4588185 0.1033995 0.2584309 0.5393747 0.5394214
## mixture:2 0.9173583 0.6015850 0.8202354 0.9387686 0.9387794
##
##
## Real Parameter f0
##
##             1
##  2.074192e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  15  (unadjusted=10)
## -2lnL:  38.56738
## AICc :  72.93102  (unadjusted=60.480423)
##
## Beta
##                    estimate           se           lcl           ucl
## pi:(Intercept)  -0.2876821 4.409586e-01 -1.151961e+00  5.765968e-01
## p:(Intercept)  -18.3001670 4.200560e+02 -8.416099e+02  8.050096e+02
## p:mixture2      41.1825760 5.891230e+04 -1.154269e+05  1.155093e+05
## p:time2         18.0770230 4.200562e+02 -8.052330e+02  8.413871e+02
## p:time3        -31.2235350 0.000000e+00 -3.122353e+01 -3.122353e+01
## p:time4         16.9138720 4.200575e+02 -8.063989e+02  8.402266e+02
## p:time5         18.3001670 4.200568e+02 -8.050112e+02  8.416115e+02
## p:time6         39.0726290 3.644717e+04 -7.139738e+04  7.147553e+04
## c:(Intercept)    0.5823754 1.222969e+00 -1.814645e+00  2.979395e+00
## c:mixture2       1.8155197 6.361953e-01  5.685768e-01  3.062463e+00
## c:time3         -1.9881291 1.178537e+00 -4.298062e+00  3.218039e-01
## c:time4         -1.0726338 1.213952e+00 -3.451979e+00  1.306712e+00
## c:time5         -0.0981485 1.292354e+00 -2.631163e+00  2.434866e+00
## c:time6         -0.5256047 1.239294e+00 -2.954620e+00  1.903411e+00
## f0:(Intercept) -36.4594690 0.000000e+00 -3.645947e+01 -3.645947e+01
##
##
## Real Parameter pi
##
##
## mixture:1 0.4285714
##
##
## Real Parameter p
##
##                       1         2            3   4   5 6
## mixture:1 1.128077e-08 0.4444444 3.105486e-22 0.2 0.5 1
## mixture:2 1.000000e+00 1.0000000 2.384468e-04 1.0 1.0 1
##
##
## Real Parameter c
##
##                   2         3         4         5         6
```

```
## mixture:1 0.6416138 0.1969047 0.3798327 0.6187455 0.5141889
## mixture:2 0.9166667 0.6010318 0.7900557 0.9088560 0.8667231
##
##
## Real Parameter f0
##
##             1
##  1.465055e-16
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  8  (unadjusted=6)
## -2lnL:  65.74697
## AICc :  82.97774  (unadjusted=78.452851)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept) -1.743633e-05    0.0000000 -1.743633e-05 -1.743633e-05
## p:(Intercept)   2.876820e-01    0.4409583 -5.765962e-01  1.151960e+00
## p:time2         6.286086e-01    0.6540470 -6.533234e-01  1.910541e+00
## p:time3        -7.731899e-01    0.6295770 -2.007161e+00  4.607810e-01
## p:time4         2.702941e-08    0.6236093 -1.222274e+00  1.222274e+00
## p:time5         8.754688e-01    0.6759764 -4.494450e-01  2.200382e+00
## p:time6         8.754687e-01    0.6759764 -4.494451e-01  2.200383e+00
## f0:(Intercept) -2.226375e+01 7645.5258000 -1.500750e+04  1.496297e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999956
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.5714286 0.7142857 0.3809524 0.5714286 0.7619048 0.7619048
## mixture:2 0.5714286 0.7142857 0.3809524 0.5714286 0.7619048 0.7619048
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.7142857 0.3809524 0.5714286 0.7619048 0.7619048
## mixture:2 0.7142857 0.3809524 0.5714286 0.7619048 0.7619048
##
##
## Real Parameter f0
##
##             1
##  2.142774e-10
##
## Output summary for FullHet model
```

```
## Name : pi(~1)p(~time)c(~time)f0(~1)
##
## Npar :  13  (unadjusted=9)
## -2lnL:  47.52058
## AICc :  76.77058  (unadjusted=67.072306)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  6.302923e-05 1721.3227000 -3373.7926000 3373.7927000
## p:(Intercept)   2.876818e-01    0.4409586    -0.5765972    1.1519607
## p:time2        -5.108253e-01    0.8027731    -2.0842605    1.0626100
## p:time3        -1.884040e+01 4890.2652000 -9603.7603000 9566.0795000
## p:time4        -1.673977e+00    1.2018510    -4.0296047    0.6816514
## p:time5        -2.876799e-01    1.0929066    -2.4297770    1.8544171
## p:time6         2.160458e+01    0.0000000    21.6045780   21.6045780
## c:(Intercept)   2.397895e+00    1.0444660     0.3507420    4.4450487
## c:time3        -2.397895e+00    1.1579763    -4.6675285   -0.1282613
## c:time4        -1.609438e+00    1.1755075    -3.9134327    0.6945570
## c:time5        -8.574504e-01    1.2229765    -3.2544844    1.5395836
## c:time6        -1.368276e+00    1.1671922    -3.6559731    0.9194206
## f0:(Intercept) -2.244812e+01    0.0000000   -22.4481200  -22.4481200
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000158
##
##
## Real Parameter p
##
##                    1         2          3         4         5 6
## mixture:1 0.5714285 0.4444445 8.7631e-09 0.1999999 0.5000005 1
## mixture:2 0.5714285 0.4444445 8.7631e-09 0.1999999 0.5000005 1
##
##
## Real Parameter c
##
##                    2         3      4         5        6
## mixture:1 0.9166667 0.5000001 0.6875 0.8235294 0.736842
## mixture:2 0.9166667 0.5000001 0.6875 0.8235294 0.736842
##
##
## Real Parameter f0
##
##            1
##  1.78199e-10
```

Et on inspecte les résultats.

```
mouse.results
```

```
##                                              model npar     AICc DeltaAICc
## 5               pi(~1)p(~time + mixture)c()f0(~1)    9 70.01264  0.000000
```

```
## 4              pi(~1)p(~mixture)c(~mixture)f0(~1)    6 71.39350  1.380860
## 3                      pi(~1)p(~mixture)c()f0(~1)    4 72.24101  2.228371
## 6 pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   15 72.93102  2.918378
## 2                          pi(~1)p(~1)c(~1)f0(~1)    4 75.09858  5.085942
## 8                    pi(~1)p(~time)c(~time)f0(~1)   13 76.77058  6.757945
## 1                            pi(~1)p(~1)c()f0(~1)    3 81.89285 11.880212
## 7                       pi(~1)p(~time)c()f0(~1)    8 82.97774 12.965100
##         weight Deviance
## 5 0.4589589709 41.07713
## 4 0.2301038458 49.30384
## 3 0.1506222627 54.52665
## 6 0.1066733867 29.18360
## 2 0.0360890549 57.38422
## 8 0.0156424502 38.13680
## 1 0.0012078655 66.31235
## 7 0.0007021633 56.36319
```

Les noms des modèles.

