TP 2 marked abundance

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On charge le package `RMark`.

```
library(RMark)
```

Et aussi le tidyverse.

```
library(tidyverse)
```

Partie 1 : le cours

Les données.

```
capsid <- convert.inp("dat/capsid.inp",
                      group.df = NULL,
                      covariates = NULL)
head(capsid)
```

```
##              ch freq
## 1 0000000000001   47
## 2 0000000000010   36
## 3 0000000000011   12
## 4 0000000000100   30
## 5 0000000000101    8
## 6 0000000000110    1
```

```
tail(capsid)
```

```
##                ch freq
## 244 1100000000000    4
## 245 1100000000000   -1
## 248 1100100100000    1
## 250 1110000000000    1
## 251 1110001000000    1
## 252 1111000000000    2
```

On charge le package `secr` qui permet d'implémenter le test de `closure`.

```
library(secr)
```

On met les données au format adéquat.

```
capsid_secr <- unRMarkInput(capsid)
```

On explore le jeu de données.

```
summary(capsid_secr)
```

```
## Object class       capthist
##
## Counts by occasion
##              1   2   3   4   5   6   7   8    9   10   11   12   13 Total
## n           54 144 166 203 186 197 231 164  161  122  118  118  142  2006
## u           54 134 127 147 132 131 134  89   60   42   44   48   47  1189
## f          690 295 123  62  13   3   0   1    2    0    0    0    0  1189
## M(t+1)      54 188 315 462 594 725 859 948 1008 1050 1094 1142 1189  1189
## losses       0   1   0   1   1   1   1   0    1    0    1    0    0     7
## detections  54 144 166 203 186 197 231 164  161  122  118  118  142  2006
```

On fait les tests de Stanley et Burnham et de Otis.

```
test <- closure.test(capsid_secr, SB = TRUE)
```

Pour Otis, on a :

```
test$Otis
```

```
##  statistic            p
##  -7.419844 5.862897e-14
```

Pour Stanley-Burnham, on a :

```
test$Xc
```

```
##  statistic df p
##   682.1555 22 0
```

Les composantes de Stanley-Burnham :

```
test$NRvsJS
```

```
##  statistic df p
##   264.6914 11 0
```

```
test$MtvsNM
```

```
##  statistic df         p
##   11.07903 11 0.4366662
```

```
test$MtvsNR
```

```
##  statistic df p
##   417.4641 11 0
```

```
test$NRvsJS
```

```
##  statistic df p
##   264.6914 11 0
```

Les sous-composantes de NR vs JS.

```
round(test$compNRvsJS, 2)
```

```
##    Occasion Chisquare df    p
## 1         2     19.26  1 0.00
## 2         3     53.24  1 0.00
## 3         4     50.12  1 0.00
## 4         5     27.88  1 0.00
## 5         6     22.70  1 0.00
## 6         7     30.18  1 0.00
## 7         8      8.24  1 0.00
## 8         9     25.47  1 0.00
## 9        10     18.55  1 0.00
## 10       11      8.17  1 0.00
## 11       12      0.88  1 0.35
```

Les sous-composantes de NM vs JS.

```
round(test$compNMvsJS, 2)
```

```
##    Occasion Chisquare df    p
## 1         2      8.77  1 0.00
## 2         3      0.59  1 0.44
## 3         4      2.42  1 0.12
## 4         5     22.65  1 0.00
## 5         6     57.85  1 0.00
## 6         7     82.95  1 0.00
## 7         8    143.12  1 0.00
## 8         9     78.76  1 0.00
## 9        10    101.06  1 0.00
## 10       11     84.54  1 0.00
## 11       12     88.37  1 0.00
```

On supprime les 3 premières et dernières occasions. On sépare d'abord les colonnes, on sélectionne les colonnes 4 à 10, on supprime les lignes de 0, puis on les recolle et on reconvertit au format requis.

```
capsid_reduced <- capsid
ch <- splitCH(capsid_reduced$ch) # sépare colonnes
head(ch)
```

```
##      Time1 Time2 Time3 Time4 Time5 Time6 Time7 Time8 Time9 Time10 Time11 Time12
## [1,]     0     0     0     0     0     0     0     0     0      0      0      0
## [2,]     0     0     0     0     0     0     0     0     0      0      0      1
## [3,]     0     0     0     0     0     0     0     0     0      0      0      1
## [4,]     0     0     0     0     0     0     0     0     0      0      1      0
## [5,]     0     0     0     0     0     0     0     0     0      0      1      0
## [6,]     0     0     0     0     0     0     0     0     0      0      1      1
##      Time13
## [1,]      1
## [2,]      0
## [3,]      1
## [4,]      0
## [5,]      1
## [6,]      0
```

```
ch_reduced <- ch[, 4:10] # sélection colonnes 4 à 10
head(ch_reduced)
```

```
##      Time4 Time5 Time6 Time7 Time8 Time9 Time10
## [1,]     0     0     0     0     0     0      0
## [2,]     0     0     0     0     0     0      0
## [3,]     0     0     0     0     0     0      0
## [4,]     0     0     0     0     0     0      0
## [5,]     0     0     0     0     0     0      0
## [6,]     0     0     0     0     0     0      0
```

```
dim(ch_reduced)
```

```
## [1] 231   7
```

```
mask <- apply(ch_reduced, 1, sum)
ch_reduced <- ch_reduced[mask > 0,] # supprime lignes de 0
head(ch_reduced)
```

```
##      Time4 Time5 Time6 Time7 Time8 Time9 Time10
## [1,]     0     0     0     0     0     0      1
## [2,]     0     0     0     0     0     0      1
## [3,]     0     0     0     0     0     0      1
## [4,]     0     0     0     0     0     0      1
## [5,]     0     0     0     0     0     0      1
## [6,]     0     0     0     0     0     0      1
```

```
dim(ch_reduced)
```

```
## [1] 206   7
```

```
freq_reduced <- capsid_reduced$freq[mask > 0]
length(freq_reduced)
```

```
## [1] 206
```

```
capsid_reduced <- data.frame(ch = collapseCH(ch_reduced), # on recolle les colonnes ensemble
                             freq = freq_reduced)
capsid_reduced_secr <- unRMarkInput(capsid_reduced) # on convertit au bon format
```

Jette un coup d'oeil.

```
summary(capsid_reduced_secr)
```

```
## Object class       capthist
##
## Counts by occasion
##              1   2   3   4   5   6   7 Total
## n          203 186 197 231 164 161 122  1264
## u          203 156 145 147  93  66  43   853
## f          559 204  68  18   3   1   0   853
## M(t+1)     203 359 504 651 744 810 853   853
## losses       1   1   1   1   0   1   0     5
## detections 203 186 197 231 164 161 122  1264
```

On refait les tests de Stanley et Burnham et de Otis.

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

```
## $Otis
##  statistic            p
##  -3.408934 0.0003260862
##
## $Xc
##  statistic df p
##   212.0965 10 0
##
## $NRvsJS
##  statistic df            p
##   46.69577  5 6.553423e-09
##
## $NMvsJS
##  statistic df p
##   208.4222  5 0
##
## $MtvsNR
##  statistic df p
##   165.4008  5 0
##
## $MtvsNM
##  statistic df         p
##   3.674328  5 0.5971889
##
## $compNRvsJS
##   Occasion  Chisquare df            p
## 1        2 14.3423440  1 0.0001523982
## 2        3 14.7847588  1 0.0001205055
## 3        4 14.5324748  1 0.0001377642
```

```
## 4        5  0.9609364  1 0.3269510743
## 5        6  2.0752608  1 0.1497043444
##
## $compNMvsJS
##   Occasion Chisquare df            p
## 1        2  12.92835  1 3.236426e-04
## 2        3  34.03060  1 5.425200e-09
## 3        4  51.93692  1 5.731251e-13
## 4        5  81.58510  1 1.678748e-19
## 5        6  27.94123  1 1.250563e-07
```

Ca change pas grand chose. Est-ce le bon fichier capsid.inp?!

Partie 2 : mouse deer

Les données

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

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

```
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.

```
mouse_secr <- unRMarkInput(mouse) # on convertit au bon format
summary(mouse_secr) # resumes
```

```
## 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
```

```
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
```

Process data

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

Create default design data

```
mouse.ddl <- make.design.data(mouse.proc)
```

Here, we set up the structures for 'p' and 'c'. I use the "share = TRUE" or "share = FALSE" options in each of the structures to indicate whether 'p' & 'c' should share the same columns of the design matrix or not. Although this is not necessary for all of the structures below, it does add a covariate "c" to the design data with c=0 for rows pertaining to parameter 'p' and c=1 for rows pertaining to parameter 'c. This is nice as it gives us the opportunity to build some of the additive structures we're interested in. We can then use the covariate "c" in formula statements if we want to. But, we don't have to include that covariate if we don't want to (e.g., see the p.dot structure).

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

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

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

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

  return(mouse.results)
}
```

Run the models and examine the output

```
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)  2.325226e-04 0.0000000  2.325226e-04  2.325226e-04
## p:(Intercept)   1.053607e-01 0.1326369 -1.546075e-01  3.653290e-01
## f0:(Intercept) -1.687385e+01 0.0000000 -1.687385e+01 -1.687385e+01
##
##
## Real Parameter pi
##
##
```

```
## mixture:1 0.5000581
##
##
## Real Parameter p
##
##                   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
##
##                   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
##
##            1
##  4.69654e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  3  (unadjusted=4)
## -2lnL:  97.98748
## AICc :  104.0946  (unadjusted=106.16685)
##
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept)  0.0000000 0.0000000  0.0000000  0.0000000
## p:(Intercept)  -0.6525621 0.3230651 -1.2857697 -0.0193545
## c:(Intercept)   0.4554755 0.1772735  0.1080194  0.8029316
## f0:(Intercept)  1.0401169 1.0904397 -1.0971450  3.1773787
##
##
## Real Parameter pi
##
##
## mixture:1 0.5
##
##
## 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
##  2.829548
##
## 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(~1)f0(~1)
##
```

```
## Npar :  5  (unadjusted=4)
## -2lnL:  97.98748
## AICc :  108.2577  (unadjusted=106.16685)
##
## Beta
##                     estimate        se        lcl        ucl
## pi:(Intercept) -9.336100e-03 0.0000000 -0.0093361 -0.0093361
## p:(Intercept)  -6.525593e-01 1.4669893 -3.5278584  2.2227399
## p:mixture2     -5.603216e-06 2.8486648 -5.5833888  5.5833776
## c:(Intercept)   4.554757e-01 0.1772735  0.1080196  0.8029317
## f0:(Intercept)  1.040118e+00 1.0904370 -1.0971384  3.1773747
##
##
## Real Parameter pi
##
##
## mixture:1 0.497666
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.3424130 0.3424130 0.3424130 0.3424130 0.3424130 0.3424130
## mixture:2 0.3424118 0.3424118 0.3424118 0.3424118 0.3424118 0.3424118
##
##
## 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
##  2.829551
##
## 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) -0.3007795 0.5739908 -1.4258014  0.8242424
## p:(Intercept)   0.6308275 0.5695643 -0.4855185  1.7471734
## p:time2         0.6813489 0.5269154 -0.3514053  1.7141031
## p:time3         0.1400699 0.5295151 -0.8977797  1.1779195
## p:time4         0.5482069 0.5267869 -0.4842954  1.5807093
## p:time5         1.3410904 0.5353023  0.2918978  2.3902829
## p:time6         1.3410904 0.5353023  0.2918979  2.3902829
```

```
## p:mixture2     -2.2472082 0.3887933 -3.0092431 -1.4851734
## f0:(Intercept)  0.8024608 1.2065500 -1.5623772  3.1672989
##
##
## Real Parameter pi
##
##
## mixture:1 0.4253669
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.6526771 0.7878771 0.6837150 0.7647741 0.8778170 0.8778170
## mixture:2 0.1657046 0.2819050 0.1859853 0.2557505 0.4316088 0.4316088
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.7878771 0.6837150 0.7647741 0.8778170 0.8778170
## mixture:2 0.2819050 0.1859853 0.2557505 0.4316088 0.4316088
##
##
## Real Parameter f0
##
##         1
##  2.231024
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c(~1)f0(~1)
##
## Npar :  10  (unadjusted=6)
## -2lnL:  93.72121
## AICc :  114.735  (unadjusted=106.1013)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept)    0.3295527    0.0000000     0.3295527    0.3295527
## p:(Intercept)    -0.7962702    0.0000000    -0.7962702   -0.7962702
## p:time2          -0.1382032    8.9184627   -17.6183900   17.3419840
## p:time3           0.1528139   14.9660550   -29.1806540   29.4862820
## p:time4          -0.0836587   15.7542040   -30.9618990   30.7945820
## p:time5           0.6697651    0.0000000     0.6697651    0.6697651
## p:time6          18.2825330 3719.3701000 -7271.6831000 7308.2482000
## p:mixture2        0.8418881   63.6701000  -123.9515100  125.6352900
## c:(Intercept)     0.4554757    0.1772735     0.1080197    0.8029318
## f0:(Intercept) -22.5442360    0.0000000   -22.5442360  -22.5442360
##
##
## Real Parameter pi
##
##
## mixture:1 0.5816505
```

```
##
##
## Real Parameter p
##
##                    1         2         3         4         5 6
## mixture:1 0.3108239 0.2820180 0.3444657 0.2931925 0.4684158 1
## mixture:2 0.5114025 0.4768702 0.5494458 0.4904909 0.6715895 1
##
##
## 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
##  1.618686e-10
##
## 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)  1.754967e-04  627.1794200 -1.229272e+03 1.229272e+03
## p:(Intercept)  -4.274442e-01    0.3318808 -1.077930e+00 2.230421e-01
## p:time2         5.328047e-01    0.4644355 -3.774889e-01 1.443098e+00
## p:time3         1.089906e-01    0.4670111 -8.063512e-01 1.024332e+00
## p:time4         4.274443e-01    0.4641207 -4.822323e-01 1.337121e+00
## p:time5         1.081371e+00    0.4765164  1.473984e-01 2.015343e+00
## p:time6         1.081371e+00    0.4765164  1.473984e-01 2.015343e+00
## f0:(Intercept) -1.769588e+01 6804.1642000 -1.335386e+04 1.331847e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000439
##
##
## Real Parameter p
##
##                    1         2         3   4         5         6
## mixture:1 0.3947368 0.5263158 0.4210527 0.5 0.6578947 0.6578947
## mixture:2 0.3947368 0.5263158 0.4210527 0.5 0.6578947 0.6578947
##
##
## Real Parameter c
```

```
##
##                   2         3   4         5         6
## mixture:1 0.5263158 0.4210527 0.5 0.6578947 0.6578947
## mixture:2 0.5263158 0.4210527 0.5 0.6578947 0.6578947
##
##
## Real Parameter f0
##
##             1
##  2.064311e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  9  (unadjusted=6)
## -2lnL:  93.72121
## AICc :  112.5469  (unadjusted=106.1013)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  2.662654e-05    0.0000000  2.662654e-05 2.662654e-05
## p:(Intercept)  -4.274441e-01    0.3318758 -1.077921e+00 2.230326e-01
## p:time2        -2.011646e-01    0.5493706 -1.277931e+00 8.756019e-01
## p:time3         2.197890e-02    0.6228145 -1.198737e+00 1.242695e+00
## p:time4        -2.657029e-01    0.7811068 -1.796672e+00 1.265266e+00
## p:time5         4.274446e-01    0.8813670 -1.300035e+00 2.154924e+00
## p:time6         1.764517e+01   27.7919290 -3.682701e+01 7.211736e+01
## c:(Intercept)   4.554755e-01    0.1772734  1.080195e-01 8.029314e-01
## f0:(Intercept) -2.098199e+01 9003.8247000 -1.766848e+04 1.762651e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000067
##
##
## Real Parameter p
##
##                   1         2   3         4         5 6
## mixture:1 0.3947368 0.3478261 0.4 0.3333334 0.5000001 1
## mixture:2 0.3947368 0.3478261 0.4 0.3333334 0.5000001 1
##
##
## 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
```

```
##  7.720356e-10
```

Examine model-selection table

```
mouse.results
```

```
##                                 model npar      AICc DeltaAICc weight Deviance
## 1               pi(~1)p(~1)c()f0(~1)    3 115.61399        NA     NA 85.44111
## 2              pi(~1)p(~1)c(~1)f0(~1)    3 104.09462        NA     NA 73.92174
## 3          pi(~1)p(~mixture)c()f0(~1)    4        NA        NA     NA  2.00000
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 108.25775        NA     NA 73.92174
## 5   pi(~1)p(~time + mixture)c()f0(~1)    9  99.58481        NA     NA 56.69338
## 6 pi(~1)p(~time + mixture)c(~1)f0(~1)   10 114.73503        NA     NA 69.65547
## 7             pi(~1)p(~time)c()f0(~1)    8 116.33249        NA     NA 75.60922
## 8           pi(~1)p(~time)c(~1)f0(~1)    9 112.54690        NA     NA 69.65547
```

examine model names and find the name of the top model

```
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"
```

examine the output from top-ranked model (#5)

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

```
##              estimate        se       lcl        ucl fixed note
## pi g1 m1    0.4253669 0.1403005 0.1937537  0.6951361
## p g1 t1 m1  0.6526771 0.1291144 0.3809499  0.8515959
## p g1 t2 m1  0.7878771 0.0986041 0.5388675  0.9219088
## p g1 t3 m1  0.6837150 0.1242590 0.4120879  0.8695670
## p g1 t4 m1  0.7647741 0.1055892 0.5071524  0.9112875
## p g1 t5 m1  0.8778170 0.0646522 0.6879265  0.9590422
## p g1 t6 m1  0.8778170 0.0646522 0.6879265  0.9590422
## p g1 t1 m2  0.1657046 0.0819023 0.0585492  0.3881237
## p g1 t2 m2  0.2819050 0.1169990 0.1122629  0.5492816
## p g1 t3 m2  0.1859853 0.0893262 0.0670600  0.4207078
## p g1 t4 m2  0.2557505 0.1106263 0.0990951  0.5177357
## p g1 t5 m2  0.4316088 0.1396369 0.1992614  0.6985360
## p g1 t6 m2  0.4316088 0.1396369 0.1992614  0.6985360
## f0 g1 a0 t1 2.2310244 2.6918424 0.3480728 14.3000830
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 40.23102 38.34807 52.30008
```

Comme dans les diapos.

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

```
##              estimate        se       lcl        ucl fixed note
## pi g1 m1    0.5000000 0.0000000 0.5000000  0.5000000
## p g1 t1 m1  0.3424124 0.0727433 0.2165697  0.4951615
## c g1 t2 m1  0.6119403 0.0420970 0.5269786  0.6906012
## f0 g1 a0 t1 2.8295477 3.0854511 0.4991961 16.0384670
```

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

```
## $`N Population Size`
##   estimate     lcl      ucl
## 1 40.82955 38.4992 54.03847
```

La même chose avec le sexe maintenant.

Les données

```
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 sépare mâles et femelles.

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

On formate les données.

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

```
## Object class       capthist
##
## Counts by occasion
##             1  2  3  4  5  6 Total
## n          12 15  8 12 16 16    79
## u          12  4  0  1  2  2    21
## f           4  1  4  3  5  4    21
## M(t+1)     12 16 16 17 19 21    21
## losses      0  0  0  0  0  0     0
## detections 12 15  8 12 16 16    79
##
## Individual covariates
##  sex
##  M:21
```

```
summary(mouseF_secr) # resumes
```

```
## Object class       capthist
##
## Counts by occasion
##            1 2  3  4  5  6 Total
## n          3 5  8  7  9  9    41
## u          3 4  6  2  1  1    17
## f          5 5  3  3  1  0    17
## M(t+1)     3 7 13 15 16 17    17
## losses     0 0  0  0  0  0     0
## detections 3 5  8  7  9  9    41
##
## Individual covariates
##  sex
##  F:17
```

On fait les tests de fermeture, 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
```

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.

Process data

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

Create default design data

```
mouse.ddl <- make.design.data(mouse.proc)
```

Liste des modèles.

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

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

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

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

  return(mouse.results)
}
```

Run the models and examine the output

```
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) -1.783795e-04 0.0000000 -1.783795e-04 -1.783795e-04
## p:(Intercept)   1.053606e-01 0.1326371 -1.546080e-01  3.653293e-01
## f0:(Intercept) -2.867627e+01 0.0000000 -2.867627e+01 -2.867627e+01
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999554
##
## Group:sexM
##
## mixture:1 0.4999554
##
##
## 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
##  3.516037e-13
##
## Group:sexM
##             1
##  3.516037e-13
##
## 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) -1.889502e-05 1448.1821000 -2838.4369000 2838.4369000
## p:(Intercept)  -5.331230e-01    0.3104180    -1.1415423    0.0752962
## c:(Intercept)   4.554755e-01    0.1772735     0.1080194    0.8029315
## f0:(Intercept) -3.145558e-01    1.7272279    -3.6999226    3.0708109
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999953
##
## Group:sexM
##
## mixture:1 0.4999953
##
##
## 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
##  0.7301131
##
## Group:sexM
##         1
##  0.7301131
##
## 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)  0.4152351 0.6397360 -0.8386476 1.6691178
## p:(Intercept)  -0.7271250 0.4231282 -1.5564563 0.1022062
## p:mixture2      2.0499904 0.3936870  1.2783639 2.8216168
## f0:(Intercept) -0.5151989 1.9307040 -4.2993787 3.2689809
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.6023425
##
## Group:sexM
##
## mixture:1 0.6023425
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.3258259 0.3258259 0.3258259 0.3258259 0.3258259 0.3258259
## mixture:2 0.7896580 0.7896580 0.7896580 0.7896580 0.7896580 0.7896580
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.3258259 0.3258259 0.3258259 0.3258259 0.3258259 0.3258259
## mixture:2 0.7896580 0.7896580 0.7896580 0.7896580 0.7896580 0.7896580
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.3258259 0.3258259 0.3258259 0.3258259 0.3258259
## mixture:2 0.7896580 0.7896580 0.7896580 0.7896580 0.7896580
##
```

```
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.3258259 0.3258259 0.3258259 0.3258259 0.3258259
## mixture:2 0.7896580 0.7896580 0.7896580 0.7896580 0.7896580
##
##
## Real Parameter f0
## Group:sexF
##         1
##  0.5973818
##
## Group:sexM
##         1
##  0.5973818
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=4)
## -2lnL:  147.5555
## AICc :  157.8258  (unadjusted=155.73487)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept) -4.2935793000 6327.9754000 -1.240713e+04 1.239854e+04
## p:(Intercept)  -0.5330122000    5.1028783 -1.053465e+01 9.468630e+00
## p:mixture2     -0.0001139117    5.1616065 -1.011686e+01 1.011664e+01
## c:(Intercept)   0.4554751000    0.1772735  1.080191e-01 8.029312e-01
## f0:(Intercept) -0.3145413000    1.7271976 -3.699849e+00 3.070766e+00
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.013472
##
## Group:sexM
##
## mixture:1 0.013472
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.3698146 0.3698146 0.3698146 0.3698146 0.3698146 0.3698146
## mixture:2 0.3697881 0.3697881 0.3697881 0.3697881 0.3697881 0.3697881
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.3698146 0.3698146 0.3698146 0.3698146 0.3698146 0.3698146
## mixture:2 0.3697881 0.3697881 0.3697881 0.3697881 0.3697881 0.3697881
##
##
## Real Parameter c
```

```
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.6119402 0.6119402 0.6119402 0.6119402 0.6119402
## mixture:2 0.6119402 0.6119402 0.6119402 0.6119402 0.6119402
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6119402 0.6119402 0.6119402 0.6119402 0.6119402
## mixture:2 0.6119402 0.6119402 0.6119402 0.6119402 0.6119402
##
##
## Real Parameter f0
## Group:sexF
##          1
##  0.7301237
##
## Group:sexM
##          1
##  0.7301237
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + sex)c(~1)f0(~1)
##
## Npar :  6  (unadjusted=5)
## -2lnL:  146.6121
## AICc :  158.9921  (unadjusted=156.88232)
##
## Beta
##                      estimate        se        lcl        ucl
## pi:(Intercept) -3.073309e+00 0.0000000 -3.0733089 -3.0733089
## p:(Intercept)  -7.198886e-01 3.4124263 -7.4082443  5.9684670
## p:mixture2      6.648660e-06 3.5502238 -6.9584322  6.9584455
## p:sexM          3.998277e-01 0.4141433 -0.4118932  1.2115486
## c:(Intercept)   4.554755e-01 0.1772735  0.1080194  0.8029315
## f0:(Intercept) -4.253450e-01 1.8511647 -4.0536280  3.2029379
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.0442218
##
## Group:sexM
##
## mixture:1 0.0442218
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.3274175 0.3274175 0.3274175 0.3274175 0.3274175 0.3274175
## mixture:2 0.3274190 0.3274190 0.3274190 0.3274190 0.3274190 0.3274190
##
## Group:sexM
```

```
##                   1         2         3         4         5         6
## mixture:1 0.4206609 0.4206609 0.4206609 0.4206609 0.4206609 0.4206609
## mixture:2 0.4206625 0.4206625 0.4206625 0.4206625 0.4206625 0.4206625
##
##
## 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
##  0.6535442
##
## Group:sexM
##          1
##  0.6535442
##
## 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)  0.8595290 0.6488555 -0.4122277 2.1312858
## p:(Intercept)  -0.2402767 0.3895824 -1.0038582 0.5233047
## p:mixture2     -2.6445024 1.5398786 -5.6626645 0.3736597
## p:sexM          1.3318665 0.4291947  0.4906450 2.1730881
## f0:(Intercept)  1.0300701 1.9350659 -2.7626591 4.8227993
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.7025622
##
## Group:sexM
##
## mixture:1 0.7025622
##
##
## 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 0.0529111 0.0529111 0.0529111 0.0529111 0.0529111 0.0529111
##
## Group:sexM
##                   1        2        3        4        5        6
## mixture:1 0.748681 0.748681 0.748681 0.748681 0.748681 0.748681
## mixture:2 0.174666 0.174666 0.174666 0.174666 0.174666 0.174666
##
##
## Real Parameter c
## Group:sexF
##                    2         3         4         5         6
## mixture:1 0.4402182 0.4402182 0.4402182 0.4402182 0.4402182
## mixture:2 0.0529111 0.0529111 0.0529111 0.0529111 0.0529111
##
## Group:sexM
##                   2        3        4        5        6
## mixture:1 0.748681 0.748681 0.748681 0.748681 0.748681
## mixture:2 0.174666 0.174666 0.174666 0.174666 0.174666
##
##
## Real Parameter f0
## Group:sexF
##         1
##  2.801262
##
## Group:sexM
##         1
##  2.801262
##
## 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) -0.3904001 0.5954132 -1.5574101  0.7766099
## p:(Intercept)   0.7291676 0.5906034 -0.4284151  1.8867502
## p:time2         0.6856496 0.5287545 -0.3507093  1.7220084
## p:time3         0.1412194 0.5316899 -0.9008927  1.1833316
## p:time4         0.5517946 0.5286142 -0.4842891  1.5878784
## p:time5         1.3531219 0.5386834  0.2973024  2.4089413
## p:time6         1.3531219 0.5386833  0.2973026  2.4089412
## p:mixture2     -2.1869349 0.4019846 -2.9748246 -1.3990451
## f0:(Intercept) -0.7217388 2.2059007 -5.0453042  3.6018266
##
##
## Real Parameter pi
## Group:sexF
##
```

```
## mixture:1 0.403621
##
## Group:sexM
##
## mixture:1 0.403621
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.6746226 0.8045246 0.7048262 0.7826135 0.8891698 0.8891699
## mixture:2 0.1888090 0.3160212 0.2113932 0.2878247 0.4738625 0.4738625
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.6746226 0.8045246 0.7048262 0.7826135 0.8891698 0.8891699
## mixture:2 0.1888090 0.3160212 0.2113932 0.2878247 0.4738625 0.4738625
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.8045246 0.7048262 0.7826135 0.8891698 0.8891699
## mixture:2 0.3160212 0.2113932 0.2878247 0.4738625 0.4738625
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.8045246 0.7048262 0.7826135 0.8891698 0.8891699
## mixture:2 0.3160212 0.2113932 0.2878247 0.4738625 0.4738625
##
##
## Real Parameter f0
## Group:sexF
##          1
##  0.4859066
##
## Group:sexM
##          1
##  0.4859066
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c(~1)f0(~1)
##
## Npar :  10  (unadjusted=6)
## -2lnL:  141.8872
## AICc :  162.901  (unadjusted=154.26727)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept)  -3.2958020 2.004068e+02 -3.960931e+02 3.895015e+02
## p:(Intercept)    3.3755513 1.048583e+03 -2.051846e+03 2.058597e+03
## p:time2         -0.1168846 1.831561e+01 -3.601548e+01 3.578171e+01
## p:time3          0.1112825 1.797714e+01 -3.512391e+01 3.534648e+01
## p:time4         -0.1761514 1.796600e+01 -3.538952e+01 3.503722e+01
```

```
## p:time5          0.5170076 1.796807e+01 -3.470042e+01 3.573443e+01
## p:time6         21.3315670 1.293371e+04 -2.532875e+04 2.537141e+04
## p:mixture2      -3.8925617 1.050696e+03 -2.063257e+03 2.055472e+03
## c:(Intercept)    0.4554757 1.772735e-01  1.080197e-01 8.029318e-01
## f0:(Intercept) -19.5074850 2.752567e+03 -5.414539e+03 5.375524e+03
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.0357155
##
## Group:sexM
##
## mixture:1 0.0357155
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5 6
## mixture:1 0.9669317 0.9629833 0.9703108 0.9608117 0.9800145 1
## mixture:2 0.3735516 0.3466279 0.3999369 0.3333301 0.4999993 1
##
## Group:sexM
##                   1         2         3         4         5 6
## mixture:1 0.9669317 0.9629833 0.9703108 0.9608117 0.9800145 1
## mixture:2 0.3735516 0.3466279 0.3999369 0.3333301 0.4999993 1
##
##
## 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
##  3.372928e-09
##
## Group:sexM
##             1
##  3.372928e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture + sex)c(~1)f0(~1)
##
## Npar :  11  (unadjusted=7)
```

```
## -2lnL:  141.1712
## AICc :  164.3934  (unadjusted=155.68027)
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept) -15.0784050 1.008286e+04 -1.977749e+04 1.974733e+04
## p:(Intercept)    0.3786215 1.584992e+00 -2.727964e+00 3.485206e+00
## p:time2         -0.1419046 5.558625e-01 -1.231395e+00 9.475859e-01
## p:time3          0.1050504 6.332077e-01 -1.136037e+00 1.346137e+00
## p:time4         -0.2689136 7.841496e-01 -1.805847e+00 1.268020e+00
## p:time5          0.3881690 8.858582e-01 -1.348113e+00 2.124451e+00
## p:time6         34.0352760 9.090409e+04 -1.781380e+05 1.782061e+05
## p:mixture2      -1.0168221 1.355889e+00 -3.674364e+00 1.640720e+00
## p:sexM           0.3745819 4.435507e-01 -4.947776e-01 1.243941e+00
## c:(Intercept)    0.4554756 1.772735e-01  1.080195e-01 8.029316e-01
## f0:(Intercept) -26.8692140 2.330124e+04 -4.569731e+04 4.564357e+04
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 2.82834e-07
##
## Group:sexM
##
## mixture:1 2.82834e-07
##
##
## Real Parameter p
## Group:sexF
##                    1         2         3         4         5 6
## mixture:1 0.5935406 0.5589044 0.6186145 0.5273995 0.6828262 1
## mixture:2 0.3456534 0.3142972 0.3697824 0.2875907 0.4378157 1
##
## Group:sexM
##                    1        2         3         4         5 6
## mixture:1 0.6798763 0.648237 0.7022957 0.6187603 0.7579315 1
## mixture:2 0.4344744 0.399986 0.4604408 0.3699264 0.5310974 1
##
##
## 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
##  2.142143e-12
##
## Group:sexM
##             1
##  2.142143e-12
##
## 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)  0.8562570 0.6675074 -0.4520576 2.1645715
## p:(Intercept)  -0.8381401 0.6738155 -2.1588184 0.4825382
## p:time2         0.6470858 0.5129320 -0.3582610 1.6524325
## p:time3         0.1318703 0.5137404 -0.8750609 1.1388014
## p:time4         0.5190744 0.5121577 -0.4847548 1.5229036
## p:time5         1.3006932 0.5277912  0.2662224 2.3351641
## p:time6         1.3006932 0.5277911  0.2662226 2.3351638
## p:mixture2     -2.5544267 1.9136248 -6.3051313 1.1962779
## p:sexM          1.3736220 0.5177323  0.3588667 2.3883773
## f0:(Intercept)  0.7154282 2.5701282 -4.3220231 5.7528795
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.701878
##
## Group:sexM
##
## mixture:1 0.701878
##
##
## 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 0.6307608 0.7654092 0.6609100 0.7416489 0.8624957 0.8624957
## mixture:2 0.1172281 0.2023197 0.1315784 0.1824449 0.3277781 0.3277781
##
##
## 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 0.2023197 0.1315784 0.1824449 0.3277781 0.3277781
##
##
## Real Parameter f0
## Group:sexF
##         1
##  2.045062
##
## Group:sexM
##         1
##  2.045062
##
## 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) -2.004699e-04 3547.9512000 -6.953985e+03  6953.9843000
## p:(Intercept)  -3.973018e-01    0.2019497 -7.931232e-01    -0.0014804
## p:sexM          9.166020e-01    0.2733469  3.808422e-01     1.4523619
## f0:(Intercept) -2.233894e+01 8079.3622000 -1.585789e+04 15813.2110000
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999499
##
## Group:sexM
##
## mixture:1 0.4999499
##
##
## 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
##  1.987564e-10
##
## Group:sexM
##             1
##  1.987564e-10
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=4)
## -2lnL:  146.6121
## AICc :  156.8823  (unadjusted=154.79143)
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept) -3.316704e-05 0.0000000 -3.316704e-05 -3.316704e-05
## p:(Intercept)  -7.198824e-01 0.3614795 -1.428382e+00 -1.138250e-02
## p:sexM          3.998280e-01 0.4141434 -4.118930e-01  1.211549e+00
## c:(Intercept)   4.554755e-01 0.1772735  1.080194e-01  8.029316e-01
## f0:(Intercept) -4.253474e-01 1.8511732 -4.053647e+00  3.202952e+00
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999917
##
## Group:sexM
##
## mixture:1 0.4999917
##
##
## 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 0.4206625 0.4206625 0.4206625 0.4206625 0.4206625 0.4206625
## mixture:2 0.4206625 0.4206625 0.4206625 0.4206625 0.4206625 0.4206625
##
##
## 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
##  0.6535427
##
## Group:sexM
##          1
##  0.6535427
##
## 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) -4.519011e-04 2509.4112000 -4.918446e+03 4.918445e+03
## p:(Intercept)  -4.274441e-01    0.3318810 -1.077931e+00 2.230426e-01
## p:time2         5.328051e-01    0.4644357 -3.774890e-01 1.443099e+00
## p:time3         1.089894e-01    0.4670112 -8.063526e-01 1.024331e+00
## p:time4         4.274441e-01    0.4641209 -4.822328e-01 1.337121e+00
## p:time5         1.081371e+00    0.4765166  1.473985e-01 2.015344e+00
## p:time6         1.081372e+00    0.4765167  1.473998e-01 2.015345e+00
## f0:(Intercept) -1.796634e+01 5606.5129000 -1.100673e+04 1.097080e+04
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.499887
##
## Group:sexM
##
## mixture:1 0.499887
##
```

```
##
## Real Parameter p
## Group:sexF
##                   1         2         3   4         5         6
## mixture:1 0.3947368 0.5263159 0.4210524 0.5 0.6578948 0.6578952
## mixture:2 0.3947368 0.5263159 0.4210524 0.5 0.6578948 0.6578952
##
## Group:sexM
##                   1         2         3   4         5         6
## mixture:1 0.3947368 0.5263159 0.4210524 0.5 0.6578948 0.6578952
## mixture:2 0.3947368 0.5263159 0.4210524 0.5 0.6578948 0.6578952
##
##
## Real Parameter c
## Group:sexF
##                   2         3   4         5         6
## mixture:1 0.5263159 0.4210524 0.5 0.6578948 0.6578952
## mixture:2 0.5263159 0.4210524 0.5 0.6578948 0.6578952
##
## Group:sexM
##                   2         3   4         5         6
## mixture:1 0.5263159 0.4210524 0.5 0.6578948 0.6578952
## mixture:2 0.5263159 0.4210524 0.5 0.6578948 0.6578952
##
##
## Real Parameter f0
## Group:sexF
##             1
##  1.575138e-08
##
## Group:sexM
##             1
##  1.575138e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  9  (unadjusted=6)
## -2lnL:  141.8872
## AICc :  160.7129  (unadjusted=154.26727)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  7.140848e-05 1.668603e+03 -3.270461e+03 3.270462e+03
## p:(Intercept)  -4.274440e-01 3.318812e-01 -1.077931e+00 2.230431e-01
## p:time2        -2.011645e-01 5.493746e-01 -1.277939e+00 8.756096e-01
## p:time3         2.197880e-02 6.228346e-01 -1.198777e+00 1.242735e+00
## p:time4        -2.657033e-01 7.811180e-01 -1.796695e+00 1.265288e+00
## p:time5         4.274444e-01 8.813694e-01 -1.300040e+00 2.154929e+00
## p:time6         2.343389e+01 6.101527e+04 -1.195665e+05 1.196134e+05
## c:(Intercept)   4.554755e-01 1.772735e-01  1.080194e-01 8.029315e-01
## f0:(Intercept) -2.246375e+01 1.010818e+04 -1.983451e+04 1.978958e+04
##
##
```

```
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.5000179
##
## Group:sexM
##
## mixture:1 0.5000179
##
##
## Real Parameter p
## Group:sexF
##                    1         2   3         4         5 6
## mixture:1 0.3947368 0.3478261 0.4 0.3333333 0.5000001 1
## mixture:2 0.3947368 0.3478261 0.4 0.3333333 0.5000001 1
##
## Group:sexM
##                    1         2   3         4         5 6
## mixture:1 0.3947368 0.3478261 0.4 0.3333333 0.5000001 1
## mixture:2 0.3947368 0.3478261 0.4 0.3333333 0.5000001 1
##
##
## 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
##  1.754354e-10
##
## Group:sexM
##             1
##  1.754354e-10
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + sex)c(~1)f0(~1)
##
## Npar :  10  (unadjusted=7)
## -2lnL:  141.1712
## AICc :  162.185  (unadjusted=155.68027)
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept) -4.244235e-04 0.0000000 -4.244235e-04 -4.244235e-04
## p:(Intercept)  -6.382122e-01 0.4191029 -1.459654e+00  1.832294e-01
```

```
## p:time2        -1.418961e-01 0.5558616 -1.231385e+00  9.475927e-01
## p:time3         1.050567e-01 0.6332026 -1.136021e+00  1.346134e+00
## p:time4        -2.688933e-01 0.7841454 -1.805818e+00  1.268032e+00
## p:time5         3.881691e-01 0.8858536 -1.348104e+00  2.124442e+00
## p:time6         2.342814e+01 0.0000000  2.342814e+01  2.342814e+01
## p:sexM          3.745834e-01 0.4435503 -4.947752e-01  1.243942e+00
## c:(Intercept)   4.554763e-01 0.1772735  1.080202e-01  8.029324e-01
## f0:(Intercept) -2.228947e+01 0.0000000 -2.228947e+01 -2.228947e+01
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4998939
##
## Group:sexM
##
## mixture:1 0.4998939
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5 6
## mixture:1 0.3456508 0.3142965 0.3697812 0.2875925 0.4378129 1
## mixture:2 0.3456508 0.3142965 0.3697812 0.2875925 0.4378129 1
##
## Group:sexM
##                   1         2         3         4         5 6
## mixture:1 0.4344719 0.3999857 0.4604398 0.3699288 0.5310949 1
## mixture:2 0.4344719 0.3999857 0.4604398 0.3699288 0.5310949 1
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.6119405 0.6119405 0.6119405 0.6119405 0.6119405
## mixture:2 0.6119405 0.6119405 0.6119405 0.6119405 0.6119405
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6119405 0.6119405 0.6119405 0.6119405 0.6119405
## mixture:2 0.6119405 0.6119405 0.6119405 0.6119405 0.6119405
##
##
## Real Parameter f0
## Group:sexF
##            1
##  2.08837e-10
##
## Group:sexM
##            1
##  2.08837e-10
##
## 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)  9.023161e-05 2835.5838000 -5557.7443000 5557.7444000
## p:(Intercept)  -9.848606e-01    0.3813511    -1.7323087   -0.2374125
## p:time2         5.630691e-01    0.4776016    -0.3730300    1.4991682
## p:time3         1.149495e-01    0.4796141    -0.8250941    1.0549931
## p:time4         4.515728e-01    0.4771381    -0.4836179    1.3867634
## p:time5         1.142637e+00    0.4904565     0.1813423    2.1039320
## p:time6         1.142637e+00    0.4904565     0.1813424    2.1039319
## p:sexM          9.614725e-01    0.2811732     0.4103730    1.5125720
## f0:(Intercept) -2.244799e+01    4.1580847   -30.5978410  -14.2981490
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.5000226
##
## Group:sexM
##
## mixture:1 0.5000226
##
##
## 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
##  1.782213e-10
##
## Group:sexM
##             1
##  1.782213e-10
```

Examine model-selection table

```
mouse.results
```

```
##                                        model npar     AICc  DeltaAICc
## 10   pi(~1)p(~time + mixture + sex)c()f0(~1)   10 146.3169  0.0000000
## 6           pi(~1)p(~mixture + sex)c()f0(~1)    5 147.2589  0.9420054
## 7          pi(~1)p(~time + mixture)c()f0(~1)    9 148.9379  2.6209832
## 3                 pi(~1)p(~mixture)c()f0(~1)    4 150.4044  4.0874273
## 11                    pi(~1)p(~sex)c()f0(~1)    4 154.3203  8.0033573
## 16             pi(~1)p(~time + sex)c()f0(~1)    9 154.5961  8.2792232
## 2                     pi(~1)p(~1)c(~1)f0(~1)    4 155.7349  9.4179473
## 12                  pi(~1)p(~sex)c(~1)f0(~1)    5 156.8823 10.5653954
## 4                pi(~1)p(~mixture)c(~1)f0(~1)    5 157.8258 11.5088454
## 5         pi(~1)p(~mixture + sex)c(~1)f0(~1)    6 158.9921 12.6752156
## 14                 pi(~1)p(~time)c(~1)f0(~1)    9 160.7129 14.3959432
## 15           pi(~1)p(~time + sex)c(~1)f0(~1)   10 162.1850 15.8680800
## 8        pi(~1)p(~time + mixture)c(~1)f0(~1)   10 162.9010 16.5840800
## 1                       pi(~1)p(~1)c()f0(~1)    3 163.7800 17.4630380
## 9  pi(~1)p(~time + mixture + sex)c(~1)f0(~1)   11 164.3934 18.0764773
## 13                   pi(~1)p(~time)c()f0(~1)    8 164.4985 18.1815394
##          weight  Deviance
## 10 4.810921e-01  92.14539
## 6  3.003823e-01 103.83095
## 7  1.297445e-01  96.95452
## 3  6.232391e-02 109.06727
## 11 8.796731e-03 112.98321
## 16 7.663335e-03 102.61275
## 2  4.336576e-03 114.39780
## 12 2.443328e-03 113.45435
## 4  1.524454e-03 114.39780
## 5  8.508249e-04 113.45435
## 14 3.599059e-04 108.72947
## 15 1.723925e-04 108.01347
## 8  1.205150e-04 108.72947
## 1  7.765649e-05 124.51511
## 9  5.714406e-05 108.01347
## 13 5.421971e-05 114.68322
```

examine model names and find the name of the top model

```
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"
```

examine the output from top-ranked model (#10)

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

```
##              estimate        se          lcl        ucl fixed note
## pi gF m1    0.7018780 0.1396728 0.3888717000  0.8970226
## p gF t1 m1  0.3019266 0.1420180 0.1035100000  0.6183471
## p gF t2 m1  0.4523812 0.1678812 0.1795660000  0.7571619
## p gF t3 m1  0.3304236 0.1489014 0.1165631000  0.6485902
## p gF t4 m1  0.4209035 0.1645764 0.1621302000  0.7319093
## p gF t5 m1  0.6136197 0.1683901 0.2830245000  0.8646680
## p gF t6 m1  0.6136197 0.1683901 0.2830245000  0.8646680
## p gF t1 m2  0.0325286 0.0769583 0.0002785658  0.8022544
## p gF t2 m2  0.0603424 0.1390173 0.0005253514  0.8869497
## p gF t3 m2  0.0369444 0.0870326 0.0003173663  0.8225534
## p gF t4 m2  0.0534796 0.1240045 0.0004640865  0.8730268
## p gF t5 m2  0.1098892 0.2423406 0.0009597044  0.9407091
## p gF t6 m2  0.1098892 0.2423406 0.0009597045  0.9407091
## p gM t1 m1  0.6307608 0.1111776 0.4012785000  0.8132252
## p gM t2 m1  0.7654092 0.0891801 0.5520866000  0.8962309
## p gM t3 m1  0.6609100 0.1075825 0.4320380000  0.8331676
## p gM t4 m1  0.7416489 0.0942108 0.5226951000  0.8827020
## p gM t5 m1  0.8624957 0.0632741 0.6879324000  0.9469434
## p gM t6 m1  0.8624957 0.0632741 0.6879324000  0.9469434
## p gM t1 m2  0.1172281 0.2214294 0.0019997000  0.8979716
## p gM t2 m2  0.2023197 0.3469996 0.0037357000  0.9449229
## p gM t3 m2  0.1315784 0.2446877 0.0022734000  0.9097068
## p gM t4 m2  0.1824449 0.3203108 0.0033055000  0.9375632
## p gM t5 m2  0.3277781 0.4798686 0.0067808000  0.9720870
## p gM t6 m2  0.3277781 0.4798686 0.0067808000  0.9720870
## f0 gF a0 t1 2.0450621 5.2560717 0.1253844000 33.3556600
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 19.04506 17.12538 50.35566
## 2 23.04506 21.12538 54.35566
```

Comme dans les diapos.

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

```
##              estimate          se           lcl       ucl fixed note
## pi gF m1    0.4999953 362.0455200 5.562580e-309 1.0000000
## p gF t1 m1  0.3697888   0.0723414  2.420373e-01 0.5188152
## c gF t2 m1  0.6119403   0.0420970  5.269786e-01 0.6906012
## f0 gF a0 t1 0.7301131   1.2610717  7.289040e-02 7.3132395
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 17.73011 17.07289 24.31324
## 2 21.73011 21.07289 28.31324
```

La même chose avec l'âge maintenant.

Les données

```
mouse <- convert.inp("dat/deer-mouse-age-3G-Y-SA-A.inp",
                     group.df = data.frame(ages = c("Y","SA", "A")),
                     covariates = NULL)
head(mouse)
```

```
##         ch freq ages
## 1:1 111111    1    Y
## 1:2 100111    1    Y
## 1:3 110011    1    Y
## 1:4 110111    1    Y
## 1:5 111111    1    Y
## 1:7 111110    1    Y
```

```
tail(mouse)
```

```
##          ch freq ages
## 3:25 001111    1    A
## 3:28 001010    1    A
## 3:29 001000    1    A
## 3:30 000100    1    A
## 3:35 000010    1    A
## 3:38 000001    1    A
```

On sépare mâles et femelles.

```
mouseY <- mouse[mouse$ages == "Y", ]
mouseSA <- mouse[mouse$ages == "SA", ]
mouseA <- mouse[mouse$ages == "A", ]
```

On formate les données.

```
mouseY_secr <- unRMarkInput(mouseY) # on convertit au bon format
mouseSA_secr <- unRMarkInput(mouseSA) # on convertit au bon format
mouseA_secr <- unRMarkInput(mouseA) # on convertit au bon format
```

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

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

```
## $Otis
##  statistic         p
##  0.5894871 0.7222327
##
## $Xc
##  statistic df         p
##   4.215069  6 0.6475973
##
## $NRvsJS
##  statistic df       p
##   2.778116  2 0.24931
##
## $NMvsJS
##  statistic df p
##          0  0 1
##
## $MtvsNR
##  statistic df         p
##   1.436953  4 0.8377477
##
## $MtvsNM
##  statistic df         p
##   4.215069  6 0.6475973
##
## $compNRvsJS
##   Occasion  Chisquare df          p
## 1        2 2.74285714  1 0.09768996
## 2        3 0.03525886  1 0.85105427
## 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        NA NA NA
```

SA ensuite.

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

```
## $Otis
##   statistic         p
##  -0.5516773 0.2905847
##
## $Xc
##    statistic df p
##  4.54041e-05  4 1
##
## $NRvsJS
##  statistic df p
##          0  0 1
```

```
##
## $NMvsJS
##  statistic df p
##          0  0 1
##
## $MtvsNR
##    statistic df p
##  4.54041e-05  4 1
##
## $MtvsNM
##    statistic df p
##  4.54041e-05  4 1
##
## $compNRvsJS
##   Occasion Chisquare df  p
## 1        2        NA NA NA
## 2        3        NA NA NA
## 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        NA NA NA
```

A enfin

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

```
## $Otis
##  statistic         p
##  0.2004625 0.5794406
##
## $Xc
##  statistic df         p
##   1.247729  4 0.8701795
##
## $NRvsJS
##  statistic df p
##          0  0 1
##
## $NMvsJS
##  statistic df p
##          0  1 1
##
## $MtvsNR
##  statistic df         p
##   1.247729  4 0.8701795
##
## $MtvsNM
##  statistic df         p
```

```
##   1.247729  3 0.7415811
##
## $compNRvsJS
##   Occasion Chisquare df  p
## 1        2        NA NA NA
## 2        3        NA NA NA
## 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  1  1
```

Les modèles maintenant.

Process data

```
mouse.proc <- process.data(mouse, begin.time = 1, model = "FullHet", groups = "ages")
```

Create default design data

```
mouse.ddl <- make.design.data(mouse.proc)
```

Liste des modèles.

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

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

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

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