```
names(mouse.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

On examine les résultats obtenus selon le meilleur modèle (#5).

```
mouse.results$p.h.time$results$real
```

```
##                 estimate           se          lcl          ucl fixed note
## pi g1 m1    4.428761e-01 0.1677462000 1.733569e-01 0.7508265000
## p g1 t1 m1  2.584252e-01 0.1356091000 8.009170e-02 0.5824313000
## p g1 t2 m1  4.588185e-01 0.1689835000 1.825778e-01 0.7629243000
## p g1 t3 m1  1.033995e-01 0.0672785000 2.705680e-02 0.3235221000
## p g1 t4 m1  2.584309e-01 0.1356109000 8.009400e-02 0.5824382000
## p g1 t5 m1  5.393747e-01 0.1691711000 2.356368e-01 0.8164387000
## p g1 t6 m1  5.394214e-01 0.1691694000 2.356694e-01 0.8164679000
## p g1 t1 m2  8.202311e-01 0.1135934000 5.019945e-01 0.9538165000
## p g1 t2 m2  9.173583e-01 0.0623674000 6.888127e-01 0.9823531000
## p g1 t3 m2  6.015850e-01 0.1590734000 2.913662e-01 0.8472127000
## p g1 t4 m2  8.202354e-01 0.1135917000 5.020006e-01 0.9538181000
## p g1 t5 m2  9.387686e-01 0.0482159000 7.476022e-01 0.9875555000
## p g1 t6 m2  9.387794e-01 0.0482085000 7.476337e-01 0.9875581000
## f0 g1 a0 t1 2.074192e-08 0.0006150207 2.843973e-12 0.0001512769
```

```
mouse.results$p.h.time$results$derived
```

```
## $`N Population Size`
##   estimate lcl      ucl
## 1       21  21 21.00015
```

On procède de même pour les femelles.

```
mouse.proc <- process.data(mouseF,
                           begin.time = 1,
                           model = "FullHet")
mouse.ddl <- make.design.data(mouse.proc)
```

La liste des modèles.

```
run.mouse <- function() {

  # sans l'effet sexe
  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.dot.behav <- list(p = list(formula =  ~ 1),
                      c = list(formula =  ~ 1))
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(p = list(formula =  ~ time),
                       c = list(formula =  ~ time))
  p.h.behav <- list(p = list(formula =  ~ mixture),
                    c = list(formula =  ~ mixture))
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  p.h.time.behav <- list(p = list(formula =  ~ mixture + time),
                         c = list(formula =  ~ mixture + time))

  mouse.model.list <- create.model.list("FullHet")

  mouse.results <- mark.wrapper(mouse.model.list,
                                data = mouse.proc,
                                ddl = mouse.ddl)

  return(mouse.results)
}
```

On lance Mark.

```
mouse.results <- run.mouse()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=2)
## -2lnL:  70.33432
## AICc :  76.57922  (unadjusted=74.455532)
##
## Beta
##                      estimate        se           lcl          ucl
## pi:(Intercept)  1.084202e-05 0.0000000  1.084202e-05 1.084202e-05
## p:(Intercept)  -4.302319e-01 0.2268953 -8.749467e-01 1.448290e-02
## f0:(Intercept) -1.077742e+00 3.2711818 -7.489259e+00 5.333774e+00
##
##
## Real Parameter pi
```

```
##
##
## mixture:1 0.5000027
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.3940709 0.3940709 0.3940709 0.3940709 0.3940709 0.3940709
## mixture:2 0.3940709 0.3940709 0.3940709 0.3940709 0.3940709 0.3940709
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.3940709 0.3940709 0.3940709 0.3940709 0.3940709
## mixture:2 0.3940709 0.3940709 0.3940709 0.3940709 0.3940709
##
##
## Real Parameter f0
##
##          1
##  0.3403632
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  68.40103
## AICc :  76.8134  (unadjusted=74.645923)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  7.212016e-06 1896.0932000 -3716.3428000 3716.3428000
## p:(Intercept)  -1.006540e+00    0.5819544    -2.1471710    0.1340902
## c:(Intercept)  -2.231436e-01    0.2738613    -0.7599117    0.3136245
## f0:(Intercept)  9.499843e-01    1.5239215    -2.0369018    3.9368704
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000018
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.2676575 0.2676575 0.2676575 0.2676575 0.2676575 0.2676575
## mixture:2 0.2676575 0.2676575 0.2676575 0.2676575 0.2676575 0.2676575
##
##
## Real Parameter c
##
```

```
##                   2         3         4         5         6
## mixture:1 0.4444444 0.4444444 0.4444444 0.4444444 0.4444444
## mixture:2 0.4444444 0.4444444 0.4444444 0.4444444 0.4444444
##
##
## Real Parameter f0
##
##         1
##  2.585669
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4
## -2lnL:  69.88198
## AICc :  78.29435
##
## Beta
##                   estimate        se       lcl       ucl
## pi:(Intercept) -0.7074695 2.7619468 -6.120885 4.7059463
## p:(Intercept)   0.2046794 1.0008672 -1.757020 2.1663791
## p:mixture2     -1.0885044 0.8765178 -2.806479 0.6294706
## f0:(Intercept)  0.0850421 2.0866682 -4.004828 4.1749119
##
##
## Real Parameter pi
##
##
## mixture:1 0.3301582
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.5509920 0.5509920 0.5509920 0.5509920 0.5509920 0.5509920
## mixture:2 0.2923858 0.2923858 0.2923858 0.2923858 0.2923858 0.2923858
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.5509920 0.5509920 0.5509920 0.5509920 0.5509920
## mixture:2 0.2923858 0.2923858 0.2923858 0.2923858 0.2923858
##
##
## Real Parameter f0
##
##         1
##  1.088763
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6
```

```
## -2lnL:  67.24578
## AICc :  80.12999
##
## Beta
##                   estimate        se       lcl       ucl
## pi:(Intercept) -0.6855413 2.1665423 -4.931964 3.5608817
## p:(Intercept)  -0.7635873 0.9320580 -2.590421 1.0632463
## p:mixture2     -0.3818866 1.2452906 -2.822656 2.0588830
## c:(Intercept)   0.7816211 1.3230076 -1.811474 3.3747160
## c:mixture2     -1.6553369 0.9806103 -3.577333 0.2666594
## f0:(Intercept)  1.0068625 1.5712104 -2.072710 4.0864348
##
##
## Real Parameter pi
##
##
## mixture:1 0.3350257
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.3178679 0.3178679 0.3178679 0.3178679 0.3178679 0.3178679
## mixture:2 0.2413168 0.2413168 0.2413168 0.2413168 0.2413168 0.2413168
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.6860294 0.6860294 0.6860294 0.6860294 0.6860294
## mixture:2 0.2944817 0.2944817 0.2944817 0.2944817 0.2944817
##
##
## Real Parameter f0
##
##      1
##  2.737
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  9
## -2lnL:  62.12122
## AICc :  82.07774
##
## Beta
##                   estimate        se        lcl       ucl
## pi:(Intercept) -0.7417543 2.0079677 -4.6773712 3.1938626
## p:(Intercept)  -0.8527032 1.0601413 -2.9305801 1.2251738
## p:time2         0.7040738 0.8546600 -0.9710600 2.3792075
## p:time3         1.5054179 0.8304245 -0.1222142 3.1330499
## p:time4         1.2546828 0.8331165 -0.3782255 2.8875911
## p:time5         1.7491630 0.8315543  0.1193165 3.3790095
## p:time6         1.7491628 0.8315543  0.1193164 3.3790092
```

```
## p:mixture2     -1.3140922 0.8181660 -2.9176976 0.2895133
## f0:(Intercept)  0.0661270 2.0573154 -3.9662113 4.0984652
##
##
## Real Parameter pi
##
##
## mixture:1 0.3226206
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.2988661 0.4629109 0.6576219 0.5991632 0.7102215 0.7102214
## mixture:2 0.1027722 0.1880514 0.3404302 0.2865677 0.3970834 0.3970834
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.4629109 0.6576219 0.5991632 0.7102215 0.7102214
## mixture:2 0.1880514 0.3404302 0.2865677 0.3970834 0.3970834
##
##
## Real Parameter f0
##
##         1
##  1.068362
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  15  (unadjusted=12)
## -2lnL:  54.99452
## AICc :  90.57592  (unadjusted=82.500138)
##
## Beta
##                    estimate           se           lcl           ucl
## pi:(Intercept)   0.5756980 5.653825e-01 -5.324517e-01  1.683848e+00
## p:(Intercept)   -0.9658818 6.899993e-01 -2.318280e+00  3.865169e-01
## p:mixture2     -18.9709470 4.374485e+02 -8.763700e+02  8.384281e+02
## p:time2          0.9960035 9.923357e-01 -9.489745e-01  2.940981e+00
## p:time3         19.3013330 4.374491e+02 -8.380989e+02  8.767016e+02
## p:time4         19.9368290 4.374492e+02 -8.374637e+02  8.773373e+02
## p:time5         19.9368290 4.374504e+02 -8.374659e+02  8.773395e+02
## p:time6         44.3859100 1.178287e+05 -2.309000e+05  2.309887e+05
## c:(Intercept)   -0.6931479 1.224744e+00 -3.093646e+00  1.707350e+00
## c:mixture2      -2.5284443 1.126034e+00 -4.735472e+00 -3.214168e-01
## c:time3         -0.2231422 1.483238e+00 -3.130289e+00  2.684005e+00
## c:time4          0.4830872 1.369536e+00 -2.201204e+00  3.167378e+00
## c:time5          1.4481900 1.384015e+00 -1.264479e+00  4.160859e+00
## c:time6          1.3999965 1.381022e+00 -1.306806e+00  4.106799e+00
## f0:(Intercept) -31.1684910 2.864074e+04 -5.616701e+04  5.610468e+04
##
```

```
##
## Real Parameter pi
##
##
## mixture:1 0.6400769
##
##
## Real Parameter p
##
##                      1            2         3         4   5 6
## mixture:1 2.757021e-01 5.075299e-01 1.0000000 1.0000000 1.0 1
## mixture:2 2.195559e-09 5.944345e-09 0.3462655 0.4999999 0.5 1
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.3333332 0.2857144 0.4476771 0.6802764 0.6697044
## mixture:2 0.0383612 0.0309263 0.0607391 0.1451197 0.1392425
##
##
## Real Parameter f0
##
##             1
##  2.908681e-14
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  8  (unadjusted=7)
## -2lnL:  62.94848
## AICc :  80.49687  (unadjusted=78.139968)
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept)  1.959570e-06 0.0000000  1.959570e-06  1.959570e-06
## p:(Intercept)  -1.554469e+00 0.6394802 -2.807851e+00 -3.010883e-01
## p:time2         6.626580e-01 0.8281839 -9.605826e-01  2.285899e+00
## p:time3         1.414955e+00 0.7993852 -1.518401e-01  2.981750e+00
## p:time4         1.178215e+00 0.8034180 -3.964843e-01  2.752914e+00
## p:time5         1.647838e+00 0.7997697  8.028880e-02  3.215386e+00
## p:time6         1.647838e+00 0.7997697  8.028890e-02  3.215386e+00
## f0:(Intercept) -1.620883e+00 5.1619222 -1.173825e+01  8.496484e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000005
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
```

```
## mixture:1 0.1744417 0.2907361 0.4651778 0.4070306 0.5233251 0.5233251
## mixture:2 0.1744417 0.2907361 0.4651778 0.4070306 0.5233251 0.5233251
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.2907361 0.4651778 0.4070306 0.5233251 0.5233251
## mixture:2 0.2907361 0.4651778 0.4070306 0.5233251 0.5233251
##
##
## Real Parameter f0
##
##         1
##  0.197724
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~time)f0(~1)
##
## Npar :  13  (unadjusted=10)
## -2lnL:  59.78988
## AICc :  89.92625  (unadjusted=82.207466)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept) -1.297343e-04 0.000000e+00 -1.297343e-04 -1.297343e-04
## p:(Intercept)  -1.540445e+00 6.212479e-01 -2.758091e+00 -3.227989e-01
## p:time2         6.241539e-01 8.578747e-01 -1.057281e+00  2.305588e+00
## p:time3         1.945910e+00 8.625238e-01  2.553631e-01  3.636457e+00
## p:time4         1.540445e+00 1.177264e+00 -7.669917e-01  3.847882e+00
## p:time5         1.540444e+00 1.544652e+00 -1.487073e+00  4.567962e+00
## p:time6         2.269971e+01 2.982520e+04 -5.843468e+04  5.848008e+04
## c:(Intercept)  -6.931460e-01 4.574963e-01 -1.589839e+00  2.035468e-01
## c:time3        -2.231449e-01 9.535734e-01 -2.092149e+00  1.645859e+00
## c:time4         2.231420e-01 7.309603e-01 -1.209540e+00  1.655824e+00
## c:time5         8.266774e-01 4.958817e-01 -1.452508e-01  1.798606e+00
## c:time6         6.931459e-01 5.875801e-01 -4.585111e-01  1.844803e+00
## f0:(Intercept) -2.295012e+01 1.331377e+04 -2.611794e+04  2.607204e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999676
##
##
## Real Parameter p
##
##                   1         2   3   4         5 6
## mixture:1 0.1764706 0.2857142 0.6 0.5 0.4999999 1
## mixture:2 0.1764706 0.2857142 0.6 0.5 0.4999999 1
##
##
## Real Parameter c
```

```
##
##                   2         3         4         5   6
## mixture:1 0.3333336 0.2857143 0.3846153 0.5333334 0.5
## mixture:2 0.3333336 0.2857143 0.3846153 0.5333334 0.5
##
##
## Real Parameter f0
##
##             1
##  1.078669e-10
```

Et on inspecte les résultats.

```
mouse.results
```

```
##                                              model npar     AICc  DeltaAICc
## 1                            pi(~1)p(~1)c()f0(~1)    3 76.57922  0.0000000
## 2                          pi(~1)p(~1)c(~1)f0(~1)    4 76.81340  0.2341782
## 3                       pi(~1)p(~mixture)c()f0(~1)    4 78.29435  1.7151332
## 4                pi(~1)p(~mixture)c(~mixture)f0(~1)    6 80.12999  3.5507706
## 7                          pi(~1)p(~time)c()f0(~1)    8 80.49687  3.9176471
## 5                 pi(~1)p(~time + mixture)c()f0(~1)    9 82.07774  5.4985248
## 8                      pi(~1)p(~time)c(~time)f0(~1)   13 89.92625 13.3470297
## 6 pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   15 90.57592 13.9966974
##         weight Deviance
## 1 0.3717066183 46.56039
## 2 0.3306352471 44.62709
## 3 0.1576753694 46.10805
## 4 0.0629738524 43.47185
## 7 0.0524196391 39.17455
## 5 0.0237799430 38.34729
## 8 0.0004698180 36.01595
## 6 0.0003395127 31.22059
```

Les noms des modèles.

```
names(mouse.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

On examine les résultats obtenus selon le meilleur modèle (#1).

```
mouse.results$p.dot$results$real
```

```
##              estimate        se       lcl       ucl fixed note
## pi g1 m1    0.5000027 0.0000000 0.5000027 0.5000027
## p g1 t1 m1  0.3940709 0.0541778 0.2942260 0.5036207
## f0 g1 a0 t1 0.3403632 1.1133899 0.0157383 7.3608447
```

```
mouse.results$p.dot$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 17.34036 17.01574 24.36084
```

Analyse avec un effet sexe

Il est un peu dommage de séparer mâles et femelles en deux analyses séparées. En effet, on pourrait vouloir tester un effet sexe sur la probabilité de détection. On reprend l'analyse en considérant le jeu de données dans son entier.

```
mouse <- convert.inp("dat/deer-mouse-sex2G-MF.inp",
                     group.df = data.frame(sex = c("M","F")),
                     covariates = NULL)
head(mouse)
```

```
##         ch freq sex
## 1:1 111111    1   M
## 1:3 110011    1   M
## 1:4 110111    1   M
## 1:5 111111    1   M
## 1:6 110111    1   M
## 1:7 111110    1   M
```

```
tail(mouse)
```

```
##          ch freq sex
## 2:28 001010    1   F
## 2:29 001000    1   F
## 2:30 000100    1   F
## 2:32 000110    1   F
## 2:34 000010    1   F
## 2:38 000001    1   F
```

On passe à la définition des modèles maintenant. On commence par préparer les données. On utilise l'option "groups =”sex"" pour préciser qu'on va considérer des modèles avec l'effet sexe.

```
mouse.proc <- process.data(mouse,
                           begin.time = 1,
                           model = "FullHet",
                           groups = "sex")
mouse.ddl <- make.design.data(mouse.proc)
```

La liste des modèles. Ce sont les mêmes qu'au-dessus, auxquels on a ajouté d'autres modèles avec l'effet sexe.