```
  return(mouse.results)
}
```

Run the models and examine the output

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~ages)c()f0(~1)
##
## Npar :  5  (unadjusted=3)
## -2lnL:  160.7806
## AICc :  171.0508  (unadjusted=166.88769)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept) -4.615346e-04    0.0000000 -4.615346e-04 -4.615346e-04
## p:(Intercept)  -3.677248e-01    0.2503558 -8.584222e-01  1.229727e-01
## p:agesSA        1.445813e-01    0.5363563 -9.066771e-01  1.195840e+00
## p:agesY         7.328386e-01    0.3023109  1.403091e-01  1.325368e+00
## f0:(Intercept) -2.142310e+01 5475.7685000 -1.075393e+04  1.071108e+04
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.4998846
##
## Group:agesSA
##
## mixture:1 0.4998846
##
## Group:agesY
##
## mixture:1 0.4998846
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5         6
## mixture:1 0.4090909 0.4090909 0.4090909 0.4090909 0.4090909 0.4090909
## mixture:2 0.4090909 0.4090909 0.4090909 0.4090909 0.4090909 0.4090909
##
## Group:agesSA
##                   1         2         3         4         5         6
## mixture:1 0.4444445 0.4444445 0.4444445 0.4444445 0.4444445 0.4444445
## mixture:2 0.4444445 0.4444445 0.4444445 0.4444445 0.4444445 0.4444445
##
## Group:agesY
##                   1         2         3         4         5         6
## mixture:1 0.5902778 0.5902778 0.5902778 0.5902778 0.5902778 0.5902778
## mixture:2 0.5902778 0.5902778 0.5902778 0.5902778 0.5902778 0.5902778
```

```
##
##
## Real Parameter c
## Group:agesA
##                   2         3         4         5         6
## mixture:1 0.4090909 0.4090909 0.4090909 0.4090909 0.4090909
## mixture:2 0.4090909 0.4090909 0.4090909 0.4090909 0.4090909
##
## Group:agesSA
##                   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:agesY
##                   2         3         4         5         6
## mixture:1 0.5902778 0.5902778 0.5902778 0.5902778 0.5902778
## mixture:2 0.5902778 0.5902778 0.5902778 0.5902778 0.5902778
##
##
## Real Parameter f0
## Group:agesA
##             1
##  4.966658e-10
##
## Group:agesSA
##             1
##  4.966658e-10
##
## Group:agesY
##             1
##  4.966658e-10
##
## Output summary for FullHet model
## Name : pi(~1)p(~ages)c(~1)f0(~1)
##
## Npar :  6  (unadjusted=5)
## -2lnL:  155.3511
## AICc :  167.7312  (unadjusted=165.62136)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  0.0000121133 1448.1722000 -2838.4176000 2838.4176000
## p:(Intercept)  -0.7111665000    0.4402539    -1.5740642    0.1517311
## p:agesSA       -0.4309323000    0.8286857    -2.0551562    1.1932917
## p:agesY         0.5428306000    0.4637140    -0.3660487    1.4517100
## c:(Intercept)   0.4554755000    0.1772735     0.1080194    0.8029315
## f0:(Intercept) -1.4552756000    3.8622809    -9.0253463    6.1147952
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.500003
##
```

```
## Group:agesSA
##
## mixture:1 0.500003
##
## Group:agesY
##
## mixture:1 0.500003
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5         6
## mixture:1 0.3293411 0.3293411 0.3293411 0.3293411 0.3293411 0.3293411
## mixture:2 0.3293411 0.3293411 0.3293411 0.3293411 0.3293411 0.3293411
##
## Group:agesSA
##                   1         2         3         4         5         6
## mixture:1 0.2419352 0.2419352 0.2419352 0.2419352 0.2419352 0.2419352
## mixture:2 0.2419352 0.2419352 0.2419352 0.2419352 0.2419352 0.2419352
##
## Group:agesY
##                   1         2         3         4         5         6
## mixture:1 0.4580151 0.4580151 0.4580151 0.4580151 0.4580151 0.4580151
## mixture:2 0.4580151 0.4580151 0.4580151 0.4580151 0.4580151 0.4580151
##
##
## Real Parameter c
## Group:agesA
##                   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:agesSA
##                   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:agesY
##                   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:agesA
##          1
##  0.2333361
##
## Group:agesSA
##          1
##  0.2333361
##
## Group:agesY
##          1
```

```
##  0.2333361
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=1)
## -2lnL:  167.2857
## AICc :  173.3928  (unadjusted=169.30335)
##
## Beta
##                      estimate       se           lcl          ucl
## pi:(Intercept)  4.599032e-04    0.000  4.599032e-04 4.599032e-04
## p:(Intercept)   1.053604e-01    0.000  1.053604e-01 1.053604e-01
## f0:(Intercept) -2.385208e+01 9618.642 -1.887639e+04 1.882869e+04
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.500115
##
## Group:agesSA
##
## mixture:1 0.500115
##
## Group:agesY
##
## mixture:1 0.500115
##
##
## Real Parameter p
## Group:agesA
##                   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:agesSA
##                   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:agesY
##                   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:agesA
##                   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:agesSA
```

```
##                   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:agesY
##                   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:agesA
##             1
##  4.376948e-11
##
## Group:agesSA
##             1
##  4.376948e-11
##
## Group:agesY
##             1
##  4.376948e-11
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  157.6756
## AICc :  165.855  (unadjusted=161.72898)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  8.794801e-06 2508.2996000 -4916.2674000 4916.2674000
## p:(Intercept)  -3.877655e-01    0.2101736    -0.7997057    0.0241747
## c:(Intercept)   4.554755e-01    0.1772735     0.1080195    0.8029316
## f0:(Intercept) -2.500561e+01    0.0000000   -25.0056100  -25.0056100
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.5000022
##
## Group:agesSA
##
## mixture:1 0.5000022
##
## Group:agesY
##
## mixture:1 0.5000022
##
##
## Real Parameter p
## Group:agesA
```

```
##                    1         2         3         4         5         6
## mixture:1 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553
## mixture:2 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553
##
## Group:agesSA
##                    1         2         3         4         5         6
## mixture:1 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553
## mixture:2 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553
##
## Group:agesY
##                    1         2         3         4         5         6
## mixture:1 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553
## mixture:2 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553
##
##
## Real Parameter c
## Group:agesA
##                    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:agesSA
##                    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:agesY
##                    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:agesA
##              1
##  1.381025e-11
##
## Group:agesSA
##              1
##  1.381025e-11
##
## Group:agesY
##              1
##  1.381025e-11
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  152.2245
## AICc :  160.4039  (unadjusted=158.33168)
##
## Beta
##                   estimate           se           lcl          ucl
```

```
## pi:(Intercept)  -0.5353026    0.6426070    -1.7948123    0.7242072
## p:(Intercept)    1.4386154    0.5278223     0.4040837    2.4731471
## p:mixture2      -2.0085527    0.4285275    -2.8484665   -1.1686388
## f0:(Intercept) -16.6668030 4304.0830000 -8452.6696000 8419.3360000
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.369281
##
## Group:agesSA
##
## mixture:1 0.369281
##
## Group:agesY
##
## mixture:1 0.369281
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5         6
## mixture:1 0.8082401 0.8082401 0.8082401 0.8082401 0.8082401 0.8082401
## mixture:2 0.3612513 0.3612513 0.3612513 0.3612513 0.3612513 0.3612513
##
## Group:agesSA
##                   1         2         3         4         5         6
## mixture:1 0.8082401 0.8082401 0.8082401 0.8082401 0.8082401 0.8082401
## mixture:2 0.3612513 0.3612513 0.3612513 0.3612513 0.3612513 0.3612513
##
## Group:agesY
##                   1         2         3         4         5         6
## mixture:1 0.8082401 0.8082401 0.8082401 0.8082401 0.8082401 0.8082401
## mixture:2 0.3612513 0.3612513 0.3612513 0.3612513 0.3612513 0.3612513
##
##
## Real Parameter c
## Group:agesA
##                   2         3         4         5         6
## mixture:1 0.8082401 0.8082401 0.8082401 0.8082401 0.8082401
## mixture:2 0.3612513 0.3612513 0.3612513 0.3612513 0.3612513
##
## Group:agesSA
##                   2         3         4         5         6
## mixture:1 0.8082401 0.8082401 0.8082401 0.8082401 0.8082401
## mixture:2 0.3612513 0.3612513 0.3612513 0.3612513 0.3612513
##
## Group:agesY
##                   2         3         4         5         6
## mixture:1 0.8082401 0.8082401 0.8082401 0.8082401 0.8082401
## mixture:2 0.3612513 0.3612513 0.3612513 0.3612513 0.3612513
##
##
```

```
## Real Parameter f0
## Group:agesA
##             1
##  5.776963e-08
##
## Group:agesSA
##             1
##  5.776963e-08
##
## Group:agesY
##             1
##  5.776963e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + ages)c()f0(~1)
##
## Npar :  6
## -2lnL:  148.8177
## AICc :  161.1978
##
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept) -0.4716176 0.5561826 -1.5617354  0.6185003
## p:(Intercept)   0.9215440 0.5684021 -0.1925242  2.0356121
## p:mixture2     -2.0255400 0.5042357 -3.0138419 -1.0372380
## p:agesSA       -0.4872586 1.0091304 -2.4651543  1.4906370
## p:agesY         0.7539119 0.4503949 -0.1288621  1.6366859
## f0:(Intercept) -1.1509926 2.8415836 -6.7204967  4.4185114
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.3842335
##
## Group:agesSA
##
## mixture:1 0.3842335
##
## Group:agesY
##
## mixture:1 0.3842335
##
##
## Real Parameter p
## Group:agesA
##                    1         2         3         4         5         6
## mixture:1 0.7153566 0.7153566 0.7153566 0.7153566 0.7153566 0.7153566
## mixture:2 0.2489919 0.2489919 0.2489919 0.2489919 0.2489919 0.2489919
##
## Group:agesSA
##                    1         2         3         4         5         6
## mixture:1 0.6068965 0.6068965 0.6068965 0.6068965 0.6068965 0.6068965
## mixture:2 0.1692074 0.1692074 0.1692074 0.1692074 0.1692074 0.1692074
```

```
##
## Group:agesY
##                    1         2         3         4         5         6
## mixture:1 0.8423019 0.8423019 0.8423019 0.8423019 0.8423019 0.8423019
## mixture:2 0.4133620 0.4133620 0.4133620 0.4133620 0.4133620 0.4133620
##
##
## Real Parameter c
## Group:agesA
##                    2         3         4         5         6
## mixture:1 0.7153566 0.7153566 0.7153566 0.7153566 0.7153566
## mixture:2 0.2489919 0.2489919 0.2489919 0.2489919 0.2489919
##
## Group:agesSA
##                    2         3         4         5         6
## mixture:1 0.6068965 0.6068965 0.6068965 0.6068965 0.6068965
## mixture:2 0.1692074 0.1692074 0.1692074 0.1692074 0.1692074
##
## Group:agesY
##                    2         3         4         5         6
## mixture:1 0.8423019 0.8423019 0.8423019 0.8423019 0.8423019
## mixture:2 0.4133620 0.4133620 0.4133620 0.4133620 0.4133620
##
##
## Real Parameter f0
## Group:agesA
##          1
##  0.3163226
##
## Group:agesSA
##          1
##  0.3163226
##
## Group:agesY
##          1
##  0.3163226
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=3)
## -2lnL:  157.6756
## AICc :  167.9459  (unadjusted=163.78279)
##
## Beta
##                       estimate           se           lcl          ucl
## pi:(Intercept)  2.775191e+00    0.0000000     2.7751910    2.7751910
## p:(Intercept)  -3.877720e-01    0.2322403    -0.8429631    0.0674191
## p:mixture2      6.451906e-05    1.6784020    -3.2896035    3.2897325
## c:(Intercept)   4.554757e-01    0.1772735     0.1080196    0.8029318
## f0:(Intercept) -1.593516e+01 3140.0699000 -6170.4722000 6138.6019000
##
##
## Real Parameter pi
```

```
## Group:agesA
##
## mixture:1 0.9413204
##
## Group:agesSA
##
## mixture:1 0.9413204
##
## Group:agesY
##
## mixture:1 0.9413204
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5         6
## mixture:1 0.4042538 0.4042538 0.4042538 0.4042538 0.4042538 0.4042538
## mixture:2 0.4042693 0.4042693 0.4042693 0.4042693 0.4042693 0.4042693
##
## Group:agesSA
##                   1         2         3         4         5         6
## mixture:1 0.4042538 0.4042538 0.4042538 0.4042538 0.4042538 0.4042538
## mixture:2 0.4042693 0.4042693 0.4042693 0.4042693 0.4042693 0.4042693
##
## Group:agesY
##                   1         2         3         4         5         6
## mixture:1 0.4042538 0.4042538 0.4042538 0.4042538 0.4042538 0.4042538
## mixture:2 0.4042693 0.4042693 0.4042693 0.4042693 0.4042693 0.4042693
##
##
## Real Parameter c
## Group:agesA
##                   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:agesSA
##                   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:agesY
##                   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:agesA
##             1
##  1.200742e-07
##
## Group:agesSA
##             1
```

```
##  1.200742e-07
##
## Group:agesY
##             1
##  1.200742e-07
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + ages)c(~1)f0(~1)
##
## Npar :  7  (unadjusted=6)
## -2lnL:  155.3511
## AICc :  169.8602  (unadjusted=167.73118)
##
## Beta
##                      estimate        se        lcl        ucl
## pi:(Intercept) -3.332739e-01 0.0000000 -0.3332739 -0.3332739
## p:(Intercept)  -7.111664e-01 0.6902946 -2.0641438  0.6418109
## p:mixture2      4.245053e-07 0.9126666 -1.7888261  1.7888270
## p:agesSA       -4.309314e-01 0.8286879 -2.0551597  1.1932968
## p:agesY         5.428305e-01 0.4637139 -0.3660487  1.4517098
## c:(Intercept)   4.554756e-01 0.1772735  0.1080195  0.8029316
## f0:(Intercept) -1.455282e+00 3.8623697 -9.0255264  6.1149632
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.4174442
##
## Group:agesSA
##
## mixture:1 0.4174442
##
## Group:agesY
##
## mixture:1 0.4174442
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5         6
## mixture:1 0.3293412 0.3293412 0.3293412 0.3293412 0.3293412 0.3293412
## mixture:2 0.3293412 0.3293412 0.3293412 0.3293412 0.3293412 0.3293412
##
## Group:agesSA
##                   1         2         3         4         5         6
## mixture:1 0.2419354 0.2419354 0.2419354 0.2419354 0.2419354 0.2419354
## mixture:2 0.2419355 0.2419355 0.2419355 0.2419355 0.2419355 0.2419355
##
## Group:agesY
##                   1         2         3         4         5         6
## mixture:1 0.4580151 0.4580151 0.4580151 0.4580151 0.4580151 0.4580151
## mixture:2 0.4580152 0.4580152 0.4580152 0.4580152 0.4580152 0.4580152
##
```

```
##
## Real Parameter c
## Group:agesA
##                   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:agesSA
##                   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:agesY
##                   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:agesA
##          1
##  0.2333346
##
## Group:agesSA
##          1
##  0.2333346
##
## Group:agesY
##          1
##  0.2333346
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  9  (unadjusted=8)
## -2lnL:  140.0045
## AICc :  158.8302  (unadjusted=156.66204)
##
## Beta
##                    estimate           se           lcl           ucl
## pi:(Intercept)  -0.4756508    0.5967552 -1.645291e+00     0.6939895
## p:(Intercept)    0.8167786    0.5935131 -3.465071e-01     1.9800643
## p:time2          0.6887697    0.5301039 -3.502340e-01     1.7277734
## p:time3          0.1419942    0.5331547 -9.029891e-01     1.1869775
## p:time4          0.5542951    0.5299029 -4.843147e-01     1.5929048
## p:time5          1.3641770    0.5413319  3.031665e-01     2.4251875
## p:time6          1.3641794    0.5413320  3.031687e-01     2.4251902
## p:mixture2      -2.1475664    0.4197036 -2.970186e+00    -1.3249473
## f0:(Intercept) -17.1739190 6091.5832000 -1.195668e+04 11922.3290000
##
##
## Real Parameter pi
## Group:agesA
##
```

```
## mixture:1 0.3832796
##
## Group:agesSA
##
## mixture:1 0.3832796
##
## Group:agesY
##
## mixture:1 0.3832796
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5         6
## mixture:1 0.6935521 0.8184005 0.7228760 0.7975536 0.8985262 0.8985265
## mixture:2 0.2090291 0.3447905 0.2334748 0.3150763 0.5083465 0.5083471
##
## Group:agesSA
##                   1         2         3         4         5         6
## mixture:1 0.6935521 0.8184005 0.7228760 0.7975536 0.8985262 0.8985265
## mixture:2 0.2090291 0.3447905 0.2334748 0.3150763 0.5083465 0.5083471
##
## Group:agesY
##                   1         2         3         4         5         6
## mixture:1 0.6935521 0.8184005 0.7228760 0.7975536 0.8985262 0.8985265
## mixture:2 0.2090291 0.3447905 0.2334748 0.3150763 0.5083465 0.5083471
##
##
## Real Parameter c
## Group:agesA
##                   2         3         4         5         6
## mixture:1 0.8184005 0.7228760 0.7975536 0.8985262 0.8985265
## mixture:2 0.3447905 0.2334748 0.3150763 0.5083465 0.5083471
##
## Group:agesSA
##                   2         3         4         5         6
## mixture:1 0.8184005 0.7228760 0.7975536 0.8985262 0.8985265
## mixture:2 0.3447905 0.2334748 0.3150763 0.5083465 0.5083471
##
## Group:agesY
##                   2         3         4         5         6
## mixture:1 0.8184005 0.7228760 0.7975536 0.8985262 0.8985265
## mixture:2 0.3447905 0.2334748 0.3150763 0.5083465 0.5083471
##
##
## Real Parameter f0
## Group:agesA
##            1
##  3.47906e-08
##
## Group:agesSA
##            1
##  3.47906e-08
##
```

```
## Group:agesY
##            1
##  3.47906e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture + ages)c()f0(~1)
##
## Npar :  11
## -2lnL:  136.5116
## AICc :  159.7338
##
## Beta
##                   estimate        se        lcl       ucl
## pi:(Intercept) -0.4476288 0.5270432 -1.4806335  0.585376
## p:(Intercept)   0.3146135 0.6457997 -0.9511538  1.580381
## p:time2         0.6943882 0.5324939 -0.3492999  1.738076
## p:time3         0.1432814 0.5355763 -0.9064482  1.193011
## p:time4         0.5588402 0.5322399 -0.4843500  1.602030
## p:time5         1.3754426 0.5442363  0.3087394  2.442146
## p:time6         1.3754426 0.5442363  0.3087393  2.442146
## p:mixture2     -2.1685758 0.5043969 -3.1571937 -1.179958
## p:agesSA       -0.5252170 1.0265508 -2.5372565  1.486823
## p:agesY         0.7772711 0.4638014 -0.1317796  1.686322
## f0:(Intercept) -1.4391817 3.5336311 -8.3650987  5.486735
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.3899247
##
## Group:agesSA
##
## mixture:1 0.3899247
##
## Group:agesY
##
## mixture:1 0.3899247
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5         6
## mixture:1 0.5780110 0.7328247 0.6125147 0.7054638 0.8442315 0.8442315
## mixture:2 0.1354084 0.2387447 0.1530754 0.2149871 0.3826017 0.3826017
##
## Group:agesSA
##                   1         2         3         4         5         6
## mixture:1 0.4475429 0.6186412 0.4831758 0.5861899 0.7622109 0.7622109
## mixture:2 0.0847742 0.1564621 0.0965728 0.1393932 0.2682074 0.2682074
##
## Group:agesY
##                   1         2         3         4         5         6
## mixture:1 0.7487364 0.8564697 0.7747215 0.8389890 0.9218194 0.9218194
```

```
## mixture:2 0.2541327 0.4055716 0.2822334 0.3733549 0.5741372 0.5741373
##
##
## Real Parameter c
## Group:agesA
##                   2         3         4         5         6
## mixture:1 0.7328247 0.6125147 0.7054638 0.8442315 0.8442315
## mixture:2 0.2387447 0.1530754 0.2149871 0.3826017 0.3826017
##
## Group:agesSA
##                   2         3         4         5         6
## mixture:1 0.6186412 0.4831758 0.5861899 0.7622109 0.7622109
## mixture:2 0.1564621 0.0965728 0.1393932 0.2682074 0.2682074
##
## Group:agesY
##                   2         3         4         5         6
## mixture:1 0.8564697 0.7747215 0.8389890 0.9218194 0.9218194
## mixture:2 0.4055716 0.2822334 0.3733549 0.5741372 0.5741373
##
##
## Real Parameter f0
## Group:agesA
##          1
##  0.2371217
##
## Group:agesSA
##          1
##  0.2371217
##
## Group:agesY
##          1
##  0.2371217
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c(~1)f0(~1)
##
## Npar :  10  (unadjusted=6)
## -2lnL:  151.5
## AICc :  172.5138  (unadjusted=163.8801)
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept)     0.7789328  146.4298700  -286.2236200  287.7814800
## p:(Intercept)     -0.8207101   64.2684820  -126.7869400  125.1455200
## p:time2           -0.0847073    0.0000000    -0.0847073   -0.0847073
## p:time3            0.2429631    0.0000000     0.2429631    0.2429631
## p:time4            0.0190033   26.0442270   -51.0276830   51.0656890
## p:time5            0.7660744   46.6399450   -90.6482190   92.1803680
## p:time6           20.0505390    0.0000000    20.0505390   20.0505390
## p:mixture2         1.1803531    0.0000000     1.1803531    1.1803531
## c:(Intercept)      0.4554776    0.1772735     0.1080215    0.8029338
## f0:(Intercept) -19.4637990 2206.0693000 -4343.3597000 4304.4321000
##
##
```

```
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.6854501
##
## Group:agesSA
##
## mixture:1 0.6854501
##
## Group:agesY
##
## mixture:1 0.6854501
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5 6
## mixture:1 0.3056129 0.2879385 0.3594512 0.3096605 0.4863445 1
## mixture:2 0.5889540 0.5683042 0.6462523 0.5935466 0.7550477 1
##
## Group:agesSA
##                   1         2         3         4         5 6
## mixture:1 0.3056129 0.2879385 0.3594512 0.3096605 0.4863445 1
## mixture:2 0.5889540 0.5683042 0.6462523 0.5935466 0.7550477 1
##
## Group:agesY
##                   1         2         3         4         5 6
## mixture:1 0.3056129 0.2879385 0.3594512 0.3096605 0.4863445 1
## mixture:2 0.5889540 0.5683042 0.6462523 0.5935466 0.7550477 1
##
##
## Real Parameter c
## Group:agesA
##                   2         3         4         5         6
## mixture:1 0.6119408 0.6119408 0.6119408 0.6119408 0.6119408
## mixture:2 0.6119408 0.6119408 0.6119408 0.6119408 0.6119408
##
## Group:agesSA
##                   2         3         4         5         6
## mixture:1 0.6119408 0.6119408 0.6119408 0.6119408 0.6119408
## mixture:2 0.6119408 0.6119408 0.6119408 0.6119408 0.6119408
##
## Group:agesY
##                   2         3         4         5         6
## mixture:1 0.6119408 0.6119408 0.6119408 0.6119408 0.6119408
## mixture:2 0.6119408 0.6119408 0.6119408 0.6119408 0.6119408
##
##
## Real Parameter f0
## Group:agesA
##             1
##  3.523543e-09
##
## Group:agesSA
```

```
##             1
##  3.523543e-09
##
## Group:agesY
##             1
##  3.523543e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture + ages)c(~1)f0(~1)
##
## Npar :  12  (unadjusted=9)
## -2lnL:  146.4202
## AICc :  171.8714  (unadjusted=165.2459)
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept)     1.5408298 4.651296e-01  6.291756e-01 2.452484e+00
## p:(Intercept)     -0.7301237 5.846637e-01 -1.876065e+00 4.158173e-01
## p:time2            0.2029312 6.599101e-01 -1.090493e+00 1.496355e+00
## p:time3            1.5037414 1.117309e+00 -6.861841e-01 3.693667e+00
## p:time4           17.0174650 1.097732e+03 -2.134537e+03 2.168572e+03
## p:time5           19.4079800 1.097729e+03 -2.132141e+03 2.170957e+03
## p:time6          138.1689600 2.021142e+05 -3.960057e+05 3.962820e+05
## p:mixture2       -19.0393590 1.097729e+03 -2.170589e+03 2.132510e+03
## p:agesSA          -1.1683113 1.275709e+00 -3.668702e+00 1.332079e+00
## p:agesY            1.0558311 6.612908e-01 -2.402988e-01 2.351961e+00
## c:(Intercept)      0.4554755 1.772735e-01  1.080194e-01 8.029315e-01
## f0:(Intercept) -112.6926100 1.664850e+05 -3.264232e+05 3.261978e+05
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.8235853
##
## Group:agesSA
##
## mixture:1 0.8235853
##
## Group:agesY
##
## mixture:1 0.8235853
##
##
## Real Parameter p
## Group:agesA
##                         1            2            3         4         5 6
## mixture:1 3.251676e-01 3.711719e-01 6.843030e-01 0.9999999 1.0000000 1
## mixture:2 2.595510e-09 3.179469e-09 1.167587e-08 0.0599728 0.4105959 1
##
## Group:agesSA
##                         1            2            3         4         5 6
## mixture:1 1.302857e-01 1.550534e-01 4.025879e-01 0.9999997 1.0000000 1
## mixture:2 8.069220e-10 9.884699e-10 3.629929e-09 0.0194488 0.1780209 1
```

```
##
## Group:agesY
##                       1            2            3        4         5 6
## mixture:1 5.807146e-01 6.291655e-01 8.616961e-01 1.000000 1.0000000 1
## mixture:2 7.460438e-09 9.138949e-09 3.356069e-08 0.154964 0.6669292 1
##
##
## Real Parameter c
## Group:agesA
##                   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:agesSA
##                   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:agesY
##                   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:agesA
##             1
##  1.143459e-49
##
## Group:agesSA
##             1
##  1.143459e-49
##
## Group:agesY
##             1
##  1.143459e-49
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  8  (unadjusted=6)
## -2lnL:  157.4538
## AICc :  174.1113  (unadjusted=169.83385)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)   0.000153041 2552.7197000 -5003.3306000 5003.3309000
## p:(Intercept)   -0.427443700    0.3318813    -1.0779310    0.2230436
## p:time2          0.532803800    0.4644361    -0.3774909    1.4430985
## p:time3          0.108990300    0.4670117    -0.8063527    1.0243333
## p:time4          0.427443400    0.4641212    -0.4822341    1.3371210
## p:time5          1.081370100    0.4765169     0.1473969    2.0153432
## p:time6          1.081370100    0.4765169     0.1473969    2.0153433
## f0:(Intercept) -17.309758000 2881.6507000 -5665.3453000 5630.7258000
```

```
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.5000383
##
## Group:agesSA
##
## mixture:1 0.5000383
##
## Group:agesY
##
## mixture:1 0.5000383
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5         6
## mixture:1 0.3947369 0.5263157 0.4210527 0.4999999 0.6578947 0.6578947
## mixture:2 0.3947369 0.5263157 0.4210527 0.4999999 0.6578947 0.6578947
##
## Group:agesSA
##                   1         2         3         4         5         6
## mixture:1 0.3947369 0.5263157 0.4210527 0.4999999 0.6578947 0.6578947
## mixture:2 0.3947369 0.5263157 0.4210527 0.4999999 0.6578947 0.6578947
##
## Group:agesY
##                   1         2         3         4         5         6
## mixture:1 0.3947369 0.5263157 0.4210527 0.4999999 0.6578947 0.6578947
## mixture:2 0.3947369 0.5263157 0.4210527 0.4999999 0.6578947 0.6578947
##
##
## Real Parameter c
## Group:agesA
##                   2         3         4         5         6
## mixture:1 0.5263157 0.4210527 0.4999999 0.6578947 0.6578947
## mixture:2 0.5263157 0.4210527 0.4999999 0.6578947 0.6578947
##
## Group:agesSA
##                   2         3         4         5         6
## mixture:1 0.5263157 0.4210527 0.4999999 0.6578947 0.6578947
## mixture:2 0.5263157 0.4210527 0.4999999 0.6578947 0.6578947
##
## Group:agesY
##                   2         3         4         5         6
## mixture:1 0.5263157 0.4210527 0.4999999 0.6578947 0.6578947
## mixture:2 0.5263157 0.4210527 0.4999999 0.6578947 0.6578947
##
##
## Real Parameter f0
## Group:agesA
##            1
##  3.03716e-08
```

```
##
## Group:agesSA
##            1
##  3.03716e-08
##
## Group:agesY
##            1
##  3.03716e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + ages)c()f0(~1)
##
## Npar :  10  (unadjusted=8)
## -2lnL:  150.6504
## AICc :  171.6642  (unadjusted=167.30792)
##
## Beta
##                       estimate           se           lcl          ucl
## pi:(Intercept) -4.962879e-05 1254.2010000 -2458.2341000 2458.2340000
## p:(Intercept)  -9.393274e-01    0.4064740    -1.7360165   -0.1426383
## p:time2         5.492749e-01    0.4716409    -0.3751413    1.4736911
## p:time3         1.122047e-01    0.4738503    -0.8165419    1.0409514
## p:time4         4.405426e-01    0.4712279    -0.4830642    1.3641494
## p:time5         1.115228e+00    0.4842693     0.1660602    2.0643959
## p:time6         1.115228e+00    0.4842693     0.1660602    2.0643959
## p:agesSA        1.513974e-01    0.5489174    -0.9244808    1.2272756
## p:agesY         7.673649e-01    0.3100128     0.1597397    1.3749900
## f0:(Intercept) -2.173565e+01    0.0000000   -21.7356490  -21.7356490
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.4999876
##
## Group:agesSA
##
## mixture:1 0.4999876
##
## Group:agesY
##
## mixture:1 0.4999876
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5         6
## mixture:1 0.2810362 0.4037047 0.3042538 0.3778263 0.5438621 0.5438621
## mixture:2 0.2810362 0.4037047 0.3042538 0.3778263 0.5438621 0.5438621
##
## Group:agesSA
##                   1         2        3         4         5         6
## mixture:1 0.3126133 0.4406178 0.337216 0.4140161 0.5811018 0.5811018
## mixture:2 0.3126133 0.4406178 0.337216 0.4140161 0.5811018 0.5811018
```

```
##
## Group:agesY
##                  1         2        3         4         5         6
## mixture:1 0.457115 0.5932247 0.485065 0.5667443 0.7197588 0.7197588
## mixture:2 0.457115 0.5932247 0.485065 0.5667443 0.7197588 0.7197588
##
##
## Real Parameter c
## Group:agesA
##                   2         3         4         5         6
## mixture:1 0.4037047 0.3042538 0.3778263 0.5438621 0.5438621
## mixture:2 0.4037047 0.3042538 0.3778263 0.5438621 0.5438621
##
## Group:agesSA
##                   2        3         4         5         6
## mixture:1 0.4406178 0.337216 0.4140161 0.5811018 0.5811018
## mixture:2 0.4406178 0.337216 0.4140161 0.5811018 0.5811018
##
## Group:agesY
##                   2        3         4         5         6
## mixture:1 0.5932247 0.485065 0.5667443 0.7197588 0.7197588
## mixture:2 0.5932247 0.485065 0.5667443 0.7197588 0.7197588
##
##
## Real Parameter f0
## Group:agesA
##             1
##  3.633522e-10
##
## Group:agesSA
##             1
##  3.633522e-10
##
## Group:agesY
##             1
##  3.633522e-10
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  9  (unadjusted=6)
## -2lnL:  151.5
## AICc :  170.3257  (unadjusted=163.8801)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  8.105539e-05    0.0000000  8.105539e-05 8.105539e-05
## p:(Intercept)  -4.274443e-01    0.3318801 -1.077929e+00 2.230407e-01
## p:time2        -2.011645e-01    0.5493728 -1.277935e+00 8.756063e-01
## p:time3         2.197910e-02    0.6228325 -1.198773e+00 1.242731e+00
## p:time4        -2.657014e-01    0.7811143 -1.796686e+00 1.265283e+00
## p:time5         4.274453e-01    0.8813673 -1.300035e+00 2.154925e+00
## p:time6         2.025335e+01   13.1162790 -5.454562e+00 4.596126e+01
## c:(Intercept)   4.554756e-01    0.1772735  1.080195e-01 8.029316e-01
```

```
## f0:(Intercept) -2.101110e+01 5148.3539000 -1.011178e+04 1.006976e+04
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.5000203
##
## Group:agesSA
##
## mixture:1 0.5000203
##
## Group:agesY
##
## mixture:1 0.5000203
##
##
## Real Parameter p
## Group:agesA
##                   1         2   3         4         5 6
## mixture:1 0.3947368 0.3478261 0.4 0.3333337 0.5000003 1
## mixture:2 0.3947368 0.3478261 0.4 0.3333337 0.5000003 1
##
## Group:agesSA
##                   1         2   3         4         5 6
## mixture:1 0.3947368 0.3478261 0.4 0.3333337 0.5000003 1
## mixture:2 0.3947368 0.3478261 0.4 0.3333337 0.5000003 1
##
## Group:agesY
##                   1         2   3         4         5 6
## mixture:1 0.3947368 0.3478261 0.4 0.3333337 0.5000003 1
## mixture:2 0.3947368 0.3478261 0.4 0.3333337 0.5000003 1
##
##
## Real Parameter c
## Group:agesA
##                   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:agesSA
##                   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:agesY
##                   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:agesA
##            1
```

```
##  7.49888e-10
##
## Group:agesSA
##            1
##  7.49888e-10
##
## Group:agesY
##            1
##  7.49888e-10
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + ages)c(~1)f0(~1)
##
## Npar :  11  (unadjusted=8)
## -2lnL:  148.1703
## AICc :  171.3925  (unadjusted=164.8278)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept) -6.943190e-05 1.659186e+03 -3.252004e+03  3.252004e+03
## p:(Intercept)  -7.664768e-01 4.828579e-01 -1.712878e+00  1.799246e-01
## p:time2        -1.370877e-01 5.599516e-01 -1.234593e+00  9.604175e-01
## p:time3         1.541320e-01 6.396157e-01 -1.099515e+00  1.407779e+00
## p:time4        -8.115670e-02 8.045960e-01 -1.658165e+00  1.495851e+00
## p:time5         5.790038e-01 9.080478e-01 -1.200770e+00  2.358778e+00
## p:time6         3.950527e+01 6.720112e+04 -1.316747e+05  1.317537e+05
## p:agesSA       -6.772186e-01 8.876415e-01 -2.416996e+00  1.062559e+00
## p:agesY         5.889151e-01 4.831343e-01 -3.580281e-01  1.535858e+00
## c:(Intercept)   4.554755e-01 1.772735e-01  1.080195e-01  8.029316e-01
## f0:(Intercept) -3.044877e+01 0.000000e+00 -3.044877e+01 -3.044877e+01
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.4999826
##
## Group:agesSA
##
## mixture:1 0.4999826
##
## Group:agesY
##
## mixture:1 0.4999826
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5 6
## mixture:1 0.3172417 0.2883185 0.3515245 0.2999295 0.4532685 1
## mixture:2 0.3172417 0.2883185 0.3515245 0.2999295 0.4532685 1
##
## Group:agesSA
##                   1         2         3         4         5 6
```

```
## mixture:1 0.1909737 0.1706846 0.2159267 0.1787481 0.2963601 1
## mixture:2 0.1909737 0.1706846 0.2159267 0.1787481 0.2963601 1
##
## Group:agesY
##                   1         2         3         4         5 6
## mixture:1 0.4557258 0.4219803 0.4941428 0.4356788 0.5990341 1
## mixture:2 0.4557258 0.4219803 0.4941428 0.4356788 0.5990341 1
##
##
## Real Parameter c
## Group:agesA
##                   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:agesSA
##                   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:agesY
##                   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:agesA
##             1
##  5.974045e-14
##
## Group:agesSA
##             1
##  5.974045e-14
##
## Group:agesY
##             1
##  5.974045e-14
```

Examine model-selection table

```
mouse.results
```

```
##                                        model npar     AICc  DeltaAICc
## 9           pi(~1)p(~time + mixture)c()f0(~1)    9 158.8302  0.0000000
## 10   pi(~1)p(~time + mixture + ages)c()f0(~1)   11 159.7338  0.9036041
## 5                  pi(~1)p(~mixture)c()f0(~1)    4 160.4039  1.5737241
## 6           pi(~1)p(~mixture + ages)c()f0(~1)    6 161.1978  2.3676324
## 4                     pi(~1)p(~1)c(~1)f0(~1)    4 165.8550  7.0248341
## 2                   pi(~1)p(~ages)c(~1)f0(~1)    6 167.7312  8.9009924
## 7                pi(~1)p(~mixture)c(~1)f0(~1)    5 167.9459  9.1157322
## 8         pi(~1)p(~mixture + ages)c(~1)f0(~1)    7 169.8602 11.0299928
## 15                  pi(~1)p(~time)c(~1)f0(~1)    9 170.3257 11.4955100
## 1                     pi(~1)p(~ages)c()f0(~1)    5 171.0508 12.2206322
```

```
## 16           pi(~1)p(~time + ages)c(~1)f0(~1)   11 171.3925 12.5623041
## 14             pi(~1)p(~time + ages)c()f0(~1)   10 171.6642 12.8340268
## 12 pi(~1)p(~time + mixture + ages)c(~1)f0(~1)   12 171.8714 13.0411847
## 11        pi(~1)p(~time + mixture)c(~1)f0(~1)   10 172.5138 13.6836468
## 3                       pi(~1)p(~1)c()f0(~1)    3 173.3928 14.5626048
## 13                   pi(~1)p(~time)c()f0(~1)    8 174.1113 15.2811062
##          weight  Deviance
## 9  0.4054341388  96.72476
## 10 0.2580507746  93.23183
## 5  0.1845824743 108.94480
## 6  0.1241067681 105.53798
## 4  0.0120919674 114.39591
## 2  0.0047325408 112.07135
## 7  0.0042507368 114.39591
## 8  0.0016322542 112.07135
## 15 0.0012933082 108.22027
## 1  0.0009000026 117.50081
## 16 0.0007586660 104.89052
## 14 0.0006622879 107.37064
## 12 0.0005971219 103.14047
## 11 0.0004330661 108.22027
## 3  0.0002790557 124.00591
## 13 0.0001948365 114.17402
```

examine model names and find the name of the top model

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

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

examine the output from top-ranked model (#5)

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

```
##                    estimate           se          lcl          ucl fixed note
## pi gA aA m1   3.832796e-01 0.1410588000 1.617464e-01 0.6668538000
## p gA aA t1 m1 6.935521e-01 0.1261438000 4.142297e-01 0.8786880000
## p gA aA t2 m1 8.184005e-01 0.0905450000 5.772390e-01 0.9370058000
## p gA aA t3 m1 7.228760e-01 0.1197422000 4.470025e-01 0.8938168000
## p gA aA t4 m1 7.975536e-01 0.0980248000 5.451620e-01 0.9283094000
## p gA aA t5 m1 8.985262e-01 0.0563510000 7.250391e-01 0.9674635000
## p gA aA t6 m1 8.985265e-01 0.0563509000 7.250396e-01 0.9674636000
## p gA aA t1 m2 2.090291e-01 0.0786983000 9.417180e-02 0.4018297000
## p gA aA t2 m2 3.447905e-01 0.1011387000 1.795352e-01 0.5585954000
## p gA aA t3 m2 2.334748e-01 0.0840821000 1.081622e-01 0.4334141000
## p gA aA t4 m2 3.150763e-01 0.0976969000 1.592512e-01 0.5276778000
## p gA aA t5 m2 5.083465e-01 0.1084041000 3.064570e-01 0.7075499000
## p gA aA t6 m2 5.083471e-01 0.1084041000 3.064575e-01 0.7075504000
## f0 gA a0 t1   3.479060e-08 0.0002119298 9.722152e-12 0.0001244977
```

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

```
## $`N Population Size`
##   estimate lcl       ucl
## 1       11  11 11.000124
## 2        3   3  3.000124
## 3       24  24 24.000124
```

Partie 3 : cigognes

On passe aux cigognes.

Les données

```
cigogne <- convert.inp("dat/cigognes-2002-3G.inp",
                    group.df = data.frame(bagues = c("metal","couleur", "darvic")),
                    covariates = NULL)
head(cigogne)
```

```
##                  ch freq bagues
## 1:1 00000000000010    1  metal
## 1:2 00000000000110    1  metal
## 1:3 00000000000100    1  metal
## 1:4 00000000000110    1  metal
## 1:8 00000000000100    1  metal
## 1:9 00000010101000    1  metal
```

```
tail(cigogne)
```

```
##                   ch freq bagues
## 3:36 00000000100010    1 darvic
## 3:38 00000000001011    1 darvic
## 3:42 00000101101111    1 darvic
## 3:43 00000000000101    1 darvic
## 3:45 01000000010111    1 darvic
## 3:46 11100001000101    1 darvic
```

On formate les données.

```
cigogne_secr <- unRMarkInput(cigogne) # on convertit au bon format
```

On fait les tests de fermeture.

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

```
## $Otis
##  statistic          p
##  -1.374711 0.08461054
##
```

```
## $Xc
##  statistic df        p
##    8.07373 16 0.946641
##
## $NRvsJS
##  statistic df         p
##   3.475137  4 0.4816688
##
## $NMvsJS
##  statistic df        p
##  0.3244725  3 0.955362
##
## $MtvsNR
##  statistic df         p
##   4.598593 12 0.9700621
##
## $MtvsNM
##  statistic df         p
##   7.749257 13 0.8595432
##
## $compNRvsJS
##    Occasion  Chisquare df         p
## 1         2         NA NA        NA
## 2         3         NA NA        NA
## 3         4         NA NA        NA
## 4         5         NA NA        NA
## 5         6         NA NA        NA
## 6         7         NA NA        NA
## 7         8         NA NA        NA
## 8         9 2.26149907  1 0.1326256
## 9        10         NA NA        NA
## 10       11 0.01238597  1 0.9113846
## 11       12 0.86498856  1 0.3523464
## 12       13 0.33626374  1 0.5619938
##
## $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
## 5         6          NA NA        NA
## 6         7          NA NA        NA
## 7         8          NA NA        NA
## 8         9          NA NA        NA
## 9        10          NA NA        NA
## 10       11 0.273944805  1 0.6006978
## 11       12 0.001124195  1 0.9732527
## 12       13 0.049403509  1 0.8241045
```

Les modèles maintenant. On sépare selon le type de bagues.

Couleur d'abord

```
cigogne_bague <- cigogne[cigogne$bagues=="couleur",]
cigogne.proc <- process.data(cigogne_bague, begin.time = 1, model = "FullHet")
cigogne.ddl <- make.design.data(cigogne.proc)
```

Liste des modèles.

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

  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  cigogne.model.list <- create.model.list("FullHet")
  cigogne.results <- mark.wrapper(cigogne.model.list,
                                  data = cigogne.proc,
                                  ddl = cigogne.ddl)
  return(cigogne.results)
}
```

Run the models and examine the output

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  2
## -2lnL:  75.81818
## AICc :  79.90577
##
## Beta
##                   estimate        se       lcl       ucl
## pi:(Intercept)  0.0000000 0.0000000  0.000000  0.000000
## p:(Intercept)  -2.1293885 0.3383855 -2.792624 -1.466153
## f0:(Intercept)  0.7410866 1.1789783 -1.569711  3.051884
##
##
## Real Parameter pi
##
##
## mixture:1 0.5
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
## mixture:2 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
##                    8         9        10        11        12        13        14
## mixture:1 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
## mixture:2 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
```

```
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
## mixture:2 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
##                    9        10        11        12        13        14
## mixture:1 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
## mixture:2 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
##
##
## Real Parameter f0
##
##         1
##  2.098214
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  75.81818
## AICc :  84.11447  (unadjusted=79.90577)
##
## Beta
##                     estimate       se         lcl         ucl
## pi:(Intercept) -12.7974650 0.000000 -12.7974650 -12.7974650
## p:(Intercept)   -1.9580944 0.000000  -1.9580944  -1.9580944
## p:mixture2      -0.1712941 0.000000  -0.1712941  -0.1712941
## f0:(Intercept)   0.7410858 1.178978  -1.5697114   3.0518829
##
##
## Real Parameter pi
##
##
## mixture:1 2.767773e-06
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1236734 0.1236734 0.1236734 0.1236734 0.1236734 0.1236734 0.1236734
## mixture:2 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
##                    8         9        10        11        12        13        14
## mixture:1 0.1236734 0.1236734 0.1236734 0.1236734 0.1236734 0.1236734 0.1236734
## mixture:2 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1236734 0.1236734 0.1236734 0.1236734 0.1236734 0.1236734 0.1236734
## mixture:2 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
##                    9        10        11        12        13        14
```

```
## mixture:1 0.1236734 0.1236734 0.1236734 0.1236734 0.1236734 0.1236734
## mixture:2 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
##
##
## Real Parameter f0
##
##         1
##  2.098212
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  17  (unadjusted=10)
## -2lnL:  42.22035
## AICc :  81.23674  (unadjusted=63.925771)
##
## Beta
##                     estimate          se           lcl          ucl
## pi:(Intercept) -15.6468920  757.370160  -1500.092400  1468.798700
## p:(Intercept)   -7.9433449 2460.255800  -4830.044800  4814.158100
## p:time2         18.9110300 3809.014000  -7446.756500  7484.578600
## p:time3         -9.8266532 9920.615300 -19454.233000 19434.580000
## p:time4         -9.8266612    0.000000     -9.826661    -9.826661
## p:time5         -9.8266293    0.000000     -9.826629    -9.826629
## p:time6         18.9110320 3809.014000  -7446.756500  7484.578600
## p:time7         18.9110310 3809.014000  -7446.756500  7484.578600
## p:time8         18.9110310 3809.014000  -7446.756500  7484.578600
## p:time9         -9.8266439    0.000000     -9.826644    -9.826644
## p:time10        18.9110320 3809.014000  -7446.756500  7484.578600
## p:time11        18.9110300 3809.014000  -7446.756500  7484.578600
## p:time12        21.0398480 3809.008700  -7444.617300  7486.697000
## p:time13        18.9110310 3809.014000  -7446.756600  7484.578600
## p:time14        21.4087930 3809.008700  -7444.248300  7487.065900
## p:mixture2     -13.2575810    0.000000    -13.257581   -13.257581
## f0:(Intercept)  -0.1348304    1.918935     -3.895944     3.626283
##
##
## Real Parameter pi
##
##
## mixture:1 1.601921e-07
##
##
## Real Parameter p
##
##                      1         2            3            4            5
## mixture:1 3.54891e-04 0.9999828 1.916849e-08 1.916834e-08 1.916895e-08
## mixture:2 6.20233e-10 0.0919633 3.348834e-14 3.348807e-14 3.348914e-14
##                   6         7         8            9        10        11
## mixture:1 0.9999828 0.9999828 0.9999828 1.916867e-08 0.9999828 0.9999828
## mixture:2 0.0919634 0.0919633 0.0919633 3.348865e-14 0.0919634 0.0919633
##                  12        13        14
## mixture:1 0.9999979 0.9999828 0.9999986
## mixture:2 0.4598174 0.0919633 0.5517805
```

```
##
##
## Real Parameter c
##
##                    2            3            4            5         6         7
## mixture:1 0.9999828 1.916849e-08 1.916834e-08 1.916895e-08 0.9999828 0.9999828
## mixture:2 0.0919633 3.348834e-14 3.348807e-14 3.348914e-14 0.0919634 0.0919633
##                    8            9        10        11        12        13
## mixture:1 0.9999828 1.916867e-08 0.9999828 0.9999828 0.9999979 0.9999828
## mixture:2 0.0919633 3.348865e-14 0.0919634 0.0919633 0.4598174 0.0919633
##                   14
## mixture:1 0.9999986
## mixture:2 0.5517805
##
##
## Real Parameter f0
##
##         1
##  0.8738641
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  16  (unadjusted=10)
## -2lnL:  42.22034
## AICc :  78.64311  (unadjusted=63.925767)
##
## Beta
##                       estimate       se           lcl           ucl
## pi:(Intercept) -1.858110e-05 0.000000 -1.858110e-05 -1.858110e-05
## p:(Intercept)  -1.965309e+01 0.000000 -1.965309e+01 -1.965309e+01
## p:time2         1.736319e+01 0.000000  1.736319e+01  1.736319e+01
## p:time3        -1.052407e+01 0.000000 -1.052407e+01 -1.052407e+01
## p:time4        -1.052408e+01 0.000000 -1.052408e+01 -1.052408e+01
## p:time5        -1.052407e+01 0.000000 -1.052407e+01 -1.052407e+01
## p:time6         1.736319e+01 0.000000  1.736319e+01  1.736319e+01
## p:time7         1.736319e+01 0.000000  1.736319e+01  1.736319e+01
## p:time8         1.736323e+01 0.000000  1.736323e+01  1.736323e+01
## p:time9        -1.052408e+01 0.000000 -1.052408e+01 -1.052408e+01
## p:time10        1.736326e+01 0.000000  1.736326e+01  1.736326e+01
## p:time11        1.736319e+01 0.000000  1.736319e+01  1.736319e+01
## p:time12        1.949203e+01 0.000000  1.949203e+01  1.949203e+01
## p:time13        1.736325e+01 0.000000  1.736325e+01  1.736325e+01
## p:time14        1.986098e+01 0.000000  1.986098e+01  1.986098e+01
## f0:(Intercept) -1.349018e-01 1.919041 -3.896222e+00  3.626418e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999954
##
##
## Real Parameter p
```

```
##
##                      1         2            3            4            5
## mixture:1 2.915883e-09 0.0919625 7.838321e-14 7.838285e-14 7.838334e-14
## mixture:2 2.915883e-09 0.0919625 7.838321e-14 7.838285e-14 7.838334e-14
##                    6         7        8            9        10        11
## mixture:1 0.0919624 0.0919627 0.091966 7.838293e-14 0.0919688 0.0919627
## mixture:2 0.0919624 0.0919627 0.091966 7.838293e-14 0.0919688 0.0919627
##                   12        13        14
## mixture:1 0.4598214 0.0919675 0.5517854
## mixture:2 0.4598214 0.0919675 0.5517854
##
##
## Real Parameter c
##
##                    2            3            4            5         6         7
## mixture:1 0.0919625 7.838321e-14 7.838285e-14 7.838334e-14 0.0919624 0.0919627
## mixture:2 0.0919625 7.838321e-14 7.838285e-14 7.838334e-14 0.0919624 0.0919627
##                   8            9        10        11        12        13
## mixture:1 0.091966 7.838293e-14 0.0919688 0.0919627 0.4598214 0.0919675
## mixture:2 0.091966 7.838293e-14 0.0919688 0.0919627 0.4598214 0.0919675
##                   14
## mixture:1 0.5517854
## mixture:2 0.5517854
##
##
## Real Parameter f0
##
##          1
##  0.8738017
```

Examine model-selection table

```
cigogne.results
```

```
##                               model npar     AICc DeltaAICc     weight Deviance
## 4           pi(~1)p(~time)c()f0(~1)   16 78.64311  0.000000 0.53472127 34.69523
## 1              pi(~1)p(~1)c()f0(~1)    2 79.90577  1.262664 0.28440908 68.29307
## 3 pi(~1)p(~time + mixture)c()f0(~1)   17 81.23674  2.593633 0.14619320 34.69523
## 2        pi(~1)p(~mixture)c()f0(~1)    4 84.11447  5.471369 0.03467646 68.29307
```

examine model names and find the name of the top model

```
names(cigogne.results)
```

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

examine the output from top-ranked models

```
(pcouleur <- cigogne.results$p.time$results$real)
```

```
##                 estimate        se          lcl          ucl fixed note
```

```
## pi g1 m1    4.999954e-01 0.0000000 4.999954e-01 4.999954e-01
## p g1 t1 m1  2.915883e-09 0.0000000 2.915883e-09 2.915883e-09
## p g1 t2 m1  9.196250e-02 0.0887729 1.244960e-02 4.486146e-01
## p g1 t3 m1  7.838321e-14 0.0000000 7.838321e-14 7.838321e-14
## p g1 t4 m1  7.838285e-14 0.0000000 7.838285e-14 7.838285e-14
## p g1 t5 m1  7.838334e-14 0.0000000 7.838334e-14 7.838334e-14
## p g1 t6 m1  9.196240e-02 0.0887728 1.244960e-02 4.486146e-01
## p g1 t7 m1  9.196270e-02 0.0887729 1.244960e-02 4.486147e-01
## p g1 t8 m1  9.196600e-02 0.0887744 1.245050e-02 4.486165e-01
## p g1 t9 m1  7.838293e-14 0.0000000 7.838293e-14 7.838293e-14
## p g1 t10 m1 9.196880e-02 0.0887756 1.245130e-02 4.486179e-01
## p g1 t11 m1 9.196270e-02 0.0887729 1.244970e-02 4.486147e-01
## p g1 t12 m1 4.598214e-01 0.1669449 1.856667e-01 7.606585e-01
## p g1 t13 m1 9.196750e-02 0.0887751 1.245090e-02 4.486172e-01
## p g1 t14 m1 5.517854e-01 0.1731613 2.378655e-01 8.292317e-01
## f0 g1 a0 t1 8.738017e-01 1.6768612 7.651570e-02 9.978725e+00
```

```
(Ncouleur <- cigogne.results$p.time$results$derived)
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1  10.8738 10.07652 19.97873
```

Darvic ensuite.

```
cigogne_bague <- cigogne[cigogne$bagues=="darvic",]
cigogne.proc <- process.data(cigogne_bague, begin.time = 1, model = "FullHet")
cigogne.ddl <- make.design.data(cigogne.proc)
```

Run the models and examine the output

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=1)
## -2lnL:  144.0227
## AICc :  150.1576  (unadjusted=146.04496)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept) -3.316152e-05 0.000000e+00 -3.316152e-05 -3.316152e-05
## p:(Intercept)  -1.299283e+00 1.806489e-01 -1.653355e+00 -9.452111e-01
## f0:(Intercept) -1.869280e+01 3.124014e+04 -6.124936e+04  6.121198e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999917
```

```
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
## mixture:2 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
##                    8         9        10        11        12        13        14
## mixture:1 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
## mixture:2 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
## mixture:2 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
##                    9        10        11        12        13        14
## mixture:1 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
## mixture:2 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
##
##
## Real Parameter f0
##
##             1
##  7.617671e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4
## -2lnL:  142.2156
## AICc :  150.4415
##
## Beta
##                   estimate        se       lcl        ucl
## pi:(Intercept) -1.4323800 1.0430922 -3.476841  0.6120808
## p:(Intercept)  -0.3699149 0.4896268 -1.329584  0.5897537
## p:mixture2     -1.2980386 0.5502853 -2.376598 -0.2194795
## f0:(Intercept) -0.7611845 2.8777570 -6.401588  4.8792193
##
##
## Real Parameter pi
##
##
## mixture:1 0.1927281
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.4085616 0.4085616 0.4085616 0.4085616 0.4085616 0.4085616 0.4085616
## mixture:2 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972
##                    8         9        10        11        12        13        14
```

```
## mixture:1 0.4085616 0.4085616 0.4085616 0.4085616 0.4085616 0.4085616 0.4085616
## mixture:2 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.4085616 0.4085616 0.4085616 0.4085616 0.4085616 0.4085616 0.4085616
## mixture:2 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972
##                   9        10        11        12        13        14
## mixture:1 0.4085616 0.4085616 0.4085616 0.4085616 0.4085616 0.4085616
## mixture:2 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972
##
##
## Real Parameter f0
##
##         1
##  0.4671128
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  17  (unadjusted=15)
## -2lnL:  91.16379
## AICc :  128.8955  (unadjusted=124.05535)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept) -1.296273e+00    0.7703674 -2.806193e+00     0.2136470
## p:(Intercept)  -1.231723e+00    1.1337332 -3.453840e+00     0.9903943
## p:time2         8.801835e-01    1.3701776 -1.805365e+00     3.5657316
## p:time3         4.030520e-06    1.5393801 -3.017181e+00     3.0171892
## p:time4        -1.822729e+01 6221.6924000 -1.221275e+04 12176.2900000
## p:time5        -1.822614e+01 6526.3299000 -1.280983e+04 12773.3810000
## p:time6         8.801835e-01    1.3701783 -1.805366e+00     3.5657330
## p:time7         8.801836e-01    1.3701786 -1.805367e+00     3.5657337
## p:time8         1.473603e+00    1.3120910 -1.098095e+00     4.0453013
## p:time9         8.801829e-01    1.3701780 -1.805366e+00     3.5657319
## p:time10        3.424740e-06    1.5393807 -3.017183e+00     3.0171896
## p:time11        8.801839e-01    1.3701785 -1.805366e+00     3.5657338
## p:time12        3.431841e+00    1.2763792  9.301380e-01     5.9335446
## p:time13        2.726653e+00    1.2674318  2.424871e-01     5.2108198
## p:time14        3.802121e+00    1.2938180  1.266238e+00     6.3380044
## p:mixture2     -2.057456e+00    0.5946380 -3.222947e+00    -0.8919658
## f0:(Intercept) -3.480521e+00   31.8864280 -6.597792e+01    59.0168780
##
##
## Real Parameter pi
##
##
## mixture:1 0.2147929
##
##
## Real Parameter p
```

```
##
##                    1         2         3            4            5         6
## mixture:1 0.2258800 0.4130092 0.2258807 3.540439e-09 3.544514e-09 0.4130092
## mixture:2 0.0359443 0.0824893 0.0359444 4.523923e-10 4.529131e-10 0.0824893
##                    7         8         9        10        11        12        13
## mixture:1 0.4130092 0.5601769 0.4130090 0.2258806 0.4130093 0.9002602 0.8168172
## mixture:2 0.0824893 0.1399655 0.0824893 0.0359444 0.0824893 0.5356052 0.3629633
##                   14
## mixture:1 0.9289320
## mixture:2 0.6254959
##
##
## Real Parameter c
##
##                    2         3            4            5         6         7
## mixture:1 0.4130092 0.2258807 3.540439e-09 3.544514e-09 0.4130092 0.4130092
## mixture:2 0.0824893 0.0359444 4.523923e-10 4.529131e-10 0.0824893 0.0824893
##                    8         9        10        11        12        13        14
## mixture:1 0.5601769 0.4130090 0.2258806 0.4130093 0.9002602 0.8168172 0.9289320
## mixture:2 0.1399655 0.0824893 0.0359444 0.0824893 0.5356052 0.3629633 0.6254959
##
##
## Real Parameter f0
##
##          1
##  0.0307914
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  16  (unadjusted=12)
## -2lnL:  97.2221
## AICc :  132.5191  (unadjusted=123.06825)
##
## Beta
##                       estimate          se            lcl          ucl
## pi:(Intercept) -6.891223e-05 3427.245900 -6717.4021000 6717.4020000
## p:(Intercept)  -2.484908e+00    1.040842    -4.5249581   -0.4448587
## p:time2         7.801599e-01    1.293933    -1.7559497    3.3162695
## p:time3         1.680088e-05    1.471964    -2.8850318    2.8850654
## p:time4        -4.183383e+01    0.000000   -41.8338340  -41.8338340
## p:time5        -4.183381e+01    0.000000   -41.8338130  -41.8338130
## p:time6         7.801888e-01    1.293929    -1.7559120    3.3162897
## p:time7         7.801519e-01    1.293934    -1.7559590    3.3162629
## p:time8         1.280935e+00    1.231538    -1.1328795    3.6947486
## p:time9         7.801728e-01    1.293931    -1.7559312    3.3162768
## p:time10       -1.101125e-05    1.471976    -2.8850840    2.8850620
## p:time11        7.801249e-01    1.293938    -1.7559945    3.3162443
## p:time12        2.954912e+00    1.186740     0.6289021    5.2809223
## p:time13        2.330758e+00    1.180201     0.0175630    4.6439527
## p:time14        3.295838e+00    1.201858     0.9401967    5.6514796
## f0:(Intercept) -1.618713e+01 3458.217100 -6794.2928000 6761.9185000
##
##
```

```
## Real Parameter pi
##
##
## mixture:1 0.4999828
##
##
## Real Parameter p
##
##                  1         2         3            4            5         6
## mixture:1 0.076923 0.1538461 0.0769241 5.657373e-20 5.657493e-20 0.1538499
## mixture:2 0.076923 0.1538461 0.0769241 5.657373e-20 5.657493e-20 0.1538499
##                   7        8         9        10        11        12        13
## mixture:1 0.1538451 0.230769 0.1538478 0.0769222 0.1538415 0.6153847 0.4615385
## mixture:2 0.1538451 0.230769 0.1538478 0.0769222 0.1538415 0.6153847 0.4615385
##                  14
## mixture:1 0.6923076
## mixture:2 0.6923076
##
##
## Real Parameter c
##
##                   2         3            4            5         6         7
## mixture:1 0.1538461 0.0769241 5.657373e-20 5.657493e-20 0.1538499 0.1538451
## mixture:2 0.1538461 0.0769241 5.657373e-20 5.657493e-20 0.1538499 0.1538451
##                   8         9        10        11        12        13        14
## mixture:1 0.230769 0.1538478 0.0769222 0.1538415 0.6153847 0.4615385 0.6923076
## mixture:2 0.230769 0.1538478 0.0769222 0.1538415 0.6153847 0.4615385 0.6923076
##
##
## Real Parameter f0
##
##            1
##  9.33296e-08
```

Examine model-selection table

```
cigogne.results
```

```
##                               model npar     AICc DeltaAICc       weight
## 3 pi(~1)p(~time + mixture)c()f0(~1)   17 128.8955   0.00000 8.595442e-01
## 4           pi(~1)p(~time)c()f0(~1)   16 132.5191   3.62357 1.404171e-01
## 1              pi(~1)p(~1)c()f0(~1)    3 150.1576  21.26207 2.076201e-05
## 2        pi(~1)p(~mixture)c()f0(~1)    4 150.4415  21.54604 1.801377e-05
##    Deviance
## 3  76.17111
## 4  82.22942
## 1 129.03005
## 2 127.22287
```

examine model names and find the name of the top model

```
names(cigogne.results)
```

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

examine the output from top-ranked models

```
(pdarvic <- cigogne.results$p.h.time$results$real)
```

```
##                  estimate           se           lcl          ucl fixed note
## pi g1 m1    2.147929e-01 1.299278e-01  5.699040e-02 5.532095e-01
## p g1 t1 m1  2.258800e-01 1.982426e-01  3.065460e-02 7.291658e-01
## p g1 t2 m1  4.130092e-01 2.205404e-01  1.057841e-01 8.071301e-01
## p g1 t3 m1  2.258807e-01 1.982443e-01  3.065430e-02 7.291693e-01
## p g1 t4 m1  3.540439e-09 2.202752e-05 -4.317040e-05 4.317748e-05
## p g1 t5 m1  3.544514e-09 2.313267e-05 -4.533649e-05 4.534358e-05
## p g1 t6 m1  4.130092e-01 2.205405e-01  1.057840e-01 8.071301e-01
## p g1 t7 m1  4.130092e-01 2.205405e-01  1.057840e-01 8.071302e-01
## p g1 t8 m1  5.601769e-01 2.062997e-01  1.979301e-01 8.679601e-01
## p g1 t9 m1  4.130090e-01 2.205405e-01  1.057840e-01 8.071300e-01
## p g1 t10 m1 2.258806e-01 1.982443e-01  3.065420e-02 7.291694e-01
## p g1 t11 m1 4.130093e-01 2.205405e-01  1.057841e-01 8.071302e-01
## p g1 t12 m1 9.002602e-01 7.305470e-02  6.469047e-01 9.780066e-01
## p g1 t13 m1 8.168172e-01 1.187962e-01  4.847020e-01 9.548288e-01
## p g1 t14 m1 9.289320e-01 5.560710e-02  7.149341e-01 9.855332e-01
## p g1 t1 m2  3.594430e-02 4.018360e-02  3.826200e-03 2.657454e-01
## p g1 t2 m2  8.248930e-02 6.815290e-02  1.515820e-02 3.443318e-01
## p g1 t3 m2  3.594440e-02 4.018400e-02  3.826200e-03 2.657492e-01
## p g1 t4 m2  4.523923e-10 2.814646e-06 -5.516253e-06 5.517158e-06
## p g1 t5 m2  4.529131e-10 2.955860e-06 -5.793033e-06 5.793939e-06
## p g1 t6 m2  8.248930e-02 6.815290e-02  1.515820e-02 3.443318e-01
## p g1 t7 m2  8.248930e-02 6.815290e-02  1.515820e-02 3.443320e-01
## p g1 t8 m2  1.399655e-01 9.422490e-02  3.390220e-02 4.301189e-01
## p g1 t9 m2  8.248930e-02 6.815290e-02  1.515810e-02 3.443318e-01
## p g1 t10 m2 3.594440e-02 4.018400e-02  3.826200e-03 2.657494e-01
## p g1 t11 m2 8.248930e-02 6.815290e-02  1.515820e-02 3.443320e-01
## p g1 t12 m2 5.356052e-01 1.610046e-01  2.448913e-01 8.039822e-01
## p g1 t13 m2 3.629633e-01 1.484663e-01  1.393096e-01 6.672970e-01
## p g1 t14 m2 6.254959e-01 1.602367e-01  3.041158e-01 8.645561e-01
## f0 g1 a0 t1 3.079140e-02 9.818263e-01  1.771583e-04 5.351754e+00
```

```
(Ndarvic <- cigogne.results$p.h.time$results$derived)
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 13.03079 13.00018 18.35175
```

Metal enfin.

```
cigogne_bague <- cigogne[cigogne$bagues=="metal",]
cigogne.proc <- process.data(cigogne_bague, begin.time = 1, model = "FullHet")
cigogne.ddl <- make.design.data(cigogne.proc)
```

Run the models and examine the output

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=2)
## -2lnL:  189.3116
## AICc :  195.3809  (unadjusted=193.34616)
##
## Beta
##                     estimate        se           lcl           ucl
## pi:(Intercept)  9.141088e-06 0.0000000  9.141088e-06  9.141088e-06
## p:(Intercept)  -1.776719e+00 0.1444937 -2.059926e+00 -1.493511e+00
## f0:(Intercept)  9.714292e-01 0.0000000  9.714292e-01  9.714292e-01
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000023
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##                   8         9        10        11        12        13        14
## mixture:1 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##                   9        10        11        12        13        14
## mixture:1 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##
##
## Real Parameter f0
##
##         1
##  2.641717
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
```

```
## -2lnL:  189.3116
## AICc :  197.4275  (unadjusted=193.34616)
##
## Beta
##                    estimate       se         lcl         ucl
## pi:(Intercept) -12.7268460 0.000000 -12.7268460 -12.7268460
## p:(Intercept)   -1.7249784 0.000000  -1.7249784  -1.7249784
## p:mixture2      -0.0517402 0.000000  -0.0517402  -0.0517402
## f0:(Intercept)   0.9714290 0.858384  -0.7110036   2.6538616
##
##
## Real Parameter pi
##
##
## mixture:1 2.970295e-06
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1512310 0.1512310 0.1512310 0.1512310 0.1512310 0.1512310 0.1512310
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##                    8         9        10        11        12        13        14
## mixture:1 0.1512310 0.1512310 0.1512310 0.1512310 0.1512310 0.1512310 0.1512310
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1512310 0.1512310 0.1512310 0.1512310 0.1512310 0.1512310 0.1512310
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##                    9        10        11        12        13        14
## mixture:1 0.1512310 0.1512310 0.1512310 0.1512310 0.1512310 0.1512310
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##
##
## Real Parameter f0
##
##         1
##  2.641717
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  17  (unadjusted=11)
## -2lnL:  115.2832
## AICc :  151.1265  (unadjusted=138.06421)
##
## Beta
##                    estimate          se          lcl         ucl
## pi:(Intercept) -13.4624340  162.435110  -331.835250  304.910380
## p:(Intercept)  -20.7173100  263.193170  -536.575940  495.141310
## p:time2         36.8842500  164.935310  -286.388960  360.157460
```

```
## p:time3         -4.5626173    0.000000    -4.562617   -4.562617
## p:time4         36.1512550  164.936950  -287.125170  359.427690
## p:time5         37.3311660  164.934670  -285.940800  360.603130
## p:time6         36.8842030  164.935310  -286.389000  360.157410
## p:time7         37.6621080  164.934300  -285.609130  360.933350
## p:time8         -4.5627982 2266.942900 -4447.771000 4438.645400
## p:time9         37.9304730  164.934040  -285.340250  361.201200
## p:time10        -4.5628882    0.000000    -4.562888   -4.562888
## p:time11        38.5498870  164.933560  -284.719900  361.819680
## p:time12        38.8866780  164.933390  -284.382770  362.156130
## p:time13        39.3481520  164.933290  -283.921110  362.617420
## p:time14        38.5498830  164.933560  -284.719910  361.819670
## p:mixture2     -18.6772000  268.222330  -544.392980  507.038580
## f0:(Intercept)   0.4804667    1.112813    -1.700648    2.661581
##
##
## Real Parameter pi
##
##
## mixture:1 1.423439e-06
##
##
## Real Parameter p
##
##                       1         2            3         4         5         6
## mixture:1 1.005973e-09 0.9999999 1.049704e-11 0.9999998 0.9999999 0.9999999
## mixture:2 7.783614e-18 0.0751419 8.121978e-20 0.0375700 0.1127109 0.0751387
##                     7            8         9           10        11        12
## mixture:1 1.0000000 1.049514e-11 1.0000000 1.049420e-11 1.0000000 1.0000000
## mixture:2 0.1502805 8.120508e-20 0.1878505 8.119778e-20 0.3005619 0.3757018
##                    13        14
## mixture:1 1.0000000 1.0000000
## mixture:2 0.4884123 0.3005611
##
##
## Real Parameter c
##
##                     2            3         4         5         6         7
## mixture:1 0.9999999 1.049704e-11 0.9999998 0.9999999 0.9999999 1.0000000
## mixture:2 0.0751419 8.121978e-20 0.0375700 0.1127109 0.0751387 0.1502805
##                       8         9           10        11        12        13
## mixture:1 1.049514e-11 1.0000000 1.049420e-11 1.0000000 1.0000000 1.0000000
## mixture:2 8.120508e-20 0.1878505 8.119778e-20 0.3005619 0.3757018 0.4884123
##                    14
## mixture:1 1.0000000
## mixture:2 0.3005611
##
##
## Real Parameter f0
##
##         1
##  1.616829
##
## Output summary for FullHet model
```

```
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  16  (unadjusted=11)
## -2lnL:  115.2831
## AICc :  148.9167  (unadjusted=138.06414)
##
## Beta
##                      estimate          se          lcl         ucl
## pi:(Intercept)  1.918126e-04  612.990210 -1201.460600 1201.461000
## p:(Intercept)  -2.113111e+01  225.565380  -463.239270  420.977050
## p:time2         1.862082e+01  225.566850  -423.490220  460.731860
## p:time3        -5.869020e+00 2516.780700 -4938.759200 4927.021200
## p:time4         1.788786e+01  225.568040  -424.225500  460.001220
## p:time5         1.906776e+01  225.566400  -423.042390  461.177910
## p:time6         1.862083e+01  225.566850  -423.490210  460.731860
## p:time7         1.939871e+01  225.566140  -422.710930  461.508340
## p:time8        -5.869005e+00 2781.572900 -5457.752000 5446.014000
## p:time9         1.966708e+01  225.565960  -422.442200  461.776360
## p:time10       -5.869137e+00 3567.353800 -6997.882700 6986.144500
## p:time11        2.028649e+01  225.565630  -421.822150  462.395120
## p:time12        2.062328e+01  225.565500  -421.485120  462.731680
## p:time13        2.108475e+01  225.565430  -421.023500  463.193010
## p:time14        2.028649e+01  225.565630  -421.822150  462.395120
## f0:(Intercept)  4.804907e-01    1.112783    -1.700565    2.661546
##
##
## Real Parameter pi
##
##
## mixture:1 0.500048
##
##
## Real Parameter p
##
##                      1         2            3         4         5         6
## mixture:1 6.65082e-10 0.0751399 1.879283e-12 0.0375702 0.1127105 0.0751405
## mixture:2 6.65082e-10 0.0751399 1.879283e-12 0.0375702 0.1127105 0.0751405
##                    7            8         9           10        11        12
## mixture:1 0.1502802 1.879311e-12 0.1878514 1.879062e-12 0.3005617 0.375702
## mixture:2 0.1502802 1.879311e-12 0.1878514 1.879062e-12 0.3005617 0.375702
##                   13        14
## mixture:1 0.4884125 0.3005619
## mixture:2 0.4884125 0.3005619
##
##
## Real Parameter c
##
##                    2            3         4         5         6         7
## mixture:1 0.0751399 1.879283e-12 0.0375702 0.1127105 0.0751405 0.1502802
## mixture:2 0.0751399 1.879283e-12 0.0375702 0.1127105 0.0751405 0.1502802
##                      8         9           10        11        12        13
## mixture:1 1.879311e-12 0.1878514 1.879062e-12 0.3005617 0.375702 0.4884125
## mixture:2 1.879311e-12 0.1878514 1.879062e-12 0.3005617 0.375702 0.4884125
##                   14
```

```
## mixture:1 0.3005619
## mixture:2 0.3005619
##
##
## Real Parameter f0
##
##         1
##  1.616868
```