```
run.mouse <- function() {

  # sans l'effet sexe
  p.dot <- list(formula =  ~ 1, share = TRUE)
```

```
  p.dot.behav <- list(p = list(formula =  ~ 1),
                      c = list(formula =  ~ 1))
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(p = list(formula =  ~ time),
                       c = list(formula =  ~ time))
  p.h.behav <- list(p = list(formula =  ~ mixture),
                    c = list(formula =  ~ mixture))
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  p.h.time.behav <- list(p = list(formula =  ~ mixture + time),
                         c = list(formula =  ~ mixture + time))

  # avec l'effet sexe
  p.sex <- list(formula =  ~ sex, share = TRUE)
  p.sex.behav <- list(p = list(formula =  ~ sex),
                      c = list(formula =  ~ sex))
  p.time.sex <- list(formula =  ~ time + sex, share = TRUE)
  p.time.behav.sex <- list(p = list(formula =  ~ sex + time),
                           c = list(formula =  ~ sex + time))
  p.h.sex <- list(formula = ~ mixture + sex, share = TRUE)
  p.h.behav.sex <- list(p = list(formula =  ~ sex + mixture),
                        c = list(formula =  ~ sex + mixture))
  p.h.time.sex <- list(formula = ~ time + mixture + sex, share = TRUE)
  p.h.time.behav.sex <- list(p = list(formula =  ~ sex + mixture + time),
                             c = list(formula =  ~ sex + mixture + time))

  mouse.model.list <- create.model.list("FullHet")

  mouse.results <- mark.wrapper(mouse.model.list,
                                data = mouse.proc,
                                ddl = mouse.ddl)

  return(mouse.results)
}
```

On fait tourner tous ces modèles, et on inspecte le classement.

```
mouse.results <- run.mouse()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=1)
## -2lnL:  157.6728
## AICc :  163.78  (unadjusted=159.69052)
##
## Beta
##                     estimate se           lcl           ucl
## pi:(Intercept)  6.912741e-04  0  6.912741e-04  6.912741e-04
## p:(Intercept)   1.053605e-01  0  1.053605e-01  1.053605e-01
## f0:(Intercept) -2.040915e+01  0 -2.040915e+01 -2.040915e+01
##
```

```
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.5001728
##
## Group:sexM
##
## mixture:1 0.5001728
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
##
## Real Parameter f0
## Group:sexF
##             1
##  1.369041e-09
##
## Group:sexM
##             1
##  1.369041e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  147.5555
## AICc :  155.7349  (unadjusted=153.66264)
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept) -3.284357e-05 0.0000000 -3.284357e-05 -3.284357e-05
```

```
## p:(Intercept)  -5.331229e-01 0.3104174 -1.141541e+00  7.529510e-02
## c:(Intercept)   4.554755e-01 0.1772735  1.080194e-01  8.029315e-01
## f0:(Intercept) -3.145561e-01 1.7272227 -3.699913e+00  3.070800e+00
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999918
##
## Group:sexM
##
## mixture:1 0.4999918
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.3697888 0.3697888 0.3697888 0.3697888 0.3697888 0.3697888
## mixture:2 0.3697888 0.3697888 0.3697888 0.3697888 0.3697888 0.3697888
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.3697888 0.3697888 0.3697888 0.3697888 0.3697888 0.3697888
## mixture:2 0.3697888 0.3697888 0.3697888 0.3697888 0.3697888 0.3697888
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
## Real Parameter f0
## Group:sexF
##          1
##  0.7301129
##
## Group:sexM
##          1
##  0.7301129
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4
## -2lnL:  142.225
## AICc :  150.4043
```

```
##
## Beta
##                   estimate        se        lcl       ucl
## pi:(Intercept)  0.4152354 0.6397354 -0.8386459 1.6691168
## p:(Intercept)  -0.7271248 0.4231258 -1.5564515 0.1022018
## p:mixture2      2.0499903 0.3936868  1.2783642 2.8216164
## f0:(Intercept) -0.5151995 1.9306847 -4.2993416 3.2689425
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.6023426
##
## Group:sexM
##
## mixture:1 0.6023426
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.3258260 0.3258260 0.3258260 0.3258260 0.3258260 0.3258260
## mixture:2 0.7896581 0.7896581 0.7896581 0.7896581 0.7896581 0.7896581
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.3258260 0.3258260 0.3258260 0.3258260 0.3258260 0.3258260
## mixture:2 0.7896581 0.7896581 0.7896581 0.7896581 0.7896581 0.7896581
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.3258260 0.3258260 0.3258260 0.3258260 0.3258260
## mixture:2 0.7896581 0.7896581 0.7896581 0.7896581 0.7896581
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.3258260 0.3258260 0.3258260 0.3258260 0.3258260
## mixture:2 0.7896581 0.7896581 0.7896581 0.7896581 0.7896581
##
##
## Real Parameter f0
## Group:sexF
##         1
##  0.5973814
##
## Group:sexM
##         1
##  0.5973814
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
```

```
##
## Npar :  6  (unadjusted=5)
## -2lnL:  136.4229
## AICc :  148.803  (unadjusted=146.69321)
##
## Beta
##                   estimate           se           lcl           ucl
## pi:(Intercept)  1.1917191 4.726019e-01  2.654193e-01     2.1180189
## p:(Intercept)  -1.2293215 5.677748e-01 -2.342160e+00    -0.1164829
## p:mixture2     23.2489530 1.129457e+04 -2.211410e+04 22160.6000000
## c:(Intercept)  -0.1304583 2.667011e-01 -6.531925e-01     0.3922759
## c:mixture2      1.8012063 4.932497e-01  8.344369e-01     2.7679757
## f0:(Intercept)  1.1667444 1.203326e+00 -1.191775e+00     3.5252636
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.7670484
##
## Group:sexM
##
## mixture:1 0.7670484
##
##
## Real Parameter p
## Group:sexF
##                    1         2         3         4         5         6
## mixture:1 0.2263002 0.2263002 0.2263002 0.2263002 0.2263002 0.2263002
## mixture:2 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
##
## Group:sexM
##                    1         2         3         4         5         6
## mixture:1 0.2263002 0.2263002 0.2263002 0.2263002 0.2263002 0.2263002
## mixture:2 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
##
##
## Real Parameter c
## Group:sexF
##                    2         3         4         5         6
## mixture:1 0.4674316 0.4674316 0.4674316 0.4674316 0.4674316
## mixture:2 0.8416755 0.8416755 0.8416755 0.8416755 0.8416755
##
## Group:sexM
##                    2         3         4         5         6
## mixture:1 0.4674316 0.4674316 0.4674316 0.4674316 0.4674316
## mixture:2 0.8416755 0.8416755 0.8416755 0.8416755 0.8416755
##
##
## Real Parameter f0
## Group:sexF
##        1
##  3.21152
##
```

```
## Group:sexM
##        1
##  3.21152
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex + mixture)c(~sex + mixture)f0(~1)
##
## Npar :  8
## -2lnL:  132.8003
## AICc :  149.4578
##
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept) -0.3408905 1.4377240 -3.1588296  2.4770487
## p:(Intercept)   0.0978083 0.9974979 -1.8572876  2.0529043
## p:sexM          0.6131530 0.7385278 -0.8343615  2.0606675
## p:mixture2     -1.7710080 1.3346326 -4.3868879  0.8448719
## c:(Intercept)   0.4071809 1.0197262 -1.5914824  2.4058443
## c:sexM          1.2375514 0.5228704  0.2127254  2.2623774
## c:mixture2     -1.4345908 0.5668539 -2.5456244 -0.3235572
## f0:(Intercept)  0.9898820 2.1297497 -3.1844274  5.1641914
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4155932
##
## Group:sexM
##
## mixture:1 0.4155932
##
##
## Real Parameter p
## Group:sexF
##                    1         2         3         4         5         6
## mixture:1 0.5244326 0.5244326 0.5244326 0.5244326 0.5244326 0.5244326
## mixture:2 0.1579981 0.1579981 0.1579981 0.1579981 0.1579981 0.1579981
##
## Group:sexM
##                    1         2         3         4         5         6
## mixture:1 0.6706136 0.6706136 0.6706136 0.6706136 0.6706136 0.6706136
## mixture:2 0.2573005 0.2573005 0.2573005 0.2573005 0.2573005 0.2573005
##
##
## Real Parameter c
## Group:sexF
##                    2         3         4         5         6
## mixture:1 0.6004117 0.6004117 0.6004117 0.6004117 0.6004117
## mixture:2 0.2635866 0.2635866 0.2635866 0.2635866 0.2635866
##
## Group:sexM
##                    2         3         4         5         6
## mixture:1 0.8381778 0.8381778 0.8381778 0.8381778 0.8381778
```