Examine model-selection table

```
cigogne.results
```

```
##                                model npar     AICc DeltaAICc       weight
## 4           pi(~1)p(~time)c()f0(~1)   16 148.9167   0.00000 7.511789e-01
## 3 pi(~1)p(~time + mixture)c()f0(~1)   17 151.1265   2.20982 2.488211e-01
## 1              pi(~1)p(~1)c()f0(~1)    3 195.3809  46.46424 6.111696e-11
## 2        pi(~1)p(~mixture)c()f0(~1)    4 197.4275  48.51082 2.196610e-11
##    Deviance
## 4  91.84761
## 3  91.84768
## 1 165.87611
## 2 165.87611
```

examine model names and find the name of the top model

```
names(cigogne.results)
```

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

examine the output from top-ranked models

```
(pmetal <- cigogne.results$p.time$results$real)
```

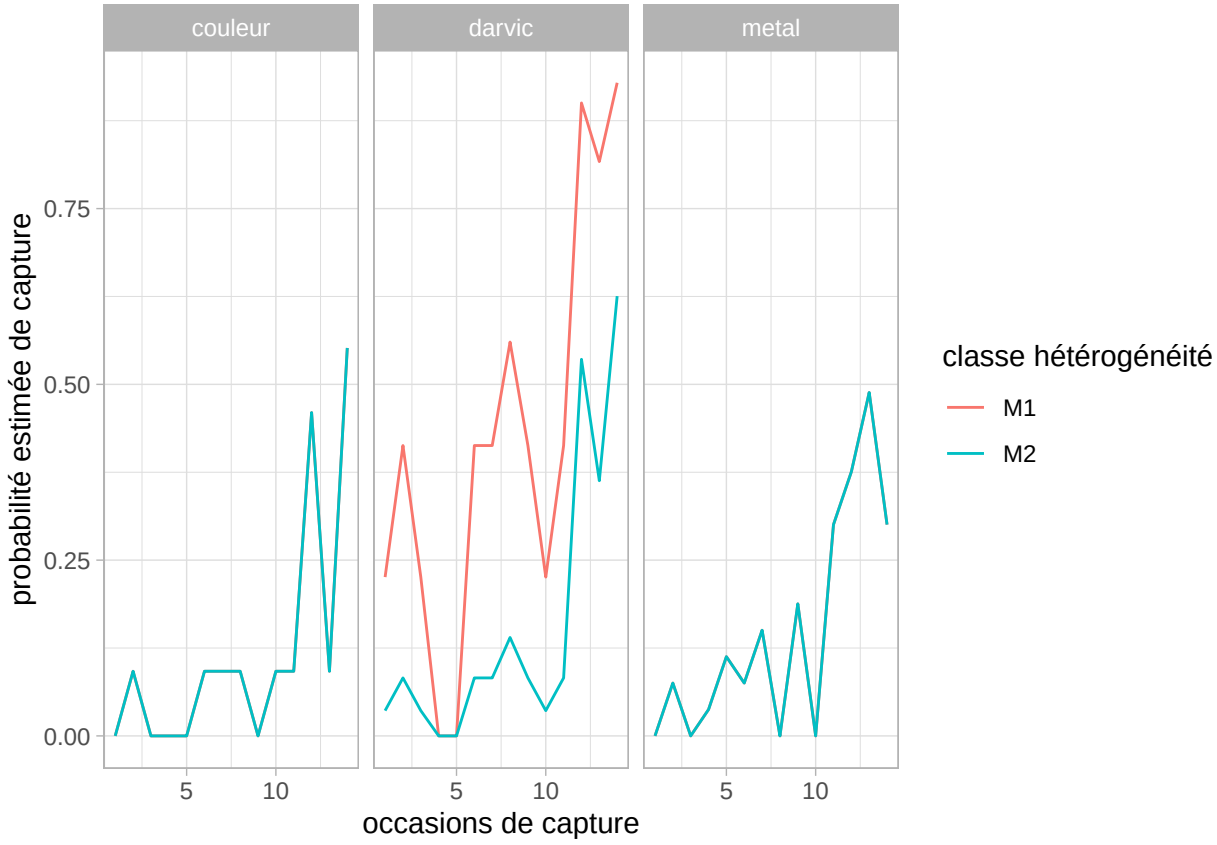
```
##                 estimate           se            lcl          ucl fixed note
## pi g1 m1    5.000480e-01 1.532475e+02  5.563752e-309 1.000000e+00
## p g1 t1 m1  6.650820e-10 1.500195e-07  -2.933731e-07 2.947033e-07
## p g1 t2 m1  7.513990e-02 5.134880e-02   1.873360e-02 2.569171e-01
## p g1 t3 m1  1.879283e-12 4.751567e-09  -9.311191e-09 9.314950e-09
## p g1 t4 m1  3.757020e-02 3.694510e-02   5.241600e-03 2.243274e-01
## p g1 t5 m1  1.127105e-01 6.176830e-02   3.647660e-02 2.988514e-01
## p g1 t6 m1  7.514050e-02 5.134900e-02   1.873380e-02 2.569177e-01
## p g1 t7 m1  1.502802e-01 7.000540e-02   5.695170e-02 3.412124e-01
## p g1 t8 m1  1.879311e-12 5.246740e-09  -1.028173e-08 1.028549e-08
## p g1 t9 m1  1.878514e-01 7.676630e-02   7.941960e-02 3.827706e-01
## p g1 t10 m1 1.879062e-12 6.717179e-09  -1.316379e-08 1.316755e-08
## p g1 t11 m1 3.005617e-01 9.116440e-02   1.551739e-01 5.013338e-01
## p g1 t12 m1 3.757020e-01 9.724740e-02   2.107397e-01 5.756178e-01
## p g1 t13 m1 4.884125e-01 1.023597e-01   2.995819e-01 6.806092e-01
## p g1 t14 m1 3.005619e-01 9.116440e-02   1.551741e-01 5.013340e-01
## f0 g1 a0 t1 1.616868e+00 1.799224e+00   2.783620e-01 9.391585e+00
```

```
(Nmetal <- cigogne.results$p.time$results$derived)
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 26.61687 25.27836 34.39159
```

Visualise les prob de détection.

```
p.estim <- data.frame(couleur = pcouleur[-c(1,16),1],
                      darvic = pdarvic[-c(1,30),1],
                      metal = pmetal[-c(1,16),1],
                      mixture = c(rep("M1", 14), rep("M2", 14)),
                      occ = c(1:14, 1:14))
p.estim <- tidyr::pivot_longer(p.estim,
                               cols = couleur:metal,
                               names_to = "type_bague",
                               values_to = "p_estim")
ggplot(data = p.estim,
       aes(x = occ, y = p_estim, color = mixture)) +
  geom_line() +
  facet_wrap(~type_bague) +
  theme_light() +
  labs(x = "occasions de capture",
       y = "probabilité estimée de capture",
       color = "classe hétérogénéité")
```



Partie 4 : cistudes

On passe à l'exercice sur les cistudes.

Les données

```
dat <- read_csv2("dat/BDD-CMR-Cistudes-Vigueirat.csv")
dat <- janitor::clean_names(dat)
```

Quelles sont les années avec le plus de marquages et recaptures?

```
dat %>%
  count(action, mois, annee, sort = TRUE)
```

```
## # A tibble: 168 x 4
##    action     mois annee     n
##    <chr>     <dbl> <dbl> <int>
##  1 Recapture     4  2007   114
##  2 Recapture     6  2007    65
##  3 Marquage      6  1997    50
##  4 Recapture     7  2006    44
##  5 Recapture     5  2007    38
##  6 Recapture     3  2007    37
##  7 Marquage      7  2006    33
##  8 Recapture     8  2006    31
##  9 Marquage      4  2007    27
## 10 Marquage      9  2005    26
## # ... with 158 more rows
```

```
dat <- dat %>% select(id_ind, jour, mois, annee)
```

On extrait les mois de juin des années 1997 et 2007.

```
dat1997 <- dat %>%
  filter(mois == 6, annee == 1997) %>%
  select(id_ind, jour) %>%
  add_column(det = 1) %>%
  arrange(id_ind)
dat2007 <- dat %>%
  filter(mois == 6, annee == 2007) %>%
  select(id_ind, jour) %>%
  add_column(det = 1) %>%
  arrange(id_ind)
```

On fait les histoires pour 1997.

```
histories1997 <- dat1997 %>%
  group_by(id_ind) %>%
  mutate(id2 = row_number()) %>%
  pivot_wider(values_from = det,
              names_from = jour) %>% # les jours en colonnes
  select(-id2) %>%
```

```
  group_by(id_ind) %>%
  summarise(across(everything(), sum, na.rm = TRUE)) %>% # on rassemble les evenements pour chaque ind
  select(-id_ind)
histories1997[is.na(histories1997)] <- 0 # les Na sont des non-détections = 0
histories1997[histories1997 > 1] <- 1 # les observations mens multiples = 1
(histories1997 <- as.matrix(histories1997))
```

```
##        7 13 10 12 25 27 3 6 11 29 14 15 16 17 18 19 20 26 30
##  [1,] 1  0  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
##  [2,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
##  [3,] 0  0  1  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
##  [4,] 0  0  0  1  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
##  [5,] 0  0  1  0  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
##  [6,] 0  0  0  0  0  1 0 0  0  0  0  0  0  0  0  0  0  0  0
##  [7,] 0  0  0  0  0  0 1 0  0  0  0  0  0  0  0  0  0  0  0
##  [8,] 0  0  0  0  0  0 0 1  0  0  0  0  0  0  0  0  0  0  0
##  [9,] 0  0  0  0  0  0 0 1  0  0  0  0  0  0  0  0  0  0  0
## [10,] 0  0  0  0  0  0 0 1  0  0  0  0  0  0  0  0  0  0  0
## [11,] 0  0  1  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [12,] 0  0  1  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [13,] 0  0  1  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [14,] 0  0  1  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [15,] 0  0  0  0  0  0 0 0  1  1  0  0  0  0  0  0  0  0  0
## [16,] 0  0  0  1  0  0 0 0  1  0  0  0  0  0  0  0  0  0  0
## [17,] 0  0  0  0  0  0 0 0  1  0  0  0  0  0  0  0  0  0  0
## [18,] 0  0  0  0  0  0 0 0  1  0  0  0  0  0  0  0  0  0  0
## [19,] 0  1  0  0  0  0 0 0  1  0  0  0  0  0  0  0  0  0  0
## [20,] 0  0  0  1  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [21,] 0  0  0  1  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [22,] 0  0  0  1  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [23,] 0  0  0  1  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [24,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [25,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [26,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [27,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [28,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [29,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [30,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [31,] 0  0  0  0  0  0 0 0  0  0  1  0  0  0  0  0  0  0  0
## [32,] 0  0  0  0  0  0 0 0  0  0  1  0  0  0  0  0  0  0  0
## [33,] 0  0  0  0  0  0 0 0  0  0  1  0  0  0  0  0  0  0  0
## [34,] 0  0  0  0  0  0 0 0  0  0  0  1  0  0  0  0  0  0  0
## [35,] 0  0  0  0  0  0 0 0  0  0  0  0  1  0  0  0  0  0  0
## [36,] 0  0  0  0  0  0 0 0  0  0  0  0  1  0  0  0  0  0  0
## [37,] 0  0  0  0  0  0 0 0  0  0  0  0  0  1  0  0  0  0  0
## [38,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  1  0  0  0  0
## [39,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  1  0  0  0  0
## [40,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  1  0  0  0
## [41,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  1  0  0  0
## [42,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  1  0  0  0
## [43,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  0  1  0  0
## [44,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  0  1  0  0
## [45,] 0  0  0  0  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
```

```
## [46,] 0  0  0  0  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [47,] 0  0  0  0  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [48,] 0  0  0  0  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [49,] 0  0  0  0  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [50,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  1  0
## [51,] 0  0  0  0  0  1 0 0  0  0  0  0  0  0  0  0  0  0  0
## [52,] 0  0  0  0  0  1 0 0  0  0  0  0  0  0  0  0  0  0  0
## [53,] 0  0  0  0  0  1 0 0  0  0  0  0  0  0  0  0  0  0  0
## [54,] 0  0  0  0  0  1 0 0  0  0  0  0  0  0  0  0  0  0  0
## [55,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  1
## [56,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  1
```

Et pour 2007.

```
histories2007 <- dat2007 %>%
  group_by(id_ind) %>%
  mutate(id2 = row_number()) %>%
  pivot_wider(values_from = det,
              names_from = jour) %>% # les jours en colonnes
  select(-id2) %>%
  group_by(id_ind) %>%
  summarise(across(everything(), sum, na.rm = TRUE)) %>% # on rassemble les evenements pour chaque ind
  select(-id_ind)
histories2007[is.na(histories2007)] <- 0 # les Na sont des non-détections = 0
histories2007[histories2007 > 1] <- 1 # les observations mens multiples = 1
(histories2007 <- as.matrix(histories2007))
```

```
##       18 13 16 25 28 20 26 4 8 11 22 14 12 21 27 5 6 24 1 19 29 7
##  [1,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [2,]  0  1  1  1  1  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [3,]  0  0  0  0  0  1  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [4,]  0  0  0  0  0  0  1 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [5,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [6,]  0  0  0  0  0  1  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [7,]  0  0  0  0  1  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [8,]  0  0  0  0  0  0  0 0 1  1  0  0  0  0  0 0 0  0 0  0  0 0
##  [9,]  0  0  0  0  0  0  1 0 0  0  1  0  0  0  0 0 0  0 0  0  0 0
## [10,]  0  0  0  0  0  0  0 0 0  0  0  1  0  0  0 0 0  0 0  0  0 0
## [11,]  0  0  0  0  0  0  0 0 0  0  0  0  1  0  0 0 0  0 0  0  0 0
## [12,]  0  0  0  0  0  0  0 0 0  0  0  0  0  1  0 0 0  0 0  0  0 0
## [13,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [14,]  0  0  0  0  1  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [15,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  1 0 0  0 0  0  0 0
## [16,]  0  0  0  0  0  0  0 0 0  1  0  0  0  0  0 0 0  0 0  0  0 0
## [17,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [18,]  0  0  0  0  0  0  0 0 0  0  0  0  0  1  0 0 0  0 0  0  0 0
## [19,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [20,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 1  0 0  0  0 0
## [21,]  0  0  0  0  0  0  1 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [22,]  0  0  0  0  1  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [23,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [24,]  0  0  0  0  0  0  0 0 0  0  0  0  0  1  0 0 0  0 0  0  0 0
## [25,]  0  0  0  1  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
```

```
## [26,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [27,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [28,]  0  0  0  0  1  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [29,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  1 0  0  0 0
## [30,]  0  0  0  0  0  0  0 0 1  0  0  0  0  0  0 0 0  0 0  0  0 0
## [31,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [32,]  0  1  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [33,]  0  0  0  0  0  0  0 0 0  0  0  0  0  1  0 0 0  0 0  0  0 0
## [34,]  0  0  0  0  0  0  0 0 0  0  0  1  0  0  0 0 0  0 0  0  0 0
## [35,]  0  0  0  0  0  0  1 0 0  0  0  0  0  1  0 0 0  0 0  0  0 0
## [36,]  0  0  0  0  0  1  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [37,]  0  0  0  0  0  1  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [38,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 1  0  0 0
## [39,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  1 0 0  0 0  0  0 0
## [40,]  0  0  0  0  0  0  0 0 0  0  1  0  0  0  0 0 0  0 0  0  0 0
## [41,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  1  0 0
## [42,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  1 0
## [43,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [44,]  0  0  0  0  0  1  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [45,]  0  0  0  1  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [46,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [47,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 1
## [48,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 1  0 0  0  0 0
## [49,]  0  0  0  1  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [50,]  0  0  0  0  0  1  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [51,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [52,]  0  0  0  0  0  0  0 0 0  0  0  0  0  1  0 0 0  0 0  0  0 0
## [53,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 1  0 0  0  0 0
## [54,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [55,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 1  0  0 0
## [56,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 1  0  0 0
## [57,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [58,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [59,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [60,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [61,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [62,]  0  1  0  0  0  0  0 0 0  0  0  0  0  0  0 0 1  0 0  0  0 0
## [63,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 1
## [64,]  0  0  0  0  0  0  0 0 1  0  0  0  0  0  0 0 0  0 0  0  0 0
## [65,]  0  0  0  0  0  0  0 0 0  1  0  0  0  0  0 0 0  0 0  0  0 0
## [66,]  0  0  0  0  0  0  0 0 0  0  1  1  0  0  0 0 0  0 0  0  0 0
## [67,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [68,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [69,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  1  0 0
```

On fait les tests et l'ajustement pour 1997.

```
cistude <- data.frame(ch = collapseCH(histories1997), freq = rep(1, nrow(histories1997)))
head(cistude)
```

```
##                    ch freq
## 1 1000000000000000000    1
## 2 0100000000000000000    1
```

```
## 3 0010000000000000000    1
## 4 0001100000000000000    1
## 5 0010100000000000000    1
## 6 0000010000000000000    1
```

```
tail(cistude)
```

```
##                      ch freq
## 51 0000010000000000000    1
## 52 0000010000000000000    1
## 53 0000010000000000000    1
## 54 0000010000000000000    1
## 55 0000000000000000001    1
## 56 0000000000000000001    1
```

On fait les tests de fermeture.

```
cistude_secr <- unRMarkInput(cistude) # on convertit au bon format
summary(cistude_secr) # resumes
```

```
## Object class       capthist
##
## Counts by occasion
##             1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 Total
## n           1  9  6  6  7  5  1  3  5  1  3  1  2  1  2  3  2  1  2    61
## u           1  9  6  6  5  5  1  3  3  0  3  1  2  1  2  3  2  1  2    56
## f          51  5  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    56
## M(t+1)      1 10 16 22 27 32 33 36 39 39 42 43 45 46 48 51 53 54 56    56
## losses      0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0     0
## detections  1  9  6  6  7  5  1  3  5  1  3  1  2  1  2  3  2  1  2    61
```

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

```
## $Otis
##  statistic          p
##  -1.783585 0.03724554
##
## $Xc
##  statistic df         p
##   7.130646 17 0.9817931
##
## $NRvsJS
##  statistic df p
##          0  0 1
##
## $NMvsJS
##  statistic df p
##          0  0 1
##
## $MtvsNR
##  statistic df         p
##   7.130646 17 0.9817931
```

```
##
## $MtvsNM
##  statistic df         p
##   7.130646 17 0.9817931
##
## $compNRvsJS
##    Occasion Chisquare df  p
## 1         2        NA NA NA
## 2         3        NA NA NA
## 3         4        NA NA NA
## 4         5        NA NA NA
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        NA NA NA
## 16       17        NA NA NA
## 17       18        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
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        NA NA NA
## 16       17        NA NA NA
## 17       18        NA NA NA
```

Process data

```
cistude.proc <- process.data(cistude, begin.time = 1, model = "FullHet")
```

Create default design data

```
cistude.ddl <- make.design.data(cistude.proc)
```

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

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

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

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

  return(cistude.results)
}
```

Run the models and examine the output

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3
## -2lnL:  46.99586
## AICc :  51.00717
##
## Beta
##                     estimate se           lcl           ucl
## pi:(Intercept)  0.0004480639  0  0.0004480639  0.0004480639
## p:(Intercept)  -4.6171079000  0 -4.6171079000 -4.6171079000
## f0:(Intercept)  5.6062386000  0  5.6062386000  5.6062386000
##
##
## Real Parameter pi
##
##
## mixture:1 0.500112
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846
## mixture:2 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846
##                    8         9        10        11        12        13        14
## mixture:1 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846
## mixture:2 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846
```

```
##                   15        16        17        18        19
## mixture:1 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846
## mixture:2 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846
## mixture:2 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846
##                    9        10        11        12        13        14        15
## mixture:1 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846
## mixture:2 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846 0.0097846
##                   16        17        18        19
## mixture:1 0.0097846 0.0097846 0.0097846 0.0097846
## mixture:2 0.0097846 0.0097846 0.0097846 0.0097846
##
##
## Real Parameter f0
##
##         1
##  272.1187
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  37.00433
## AICc :  45.04211  (unadjusted=43.026975)
##
## Beta
##                       estimate          se          lcl         ucl
## pi:(Intercept)  7.691415e-06 647.6394500 -1269.373300 1269.373300
## p:(Intercept)  -2.376333e+00   0.3075740    -2.979179   -1.773488
## c:(Intercept)  -4.839452e+00   0.4489791    -5.719451   -3.959452
## f0:(Intercept)  2.501695e+00   0.7124751     1.105244    3.898146
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000019
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953
## mixture:2 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953
##                    8         9        10        11        12        13        14
## mixture:1 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953
## mixture:2 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953
##                   15        16        17        18        19
## mixture:1 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953
```

```
## mixture:2 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493
## mixture:2 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493
##                   9        10        11        12        13        14        15
## mixture:1 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493
## mixture:2 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493
##                  16        17        18        19
## mixture:1 0.0078493 0.0078493 0.0078493 0.0078493
## mixture:2 0.0078493 0.0078493 0.0078493 0.0078493
##
##
## Real Parameter f0
##
##         1
##  12.20316
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  46.99586
## AICc :  55.03363  (unadjusted=51.007167)
##
## Beta
##                   estimate           se          lcl         ucl
## pi:(Intercept) -18.532468 2377.6068000 -4678.641900 4641.577000
## p:(Intercept)   -2.948091    0.0000000    -2.948091   -2.948091
## p:mixture2      -1.669010    0.0000000    -1.669010   -1.669010
## f0:(Intercept)   5.606233    0.5052699     4.615904    6.596562
##
##
## Real Parameter pi
##
##
## mixture:1 8.942342e-09
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0498268 0.0498268 0.0498268 0.0498268 0.0498268 0.0498268 0.0498268
## mixture:2 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
##                   8         9        10        11        12        13        14
## mixture:1 0.0498268 0.0498268 0.0498268 0.0498268 0.0498268 0.0498268 0.0498268
## mixture:2 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
##                  15        16        17        18        19
## mixture:1 0.0498268 0.0498268 0.0498268 0.0498268 0.0498268
## mixture:2 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
##
```

```
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0498268 0.0498268 0.0498268 0.0498268 0.0498268 0.0498268 0.0498268
## mixture:2 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
##                    9        10        11        12        13        14        15
## mixture:1 0.0498268 0.0498268 0.0498268 0.0498268 0.0498268 0.0498268 0.0498268
## mixture:2 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
##                   16        17        18        19
## mixture:1 0.0498268 0.0498268 0.0498268 0.0498268
## mixture:2 0.0097847 0.0097847 0.0097847 0.0097847
##
##
## Real Parameter f0
##
##         1
##  272.1172
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (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
## c:(Intercept)       -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             7             8             9            10
## 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
##                        11            12            13            14            15
## 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
##                        16            17            18            19
## mixture:1 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
##
##
## 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
##                        7             8             9            10            11
## 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
##                       12            13            14            15            16
## 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
##                       17            18            19
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309
##
##
## Real Parameter f0
##
##   1
##  NA
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  22  (unadjusted=20)
## -2lnL:  16.12256
## AICc :  61.0947  (unadjusted=56.927928)
##
## Beta
##                       estimate           se           lcl         ucl
## pi:(Intercept) -1.821028e+01 1353.9580000 -2671.9680000 2635.547400
## p:(Intercept)  -3.739018e+00    0.0000000    -3.7390177   -3.739018
## p:time2         2.223115e+00    1.0574000     0.1506106    4.295619
## p:time3         1.807997e+00    1.0833044    -0.3152792    3.931274
## p:time4         1.807997e+00    1.0833053    -0.3152809    3.931276
## p:time5         1.965335e+00    1.0722736    -0.1363217    4.066991
## p:time6         1.622496e+00    1.0985690    -0.5306994    3.775691
## p:time7         1.338178e-04    1.4167217    -2.7766408    2.776908
## p:time8         1.105443e+00    1.1576281    -1.1635085    3.374394
## p:time9         1.622476e+00    1.0985714    -0.5307236    3.775676
## p:time10        5.248876e-04    1.4165693    -2.7759511    2.777001
## p:time11        1.105223e+00    1.1576592    -1.1637893    3.374235
## p:time12        3.644032e-04    1.4166458    -2.7762614    2.776990
## p:time13        6.966589e-01    1.2275186    -1.7092777    3.102595
## p:time14        4.587228e-04    1.4165716    -2.7760216    2.776939
## p:time15        6.967287e-01    1.2275072    -1.7091855    3.102643
## p:time16        1.105237e+00    1.1576576    -1.1637717    3.374246
## p:time17        6.965825e-01    1.2275385    -1.7093931    3.102558
## p:time18        1.415193e-04    1.4167267    -2.7766429    2.776926
## p:time19        6.966884e-01    1.2275180    -1.7092468    3.102624
## p:mixture2     -2.022474e+00    0.0000000    -2.0224737   -2.022474
```

```
## f0:(Intercept)  5.571020e+00    0.5064239     4.5784294    6.563611
##
##
## Real Parameter pi
##
##
## mixture:1 1.234178e-08
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0232252 0.1800656 0.1266377 0.1266377 0.1450849 0.1075013 0.0232282
## mixture:2 0.0031365 0.0282398 0.0188263 0.0188263 0.0219637 0.0156888 0.0031370
##                    8         9        10        11        12        13        14
## mixture:1 0.0670086 0.1074995 0.0232371 0.0669949 0.0232335 0.0455485 0.0232356
## mixture:2 0.0094145 0.0156885 0.0031382 0.0094124 0.0031377 0.0062753 0.0031380
##                   15        16        17        18        19
## mixture:1 0.0455515 0.0669958 0.0455452 0.0232284 0.0455498
## mixture:2 0.0062758 0.0094126 0.0062749 0.0031370 0.0062755
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1800656 0.1266377 0.1266377 0.1450849 0.1075013 0.0232282 0.0670086
## mixture:2 0.0282398 0.0188263 0.0188263 0.0219637 0.0156888 0.0031370 0.0094145
##                    9        10        11        12        13        14        15
## mixture:1 0.1074995 0.0232371 0.0669949 0.0232335 0.0455485 0.0232356 0.0455515
## mixture:2 0.0156885 0.0031382 0.0094124 0.0031377 0.0062753 0.0031380 0.0062758
##                   16        17        18        19
## mixture:1 0.0669958 0.0455452 0.0232284 0.0455498
## mixture:2 0.0094126 0.0062749 0.0031370 0.0062755
##
##
## Real Parameter f0
##
##        1
##  262.702
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c(~1)f0(~1)
##
## Npar :  23  (unadjusted=18)
## -2lnL:  12.36969
## AICc :  59.43122  (unadjusted=49.024231)
##
## Beta
##                   estimate           se           lcl           ucl
## pi:(Intercept)  -4.325550 2.581213e+00 -9.384728e+00  7.336282e-01
## p:(Intercept)   10.481522 2.247035e+01 -3.356037e+01  5.452341e+01
## p:time2          3.688892 5.899800e+00 -7.874715e+00  1.525250e+01
## p:time3          3.423191 5.782784e+00 -7.911065e+00  1.475745e+01
## p:time4          3.585710 5.867612e+00 -7.914810e+00  1.508623e+01
```

```
## p:time5          3.562453 5.870884e+00 -7.944480e+00  1.506939e+01
## p:time6          3.751695 5.837662e+00 -7.690122e+00  1.519351e+01
## p:time7          2.184817 5.276466e+00 -8.157057e+00  1.252669e+01
## p:time8          3.423191 5.883548e+00 -8.108564e+00  1.495495e+01
## p:time9          3.585710 5.884298e+00 -7.947513e+00  1.511893e+01
## p:time10       -13.809848 2.993410e+03 -5.880893e+03  5.853273e+03
## p:time11         3.779866 6.203596e+00 -8.379181e+00  1.593891e+01
## p:time12         2.755362 5.942202e+00 -8.891354e+00  1.440208e+01
## p:time13         3.615562 6.067859e+00 -8.277441e+00  1.550857e+01
## p:time14         3.017727 5.396213e+00 -7.558851e+00  1.359431e+01
## p:time15         3.934017 5.904047e+00 -7.637916e+00  1.550595e+01
## p:time16         4.809486 5.896273e+00 -6.747210e+00  1.636618e+01
## p:time17         4.914846 5.921658e+00 -6.691603e+00  1.652129e+01
## p:time18         4.627163 5.977685e+00 -7.089099e+00  1.634342e+01
## p:time19        80.120882 1.632058e+07 -3.198825e+07  3.198841e+07
## p:mixture2     -15.801833 2.830048e+01 -7.127078e+01  3.966711e+01
## c:(Intercept)   -4.839453 4.489794e-01 -5.719453e+00 -3.959453e+00
## f0:(Intercept) -70.782028 3.162265e+07 -6.198046e+07  6.198032e+07
##
##
## Real Parameter pi
##
##
## mixture:1 0.0130536
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.9999720 0.9999993 0.9999991 0.9999992 0.9999992 0.9999993 0.9999968
## mixture:2 0.0048674 0.1636360 0.1304348 0.1500000 0.1470588 0.1724138 0.0416667
##                    8         9           10        11        12        13
## mixture:1 0.9999991 0.9999992 3.461210e-02 0.9999994 0.9999982 0.9999992
## mixture:2 0.1304348 0.1500000 4.919008e-09 0.1764706 0.0714286 0.1538460
##                   14        15        16        17        18 19
## mixture:1 0.9999986 0.9999995 0.9999998 0.9999998 0.9999997  1
## mixture:2 0.0909091 0.2000000 0.3750000 0.4000000 0.3333332  1
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493
## mixture:2 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493
##                    9        10        11        12        13        14        15
## mixture:1 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493
## mixture:2 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493
##                   16        17        18        19
## mixture:1 0.0078493 0.0078493 0.0078493 0.0078493
## mixture:2 0.0078493 0.0078493 0.0078493 0.0078493
##
##
## Real Parameter f0
##
```

```
##             1
##  1.818678e-31
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  21
## -2lnL:  16.12256
## AICc :  56.92793
##
## Beta
##                      estimate se           lcl           ucl
## pi:(Intercept)  5.975392e-04  0  5.975392e-04  5.975392e-04
## p:(Intercept)  -5.761064e+00  0 -5.761064e+00 -5.761064e+00
## p:time2         2.222711e+00  0  2.222711e+00  2.222711e+00
## p:time3         1.807606e+00  0  1.807606e+00  1.807606e+00
## p:time4         1.807605e+00  0  1.807605e+00  1.807605e+00
## p:time5         1.964959e+00  0  1.964959e+00  1.964959e+00
## p:time6         1.622091e+00  0  1.622091e+00  1.622091e+00
## p:time7        -2.277369e-05  0 -2.277369e-05 -2.277369e-05
## p:time8         1.104910e+00  0  1.104910e+00  1.104910e+00
## p:time9         1.622092e+00  0  1.622092e+00  1.622092e+00
## p:time10       -2.208989e-05  0 -2.208989e-05 -2.208989e-05
## p:time11        1.104909e+00  0  1.104909e+00  1.104909e+00
## p:time12       -2.819857e-05  0 -2.819857e-05 -2.819857e-05
## p:time13        6.962833e-01  0  6.962833e-01  6.962833e-01
## p:time14       -6.183560e-06  0 -6.183560e-06 -6.183560e-06
## p:time15        6.962793e-01  0  6.962793e-01  6.962793e-01
## p:time16        1.104910e+00  0  1.104910e+00  1.104910e+00
## p:time17        6.962851e-01  0  6.962851e-01  6.962851e-01
## p:time18       -2.601980e-05  0 -2.601980e-05 -2.601980e-05
## p:time19        6.962810e-01  0  6.962810e-01  6.962810e-01
## f0:(Intercept)  5.570981e+00  0  5.570981e+00  5.570981e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5001494
##
##
## Real Parameter p
##
##                    1         2        3        4         5         6         7
## mixture:1 0.0031379 0.0282405 0.018827 0.018827 0.0219648 0.0156891 0.0031378
## mixture:2 0.0031379 0.0282405 0.018827 0.018827 0.0219648 0.0156891 0.0031378
##                    8         9        10        11        12        13        14
## mixture:1 0.0094135 0.0156892 0.0031378 0.0094135 0.0031378 0.0062757 0.0031379
## mixture:2 0.0094135 0.0156892 0.0031378 0.0094135 0.0031378 0.0062757 0.0031379
##                   15        16        17        18        19
## mixture:1 0.0062756 0.0094135 0.0062757 0.0031378 0.0062756
## mixture:2 0.0062756 0.0094135 0.0062757 0.0031378 0.0062756
##
##
```

```
## Real Parameter c
##
##                   2        3        4         5         6         7         8
## mixture:1 0.0282405 0.018827 0.018827 0.0219648 0.0156891 0.0031378 0.0094135
## mixture:2 0.0282405 0.018827 0.018827 0.0219648 0.0156891 0.0031378 0.0094135
##                   9        10        11        12        13        14        15
## mixture:1 0.0156892 0.0031378 0.0094135 0.0031378 0.0062757 0.0031379 0.0062756
## mixture:2 0.0156892 0.0031378 0.0094135 0.0031378 0.0062757 0.0031379 0.0062756
##                  16        17        18        19
## mixture:1 0.0094135 0.0062757 0.0031378 0.0062756
## mixture:2 0.0094135 0.0062757 0.0031378 0.0062756
##
##
## Real Parameter f0
##
##         1
##  262.6917
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  22  (unadjusted=18)
## -2lnL:  12.36969
## AICc :  57.34183  (unadjusted=49.024231)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept) -2.448161e-04    0.0000000 -2.448161e-04 -2.448161e-04
## p:(Intercept)  -4.007391e+00    1.0090728 -5.985174e+00 -2.029608e+00
## p:time2         2.375981e+00    1.0728827  2.731313e-01  4.478832e+00
## p:time3         2.110275e+00    1.0999517 -4.563010e-02  4.266180e+00
## p:time4         2.272787e+00    1.1019559  1.129530e-01  4.432620e+00
## p:time5         2.249540e+00    1.1192449  5.581980e-02  4.443260e+00
## p:time6         2.438769e+00    1.1224506  2.387663e-01  4.638773e+00
## p:time7         8.718915e-01    1.4358650 -1.942404e+00  3.686187e+00
## p:time8         2.110273e+00    1.1838751 -2.101221e-01  4.430668e+00
## p:time9         2.272787e+00    1.1875963 -5.490180e-02  4.600476e+00
## p:time10       -1.741157e+01 4956.3401000 -9.731838e+03  9.697015e+03
## p:time11        2.466944e+00    1.1928915  1.288762e-01  4.805011e+00
## p:time12        1.442452e+00    1.4474590 -1.394568e+00  4.279472e+00
## p:time13        2.302633e+00    1.2685185 -1.836629e-01  4.788930e+00
## p:time14        1.704795e+00    1.4554168 -1.147822e+00  4.557412e+00
## p:time15        2.621094e+00    1.2818847  1.085995e-01  5.133588e+00
## p:time16        3.496570e+00    1.2456162  1.055162e+00  5.937977e+00
## p:time17        3.601930e+00    1.3607203  9.349184e-01  6.268942e+00
## p:time18        3.314284e+00    1.5868858  2.039881e-01  6.424581e+00
## p:time19        2.185164e+01 4945.5709000 -9.671468e+03  9.715171e+03
## c:(Intercept)  -4.839442e+00    0.4489769 -5.719436e+00 -3.959447e+00
## f0:(Intercept) -1.851003e+01 2550.0451000 -5.016599e+03  4.979578e+03
##
##
## Real Parameter pi
##
##
```

```
## mixture:1 0.4999388
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0178561 0.1636373 0.1304353 0.1499996 0.1470597 0.172413 0.0416665
## mixture:2 0.0178561 0.1636373 0.1304353 0.1499996 0.1470597 0.172413 0.0416665
##                   8         9           10        11        12        13
## mixture:1 0.130435 0.1499996 4.987256e-10 0.1764702 0.0714293 0.1538449
## mixture:2 0.130435 0.1499996 4.987256e-10 0.1764702 0.0714293 0.1538449
##                  14        15       16       17        18 19
## mixture:1 0.0909082 0.1999995 0.375001 0.400001 0.3333423  1
## mixture:2 0.0909082 0.1999995 0.375001 0.400001 0.3333423  1
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494
## mixture:2 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494
##                   9        10        11        12        13        14        15
## mixture:1 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494
## mixture:2 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494
##                  16        17        18        19
## mixture:1 0.0078494 0.0078494 0.0078494 0.0078494
## mixture:2 0.0078494 0.0078494 0.0078494 0.0078494
##
##
## Real Parameter f0
##
##             1
##  9.145243e-09
```

Examine model-selection table

```
cistude.results
```

```
##                                 model npar     AICc DeltaAICc weight Deviance
## 1               pi(~1)p(~1)c()f0(~1)    3 53.01850        NA     NA 67.14458
## 2             pi(~1)p(~1)c(~1)f0(~1)    4 45.04211        NA     NA 57.15306
## 3          pi(~1)p(~mixture)c()f0(~1)    4 55.03363        NA     NA 67.14458
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5       NA        NA     NA  2.00000
## 5   pi(~1)p(~time + mixture)c()f0(~1)   22 61.09470        NA     NA 36.27128
## 6 pi(~1)p(~time + mixture)c(~1)f0(~1)   23 59.43122        NA     NA 32.51841
## 7            pi(~1)p(~time)c()f0(~1)   21 59.00931        NA     NA 36.27128
## 8          pi(~1)p(~time)c(~1)f0(~1)   22 57.34183        NA     NA 32.51841
```

examine model names and find the name of the top model

```
names(cistude.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"
```

examine the output from top-ranked model (#5)

```
cistude.results$p.dot$results$real
```

```
##                 estimate se         lcl         ucl fixed note
## pi g1 m1       0.5001120  0   0.5001120   0.5001120
## p g1 t1 m1     0.0097846  0   0.0097846   0.0097846
## f0 g1 a0 t1 272.1187500  0 272.1187500 272.1187500
```

```
cistude.results$p.dot$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 328.1187 328.1187 328.1187
```

Idem avec 2007.

```
cistude <- data.frame(ch = collapseCH(histories2007), freq = rep(1, nrow(histories2007)))
head(cistude)
```

```
##                         ch freq
## 1 10000000000000000000000    1
## 2 01111000000000000000000    1
## 3 00000100000000000000000    1
## 4 00000010000000000000000    1
## 5 00000001000000000000000    1
## 6 00000100000000000000000    1
```

```
tail(cistude)
```

```
##                          ch freq
## 64 000000001000000000000000    1
## 65 000000000100000000000000    1
## 66 000000000011000000000000    1
## 67 100000000000000000000000    1
## 68 100000000000000000000000    1
## 69 100000000000000000000100    1
```

On fait les tests de fermeture.

```
cistude_secr <- unRMarkInput(cistude) # on convertit au bon format
summary(cistude_secr) # resumes
```

```
## Object class       capthist
##
## Counts by occasion
##             1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22
```

```
## n           7  3  1  4  5  6  4  8  3  3  3  3  1  6  2  7  4  1  3  2  1  2
## u           7  3  0  3  4  6  4  8  3  2  2  2  1  5  2  6  3  1  3  1  1  2
## f          61  7  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
## M(t+1)      7 10 10 13 17 23 27 35 38 40 42 44 45 50 52 58 61 62 65 66 67 69
## losses      0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
## detections  7  3  1  4  5  6  4  8  3  3  3  3  1  6  2  7  4  1  3  2  1  2
##            Total
## n             79
## u             69
## f             69
## M(t+1)        69
## losses         0
## detections    79
```

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

```
## $Otis
##  statistic          p
##  -2.169297 0.01503008
##
## $Xc
##  statistic df         p
##   25.54082 20 0.1815182
##
## $NRvsJS
##  statistic df p
##          0  0 1
##
## $NMvsJS
##  statistic df p
##          0  0 1
##
## $MtvsNR
##  statistic df         p
##   25.54082 20 0.1815182
##
## $MtvsNM
##  statistic df         p
##   25.54082 20 0.1815182
##
## $compNRvsJS
##    Occasion Chisquare df  p
## 1         2        NA NA NA
## 2         3        NA NA NA
## 3         4        NA NA NA
## 4         5        NA NA NA
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
```

```
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        NA NA NA
## 16       17        NA NA NA
## 17       18        NA NA NA
## 18       19        NA NA NA
## 19       20        NA NA NA
## 20       21        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
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        NA NA NA
## 16       17        NA NA NA
## 17       18        NA NA NA
## 18       19        NA NA NA
## 19       20        NA NA NA
## 20       21        NA NA NA
```

Process data

```
cistude.proc <- process.data(cistude, begin.time = 1, model = "FullHet")
```

Create default design data

```
cistude.ddl <- make.design.data(cistude.proc)
```

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

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

  cistude.model.list <- create.model.list("FullHet")
```

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

  return(cistude.results)
}
```

Run the models and examine the output

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=2)
## -2lnL:  85.99303
## AICc :  92.00888  (unadjusted=90.000953)
##
## Beta
##                     estimate        se           lcl           ucl
## pi:(Intercept)  5.076115e-05 0.0000000  5.076115e-05  5.076115e-05
## p:(Intercept)  -4.304988e+00 0.0000000 -4.304988e+00 -4.304988e+00
## f0:(Intercept)  5.301131e+00 0.1398699  5.026986e+00  5.575276e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000127
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
## mixture:2 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
##                    8         9        10        11        12        13        14
## mixture:1 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
## mixture:2 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
##                   15        16        17        18        19        20        21
## mixture:1 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
## mixture:2 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
##                   22
## mixture:1 0.0133212
## mixture:2 0.0133212
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
## mixture:2 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
```

```
##                   9        10        11        12        13        14        15
## mixture:1 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
## mixture:2 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
##                  16        17        18        19        20        21        22
## mixture:1 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
## mixture:2 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
##
##
## Real Parameter f0
##
##         1
##  200.5634
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  83.46629
## AICc :  91.49273  (unadjusted=89.48214)
##
## Beta
##                       estimate           se          lcl         ucl
## pi:(Intercept) -0.0005220291 1774.5460000 -3478.110800 3478.109800
## p:(Intercept)  -3.1173557000    0.4578073    -4.014658   -2.220053
## c:(Intercept)  -4.4091554000    0.3181455    -5.032721   -3.785590
## f0:(Intercept)  3.7564039000    0.7299594     2.325683    5.187124
##
##
## Real Parameter pi
##
##
## mixture:1 0.4998695
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397
## mixture:2 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397
##                   8         9        10        11        12        13        14
## mixture:1 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397
## mixture:2 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397
##                  15        16        17        18        19        20        21
## mixture:1 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397
## mixture:2 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397
##                  22
## mixture:1 0.042397
## mixture:2 0.042397
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
```

```
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##                   9        10        11        12        13        14        15
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##                  16        17        18        19        20        21        22
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##
##
## Real Parameter f0
##
##         1
##  42.79426
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4
## -2lnL:  83.21729
## AICc :  91.24373
##
## Beta
##                  estimate        se       lcl        ucl
## pi:(Intercept) -5.259827 1.6096071 -8.414657 -2.1049973
## p:(Intercept)  -1.956464 1.0035332 -3.923389  0.0104612
## p:mixture2     -2.720607 0.9669133 -4.615757 -0.8254565
## f0:(Intercept)  5.693511 0.4901408  4.732835  6.6541867
##
##
## Real Parameter pi
##
##
## mixture:1 0.0051693
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
##                   8         9        10        11        12        13        14
## mixture:1 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
##                  15        16        17        18        19        20        21
## mixture:1 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
##                  22
## mixture:1 0.1238502
## mixture:2 0.0092204
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
```

```
## mixture:1 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
##                   9        10        11        12        13        14        15
## mixture:1 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
##                  16        17        18        19        20        21        22
## mixture:1 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502 0.1238502
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
##
##
## Real Parameter f0
##
##         1
##  296.9342
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=4)
## -2lnL:  82.24349
## AICc :  92.28317  (unadjusted=90.269924)
##
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept)  -3.795360 0.9936868  -5.742986  -1.847733
## p:(Intercept)   14.842994 0.0000000  14.842994  14.842994
## p:mixture2     -18.215131 0.0000000 -18.215131 -18.215131
## c:(Intercept)   -4.409112 0.3181388  -5.032665  -3.785560
## f0:(Intercept)   4.087740 0.9025792   2.318685   5.856795
##
##
## Real Parameter pi
##
##
## mixture:1 0.0219808
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.9999996 0.9999996 0.9999996 0.9999996 0.9999996 0.9999996 0.9999996
## mixture:2 0.0331777 0.0331777 0.0331777 0.0331777 0.0331777 0.0331777 0.0331777
##                   8         9        10        11        12        13        14
## mixture:1 0.9999996 0.9999996 0.9999996 0.9999996 0.9999996 0.9999996 0.9999996
## mixture:2 0.0331777 0.0331777 0.0331777 0.0331777 0.0331777 0.0331777 0.0331777
##                  15        16        17        18        19        20        21
## mixture:1 0.9999996 0.9999996 0.9999996 0.9999996 0.9999996 0.9999996 0.9999996
## mixture:2 0.0331777 0.0331777 0.0331777 0.0331777 0.0331777 0.0331777 0.0331777
##                  22
## mixture:1 0.9999996
## mixture:2 0.0331777
##
##
## Real Parameter c
```

```
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197
## mixture:2 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197
##                    9        10        11        12        13        14        15
## mixture:1 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197
## mixture:2 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197
##                   16        17        18        19        20        21        22
## mixture:1 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197
## mixture:2 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197 0.0120197
##
##
## Real Parameter f0
##
##         1
##  59.60503
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  25
## -2lnL:  56.76562
## AICc :  107.6369
##
## Beta
##                       estimate        se        lcl        ucl
## pi:(Intercept) -5.283653e+00 1.5634213 -8.3479590 -2.2193476
## p:(Intercept)  -1.205610e+00 1.0757032 -3.3139886  0.9027682
## p:time2        -8.664608e-01 0.6970417 -2.2326625  0.4997410
## p:time3        -1.975414e+00 1.0737550 -4.0799740  0.1291459
## p:time4        -5.738162e-01 0.6343304 -1.8171038  0.6694715
## p:time5        -3.458309e-01 0.5934950 -1.5090812  0.8174194
## p:time6        -1.587821e-01 0.5646106 -1.2654188  0.9478547
## p:time7        -5.738163e-01 0.6343295 -1.8171022  0.6694696
## p:time8         1.380638e-01 0.5262440 -0.8933744  1.1695020
## p:time9        -8.664603e-01 0.6970410 -2.2326607  0.4997400
## p:time10       -8.664621e-01 0.6970433 -2.2326670  0.4997428
## p:time11       -8.664620e-01 0.6970416 -2.2326636  0.4997395
## p:time12       -8.664603e-01 0.6970420 -2.2326627  0.4997421
## p:time13       -1.975411e+00 1.0737529 -4.0799667  0.1291446
## p:time14       -1.587805e-01 0.5646103 -1.2654167  0.9478556
## p:time15       -1.277023e+00 0.8079135 -2.8605333  0.3064878
## p:time16       -1.311420e-06 0.5430241 -1.0643285  1.0643258
## p:time17       -5.738155e-01 0.6343294 -1.8171011  0.6694702
## p:time18       -1.975408e+00 1.0737502 -4.0799581  0.1291430
## p:time19       -8.664596e-01 0.6970421 -2.2326621  0.4997429
## p:time20       -1.277022e+00 0.8079133 -2.8605317  0.3064887
## p:time21       -1.975415e+00 1.0737536 -4.0799717  0.1291427
## p:time22       -1.277022e+00 0.8079127 -2.8605309  0.3064869
## p:mixture2     -2.772613e+00 0.9754447 -4.6844842 -0.8607409
## f0:(Intercept)  5.673248e+00 0.4870532  4.7186238  6.6278724
##
##
## Real Parameter pi
```

```
##
##
## mixture:1 0.0050482
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.2304787 0.1118412 0.0398861 0.1443740 0.1748782 0.2035274 0.1443740
## mixture:2 0.0183749 0.0078087 0.0025897 0.0104356 0.0130729 0.0157196 0.0104356
##                   8         9        10        11        12        13        14
## mixture:1 0.2558700 0.1118412 0.1118410 0.1118410 0.1118412 0.0398862 0.2035276
## mixture:2 0.0210381 0.0078087 0.0078086 0.0078086 0.0078087 0.0025897 0.0157196
##                  15        16        17        18        19        20        21
## mixture:1 0.0770847 0.2304785 0.1443741 0.0398863 0.1118413 0.0770848 0.0398861
## mixture:2 0.0051930 0.0183749 0.0104356 0.0025897 0.0078087 0.0051930 0.0025897
##                  22
## mixture:1 0.0770847
## mixture:2 0.0051930
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.1118412 0.0398861 0.1443740 0.1748782 0.2035274 0.1443740 0.2558700
## mixture:2 0.0078087 0.0025897 0.0104356 0.0130729 0.0157196 0.0104356 0.0210381
##                   9        10        11        12        13        14        15
## mixture:1 0.1118412 0.1118410 0.1118410 0.1118412 0.0398862 0.2035276 0.0770847
## mixture:2 0.0078087 0.0078086 0.0078086 0.0078087 0.0025897 0.0157196 0.0051930
##                  16        17        18        19        20        21        22
## mixture:1 0.2304785 0.1443741 0.0398863 0.1118413 0.0770848 0.0398861 0.0770847
## mixture:2 0.0183749 0.0104356 0.0025897 0.0078087 0.0051930 0.0025897 0.0051930
##
##
## Real Parameter f0
##
##         1
##  290.9781
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c(~1)f0(~1)
##
## Npar :  26  (unadjusted=21)
## -2lnL:  51.61744
## AICc :  104.5591  (unadjusted=94.235084)
##
## Beta
##                    estimate           se          lcl         ucl
## pi:(Intercept)  -5.3086078  512.1251700 -1009.074000  998.456750
## p:(Intercept)    6.9588787    0.0000000     6.958879    6.958879
## p:time2         -0.7481173   25.9226290   -51.556471   50.060237
## p:time3        -16.1069000 1292.8035000 -2550.001700 2517.787900
## p:time4         -0.6958554   25.9789010   -51.614503   50.222792
## p:time5         -0.3340528   25.9774600   -51.249875   50.581770
```

```
## p:time6          0.1940384   25.9758940   -50.718715   51.106792
## p:time7         -0.1204635   25.9775640   -51.036491   50.795564
## p:time8          0.7840084   25.9752270   -50.127438   51.695455
## p:time9         -0.1044729   25.9793660   -51.024031   50.815085
## p:time10        -0.4432353   25.9825950   -51.369122   50.482651
## p:time11        -0.3717494   25.9826150   -51.297675   50.554176
## p:time12        -0.2947884   25.9827510   -51.220982   50.631405
## p:time13        -0.9471322   25.9922970   -51.892035   49.997771
## p:time14         0.8959183   25.9771120   -50.019222   51.811059
## p:time15         0.0908716   25.9830380   -50.835884   51.017627
## p:time16         1.6247749   25.9772000   -49.290538   52.540088
## p:time17         1.2501091   25.9810900   -49.672828   52.173046
## p:time18         0.2850178   25.9945130   -50.664229   51.234265
## p:time19         1.9432472   25.9834910   -48.984397   52.870892
## p:time20         1.1323055   25.9979520   -49.823681   52.088292
## p:time21         1.5377593   26.0011190   -49.424436   52.499954
## p:time22        25.2252530    0.0000000    25.225253   25.225253
## p:mixture2      -9.1897934    0.0000000    -9.189793   -9.189793
## c:(Intercept)   -4.4091469    0.3181442    -5.032710   -3.785584
## f0:(Intercept) -26.3961930    0.0000000   -26.396193  -26.396193
##
##
## Real Parameter pi
##
##
## mixture:1 0.0049244
##
##
## Real Parameter p
##
##                    1         2            3         4         5         6
## mixture:1 0.9990507 0.9979963 1.064189e-04 0.9980981 0.9986747 0.9992180
## mixture:2 0.0970085 0.0483822 1.086396e-08 0.0508460 0.0714274 0.1153852
##                    7         8         9        10        11        12        13
## mixture:1 0.9989293 0.9995664 0.9989463 0.9985221 0.9986239 0.9987257 0.9975562
## mixture:2 0.0869563 0.1904781 0.0882343 0.0645160 0.0689672 0.0740758 0.0400003
##                   14        15        16        17        18        19        20
## mixture:1 0.9996123 0.9991331 0.9998129 0.9997279 0.9992860 0.9998639 0.9996939
## mixture:2 0.2083341 0.1052653 0.3529402 0.2727319 0.1250014 0.4285750 0.2500006
##                   21 22
## mixture:1 0.9997959  1
## mixture:2 0.3333315  1
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193
## mixture:2 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193
##                    9        10        11        12        13        14        15
## mixture:1 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193
## mixture:2 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193
##                   16        17        18        19        20        21        22
## mixture:1 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193
```

```
## mixture:2 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193 0.0120193
##
##
## Real Parameter f0
##
##             1
##  3.437787e-12
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  24  (unadjusted=23)
## -2lnL:  59.63505
## AICc :  108.4388  (unadjusted=106.374)
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept) -3.719527e-04 0.0000000 -0.0003719527 -0.0003719527
## p:(Intercept)  -3.609595e+00 0.4422555 -4.4764154000 -2.7427737000
## p:time2        -8.626393e-01 0.6691130 -2.1741008000  0.4488222000
## p:time3        -1.968838e+00 1.0194150 -3.9668918000  0.0292151000
## p:time4        -5.711435e-01 0.6036442 -1.7542863000  0.6119992000
## p:time5        -3.441717e-01 0.5607105 -1.4431644000  0.7548210000
## p:time6        -1.580052e-01 0.5301646 -1.1971279000  0.8811175000
## p:time7        -5.711444e-01 0.6036444 -1.7542874000  0.6119987000
## p:time8         1.374091e-01 0.4893277 -0.8216731000  1.0964913000
## p:time9        -8.626408e-01 0.6691124 -2.1741012000  0.4488195000
## p:time10       -8.626402e-01 0.6691124 -2.1741004000  0.4488201000
## p:time11       -8.626403e-01 0.5122449 -1.8666403000  0.1413598000
## p:time12       -8.626399e-01 0.6691122 -2.1740999000  0.4488201000
## p:time13       -1.968837e+00 1.0556355 -4.0378827000  0.1002084000
## p:time14       -1.580054e-01 0.5301647 -1.1971283000  0.8811176000
## p:time15       -1.271903e+00 0.7838191 -2.8081887000  0.2643823000
## p:time16        4.138417e-06 0.5072296 -0.9941659000  0.9941742000
## p:time17       -5.711435e-01 0.4544525 -1.4618704000  0.3195834000
## p:time18       -1.968840e+00 1.0556372 -4.0378890000  0.1002089000
## p:time19       -8.626390e-01 0.6691125 -2.1740996000  0.4488215000
## p:time20       -1.271906e+00 0.7838191 -2.8081911000  0.2643799000
## p:time21       -1.968838e+00 1.0556372 -4.0378868000  0.1002110000
## p:time22       -1.271905e+00 0.7838187 -2.8081897000  0.2643797000
## f0:(Intercept)  5.281459e+00 0.3844236  4.5279887000  6.0349290000
##
##
## Real Parameter pi
##
##
## mixture:1 0.499907
##
##
## Real Parameter p
##
##                    1         2         3        4         5         6        7
## mixture:1 0.0263497 0.0112928 0.0037643 0.015057 0.0188213 0.0225856 0.015057
## mixture:2 0.0263497 0.0112928 0.0037643 0.015057 0.0188213 0.0225856 0.015057
```

```
##                    8         9        10        11        12        13        14
## mixture:1 0.0301141 0.0112928 0.0112928 0.0112928 0.0112928 0.0037643 0.0225856
## mixture:2 0.0301141 0.0112928 0.0112928 0.0112928 0.0112928 0.0037643 0.0225856
##                   15        16       17        18        19        20        21
## mixture:1 0.0075285 0.0263498 0.015057 0.0037643 0.0112928 0.0075285 0.0037643
## mixture:2 0.0075285 0.0263498 0.015057 0.0037643 0.0112928 0.0075285 0.0037643
##                   22
## mixture:1 0.0075285
## mixture:2 0.0075285
##
##
## Real Parameter c
##
##                    2         3        4         5         6        7         8
## mixture:1 0.0112928 0.0037643 0.015057 0.0188213 0.0225856 0.015057 0.0301141
## mixture:2 0.0112928 0.0037643 0.015057 0.0188213 0.0225856 0.015057 0.0301141
##                    9        10        11        12        13        14        15
## mixture:1 0.0112928 0.0112928 0.0112928 0.0112928 0.0037643 0.0225856 0.0075285
## mixture:2 0.0112928 0.0112928 0.0112928 0.0112928 0.0037643 0.0225856 0.0075285
##                   16       17        18        19        20        21        22
## mixture:1 0.0263498 0.015057 0.0037643 0.0112928 0.0075285 0.0037643 0.0075285
## mixture:2 0.0263498 0.015057 0.0037643 0.0112928 0.0075285 0.0037643 0.0075285
##
##
## Real Parameter f0
##
##         1
##  196.6566
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  25  (unadjusted=21)
## -2lnL:  51.61744
## AICc :  102.4887  (unadjusted=94.235083)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept)   0.000292408    0.0000000  2.924080e-04  2.924080e-04
## p:(Intercept)   -2.181224600    0.3987248 -2.962725e+00 -1.399724e+00
## p:time2         -0.797700900    0.7136276 -2.196411e+00  6.010092e-01
## p:time3        -19.164157000 8204.7248000 -1.610042e+04  1.606210e+04
## p:time4         -0.745514400    0.7142622 -2.145468e+00  6.544396e-01
## p:time5         -0.383724900    0.6543792 -1.666308e+00  8.988584e-01
## p:time6          0.144342300    0.5893951 -1.010872e+00  1.299557e+00
## p:time7         -0.170150500    0.6578685 -1.459573e+00  1.119272e+00
## p:time8          0.734305700    0.5598154 -3.629326e-01  1.831544e+00
## p:time9         -0.154150300    0.7242748 -1.573729e+00  1.265428e+00
## p:time10        -0.492923400    0.8327406 -2.125095e+00  1.139248e+00
## p:time11        -0.421465800    0.8342758 -2.056646e+00  1.213715e+00
## p:time12        -0.344504400    0.8360520 -1.983166e+00  1.294158e+00
## p:time13        -0.996826400    1.0957401 -3.144477e+00  1.150824e+00
## p:time14         0.846223900    0.6415709 -4.112551e-01  2.103703e+00
## p:time15         0.041159000    0.8472225 -1.619397e+00  1.701715e+00
```

```
## p:time16         1.575088700    0.6454111  3.100829e-01  2.840094e+00
## p:time17         1.200396300    0.7856926 -3.395612e-01  2.740354e+00
## p:time18         0.235314700    1.1409717 -2.000990e+00  2.471619e+00
## p:time19         1.893542800    0.8615771  2.048516e-01  3.582234e+00
## p:time20         1.082612300    1.2216010 -1.311726e+00  3.476950e+00
## p:time21         1.488077400    1.2880139 -1.036430e+00  4.012585e+00
## p:time22        24.936653000    0.0000000  2.493665e+01  2.493665e+01
## c:(Intercept)   -4.409155500    0.3181455 -5.032721e+00 -3.785590e+00
## f0:(Intercept) -21.772494000   51.2008170 -1.221261e+02  7.858111e+01
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000731
##
##
## Real Parameter p
##
##                    1         2            3         4         5         6
## mixture:1 0.1014492 0.0483871 5.368076e-10 0.0508475 0.0714286 0.1153846
## mixture:2 0.1014492 0.0483871 5.368076e-10 0.0508475 0.0714286 0.1153846
##                    7         8         9        10        11       12        13
## mixture:1 0.0869565 0.1904762 0.0882353 0.0645162 0.0689655 0.074074 0.0400001
## mixture:2 0.0869565 0.1904762 0.0882353 0.0645162 0.0689655 0.074074 0.0400001
##                   14        15        16        17    18        19   20
## mixture:1 0.2083334 0.1052632 0.3529411 0.2727275 0.125 0.4285715 0.25
## mixture:2 0.2083334 0.1052632 0.3529411 0.2727275 0.125 0.4285715 0.25
##                   21 22
## mixture:1 0.3333333  1
## mixture:2 0.3333333  1
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##                    9        10        11        12        13        14        15
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##                   16        17        18        19        20        21        22
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##
##
## Real Parameter f0
##
##             1
##  3.502081e-10
```

Examine model-selection table

```
cistude.results
```

```
##                                 model npar      AICc  DeltaAICc       weight
## 3          pi(~1)p(~mixture)c()f0(~1)    4  91.24373  0.0000000 3.159467e-01
## 2              pi(~1)p(~1)c(~1)f0(~1)    4  91.49273  0.2489940 2.789623e-01
## 1                pi(~1)p(~1)c()f0(~1)    3  92.00888  0.7651525 2.155079e-01
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5  92.28317  1.0394370 1.878897e-01
## 8           pi(~1)p(~time)c(~1)f0(~1)   25 102.48875 11.2450181 1.142324e-03
## 6 pi(~1)p(~time + mixture)c(~1)f0(~1)   26 104.55909 13.3153554 4.057151e-04
## 5   pi(~1)p(~time + mixture)c()f0(~1)   25 107.63693 16.3932001 8.707143e-05
## 7             pi(~1)p(~time)c()f0(~1)   24 108.43880 17.1950653 5.831132e-05
##    Deviance
## 3 112.66139
## 2 112.91038
## 1 115.43712
## 4 111.68758
## 8  81.06153
## 6  81.06153
## 5  86.20971
## 7  89.07914
```

examine model names and find the name of the top model

```
names(cistude.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"
```

examine the output from top-ranked model (#5)

```
cistude.results$p.dot$results$real
```

```
##                estimate       se         lcl         ucl fixed note
## pi g1 m1      0.5000127  0.00000   0.5000127   0.5000127
## p g1 t1 m1    0.0133212  0.00000   0.0133212   0.0133212
## f0 g1 a0 t1 200.5634200 28.05278 152.6751400 263.4724200
```

```
cistude.results$p.dot$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 269.5634 221.6751 332.4724
```

Partie 5 : monarques

On passe à l'analyse des données monarques.

Les données.