```
## mixture:2 0.5523429 0.5523429 0.5523429 0.5523429 0.5523429
##
##
## Real Parameter f0
## Group:sexF
##         1
##  2.690917
##
## Group:sexM
##         1
##  2.690917
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + sex)c()f0(~1)
##
## Npar :  5
## -2lnL:  136.9887
## AICc :  147.2589
##
## Beta
##                  estimate        se        lcl       ucl
## pi:(Intercept)  0.8595293 0.6488549 -0.4122263 2.1312848
## p:(Intercept)  -0.2402764 0.3895833 -1.0038597 0.5233070
## p:mixture2     -2.6445006 1.5398830 -5.6626714 0.3736702
## p:sexM          1.3318664 0.4291950  0.4906442 2.1730887
## f0:(Intercept)  1.0300678 1.9350729 -2.7626752 4.8228108
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.7025623
##
## Group:sexM
##
## mixture:1 0.7025623
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.4402182 0.4402182 0.4402182 0.4402182 0.4402182 0.4402182
## mixture:2 0.0529112 0.0529112 0.0529112 0.0529112 0.0529112 0.0529112
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.7486810 0.7486810 0.7486810 0.7486810 0.7486810 0.7486810
## mixture:2 0.1746663 0.1746663 0.1746663 0.1746663 0.1746663 0.1746663
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.4402182 0.4402182 0.4402182 0.4402182 0.4402182
```

```
## mixture:2 0.0529112 0.0529112 0.0529112 0.0529112 0.0529112
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.7486810 0.7486810 0.7486810 0.7486810 0.7486810
## mixture:2 0.1746663 0.1746663 0.1746663 0.1746663 0.1746663
##
##
## Real Parameter f0
## Group:sexF
##         1
##  2.801256
##
## Group:sexM
##         1
##  2.801256
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  9
## -2lnL:  130.1122
## AICc :  148.9379
##
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept) -0.3903994 0.5954131 -1.5574092  0.7766104
## p:(Intercept)   0.7291668 0.5906031 -0.4284154  1.8867490
## p:time2         0.6856499 0.5287543 -0.3507085  1.7220083
## p:time3         0.1412197 0.5316896 -0.9008920  1.1833314
## p:time4         0.5517951 0.5286140 -0.4842883  1.5878784
## p:time5         1.3531225 0.5386831  0.2973035  2.4089415
## p:time6         1.3531224 0.5386832  0.2973034  2.4089414
## p:mixture2     -2.1869349 0.4019844 -2.9748243 -1.3990456
## f0:(Intercept) -0.7217382 2.2058888 -5.0452804  3.6018040
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4036212
##
## Group:sexM
##
## mixture:1 0.4036212
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.6746224 0.8045246 0.7048261 0.7826135 0.8891698 0.8891698
## mixture:2 0.1888089 0.3160211 0.2113931 0.2878246 0.4738624 0.4738624
##
## Group:sexM
```

```
##                   1         2         3         4         5         6
## mixture:1 0.6746224 0.8045246 0.7048261 0.7826135 0.8891698 0.8891698
## mixture:2 0.1888089 0.3160211 0.2113931 0.2878246 0.4738624 0.4738624
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.8045246 0.7048261 0.7826135 0.8891698 0.8891698
## mixture:2 0.3160211 0.2113931 0.2878246 0.4738624 0.4738624
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.8045246 0.7048261 0.7826135 0.8891698 0.8891698
## mixture:2 0.3160211 0.2113931 0.2878246 0.4738624 0.4738624
##
##
## Real Parameter f0
## Group:sexF
##          1
##  0.4859069
##
## Group:sexM
##          1
##  0.4859069
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  15  (unadjusted=12)
## -2lnL:  117.1462
## AICc :  149.4104  (unadjusted=142.59738)
##
## Beta
##                     estimate           se           lcl           ucl
## pi:(Intercept)     0.5724643 3.633274e-01 -1.396575e-01     1.2845861
## p:(Intercept)     -2.8772941 1.278703e+00 -5.383552e+00    -0.3710364
## p:mixture2        23.7869450 1.061867e+04 -2.078881e+04 20836.3880000
## p:time2            2.2486863 1.351572e+00 -4.003955e-01     4.8977681
## p:time3            2.4718270 1.383061e+00 -2.389736e-01     5.1826277
## p:time4            2.1841444 1.461192e+00 -6.797920e-01     5.0480807
## p:time5            2.8772923 1.517151e+00 -9.632400e-02     5.8509086
## p:time6           41.0930030 0.000000e+00  4.109300e+01    41.0930030
## c:(Intercept)     -0.3391174 8.083503e-01 -1.923484e+00     1.2452492
## c:mixture2         1.9698523 4.916152e-01  1.006287e+00     2.9334180
## c:time3           -1.1887947 8.298538e-01 -2.815308e+00     0.4377188
## c:time4           -0.3216365 8.302093e-01 -1.948847e+00     1.3055738
## c:time5            0.4774465 8.549641e-01 -1.198283e+00     2.1531762
## c:time6            0.2405251 8.399634e-01 -1.405803e+00     1.8868534
## f0:(Intercept) -55.3928630 0.000000e+00 -5.539286e+01   -55.3928630
##
##
## Real Parameter pi
## Group:sexF
```

```
##
## mixture:1 0.6393316
##
## Group:sexM
##
## mixture:1 0.6393316
##
##
## Real Parameter p
## Group:sexF
##                    1         2         3         4         5 6
## mixture:1 0.0532875 0.3478263 0.3999995 0.3333328 0.4999995 1
## mixture:2 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1
##
## Group:sexM
##                    1         2         3         4         5 6
## mixture:1 0.0532875 0.3478263 0.3999995 0.3333328 0.4999995 1
## mixture:2 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1
##
##
## Real Parameter c
## Group:sexF
##                    2         3         4         5         6
## mixture:1 0.4160239 0.1782994 0.3405703 0.5345272 0.4753719
## mixture:2 0.8362703 0.6087213 0.7873622 0.8916958 0.8666040
##
## Group:sexM
##                    2         3         4         5         6
## mixture:1 0.4160239 0.1782994 0.3405703 0.5345272 0.4753719
## mixture:2 0.8362703 0.6087213 0.7873622 0.8916958 0.8666040
##
##
## Real Parameter f0
## Group:sexF
##             1
##  8.773753e-25
##
## Group:sexM
##             1
##  8.773753e-25
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex + mixture + time)c(~sex + mixture + time)f0(~1)
##
## Npar :  17  (unadjusted=12)
## -2lnL:  108.3403
## AICc :  145.2546  (unadjusted=133.7915)
##
## Beta
##                   estimate           se           lcl           ucl
## pi:(Intercept)   1.6739810 4.448790e-01  8.020181e-01     2.5459439
## p:(Intercept)   -0.9923181 5.125918e-01 -1.996998e+00     0.0123618
## p:sexM           1.5838754 6.015661e-01  4.048058e-01     2.7629450
## p:mixture2     -49.4196570 3.019391e+02 -6.412202e+02   542.3809400
```

```
## p:time2          0.4213341 6.686059e-01 -8.891336e-01     1.7318018
## p:time3          1.5591529 8.712045e-01 -1.484079e-01     3.2667137
## p:time4         16.4792310 3.071492e+03 -6.003645e+03  6036.6030000
## p:time5         49.3315950 3.019391e+02 -5.424690e+02   641.1321900
## p:time6        104.8754500 4.892162e+04 -9.578150e+04 95991.2470000
## c:(Intercept)    0.3483335 7.244692e-01 -1.071626e+00     1.7682932
## c:sexM           1.4135562 4.097317e-01  6.104820e-01     2.2166305
## c:mixture2     -18.3933890 3.008425e+03 -5.914906e+03  5878.1196000
## c:time3         -1.6392167 8.023450e-01 -3.211813e+00    -0.0666205
## c:time4         -0.9000131 7.808560e-01 -2.430491e+00     0.6304647
## c:time5         -0.2174429 7.891950e-01 -1.764265e+00     1.3293794
## c:time6         -0.2174436 7.891946e-01 -1.764265e+00     1.3293779
## f0:(Intercept) -29.3380820 1.269206e+04 -2.490577e+04 24847.0920000
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.8421059
##
## Group:sexM
##
## mixture:1 0.8421059
##
##
## Real Parameter p
## Group:sexF
##                       1            2            3            4         5 6
## mixture:1 2.704545e-01 3.610098e-01 6.380325e-01 9.999998e-01 1.0000000 1
## mixture:2 1.277490e-22 1.946886e-22 6.074199e-22 1.833145e-15 0.2534342 1
##
## Group:sexM
##                       1            2            3            4         5 6
## mixture:1 6.437224e-01 7.335856e-01 8.957351e-01 1.000000e+00 1.0000000 1
## mixture:2 6.226241e-22 9.488749e-22 2.960448e-21 8.934395e-15 0.6232805 1
##
##
## Real Parameter c
## Group:sexF
##                       2            3            4           5            6
## mixture:1 5.862134e-01 2.157034e-01 3.654748e-01 5.32676e-01 5.326758e-01
## mixture:2 1.455902e-08 2.826372e-09 5.919177e-09 1.17138e-08 1.171379e-08
##
## Group:sexM
##                       2            3            4            5            6
## mixture:1 8.534462e-01 5.306298e-01 7.030526e-01 8.241102e-01 8.241101e-01
## mixture:2 5.984553e-08 1.161793e-08 2.433106e-08 4.815013e-08 4.815009e-08
##
##
## Real Parameter f0
## Group:sexF
##             1
##  1.813982e-13
##
```