```
dat <- readxl::read_xlsx("dat/CMR-Monarque-2019.xlsx") %>%
  janitor::clean_names() %>%
  select(session, identifiant) %>%
  filter(identifiant != 0) %>%
  add_column(det = 1) %>%
  arrange(identifiant)
dat
```

```
## # A tibble: 327 x 3
##    session   identifiant   det
##    <chr>           <dbl> <dbl>
##  1 Session 1           1     1
##  2 Session 1           2     1
##  3 Session 1           3     1
##  4 Session 2           3     1
##  5 Session 1           4     1
##  6 Session 2           4     1
##  7 Session 1           5     1
##  8 Session 1           6     1
##  9 Session 4           6     1
## 10 Session 1           7     1
## # ... with 317 more rows
```

On construit les histoire de capture.

```
histoires <- dat %>%
  group_by(identifiant) %>%
  mutate(id2 = row_number()) %>%
  pivot_wider(values_from = det,
              names_from = session) %>% # les jours en colonnes
  select(-id2) %>%
  group_by(identifiant) %>%
  summarise(across(everything(), sum, na.rm = TRUE)) %>% # on rassemble les evenements pour chaque ind
  select(-identifiant)
histoires[is.na(histoires)] <- 0 # les Na sont des non-détections = 0
histoires[histoires > 1] <- 1 # les observations mens multiples = 1
(histoires <- as.matrix(histoires))
```

```
##        Session 1 Session 2 Session 4 Session 3 Session 5 Session 6 Session 8
##   [1,]         1         0         0         0         0         0         0
##   [2,]         1         0         0         0         0         0         0
##   [3,]         1         1         0         0         0         0         0
##   [4,]         1         1         0         0         0         0         0
##   [5,]         1         0         0         0         0         0         0
##   [6,]         1         0         1         0         0         0         0
##   [7,]         1         0         0         0         0         0         0
##   [8,]         1         1         1         1         0         0         0
##   [9,]         1         0         0         0         0         0         0
##  [10,]         1         0         0         0         0         0         0
##  [11,]         1         0         0         0         0         0         0
##  [12,]         1         0         0         0         0         0         0
##  [13,]         1         0         0         0         0         0         0
##  [14,]         1         0         0         0         0         0         0
```

```
##  [15,]         1         0         0         0         0         0         0
##  [16,]         1         0         0         0         0         0         0
##  [17,]         0         1         0         0         0         0         0
##  [18,]         0         1         0         1         0         0         0
##  [19,]         0         1         0         0         0         0         0
##  [20,]         0         1         0         1         0         0         0
##  [21,]         0         1         0         0         0         0         0
##  [22,]         0         1         1         1         0         0         0
##  [23,]         0         1         1         0         0         0         0
##  [24,]         0         1         0         0         0         0         0
##  [25,]         0         1         1         0         1         1         0
##  [26,]         0         1         0         0         0         0         0
##  [27,]         0         1         0         0         0         0         1
##  [28,]         0         1         0         1         0         0         0
##  [29,]         0         1         0         0         0         0         0
##  [30,]         0         1         0         0         0         0         0
##  [31,]         0         1         0         0         0         0         0
##  [32,]         0         1         0         0         0         0         0
##  [33,]         0         1         0         0         0         0         0
##  [34,]         0         1         0         1         0         0         0
##  [35,]         0         1         0         0         0         0         0
##  [36,]         0         1         0         0         0         0         0
##  [37,]         0         1         0         0         0         0         0
##  [38,]         0         1         0         0         0         0         0
##  [39,]         0         1         0         1         0         0         0
##  [40,]         0         1         0         0         0         0         0
##  [41,]         0         1         0         0         0         0         0
##  [42,]         0         0         0         1         0         0         0
##  [43,]         0         0         0         1         0         0         0
##  [44,]         0         0         0         1         0         0         0
##  [45,]         0         0         0         1         0         0         0
##  [46,]         0         0         0         1         0         0         0
##  [47,]         0         0         0         1         0         0         0
##  [48,]         0         0         0         1         0         0         0
##  [49,]         0         0         0         1         0         0         0
##  [50,]         0         0         0         1         1         0         0
##  [51,]         0         0         0         1         0         0         0
##  [52,]         0         0         1         1         0         0         0
##  [53,]         0         0         0         1         0         0         0
##  [54,]         0         0         0         1         0         0         0
##  [55,]         0         0         0         1         0         0         0
##  [56,]         0         0         0         1         0         0         0
##  [57,]         0         0         0         1         0         0         0
##  [58,]         0         0         0         1         0         0         0
##  [59,]         0         0         0         1         0         0         0
##  [60,]         0         0         0         1         0         0         0
##  [61,]         0         0         1         1         0         1         0
##  [62,]         0         0         0         1         0         0         0
##  [63,]         0         0         0         1         0         0         0
##  [64,]         0         0         0         1         0         0         0
##  [65,]         0         0         0         1         0         0         0
##  [66,]         0         0         0         1         1         0         0
##  [67,]         0         0         1         1         0         0         0
##  [68,]         0         0         0         1         0         0         0
```

```
##  [69,]         0         0         0         1         0         0         0
##  [70,]         0         0         0         1         0         0         0
##  [71,]         0         0         0         1         1         0         0
##  [72,]         0         0         1         0         0         0         0
##  [73,]         0         0         1         0         0         0         0
##  [74,]         0         0         1         0         0         0         0
##  [75,]         0         0         1         0         0         0         0
##  [76,]         0         0         1         0         0         0         0
##  [77,]         0         0         1         0         0         0         0
##  [78,]         0         0         1         0         0         1         0
##  [79,]         0         0         1         0         0         0         0
##  [80,]         0         0         1         0         0         0         0
##  [81,]         0         0         1         0         0         1         0
##  [82,]         0         0         1         0         0         0         0
##  [83,]         0         0         1         0         0         0         0
##  [84,]         0         0         1         0         0         0         0
##  [85,]         0         0         1         0         0         0         0
##  [86,]         0         0         1         0         0         0         0
##  [87,]         0         0         1         0         0         0         0
##  [88,]         0         0         1         0         1         0         0
##  [89,]         0         0         1         0         0         0         0
##  [90,]         0         0         1         0         0         0         0
##  [91,]         0         0         1         0         0         0         0
##  [92,]         0         0         1         0         0         0         0
##  [93,]         0         0         1         0         0         0         0
##  [94,]         0         0         1         0         1         0         0
##  [95,]         0         0         1         0         0         0         0
##  [96,]         0         0         1         0         0         0         0
##  [97,]         0         0         1         0         0         0         0
##  [98,]         0         0         1         0         0         0         0
##  [99,]         0         0         1         0         1         0         0
## [100,]         0         0         1         0         0         0         0
## [101,]         0         0         1         0         0         0         0
## [102,]         0         0         1         0         0         0         0
## [103,]         0         0         1         0         0         0         0
## [104,]         0         0         1         0         1         0         0
## [105,]         0         0         1         0         1         0         0
## [106,]         0         0         1         0         0         0         0
## [107,]         0         0         1         0         0         0         0
## [108,]         0         0         1         0         1         0         0
## [109,]         0         0         1         0         0         0         0
## [110,]         0         0         1         0         0         0         0
## [111,]         0         0         1         0         0         0         0
## [112,]         0         0         1         0         0         0         0
## [113,]         0         0         1         0         0         0         0
## [114,]         0         0         1         0         0         0         0
## [115,]         0         0         1         0         0         0         0
## [116,]         0         0         1         0         0         0         0
## [117,]         0         0         1         0         0         0         0
## [118,]         0         0         1         0         0         0         0
## [119,]         0         0         1         0         0         0         0
## [120,]         0         0         1         0         1         0         0
## [121,]         0         0         1         0         0         1         0
## [122,]         0         0         1         0         0         0         0
```

```
## [123,]    0    0    1    0    0    0    0
## [124,]    0    0    1    0    0    0    0
## [125,]    0    0    1    0    1    0    0
## [126,]    0    0    1    0    0    0    0
## [127,]    0    0    1    0    0    0    0
## [128,]    0    0    1    0    0    0    0
## [129,]    0    0    1    0    0    0    0
## [130,]    0    0    1    0    0    0    0
## [131,]    0    0    1    0    0    0    0
## [132,]    0    0    1    0    0    0    0
## [133,]    0    0    1    0    0    0    0
## [134,]    0    0    1    0    0    0    0
## [135,]    0    0    1    0    0    0    0
## [136,]    0    0    1    0    0    0    0
## [137,]    0    0    1    0    0    0    0
## [138,]    0    0    1    0    0    0    0
## [139,]    0    0    1    0    0    0    0
## [140,]    0    0    1    0    0    0    0
## [141,]    0    0    1    0    0    0    0
## [142,]    0    0    1    0    0    0    0
## [143,]    0    0    1    0    0    0    0
## [144,]    0    0    1    0    0    0    0
## [145,]    0    0    1    0    0    0    0
## [146,]    0    0    1    0    0    0    0
## [147,]    0    0    1    0    0    0    0
## [148,]    0    0    0    0    1    0    0
## [149,]    0    0    0    0    1    1    0
## [150,]    0    0    0    0    1    0    0
## [151,]    0    0    0    0    1    0    0
## [152,]    0    0    0    0    1    1    0
## [153,]    0    0    0    0    1    0    0
## [154,]    0    0    0    0    1    0    0
## [155,]    0    0    0    0    1    0    0
## [156,]    0    0    0    0    1    0    0
## [157,]    0    0    0    0    1    0    0
## [158,]    0    0    0    0    1    0    0
## [159,]    0    0    0    0    1    0    0
## [160,]    0    0    0    0    1    1    0
## [161,]    0    0    0    0    1    0    0
## [162,]    0    0    0    0    1    0    0
## [163,]    0    0    0    0    1    0    0
## [164,]    0    0    0    0    1    0    0
## [165,]    0    0    0    0    1    0    0
## [166,]    0    0    0    0    1    0    0
## [167,]    0    0    0    0    1    0    0
## [168,]    0    0    0    0    1    0    0
## [169,]    0    0    0    0    1    0    0
## [170,]    0    0    0    0    1    1    0
## [171,]    0    0    0    0    1    0    0
## [172,]    0    0    0    0    1    0    0
## [173,]    0    0    0    0    1    1    0
## [174,]    0    0    0    0    1    0    0
## [175,]    0    0    0    0    1    0    0
## [176,]    0    0    0    0    1    0    0
```

```
## [177,]    0    0    0    0    1    1    0
## [178,]    0    0    0    0    1    0    0
## [179,]    0    0    0    0    1    1    0
## [180,]    0    0    0    0    1    0    0
## [181,]    0    0    0    0    1    0    0
## [182,]    0    0    0    0    1    0    0
## [183,]    0    0    0    0    1    1    0
## [184,]    0    0    0    0    1    0    0
## [185,]    0    0    0    0    1    0    0
## [186,]    0    0    0    0    1    0    0
## [187,]    0    0    0    0    1    0    0
## [188,]    0    0    0    0    1    0    0
## [189,]    0    0    0    0    1    1    0
## [190,]    0    0    0    0    1    0    0
## [191,]    0    0    0    0    1    0    0
## [192,]    0    0    0    0    1    0    0
## [193,]    0    0    0    0    1    0    0
## [194,]    0    0    0    0    1    0    0
## [195,]    0    0    0    0    1    0    0
## [196,]    0    0    0    0    1    0    0
## [197,]    0    0    0    0    1    0    0
## [198,]    0    0    0    0    1    0    0
## [199,]    0    0    0    0    1    0    0
## [200,]    0    0    0    0    1    1    0
## [201,]    0    0    0    0    0    1    0
## [202,]    0    0    0    0    0    1    0
## [203,]    0    0    0    0    0    1    0
## [204,]    0    0    0    0    0    1    0
## [205,]    0    0    0    0    0    1    0
## [206,]    0    0    0    0    0    1    0
## [207,]    0    0    0    0    0    1    0
## [208,]    0    0    0    0    0    1    0
## [209,]    0    0    0    0    0    1    0
## [210,]    0    0    0    0    0    1    0
## [211,]    0    0    0    0    0    1    0
## [212,]    0    0    0    0    0    1    0
## [213,]    0    0    0    0    0    1    0
## [214,]    0    0    0    0    0    1    0
## [215,]    0    0    0    0    0    1    0
## [216,]    0    0    0    0    0    1    0
## [217,]    0    0    0    0    0    1    0
## [218,]    0    0    0    0    0    1    0
## [219,]    0    0    0    0    0    1    0
## [220,]    0    0    0    0    0    1    1
## [221,]    0    0    0    0    0    1    0
## [222,]    0    0    0    0    0    1    0
## [223,]    0    0    0    0    0    1    0
## [224,]    0    0    0    0    0    1    0
## [225,]    0    0    0    0    0    1    0
## [226,]    0    0    0    0    0    1    1
## [227,]    0    0    0    0    0    1    0
## [228,]    0    0    0    0    0    1    0
## [229,]    0    0    0    0    0    1    0
## [230,]    0    0    0    0    0    1    0
```

```
## [231,]         0         0         0         0         0         1         0
## [232,]         0         0         0         0         0         1         0
## [233,]         0         0         0         0         0         1         0
## [234,]         0         0         0         0         0         1         0
## [235,]         0         0         0         0         0         0         0
## [236,]         0         0         0         0         0         0         1
## [237,]         0         0         0         0         0         0         1
## [238,]         0         0         0         0         0         0         0
## [239,]         0         0         0         0         0         0         0
## [240,]         0         0         0         0         0         0         1
## [241,]         0         0         0         0         0         0         1
## [242,]         0         0         0         0         0         0         0
## [243,]         0         0         0         0         0         0         0
## [244,]         0         0         0         0         0         0         0
## [245,]         0         0         0         0         0         0         1
## [246,]         0         0         0         0         0         0         1
## [247,]         0         0         0         0         0         0         0
## [248,]         0         0         0         0         0         0         1
## [249,]         0         0         0         0         0         0         0
## [250,]         0         0         0         0         0         0         0
## [251,]         0         0         0         0         0         0         0
## [252,]         0         0         0         0         0         0         0
## [253,]         0         0         0         0         0         0         0
## [254,]         0         0         0         0         0         0         1
## [255,]         0         0         0         0         0         0         1
## [256,]         0         0         0         0         0         0         1
## [257,]         0         0         0         0         0         0         1
## [258,]         0         0         0         0         0         0         1
## [259,]         0         0         0         0         0         0         1
## [260,]         0         0         0         0         0         0         1
## [261,]         0         0         0         0         0         0         1
## [262,]         0         0         0         0         0         0         1
## [263,]         0         0         0         0         0         0         1
## [264,]         0         0         0         0         0         0         1
## [265,]         0         0         0         0         0         0         1
## [266,]         0         0         0         0         0         0         1
## [267,]         0         0         0         0         0         0         0
##        Session 7 Session 11 Session 9
##   [1,]         0          0         0
##   [2,]         0          0         0
##   [3,]         0          0         0
##   [4,]         0          0         0
##   [5,]         0          0         0
##   [6,]         0          0         0
##   [7,]         0          0         0
##   [8,]         0          0         0
##   [9,]         0          0         0
##  [10,]         0          0         0
##  [11,]         0          0         0
##  [12,]         0          0         0
##  [13,]         0          0         0
##  [14,]         0          0         0
##  [15,]         0          0         0
##  [16,]         0          0         0
```

```
##  [17,]         0          0         0
##  [18,]         0          0         0
##  [19,]         0          0         0
##  [20,]         0          0         0
##  [21,]         0          0         0
##  [22,]         0          0         0
##  [23,]         0          0         0
##  [24,]         0          0         0
##  [25,]         0          0         0
##  [26,]         0          0         0
##  [27,]         0          0         0
##  [28,]         0          0         0
##  [29,]         0          0         0
##  [30,]         0          0         0
##  [31,]         0          0         0
##  [32,]         0          0         0
##  [33,]         0          0         0
##  [34,]         0          0         0
##  [35,]         0          0         0
##  [36,]         0          0         0
##  [37,]         0          0         0
##  [38,]         0          0         0
##  [39,]         0          0         0
##  [40,]         0          0         0
##  [41,]         0          0         0
##  [42,]         0          0         0
##  [43,]         0          0         0
##  [44,]         0          0         0
##  [45,]         0          0         0
##  [46,]         0          0         0
##  [47,]         0          0         0
##  [48,]         0          0         0
##  [49,]         0          0         0
##  [50,]         0          0         0
##  [51,]         0          0         0
##  [52,]         0          0         0
##  [53,]         0          0         0
##  [54,]         0          0         0
##  [55,]         0          0         0
##  [56,]         0          0         0
##  [57,]         0          0         0
##  [58,]         0          0         0
##  [59,]         0          0         0
##  [60,]         0          0         0
##  [61,]         0          0         0
##  [62,]         0          0         0
##  [63,]         0          0         0
##  [64,]         0          0         0
##  [65,]         0          0         0
##  [66,]         0          0         0
##  [67,]         0          0         0
##  [68,]         0          0         0
##  [69,]         0          0         0
##  [70,]         0          0         0
```

```
##  [71,]         0          0         0
##  [72,]         0          0         0
##  [73,]         0          0         0
##  [74,]         0          0         0
##  [75,]         0          0         0
##  [76,]         0          0         0
##  [77,]         0          0         0
##  [78,]         0          0         0
##  [79,]         0          0         0
##  [80,]         0          0         0
##  [81,]         0          0         0
##  [82,]         0          0         0
##  [83,]         0          0         0
##  [84,]         0          0         0
##  [85,]         0          0         0
##  [86,]         0          0         0
##  [87,]         0          0         0
##  [88,]         0          0         0
##  [89,]         0          0         0
##  [90,]         0          0         0
##  [91,]         0          0         0
##  [92,]         0          0         0
##  [93,]         0          0         0
##  [94,]         0          0         0
##  [95,]         0          0         0
##  [96,]         0          0         0
##  [97,]         0          0         0
##  [98,]         0          0         0
##  [99,]         0          0         0
## [100,]         0          0         0
## [101,]         0          0         0
## [102,]         0          0         0
## [103,]         0          0         0
## [104,]         0          0         0
## [105,]         0          0         0
## [106,]         0          0         0
## [107,]         0          0         0
## [108,]         0          0         0
## [109,]         0          0         0
## [110,]         0          0         0
## [111,]         0          0         0
## [112,]         0          0         0
## [113,]         0          0         0
## [114,]         0          0         0
## [115,]         0          0         0
## [116,]         0          0         0
## [117,]         0          0         0
## [118,]         0          0         0
## [119,]         0          0         0
## [120,]         0          0         0
## [121,]         0          0         0
## [122,]         0          0         0
## [123,]         0          0         0
## [124,]         0          0         0
```

```
## [125,]         0          0         0
## [126,]         0          0         0
## [127,]         0          0         0
## [128,]         0          0         0
## [129,]         0          0         0
## [130,]         0          0         0
## [131,]         0          0         0
## [132,]         0          0         0
## [133,]         0          0         0
## [134,]         0          0         0
## [135,]         0          0         0
## [136,]         0          0         0
## [137,]         0          0         0
## [138,]         0          0         0
## [139,]         0          0         0
## [140,]         0          0         0
## [141,]         0          0         0
## [142,]         0          0         0
## [143,]         0          0         0
## [144,]         0          0         0
## [145,]         0          0         0
## [146,]         0          0         0
## [147,]         0          0         0
## [148,]         0          0         0
## [149,]         0          0         0
## [150,]         0          0         0
## [151,]         0          0         0
## [152,]         0          0         0
## [153,]         0          0         0
## [154,]         0          0         0
## [155,]         0          0         0
## [156,]         0          0         0
## [157,]         0          0         0
## [158,]         0          0         0
## [159,]         0          0         0
## [160,]         0          0         0
## [161,]         0          0         0
## [162,]         0          0         0
## [163,]         0          0         0
## [164,]         0          0         0
## [165,]         0          0         0
## [166,]         0          0         0
## [167,]         0          0         0
## [168,]         0          0         0
## [169,]         0          0         0
## [170,]         0          0         0
## [171,]         0          0         0
## [172,]         0          0         0
## [173,]         0          0         0
## [174,]         0          0         0
## [175,]         0          0         0
## [176,]         0          0         0
## [177,]         0          0         0
## [178,]         0          0         0
```

```
## [179,]         0          0         0
## [180,]         0          0         0
## [181,]         1          0         0
## [182,]         0          0         0
## [183,]         0          0         0
## [184,]         0          0         0
## [185,]         0          0         0
## [186,]         0          0         0
## [187,]         0          0         0
## [188,]         0          0         0
## [189,]         0          0         0
## [190,]         0          0         0
## [191,]         0          0         0
## [192,]         0          0         0
## [193,]         0          0         0
## [194,]         0          0         0
## [195,]         0          0         0
## [196,]         0          0         0
## [197,]         0          0         0
## [198,]         0          0         0
## [199,]         0          0         0
## [200,]         0          0         0
## [201,]         0          0         0
## [202,]         0          0         0
## [203,]         0          0         0
## [204,]         0          0         0
## [205,]         0          0         0
## [206,]         0          0         0
## [207,]         0          0         0
## [208,]         0          0         0
## [209,]         0          0         0
## [210,]         0          0         0
## [211,]         0          0         0
## [212,]         0          0         0
## [213,]         0          0         0
## [214,]         0          0         0
## [215,]         0          0         0
## [216,]         0          0         0
## [217,]         0          0         0
## [218,]         0          0         0
## [219,]         0          0         0
## [220,]         0          0         0
## [221,]         0          0         0
## [222,]         0          0         0
## [223,]         0          0         0
## [224,]         0          0         0
## [225,]         0          0         0
## [226,]         1          0         0
## [227,]         0          0         0
## [228,]         0          0         0
## [229,]         0          0         0
## [230,]         0          0         0
## [231,]         0          0         0
## [232,]         0          0         0
```

```
## [233,]         0          0         0
## [234,]         0          0         0
## [235,]         1          0         0
## [236,]         1          0         0
## [237,]         1          0         0
## [238,]         1          0         0
## [239,]         1          0         0
## [240,]         1          0         0
## [241,]         1          0         0
## [242,]         1          0         0
## [243,]         1          0         0
## [244,]         1          0         0
## [245,]         1          1         0
## [246,]         1          0         1
## [247,]         1          0         0
## [248,]         1          0         0
## [249,]         1          0         0
## [250,]         1          0         0
## [251,]         1          0         0
## [252,]         1          0         0
## [253,]         1          0         0
## [254,]         0          0         0
## [255,]         0          0         0
## [256,]         0          0         0
## [257,]         0          0         0
## [258,]         0          0         0
## [259,]         0          0         0
## [260,]         0          0         0
## [261,]         0          0         0
## [262,]         0          0         0
## [263,]         0          0         0
## [264,]         0          0         1
## [265,]         0          0         0
## [266,]         0          0         0
## [267,]         0          0         1
```

On fait les tests et l'ajustement.

```
monarque <- data.frame(ch = collapseCH(histoires), freq = rep(1, nrow(histoires)))
head(monarque)
```

```
##           ch freq
## 1 1000000000    1
## 2 1000000000    1
## 3 1100000000    1
## 4 1100000000    1
## 5 1000000000    1
## 6 1010000000    1
```

```
tail(monarque)
```

```
##             ch freq
```

```
## 262 0000001000    1
## 263 0000001000    1
## 264 0000001001    1
## 265 0000001000    1
## 266 0000001000    1
## 267 0000000001    1
```

On fait les tests de fermeture.

```
monarque_secr <- unRMarkInput(monarque) # on convertit au bon format
summary(monarque_secr) # resumes
```

```
## Object class       capthist
##
## Counts by occasion
##              1  2   3   4   5   6   7   8   9  10 Total
## n           16 28  84  37  65  49  23  21   1   3   327
## u           16 25  79  27  53  34  20  12   0   1   267
## f          216 44   5   2   0   0   0   0   0   0   267
## M(t+1)      16 41 120 147 200 234 254 266 266 267   267
## losses       0  0   0   0   0   0   0   0   0   0     0
## detections  16 28  84  37  65  49  23  21   1   3   327
```

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

```
## $Otis
##  statistic            p
##  -5.547468 1.449177e-08
##
## $Xc
##  statistic df p
##   141.1563 12 0
##
## $NRvsJS
##  statistic df            p
##   19.87966  4 0.0005274697
##
## $NMvsJS
##  statistic df           p
##   16.07242  4 0.002923506
##
## $MtvsNR
##  statistic df p
##   121.2766  8 0
##
## $MtvsNM
##  statistic df p
##   125.0839  8 0
##
## $compNRvsJS
##   Occasion Chisquare df           p
## 1        2        NA NA          NA
```

```
## 2        3 0.5053096  1 0.477176389
## 3        4 7.3648815  1 0.006650998
## 4        5 4.1689058  1 0.041172382
## 5        6 7.8405619  1 0.005108672
## 6        7        NA NA          NA
## 7        8        NA NA          NA
## 8        9        NA NA          NA
##
## $compNMvsJS
##   Occasion   Chisquare df           p
## 1        2  3.55114885  1 0.0595042378
## 2        3  0.20746622  1 0.6487606427
## 3        4  0.02747251  1 0.8683550038
## 4        5 12.28633623  1 0.0004562866
## 5        6          NA NA           NA
## 6        7          NA NA           NA
## 7        8          NA NA           NA
## 8        9          NA NA           NA
```

On sélectionne les occasions 2 à 5.

```
monarque_reduced <- monarque
ch <- splitCH(monarque_reduced$ch) # sépare colonnes
head(ch)
```

```
##      Time1 Time2 Time3 Time4 Time5 Time6 Time7 Time8 Time9 Time10
## [1,]     1     0     0     0     0     0     0     0     0      0
## [2,]     1     0     0     0     0     0     0     0     0      0
## [3,]     1     1     0     0     0     0     0     0     0      0
## [4,]     1     1     0     0     0     0     0     0     0      0
## [5,]     1     0     0     0     0     0     0     0     0      0
## [6,]     1     0     1     0     0     0     0     0     0      0
```

```
ch_reduced <- ch[, 2:5] # sélection colonnes 2 à 5
head(ch_reduced)
```

```
##      Time2 Time3 Time4 Time5
## [1,]     0     0     0     0
## [2,]     0     0     0     0
## [3,]     1     0     0     0
## [4,]     1     0     0     0
## [5,]     0     0     0     0
## [6,]     0     1     0     0
```

```
dim(ch_reduced)
```

```
## [1] 267   4
```

```
mask <- apply(ch_reduced, 1, sum)
ch_reduced <- ch_reduced[mask > 0,] # supprime lignes de 0
head(ch_reduced)
```

```
##      Time2 Time3 Time4 Time5
## [1,]     1     0     0     0
## [2,]     1     0     0     0
## [3,]     0     1     0     0
## [4,]     1     1     1     0
## [5,]     1     0     0     0
## [6,]     1     0     1     0
```

```
dim(ch_reduced)
```

```
## [1] 188   4
```

```
freq_reduced <- monarque_reduced$freq[mask > 0]
length(freq_reduced)
```

```
## [1] 188
```

```
monarque_reduced <- data.frame(ch = collapseCH(ch_reduced), # on recolle les colonnes ensemble
                               freq = freq_reduced)
monarque_reduced_secr <- unRMarkInput(monarque_reduced) # on convertit au bon format
```

Jette un coup d'oeil.

```
summary(monarque_reduced_secr)
```

```
## Object class       capthist
##
## Counts by occasion
##              1   2   3   4 Total
## n           28  84  37  65   214
## u           28  80  27  53   188
## f          165  20   3   0   188
## M(t+1)      28 108 135 188   188
## losses       0   0   0   0     0
## detections  28  84  37  65   214
```

On refait les tests de Stanley et Burnham et de Otis.

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

```
## $Otis
##  statistic         p
##      -0.55 0.2911597
##
## $Xc
##  statistic df         p
##   2.960724  4 0.5644195
##
## $NRvsJS
##  statistic df         p
```

```
##    2.44383  2 0.2946653
##
## $NMvsJS
##  statistic df         p
##  0.2619026  2 0.8772605
##
## $MtvsNR
##  statistic df         p
##  0.5168942  2 0.7722499
##
## $MtvsNM
##  statistic df        p
##   2.698822  2 0.259393
##
## $compNRvsJS
##   Occasion Chisquare df         p
## 1        2 0.1051976  1 0.7456792
## 2        3 2.3386325  1 0.1262003
##
## $compNMvsJS
##   Occasion Chisquare df         p
## 1        2 0.2235364  1 0.6363585
## 2        3 0.0383662  1 0.8447096
```

On passe aux analyses.