```
## Group:sexM
##             1
##  1.813982e-13
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture + sex)c()f0(~1)
##
## Npar :  10
## -2lnL:  125.3031
## AICc :  146.3169
##
## Beta
##                   estimate        se        lcl       ucl
## pi:(Intercept)  0.8562576 0.6675076 -0.4520575 2.1645726
## p:(Intercept)  -0.8381402 0.6738124 -2.1588125 0.4825321
## p:time2         0.6470860 0.5129320 -0.3582607 1.6524328
## p:time3         0.1318704 0.5137405 -0.8750609 1.1388018
## p:time4         0.5190745 0.5121576 -0.4847544 1.5229035
## p:time5         1.3006932 0.5277911  0.2662226 2.3351638
## p:time6         1.3006932 0.5277911  0.2662226 2.3351639
## p:mixture2     -2.5544260 1.9136069 -6.3050957 1.1962436
## p:sexM          1.3736220 0.5177311  0.3588691 2.3883749
## f0:(Intercept)  0.7154270 2.5701039 -4.3219768 5.7528308
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.7018782
##
## Group:sexM
##
## mixture:1 0.7018782
##
##
## Real Parameter p
## Group:sexF
##                    1         2         3         4         5         6
## mixture:1 0.3019266 0.4523812 0.3304236 0.4209035 0.6136197 0.6136197
## mixture:2 0.0325286 0.0603424 0.0369444 0.0534796 0.1098892 0.1098892
##
## Group:sexM
##                    1         2         3         4         5         6
## mixture:1 0.6307607 0.7654092 0.6609100 0.7416489 0.8624957 0.8624957
## mixture:2 0.1172282 0.2023198 0.1315785 0.1824450 0.3277782 0.3277782
##
##
## Real Parameter c
## Group:sexF
##                    2         3         4         5         6
## mixture:1 0.4523812 0.3304236 0.4209035 0.6136197 0.6136197
## mixture:2 0.0603424 0.0369444 0.0534796 0.1098892 0.1098892
##
## Group:sexM
```

```
##                   2         3         4         5         6
## mixture:1 0.7654092 0.6609100 0.7416489 0.8624957 0.8624957
## mixture:2 0.2023198 0.1315785 0.1824450 0.3277782 0.3277782
##
##
## Real Parameter f0
## Group:sexF
##        1
##  2.04506
##
## Group:sexM
##        1
##  2.04506
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  146.1409
## AICc :  154.3203  (unadjusted=150.19425)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept)  3.628474e-05    0.0000000  3.628474e-05  3.628474e-05
## p:(Intercept)  -3.973018e-01    0.2019497 -7.931233e-01 -1.480400e-03
## p:sexM          9.166021e-01    0.2733469  3.808422e-01  1.452362e+00
## f0:(Intercept) -1.705755e+01 3343.6164000 -6.570546e+03  6.536431e+03
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.5000091
##
## Group:sexM
##
## mixture:1 0.5000091
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.4019608 0.4019608 0.4019608 0.4019608 0.4019608 0.4019608
## mixture:2 0.4019608 0.4019608 0.4019608 0.4019608 0.4019608 0.4019608
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
## mixture:2 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
```

```
## mixture:1 0.4019608 0.4019608 0.4019608 0.4019608 0.4019608
## mixture:2 0.4019608 0.4019608 0.4019608 0.4019608 0.4019608
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
## mixture:2 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
##
##
## Real Parameter f0
## Group:sexF
##             1
##  3.908398e-08
##
## Group:sexM
##             1
##  3.908398e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex)c(~sex)f0(~1)
##
## Npar :  6  (unadjusted=5)
## -2lnL:  135.9211
## AICc :  148.3012  (unadjusted=146.19141)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept) -1.315264e-06 0.000000e+00 -1.315264e-06 -1.315264e-06
## p:(Intercept)  -7.198821e-01 3.614792e-01 -1.428381e+00 -1.138290e-02
## p:sexM          3.998280e-01 4.141434e-01 -4.118932e-01  1.211549e+00
## c:(Intercept)  -2.231435e-01 1.753813e-05 -2.231779e-01 -2.231091e-01
## c:sexM          1.192544e+00 2.503915e-01  7.017766e-01  1.683312e+00
## f0:(Intercept) -4.253487e-01 1.851169e+00 -4.053641e+00  3.202943e+00
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999997
##
## Group:sexM
##
## mixture:1 0.4999997
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.3274189 0.3274189 0.3274189 0.3274189 0.3274189 0.3274189
## mixture:2 0.3274189 0.3274189 0.3274189 0.3274189 0.3274189 0.3274189
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.4206626 0.4206626 0.4206626 0.4206626 0.4206626 0.4206626
```

```
## mixture:2 0.4206626 0.4206626 0.4206626 0.4206626 0.4206626 0.4206626
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.4444445 0.4444445 0.4444445 0.4444445 0.4444445
## mixture:2 0.4444445 0.4444445 0.4444445 0.4444445 0.4444445
##
## Group:sexM
##               2     3     4     5     6
## mixture:1 0.725 0.725 0.725 0.725 0.725
## mixture:2 0.725 0.725 0.725 0.725 0.725
##
##
## Real Parameter f0
## Group:sexF
##          1
##  0.6535418
##
## Group:sexM
##          1
##  0.6535418
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  8  (unadjusted=6)
## -2lnL:  147.8409
## AICc :  164.4985  (unadjusted=160.22102)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept)  -0.0001980    0.0000000    -0.0001980   -0.0001980
## p:(Intercept)   -0.4274441    0.3318811    -1.0779310    0.2230428
## p:time2          0.5328047    0.4644358    -0.3774896    1.4430989
## p:time3          0.1089904    0.4670115    -0.8063521    1.0243329
## p:time4          0.4274441    0.4641209    -0.4822330    1.3371211
## p:time5          1.0813706    0.4765167     0.1473979    2.0153434
## p:time6          1.0813706    0.4765167     0.1473978    2.0153433
## f0:(Intercept) -17.2475850 3500.1199000 -6877.4827000 6842.9876000
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999505
##
## Group:sexM
##
## mixture:1 0.4999505
##
##
## Real Parameter p
```

```
## Group:sexF
##                   1         2         3   4         5         6
## mixture:1 0.3947368 0.5263158 0.4210526 0.5 0.6578948 0.6578947
## mixture:2 0.3947368 0.5263158 0.4210526 0.5 0.6578948 0.6578947
##
## Group:sexM
##                   1         2         3   4         5         6
## mixture:1 0.3947368 0.5263158 0.4210526 0.5 0.6578948 0.6578947
## mixture:2 0.3947368 0.5263158 0.4210526 0.5 0.6578948 0.6578947
##
##
## Real Parameter c
## Group:sexF
##                   2         3   4         5         6
## mixture:1 0.5263158 0.4210526 0.5 0.6578948 0.6578947
## mixture:2 0.5263158 0.4210526 0.5 0.6578948 0.6578947
##
## Group:sexM
##                   2         3   4         5         6
## mixture:1 0.5263158 0.4210526 0.5 0.6578948 0.6578947
## mixture:2 0.5263158 0.4210526 0.5 0.6578948 0.6578947
##
##
## Real Parameter f0
## Group:sexF
##             1
##  3.231983e-08
##
## Group:sexM
##             1
##  3.231983e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~time)f0(~1)
##
## Npar :  13  (unadjusted=10)
## -2lnL:  135.2228
## AICc :  162.9238  (unadjusted=156.23664)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept)  5.644843e-04 1.284711e+00 -2.517470e+00     2.5185988
## p:(Intercept)  -4.274440e-01 3.318804e-01 -1.077930e+00     0.2230415
## p:time2        -2.011646e-01 5.493730e-01 -1.277936e+00     0.8756064
## p:time3         2.197890e-02 6.228322e-01 -1.198772e+00     1.2427301
## p:time4        -2.657033e-01 7.811172e-01 -1.796693e+00     1.2652864
## p:time5         4.274437e-01 8.813686e-01 -1.300039e+00     2.1549262
## p:time6         2.921203e+01 0.000000e+00  2.921203e+01    29.2120280
## c:(Intercept)   1.386295e+00 6.454960e-01  1.211224e-01     2.6514668
## c:time3        -1.648659e+00 7.704466e-01 -3.158734e+00    -0.1385835
## c:time4        -1.178655e+00 7.457130e-01 -2.640253e+00     0.2829423
## c:time5        -5.978374e-01 7.497462e-01 -2.067340e+00     0.8716652
## c:time6        -8.602015e-01 7.341951e-01 -2.299224e+00     0.5788209
## f0:(Intercept) -2.724582e+01 1.829297e+04 -3.588147e+04 35826.9740000
```

```
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.5001411
##
## Group:sexM
##
## mixture:1 0.5001411
##
##
## Real Parameter p
## Group:sexF
##                   1         2   3         4         5 6
## mixture:1 0.3947368 0.3478261 0.4 0.3333333 0.4999999 1
## mixture:2 0.3947368 0.3478261 0.4 0.3333333 0.4999999 1
##
## Group:sexM
##                   1         2   3         4         5 6
## mixture:1 0.3947368 0.3478261 0.4 0.3333333 0.4999999 1
## mixture:2 0.3947368 0.3478261 0.4 0.3333333 0.4999999 1
##
##
## Real Parameter c
## Group:sexF
##             2         3         4      5         6
## mixture:1 0.8 0.4347826 0.5517241 0.6875 0.6285714
## mixture:2 0.8 0.4347826 0.5517241 0.6875 0.6285714
##
## Group:sexM
##             2         3         4      5         6
## mixture:1 0.8 0.4347826 0.5517241 0.6875 0.6285714
## mixture:2 0.8 0.4347826 0.5517241 0.6875 0.6285714
##
##
## Real Parameter f0
## Group:sexF
##             1
##  1.469908e-12
##
## Group:sexM
##             1
##  1.469908e-12
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex + time)c(~sex + time)f0(~1)
##
## Npar :  15  (unadjusted=12)
## -2lnL:  123.0009
## AICc :  155.2651  (unadjusted=148.45211)
##
## Beta
##                     estimate           se           lcl           ucl
```

```
## pi:(Intercept)  1.280104e-04    0.0000000  1.280104e-04  1.280104e-04
## p:(Intercept)  -6.382107e-01    0.4191035 -1.459653e+00  1.832322e-01
## p:sexM          3.745847e-01    0.4435509 -4.947751e-01  1.243945e+00
## p:time2        -1.419025e-01    0.5558621 -1.231392e+00  9.475871e-01
## p:time3         1.050519e-01    0.6332034 -1.136027e+00  1.346131e+00
## p:time4        -2.689035e-01    0.7841458 -1.805829e+00  1.268022e+00
## p:time5         3.881618e-01    0.8858553 -1.348115e+00  2.124438e+00
## p:time6         1.922800e+01   17.2534920 -1.458885e+01  5.304484e+01
## c:(Intercept)   4.237532e-01    0.7181419 -9.838049e-01  1.831311e+00
## c:sexM          1.302281e+00    0.3949167  5.282444e-01  2.076318e+00
## c:time3        -1.629312e+00    0.7970576 -3.191546e+00 -6.707950e-02
## c:time4        -9.168665e-01    0.7755343 -2.436914e+00  6.031807e-01
## c:time5        -2.480105e-01    0.7834279 -1.783529e+00  1.287508e+00
## c:time6        -5.521769e-01    0.7652601 -2.052087e+00  9.477329e-01
## f0:(Intercept) -2.045624e+01 5778.2252000 -1.134578e+04  1.130486e+04
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.500032
##
## Group:sexM
##
## mixture:1 0.500032
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5 6
## mixture:1 0.3456511 0.3142955 0.3697805 0.2875907 0.4378115 1
## mixture:2 0.3456511 0.3142955 0.3697805 0.2875907 0.4378115 1
##
## Group:sexM
##                   1         2         3         4         5 6
## mixture:1 0.4344726 0.3999848 0.4604393 0.3699271 0.5310938 1
## mixture:2 0.4344726 0.3999848 0.4604393 0.3699271 0.5310938 1
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.604381 0.2304877 0.3791604 0.5438229 0.4679381
## mixture:2 0.604381 0.2304877 0.3791604 0.5438229 0.4679381
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.8489045 0.5241616 0.6919321 0.8142739 0.7638415
## mixture:2 0.8489045 0.5241616 0.6919321 0.8142739 0.7638415
##
##
## Real Parameter f0
## Group:sexF
##             1
```

```
##  1.306075e-09
##
## Group:sexM
##             1
##  1.306075e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + sex)c()f0(~1)
##
## Npar :  9  (unadjusted=7)
## -2lnL:  135.7705
## AICc :  154.5961  (unadjusted=150.27955)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept) -3.731203e-04    0.0000000 -3.731203e-04 -3.731203e-04
## p:(Intercept)  -9.848608e-01    0.3813508 -1.732308e+00 -2.374133e-01
## p:time2         5.630693e-01    0.4776012 -3.730291e-01  1.499168e+00
## p:time3         1.149499e-01    0.4796135 -8.250926e-01  1.054992e+00
## p:time4         4.515732e-01    0.4771376 -4.836166e-01  1.386763e+00
## p:time5         1.142637e+00    0.4904562  1.813431e-01  2.103932e+00
## p:time6         1.142637e+00    0.4904563  1.813430e-01  2.103932e+00
## p:sexM          9.614725e-01    0.2811732  4.103731e-01  1.512572e+00
## f0:(Intercept) -2.318969e+01 9418.5022000 -1.848345e+04  1.843708e+04
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999067
##
## Group:sexM
##
## mixture:1 0.4999067
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.2719284 0.3960881 0.2952728 0.3697504 0.5393625 0.5393625
## mixture:2 0.2719284 0.3960881 0.2952728 0.3697504 0.5393625 0.5393625
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.4941532 0.6317382 0.5228744 0.6054401 0.7538494 0.7538494
## mixture:2 0.4941532 0.6317382 0.5228744 0.6054401 0.7538494 0.7538494
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.3960881 0.2952728 0.3697504 0.5393625 0.5393625
## mixture:2 0.3960881 0.2952728 0.3697504 0.5393625 0.5393625
##
```

```
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6317382 0.5228744 0.6054401 0.7538494 0.7538494
## mixture:2 0.6317382 0.5228744 0.6054401 0.7538494 0.7538494
##
##
## Real Parameter f0
## Group:sexF
##             1
##  8.488784e-11
##
## Group:sexM
##             1
##  8.488784e-11
```

```
mouse.results
```

```
##                                                                 model npar     AICc
## 9  pi(~1)p(~sex + mixture + time)c(~sex + mixture + time)f0(~1)   17 145.2546
## 10                      pi(~1)p(~time + mixture + sex)c()f0(~1)   10 146.3169
## 6                              pi(~1)p(~mixture + sex)c()f0(~1)    5 147.2589
## 12                                   pi(~1)p(~sex)c(~sex)f0(~1)    6 148.3012
## 4                             pi(~1)p(~mixture)c(~mixture)f0(~1)    6 148.8030
## 7                              pi(~1)p(~time + mixture)c()f0(~1)    9 148.9379
## 8              pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   15 149.4104
## 5                pi(~1)p(~sex + mixture)c(~sex + mixture)f0(~1)    8 149.4578
## 3                                    pi(~1)p(~mixture)c()f0(~1)    4 150.4044
## 11                                       pi(~1)p(~sex)c()f0(~1)    4 154.3203
## 16                                 pi(~1)p(~time + sex)c()f0(~1)    9 154.5961
## 15                     pi(~1)p(~sex + time)c(~sex + time)f0(~1)   15 155.2651
## 2                                      pi(~1)p(~1)c(~1)f0(~1)    4 155.7349
## 14                                pi(~1)p(~time)c(~time)f0(~1)   13 162.9238
## 1                                        pi(~1)p(~1)c()f0(~1)    3 163.7800
## 13                                    pi(~1)p(~time)c()f0(~1)    8 164.4985
##    DeltaAICc       weight  Deviance
## 9   0.000000 3.499891e-01  75.18263
## 10  1.062299 2.057686e-01  92.14539
## 6   2.004305 1.284770e-01 103.83095
## 12  3.046605 7.629440e-02 102.76344
## 4   3.548405 5.936469e-02 103.26524
## 7   3.683282 5.549322e-02  96.95452
## 8   4.155735 4.381755e-02  83.98851
## 5   4.203169 4.279057e-02  99.64255
## 3   5.149726 2.665665e-02 109.06727
## 11  9.065656 3.762463e-03 112.98321
## 16  9.341522 3.277696e-03 102.61275
## 15 10.010465 2.345901e-03  89.84324
## 2  10.480246 1.854803e-03 114.39780
## 14 17.669129 5.096264e-05 102.06511
## 1  18.525337 3.321457e-05 124.51511
## 13 19.243839 2.319039e-05 114.68322
```

Les noms des modèles.

```
names(mouse.results)
```

```
##  [1] "p.dot"              "p.dot.behav"        "p.h"
##  [4] "p.h.behav"          "p.h.behav.sex"      "p.h.sex"
##  [7] "p.h.time"           "p.h.time.behav"     "p.h.time.behav.sex"
## [10] "p.h.time.sex"       "p.sex"              "p.sex.behav"
## [13] "p.time"             "p.time.behav"       "p.time.behav.sex"
## [16] "p.time.sex"         "model.table"
```

On examine le meilleur modèle selon l'AIC (#9).

```
mouse.results$p.h.time.behav.sex$results$real
```

```
##                  estimate           se            lcl          ucl fixed note
## pi gF m1    8.421059e-01 5.915270e-02   6.904060e-01 9.273005e-01
## p gF t1 m1  2.704545e-01 1.011389e-01   1.195185e-01 5.030904e-01
## p gF t2 m1  3.610098e-01 1.245746e-01   1.639072e-01 6.195105e-01
## p gF t3 m1  6.380325e-01 1.659036e-01   3.012915e-01 8.781284e-01
## p gF t4 m1  9.999998e-01 5.773886e-04  2.959139e-302 1.000000e+00
## p gF t5 m1  1.000000e+00 0.000000e+00   1.000000e+00 1.000000e+00
## p gF t6 m1  1.000000e+00 0.000000e+00   1.000000e+00 1.000000e+00
## p gF t1 m2  1.277490e-22 3.857245e-20  -7.547425e-20 7.572975e-20
## p gF t2 m2  1.946886e-22 5.878421e-20  -1.150224e-19 1.154117e-19
## p gF t3 m2  6.074199e-22 1.834043e-19  -3.588651e-19 3.600799e-19
## p gF t4 m2  1.833145e-15 5.657698e-12  -1.108726e-11 1.109092e-11
## p gF t5 m2  2.534342e-01 1.837160e-01   4.817620e-02 6.948212e-01
## p gF t6 m2  1.000000e+00 0.000000e+00   1.000000e+00 1.000000e+00
## p gM t1 m1  6.437224e-01 1.058947e-01   4.222774e-01 8.170587e-01
## p gM t2 m1  7.335856e-01 1.332246e-01   4.198991e-01 9.128523e-01
## p gM t3 m1  8.957351e-01 8.575460e-02   5.868669e-01 9.811163e-01
## p gM t4 m1  1.000000e+00 1.184677e-04  1.442227e-301 1.000000e+00
## p gM t5 m1  1.000000e+00 0.000000e+00   1.000000e+00 1.000000e+00
## p gM t6 m1  1.000000e+00 0.000000e+00   1.000000e+00 1.000000e+00
## p gM t1 m2  6.226241e-22 1.879946e-19  -3.678468e-19 3.690920e-19
## p gM t2 m2  9.488749e-22 2.865031e-19  -5.605972e-19 5.624949e-19
## p gM t3 m2  2.960448e-21 8.938787e-19  -1.749042e-18 1.754963e-18
## p gM t4 m2  8.934395e-15 2.757453e-11  -5.403714e-11 5.405501e-11
## p gM t5 m2  6.232805e-01 2.085373e-01   2.249131e-01 9.041536e-01
## p gM t6 m2  1.000000e+00 0.000000e+00   1.000000e+00 1.000000e+00
## c gF t2 m1  5.862134e-01 1.757325e-01   2.550940e-01 8.542453e-01
## c gF t3 m1  2.157034e-01 9.160870e-02   8.688900e-02 4.428656e-01
## c gF t4 m1  3.654748e-01 1.046742e-01   1.921087e-01 5.824909e-01
## c gF t5 m1  5.326760e-01 1.078980e-01   3.276886e-01 7.271953e-01
## c gF t6 m1  5.326758e-01 1.078980e-01   3.276885e-01 7.271952e-01
## c gF t2 m2  1.455902e-08 4.379971e-05  -8.583287e-05 8.586199e-05
## c gF t3 m2  2.826372e-09 8.502927e-06  -1.666291e-05 1.666856e-05
## c gF t4 m2  5.919177e-09 1.780740e-05  -3.489658e-05 3.490842e-05
## c gF t5 m2  1.171380e-08 3.524009e-05  -6.905886e-05 6.908229e-05
## c gF t6 m2  1.171379e-08 3.524006e-05  -6.905881e-05 6.908224e-05
## c gM t2 m1  8.534462e-01 8.543790e-02   6.042095e-01 9.569234e-01
## c gM t3 m1  5.306298e-01 1.120124e-01   3.189041e-01 7.318754e-01
## c gM t4 m1  7.030526e-01 9.222210e-02   4.990161e-01 8.491165e-01
```

```
## c gM t5 m1  8.241102e-01 6.833800e-02   6.503103e-01 9.219031e-01
## c gM t6 m1  8.241101e-01 6.833800e-02   6.503102e-01 9.219031e-01
## c gM t2 m2  5.984553e-08 1.800408e-04  3.329018e-316 1.000000e+00
## c gM t3 m2  1.161793e-08 3.495168e-05  -6.849368e-05 6.851692e-05
## c gM t4 m2  2.433106e-08 7.319816e-05  1.353460e-316 1.000000e+00
## c gM t5 m2  4.815013e-08 1.448560e-04  2.678440e-316 1.000000e+00
## c gM t6 m2  4.815009e-08 1.448559e-04  2.678438e-316 1.000000e+00
## f0 gF a0 t1 1.813982e-13 2.302317e-09   3.616502e-17 9.098661e-10
```

```
mouse.results$p.h.time.behav.sex$results$derived
```

```
## $`N Population Size`
##   estimate lcl ucl
## 1       17  17  17
## 2       21  21  21
```

Et un autre modèle, le modèle #2 classé 13ème.

```
mouse.results$p.dot.behav$results$real
```

```
##              estimate        se       lcl       ucl fixed note
## pi gF m1    0.4999918 0.0000000 0.4999918 0.4999918
## p gF t1 m1  0.3697888 0.0723412 0.2420376 0.5188149
## c gF t2 m1  0.6119403 0.0420970 0.5269786 0.6906012
## f0 gF a0 t1 0.7301129 1.2610676 0.0728907 7.3132102
```

```
mouse.results$p.dot.behav$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 17.73011 17.07289 24.31321
## 2 21.73011 21.07289 28.31321
```

Nettoyage

On supprime les fichiers temporaires.

```
rm(list = ls(all = TRUE))
cleanup(ask = FALSE)
```