```
monarque.proc <- process.data(monarque_reduced, begin.time = 1, model = "FullHet")
```

Create default design data

```
monarque.ddl <- make.design.data(monarque.proc)
```

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

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

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

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

  return(monarque.results)
}
```

Run the models and examine the output

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  2  (unadjusted=3)
## -2lnL:  -896.4989
## AICc :  -892.4829  (unadjusted=-892.48287)
##
## Beta
##                 estimate se       lcl       ucl
## pi:(Intercept)  0.000000  0  0.000000  0.000000
## p:(Intercept)  -2.359285  0 -2.359285 -2.359285
## f0:(Intercept)  6.067756  0  6.067756  6.067756
##
##
## Real Parameter pi
##
##
## mixture:1 0.5
##
##
## Real Parameter p
##
##                   1         2         3         4
## mixture:1 0.0863306 0.0863306 0.0863306 0.0863306
## mixture:2 0.0863306 0.0863306 0.0863306 0.0863306
##
##
## Real Parameter c
##
##                   2         3         4
## mixture:1 0.0863306 0.0863306 0.0863306
## mixture:2 0.0863306 0.0863306 0.0863306
##
##
## Real Parameter f0
##
##         1
##  431.7107
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  3  (unadjusted=2)
## -2lnL:  -900.3404
## AICc :  -894.3083  (unadjusted=-896.3244)
##
## Beta
##                 estimate se       lcl       ucl
## pi:(Intercept)  0.000000  0  0.000000  0.000000
## p:(Intercept)  -8.367505  0 -8.367505 -8.367505
```

```
## c:(Intercept)  -2.243027  0 -2.243027 -2.243027
## f0:(Intercept) 12.217670  0 12.217670 12.217670
##
##
## Real Parameter pi
##
##
## mixture:1 0.5
##
##
## Real Parameter p
##
##                       1            2            3            4
## mixture:1 0.0002322405 0.0002322405 0.0002322405 0.0002322405
## mixture:2 0.0002322405 0.0002322405 0.0002322405 0.0002322405
##
##
## Real Parameter c
##
##                    2         3         4
## mixture:1 0.0959527 0.0959527 0.0959527
## mixture:2 0.0959527 0.0959527 0.0959527
##
##
## Real Parameter f0
##
##         1
##  202332.9
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4
## -2lnL:  -897.6947
## AICc :  -889.6412
##
## Beta
##                  estimate       se       lcl       ucl
## pi:(Intercept) -2.584715 2.017599 -6.539208  1.369779
## p:(Intercept)  -1.325661 1.550212 -4.364076  1.712754
## p:mixture2     -2.086548 2.368115 -6.728054  2.554959
## f0:(Intercept)  6.924666 2.776785  1.482168 12.367164
##
##
## Real Parameter pi
##
##
## mixture:1 0.0701287
##
##
## Real Parameter p
##
##                    1         2         3         4
## mixture:1 0.2098780 0.2098780 0.2098780 0.2098780
```

```
## mixture:2 0.0319161 0.0319161 0.0319161 0.0319161
##
##
## Real Parameter c
##
##                   2         3         4
## mixture:1 0.2098780 0.2098780 0.2098780
## mixture:2 0.0319161 0.0319161 0.0319161
##
##
## Real Parameter f0
##
##         1
##  1017.055
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=2)
## -2lnL:  -900.3394
## AICc :  -890.259  (unadjusted=-896.32337)
##
## Beta
##                  estimate         se        lcl        ucl
## pi:(Intercept) 19.372721 64.1076510 -106.27828 145.023720
## p:(Intercept)  -8.250423 19.5731040  -46.61371  30.112862
## p:mixture2     10.745717  0.0000000   10.74572  10.745717
## c:(Intercept)  -2.242996  0.2062415   -2.64723  -1.838763
## f0:(Intercept) 12.100799 19.5808870  -26.27774  50.479339
##
##
## Real Parameter pi
##
##
## mixture:1 1
##
##
## Real Parameter p
##
##                       1            2            3            4
## mixture:1 0.0002610799 0.0002610799 0.0002610799 0.0002610799
## mixture:2 0.9238113000 0.9238113000 0.9238113000 0.9238113000
##
##
## Real Parameter c
##
##                   2         3         4
## mixture:1 0.0959553 0.0959553 0.0959553
## mixture:2 0.0959553 0.0959553 0.0959553
##
##
## Real Parameter f0
##
##         1
```

```
##  180015.7
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  7
## -2lnL:  -939.118
## AICc :  -924.9674
##
## Beta
##                   estimate        se        lcl       ucl
## pi:(Intercept) -2.7264971 1.9680439 -6.5838633  1.130869
## p:(Intercept)  -1.8555191 1.6062908 -5.0038490  1.292811
## p:time2         1.2126218 0.2287285  0.7643139  1.660930
## p:time3         0.2979835 0.2589411 -0.2095411  0.805508
## p:time4         0.9190331 0.2357521  0.4569589  1.381107
## p:mixture2     -2.1759396 2.0978668 -6.2877586  1.935879
## f0:(Intercept)  6.8530700 2.6723858  1.6151937 12.090946
##
##
## Real Parameter pi
##
##
## mixture:1 0.0614278
##
##
## Real Parameter p
##
##                    1         2         3         4
## mixture:1 0.1352262 0.3445919 0.1740006 0.2816107
## mixture:2 0.0174389 0.0563147 0.0233513 0.0425976
##
##
## Real Parameter c
##
##                    2         3         4
## mixture:1 0.3445919 0.1740006 0.2816107
## mixture:2 0.0563147 0.0233513 0.0425976
##
##
## Real Parameter f0
##
##         1
##  946.7831
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c(~1)f0(~1)
##
## Npar :  8  (unadjusted=4)
## -2lnL:  -946.3182
## AICc :  -930.1244  (unadjusted=-938.26465)
##
## Beta
##                   estimate           se          lcl         ucl
```

```
## pi:(Intercept)   6.144804 1762.3602000 -3448.081200 3460.370800
## p:(Intercept)   -1.746663    6.3299804   -14.153425   10.660098
## p:time2          1.744951    3.5796342    -5.271132    8.761035
## p:time3          1.071249    4.8500596    -8.434868   10.577366
## p:time4         21.736266 3018.0354000 -5893.613300 5937.085800
## p:mixture2       1.202391  606.2127800 -1186.974700 1189.379500
## c:(Intercept)   -2.243161    0.2062599    -2.647430   -1.838891
## f0:(Intercept) -28.222013    0.0000000   -28.222013  -28.222013
##
##
## Real Parameter pi
##
##
## mixture:1 0.99786
##
##
## Real Parameter p
##
##                    1         2         3 4
## mixture:1 0.1484685 0.4995720 0.3372856 1
## mixture:2 0.3671943 0.7686456 0.6287778 1
##
##
## Real Parameter c
##
##                   2         3         4
## mixture:1 0.0959411 0.0959411 0.0959411
## mixture:2 0.0959411 0.0959411 0.0959411
##
##
## Real Parameter f0
##
##             1
##  5.537779e-13
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  6  (unadjusted=5)
## -2lnL:  -937.6803
## AICc :  -925.5675  (unadjusted=-927.59983)
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept)  7.867019e-05 0.0000000  7.867019e-05  7.867019e-05
## p:(Intercept)  -2.992043e+00 0.1936662 -3.371628e+00 -2.612457e+00
## p:time2         1.204383e+00 0.2267237  7.600049e-01  1.648762e+00
## p:time3         2.949760e-01 0.2575952 -2.099106e-01  7.998626e-01
## p:time4         9.107994e-01 0.2341171  4.519299e-01  1.369669e+00
## f0:(Intercept)  5.986295e+00 0.0000000  5.986295e+00  5.986295e+00
##
##
## Real Parameter pi
##
```

```
##
## mixture:1 0.5000197
##
##
## Real Parameter p
##
##                   1         2         3         4
## mixture:1 0.0477867 0.1433599 0.0631467 0.1109333
## mixture:2 0.0477867 0.1433599 0.0631467 0.1109333
##
##
## Real Parameter c
##
##                   2         3         4
## mixture:1 0.1433599 0.0631467 0.1109333
## mixture:2 0.1433599 0.0631467 0.1109333
##
##
## Real Parameter f0
##
##         1
##  397.9377
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  6  (unadjusted=4)
## -2lnL:  -946.3182
## AICc :  -934.2054  (unadjusted=-938.26465)
##
## Beta
##                   estimate           se           lcl          ucl
## pi:(Intercept)   0.000000    0.0000000  0.000000e+00     0.000000
## p:(Intercept)   -1.742969    0.2048518 -2.144479e+00    -1.341460
## p:time2          1.742969    0.2587746  1.235771e+00     2.250167
## p:time3          1.068514    0.3128406  4.553467e-01     1.681682
## p:time4         24.305337 6690.6213000 -1.308931e+04 13137.923000
## c:(Intercept)   -2.243162    0.2062600 -2.647431e+00    -1.838892
## f0:(Intercept) -23.752099 7528.9284000 -1.478045e+04 14732.948000
##
##
## Real Parameter pi
##
##
## mixture:1 0.5
##
##
## Real Parameter p
##
##                   1   2      3 4
## mixture:1 0.1489362 0.5 0.3375 1
## mixture:2 0.1489362 0.5 0.3375 1
##
##
```

```
## Real Parameter c
##
##                  2        3        4
## mixture:1 0.095941 0.095941 0.095941
## mixture:2 0.095941 0.095941 0.095941
##
##
## Real Parameter f0
##
##             1
##  4.837203e-11
```

Examine model-selection table

```
monarque.results
```

```
##                                 model npar      AICc DeltaAICc       weight
## 8           pi(~1)p(~time)c(~1)f0(~1)    6 -934.2054  0.000000 8.672002e-01
## 6 pi(~1)p(~time + mixture)c(~1)f0(~1)    8 -930.1244  4.081057 1.127013e-01
## 7             pi(~1)p(~time)c()f0(~1)    6 -925.5675  8.637940 1.154555e-02
## 5   pi(~1)p(~time + mixture)c()f0(~1)    7 -924.9674  9.238006 8.552870e-03
## 2              pi(~1)p(~1)c(~1)f0(~1)    3 -894.3083 39.897114 1.881790e-09
## 1                pi(~1)p(~1)c()f0(~1)    2 -892.4829 41.722580 7.553989e-10
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 -890.2590 43.946477 2.484638e-10
## 3          pi(~1)p(~mixture)c()f0(~1)    4 -889.6412 44.564246 1.824384e-10
##   Deviance
## 8 19.67130
## 6 19.67130
## 7 28.30923
## 5 26.87151
## 2 65.64907
## 1 69.49060
## 4 65.65009
## 3 68.29474
```

examine model names and find the name of the top model

```
names(monarque.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"
```

examine the output from top-ranked model (#8)

```
monarque.results$p.time.behav$results$real
```

```
##                 estimate           se          lcl          ucl fixed note
## pi g1 m1    5.000000e-01 0.000000e+00 5.000000e-01 5.000000e-01
## p g1 t1 m1  1.489362e-01 2.596580e-02 1.048483e-01 2.072701e-01
## p g1 t2 m1  5.000000e-01 3.952850e-02 4.231384e-01 5.768616e-01
```

```
## p g1 t3 m1  3.375000e-01 5.286700e-02 2.427094e-01 4.474379e-01
## p g1 t4 m1  1.000000e+00 1.063542e-06 9.999979e-01 1.000002e+00
## c g1 t2 m1  9.594100e-02 1.789020e-02 6.614750e-02 1.371824e-01
## f0 g1 a0 t1 4.837203e-11 3.641895e-07 1.224506e-14 1.910855e-07
```

```
monarque.results$p.time.behav$results$derived
```

```
## $`N Population Size`
##   estimate lcl ucl
## 1      188 188 188
```

Autre modèle.

```
monarque.results$p.h.time.behav$results$real
```

```
##                 estimate           se           lcl          ucl fixed note
## pi g1 m1    9.978600e-01 3.763392e+00 2.593814e-306 1.000000e+00
## p g1 t1 m1  1.484685e-01 8.002717e-01  7.132556e-07 9.999765e-01
## p g1 t2 m1  4.995720e-01 7.395739e-01  3.018500e-03 9.969712e-01
## p g1 t3 m1  3.372856e-01 3.952584e-01  1.565340e-02 9.421582e-01
## p g1 t4 m1  1.000000e+00 6.285970e-06  9.999877e-01 1.000012e+00
## p g1 t1 m2  3.671943e-01 1.407004e+02 3.227826e-309 1.000000e+00
## p g1 t2 m2  7.686456e-01 1.078859e+02 1.848132e-308 1.000000e+00
## p g1 t3 m2  6.287778e-01 1.416464e+02 9.422101e-309 1.000000e+00
## p g1 t4 m2  1.000000e+00 1.942287e-06  9.999962e-01 1.000004e+00
## c g1 t2 m1  9.594110e-02 1.789020e-02  6.614760e-02 1.371825e-01
## f0 g1 a0 t1 5.537779e-13 0.000000e+00  5.537779e-13 5.537779e-13
```

```
monarque.results$p.h.time.behav$results$derived
```

```
## $`N Population Size`
##   estimate lcl ucl
## 1      188 188 188
```

Autre modèle.

```
monarque.results$p.time$results$real
```

```
##                estimate        se         lcl         ucl fixed note
## pi g1 m1      0.5000197 0.0000000   0.5000197   0.5000197
## p g1 t1 m1    0.0477867 0.0088124   0.0331940   0.0683410
## p g1 t2 m1    0.1433599 0.0144773   0.1172519   0.1741346
## p g1 t3 m1    0.0631467 0.0100481   0.0460901   0.0859466
## p g1 t4 m1    0.1109333 0.0129740   0.0879383   0.1390247
## f0 g1 a0 t1 397.9376700 0.0000000 397.9376700 397.9376700
```

```
monarque.results$p.time$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 585.9377 585.9377 585.9377
```

Modèle des diapos

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

```
##                  estimate           se          lcl          ucl fixed note
## pi g1 m1        0.0614278    0.1134665 1.380600e-03 7.559993e-01
## p g1 t1 m1      0.1352262    0.1878398 6.667300e-03 7.846226e-01
## p g1 t2 m1      0.3445919    0.3626300 2.209760e-02 9.244321e-01
## p g1 t3 m1      0.1740006    0.2307898 8.969900e-03 8.305873e-01
## p g1 t4 m1      0.2816107    0.3248227 1.656980e-02 9.011876e-01
## p g1 t1 m2      0.0174389    0.0578016 2.386155e-05 9.295830e-01
## p g1 t2 m2      0.0563147    0.1791646 8.054027e-05 9.778820e-01
## p g1 t3 m2      0.0233513    0.0769155 3.219153e-05 9.466888e-01
## p g1 t4 m2      0.0425976    0.1374877 6.006820e-05 9.705486e-01
## f0 g1 a0 t1 946.7831000 2530.1698000 5.541192e+01 1.617699e+04
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 1134.783 243.4119 16364.99
```

Partie 6 : iguanes

Données 2006

Les données

```
iguane <- convert.inp("dat/iguanes-2006-2sexes-FM.inp",
                      group.df = data.frame(sex = c("F","M")),
                      covariates = NULL)
head(iguane)
```

```
##                     ch freq sex
## 1:1 00000000000001000    1   F
## 1:2 00000000000001000    1   F
## 1:3 00000000000010000    1   F
## 1:4 00010000000000000    1   F
## 1:5 00001000000000000    1   F
## 1:6 00000000000010000    1   F
```

```
tail(iguane)
```

```
##                      ch freq sex
## 2:156 00000010000010000    1   M
## 2:157 00000001000000010    1   M
## 2:158 00000100100000000    1   M
## 2:159 00000010000000100    1   M
## 2:160 01000000100000000    1   M
## 2:161 01100000100000000    1   M
```

On sépare mâles et femelles.

```
iguaneM <- iguane[iguane$sex == "M", ]
iguaneF <- iguane[iguane$sex == "F", ]
```

On formate les données.

```
iguane_secr <- unRMarkInput(iguane) # on convertit au bon format
iguaneM_secr <- unRMarkInput(iguaneM) # on convertit au bon format
iguaneF_secr <- unRMarkInput(iguaneF) # on convertit au bon format
summary(iguane_secr) # resumes
```

```
## Object class       capthist
##
## Counts by occasion
##              1  2  3  4  5  6  7  8  9 10 11  12  13  14  15  16  17 Total
## n            1 10  4 11 12 11 13 10 10  4 18  17  16  11  12  19   1   180
## u            1 10  3 11 12 10 12 10  7  3 16  16  14  11   8  16   1   161
## f          145 13  3  0  0  0  0  0  0  0  0   0   0   0   0   0   0   161
## M(t+1)       1 11 14 25 37 47 59 69 76 79 95 111 125 136 144 160 161   161
## losses       0  0  0  0  0  0  0  0  0  0  0   0   0   0   0   0   0     0
## detections   1 10  4 11 12 11 13 10 10  4 18  17  16  11  12  19   1   180
##
## Individual covariates
##  sex
##  F:89
##  M:72
```

```
summary(iguaneM_secr) # resumes
```

```
## Object class       capthist
##
## Counts by occasion
##              1 2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 Total
## n            0 9  3  4  8  6  6  2  5  1  5  5  9  4  6  9  1    83
## u            0 9  2  4  8  5  5  2  2  1  5  5  8  4  4  7  1    72
## f           62 9  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0    72
## M(t+1)       0 9 11 15 23 28 33 35 37 38 43 48 56 60 64 71 72    72
## losses       0 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0     0
## detections   0 9  3  4  8  6  6  2  5  1  5  5  9  4  6  9  1    83
##
## Individual covariates
##  sex
##  M:72
```

```
summary(iguaneF_secr) # resumes
```

```
## Object class       capthist
##
## Counts by occasion
##              1 2 3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 Total
```

```
## n           1 1 1  7  4  5  7  8  5  3 13 12  7  7  6 10  0    97
## u           1 1 1  7  4  5  7  8  5  2 11 11  6  7  4  9  0    89
## f          83 4 2  0  0  0  0  0  0  0  0  0  0  0  0  0  0    89
## M(t+1)      1 2 3 10 14 19 26 34 39 41 52 63 69 76 80 89 89    89
## losses      0 0 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0     0
## detections  1 1 1  7  4  5  7  8  5  3 13 12  7  7  6 10  0    97
##
## Individual covariates
##  sex
##  F:89
```

Les deux sexes ensemble.

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

```
## $Otis
##  statistic          p
##  -1.894954 0.02904928
##
## $Xc
##  statistic df         p
##   10.06825 16 0.8630401
##
## $NRvsJS
##  statistic df        p
##   1.475048  1 0.224551
##
## $NMvsJS
##   statistic df         p
##  0.04058442  1 0.8403422
##
## $MtvsNR
##  statistic df         p
##   8.593198 15 0.8978099
##
## $MtvsNM
##  statistic df         p
##   10.02766 15 0.8179963
##
## $compNRvsJS
##    Occasion Chisquare df        p
## 1         2        NA NA       NA
## 2         3        NA NA       NA
## 3         4        NA NA       NA
## 4         5        NA NA       NA
## 5         6        NA NA       NA
## 6         7        NA NA       NA
## 7         8        NA NA       NA
## 8         9        NA NA       NA
## 9        10        NA NA       NA
## 10       11        NA NA       NA
## 11       12        NA NA       NA
## 12       13        NA NA       NA
```

```
## 13       14        NA NA       NA
## 14       15  1.475048  1 0.224551
## 15       16        NA NA       NA
##
## $compNMvsJS
##    Occasion  Chisquare df         p
## 1         2         NA NA        NA
## 2         3         NA NA        NA
## 3         4 0.04058442  1 0.8403422
## 4         5         NA NA        NA
## 5         6         NA NA        NA
## 6         7         NA NA        NA
## 7         8         NA NA        NA
## 8         9         NA NA        NA
## 9        10         NA NA        NA
## 10       11         NA NA        NA
## 11       12         NA NA        NA
## 12       13         NA NA        NA
## 13       14         NA NA        NA
## 14       15         NA NA        NA
## 15       16         NA NA        NA
```

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

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

```
## $Otis
##   statistic        p
##  -0.5883371 0.278153
##
## $Xc
##  statistic df  p
##          0 NA NA
##
## $NRvsJS
##  statistic df p
##          0  0 1
##
## $NMvsJS
##  statistic df p
##          0  0 1
##
## $MtvsNR
##  statistic df  p
##         NA NA NA
##
## $MtvsNM
##  statistic df  p
##         NA NA NA
##
## $compNRvsJS
##    Occasion Chisquare df  p
## 1         2        NA NA NA
```

```
## 2         3        NA NA NA
## 3         4        NA NA NA
## 4         5        NA NA NA
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        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
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        NA NA NA
```

Femelles ensuite

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

```
## $Otis
##  statistic          p
##  -1.813781 0.03485574
##
## $Xc
##  statistic df  p
##          0 NA NA
##
## $NRvsJS
##  statistic df p
##          0  0 1
##
## $NMvsJS
##  statistic df p
##          0  0 1
##
```

```
## $MtvsNR
##  statistic df  p
##         NA NA NA
##
## $MtvsNM
##  statistic df  p
##         NA NA NA
##
## $compNRvsJS
##    Occasion Chisquare df  p
## 1         2        NA NA NA
## 2         3        NA NA NA
## 3         4        NA NA NA
## 4         5        NA NA NA
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        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
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        NA NA NA
```

Les modèles maintenant. On commence par le jeu de données avec les deux sexes ensemble.

Process data

```
iguane.proc <- process.data(iguane, begin.time = 1, model = "FullHet")
```

Create default design data

```
iguane.ddl <- make.design.data(iguane.proc)
```

Liste des modèles.

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

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

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

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

  return(iguane.results)
}
```

Run the models and examine the output

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3
## -2lnL:  -203.4014
## AICc :  -199.397
##
## Beta
##                     estimate se           lcl           ucl
## pi:(Intercept)  0.0005253904  0  0.0005253904  0.0005253904
## p:(Intercept)  -4.2377901000  0 -4.2377901000 -4.2377901000
## f0:(Intercept)  6.3679686000  0  6.3679686000  6.3679686000
##
##
## Real Parameter pi
##
##
## mixture:1 0.5001313
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
```

```
## mixture:1 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
## mixture:2 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
##                   8         9        10        11        12        13        14
## mixture:1 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
## mixture:2 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
##                  15        16        17
## mixture:1 0.0142339 0.0142339 0.0142339
## mixture:2 0.0142339 0.0142339 0.0142339
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
## mixture:2 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
##                   9        10        11        12        13        14        15
## mixture:1 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
## mixture:2 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
##                  16        17
## mixture:1 0.0142339 0.0142339
## mixture:2 0.0142339 0.0142339
##
##
## Real Parameter f0
##
##         1
##  582.8726
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  -207.0338
## AICc :  -199.0191  (unadjusted=-203.02939)
##
## Beta
##                    estimate se         lcl         ucl
## pi:(Intercept)  -0.0494572  0  -0.0494572  -0.0494572
## p:(Intercept)  -10.6405160  0 -10.6405160 -10.6405160
## c:(Intercept)   -4.1175810  0  -4.1175810  -4.1175810
## f0:(Intercept)  12.8896340  0  12.8896340  12.8896340
##
##
## Real Parameter pi
##
##
## mixture:1 0.4876382
##
##
## Real Parameter p
##
##                       1            2            3            4            5
## mixture:1 2.392613e-05 2.392613e-05 2.392613e-05 2.392613e-05 2.392613e-05
## mixture:2 2.392613e-05 2.392613e-05 2.392613e-05 2.392613e-05 2.392613e-05
```

```
##                       6            7            8            9           10
## mixture:1 2.392613e-05 2.392613e-05 2.392613e-05 2.392613e-05 2.392613e-05
## mixture:2 2.392613e-05 2.392613e-05 2.392613e-05 2.392613e-05 2.392613e-05
##                      11           12           13           14           15
## mixture:1 2.392613e-05 2.392613e-05 2.392613e-05 2.392613e-05 2.392613e-05
## mixture:2 2.392613e-05 2.392613e-05 2.392613e-05 2.392613e-05 2.392613e-05
##                      16           17
## mixture:1 2.392613e-05 2.392613e-05
## mixture:2 2.392613e-05 2.392613e-05
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0160229 0.0160229 0.0160229 0.0160229 0.0160229 0.0160229 0.0160229
## mixture:2 0.0160229 0.0160229 0.0160229 0.0160229 0.0160229 0.0160229 0.0160229
##                   9        10        11        12        13        14        15
## mixture:1 0.0160229 0.0160229 0.0160229 0.0160229 0.0160229 0.0160229 0.0160229
## mixture:2 0.0160229 0.0160229 0.0160229 0.0160229 0.0160229 0.0160229 0.0160229
##                  16        17
## mixture:1 0.0160229 0.0160229
## mixture:2 0.0160229 0.0160229
##
##
## Real Parameter f0
##
##         1
##  396183.9
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  -205.2279
## AICc :  -197.2132  (unadjusted=-199.21911)
##
## Beta
##                  estimate         se        lcl       ucl
## pi:(Intercept) -5.958179 44.3534840 -92.891010 80.974651
## p:(Intercept)  -3.348549  0.5896256  -4.504215 -2.192883
## p:mixture2     -5.815320 44.9591640 -93.935284 82.304644
## f0:(Intercept) 10.915003 44.8658140 -77.021994 98.852000
##
##
## Real Parameter pi
##
##
## mixture:1 0.002578
##
##
## Real Parameter p
##
##                       1            2            3            4            5
## mixture:1 0.0339427000 0.0339427000 0.0339427000 0.0339427000 0.0339427000
```

```
## mixture:2 0.0001047458 0.0001047458 0.0001047458 0.0001047458 0.0001047458
##                      6            7            8            9           10
## mixture:1 0.0339427000 0.0339427000 0.0339427000 0.0339427000 0.0339427000
## mixture:2 0.0001047458 0.0001047458 0.0001047458 0.0001047458 0.0001047458
##                     11           12           13           14           15
## mixture:1 0.0339427000 0.0339427000 0.0339427000 0.0339427000 0.0339427000
## mixture:2 0.0001047458 0.0001047458 0.0001047458 0.0001047458 0.0001047458
##                     16           17
## mixture:1 0.0339427000 0.0339427000
## mixture:2 0.0001047458 0.0001047458
##
##
## Real Parameter c
##
##                      2            3            4            5            6
## mixture:1 0.0339427000 0.0339427000 0.0339427000 0.0339427000 0.0339427000
## mixture:2 0.0001047458 0.0001047458 0.0001047458 0.0001047458 0.0001047458
##                      7            8            9           10           11
## mixture:1 0.0339427000 0.0339427000 0.0339427000 0.0339427000 0.0339427000
## mixture:2 0.0001047458 0.0001047458 0.0001047458 0.0001047458 0.0001047458
##                     12           13           14           15           16
## mixture:1 0.0339427000 0.0339427000 0.0339427000 0.0339427000 0.0339427000
## mixture:2 0.0001047458 0.0001047458 0.0001047458 0.0001047458 0.0001047458
##                     17
## mixture:1 0.0339427000
## mixture:2 0.0001047458
##
##
## Real Parameter f0
##
##         1
##  54995.29
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=2)
## -2lnL:  -207.0207
## AICc :  -196.9987  (unadjusted=-203.0163)
##
## Beta
##                   estimate         se        lcl       ucl
## pi:(Intercept) -18.571740 20.9135130 -59.562226 22.418745
## p:(Intercept)    1.398062  5.1212574  -8.639603 11.435727
## p:mixture2     -12.912532 17.6697100 -47.545164 21.720100
## c:(Intercept)   -4.128123  0.2320996  -4.583038 -3.673208
## f0:(Intercept)  13.758253 17.7964470 -21.122783 48.639289
##
##
## Real Parameter pi
##
##
## mixture:1 8.597964e-09
##
```

```
##
## Real Parameter p
##
##                      1            2            3            4            5
## mixture:1 8.018762e-01 8.018762e-01 8.018762e-01 8.018762e-01 8.018762e-01
## mixture:2 9.984463e-06 9.984463e-06 9.984463e-06 9.984463e-06 9.984463e-06
##                      6            7            8            9           10
## mixture:1 8.018762e-01 8.018762e-01 8.018762e-01 8.018762e-01 8.018762e-01
## mixture:2 9.984463e-06 9.984463e-06 9.984463e-06 9.984463e-06 9.984463e-06
##                     11           12           13           14           15
## mixture:1 8.018762e-01 8.018762e-01 8.018762e-01 8.018762e-01 8.018762e-01
## mixture:2 9.984463e-06 9.984463e-06 9.984463e-06 9.984463e-06 9.984463e-06
##                     16           17
## mixture:1 8.018762e-01 8.018762e-01
## mixture:2 9.984463e-06 9.984463e-06
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0158576 0.0158576 0.0158576 0.0158576 0.0158576 0.0158576 0.0158576
## mixture:2 0.0158576 0.0158576 0.0158576 0.0158576 0.0158576 0.0158576 0.0158576
##                   9        10        11        12        13        14        15
## mixture:1 0.0158576 0.0158576 0.0158576 0.0158576 0.0158576 0.0158576 0.0158576
## mixture:2 0.0158576 0.0158576 0.0158576 0.0158576 0.0158576 0.0158576 0.0158576
##                  16        17
## mixture:1 0.0158576 0.0158576
## mixture:2 0.0158576 0.0158576
##
##
## Real Parameter f0
##
##         1
##  944350.6
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  20  (unadjusted=18)
## -2lnL:  -260.1053
## AICc :  -219.7961  (unadjusted=-223.85369)
##
## Beta
##                       estimate           se           lcl         ucl
## pi:(Intercept) -2.063100e+01 1071.6111000 -2120.9888000 2079.726800
## p:(Intercept)  -2.530107e+00    0.0000000    -2.5301067   -2.530107
## p:time2         2.314846e+00    1.0500040     0.2568376    4.372853
## p:time3         1.390284e+00    1.1191474    -0.8032451    3.583813
## p:time4         2.411536e+00    1.0456673     0.3620285    4.461044
## p:time5         2.499936e+00    1.0420404     0.4575365    4.542335
## p:time6         2.411539e+00    1.0456672     0.3620314    4.461047
## p:time7         2.581366e+00    1.0389618     0.5450006    4.617731
## p:time8         2.314842e+00    1.0500035     0.2568349    4.372849
## p:time9         2.314844e+00    1.0500034     0.2568373    4.372851
```

```
## p:time10        1.390285e+00    1.1191439    -0.8032369    3.583807
## p:time11        2.913758e+00    1.0286387     0.8976263    4.929890
## p:time12        2.855202e+00    1.0302236     0.8359638    4.874440
## p:time13        2.793184e+00    1.0320039     0.7704564    4.815912
## p:time14        2.411539e+00    1.0456675     0.3620309    4.461048
## p:time15        2.499937e+00    1.0420401     0.4575386    4.542336
## p:time16        2.969225e+00    1.0272190     0.9558752    4.982574
## p:time17       -1.073926e-04    1.4150289    -2.7735641    2.773349
## p:mixture2     -4.065578e+00    0.0000000    -4.0655778   -4.065578
## f0:(Intercept)  6.349158e+00    0.2691008     5.8217205    6.876596
##
##
## Real Parameter pi
##
##
## mixture:1 1.096654e-09
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0737744 0.4463916 0.2423529 0.4703921 0.4924578 0.4703928 0.512812
## mixture:2 0.0013644 0.0136424 0.0054569 0.0150066 0.0163708 0.0150066 0.017735
##                    8         9        10        11        12        13        14
## mixture:1 0.4463907 0.4463912 0.2423531 0.5947535 0.5805655 0.5653926 0.4703928
## mixture:2 0.0136423 0.0136423 0.0054569 0.0245562 0.0231920 0.0218278 0.0150066
##                   15        16        17
## mixture:1 0.4924582 0.6080488 0.0737670
## mixture:2 0.0163708 0.0259205 0.0013642
##
##
## Real Parameter c
##
##                    2         3         4         5         6        7         8
## mixture:1 0.4463916 0.2423529 0.4703921 0.4924578 0.4703928 0.512812 0.4463907
## mixture:2 0.0136424 0.0054569 0.0150066 0.0163708 0.0150066 0.017735 0.0136423
##                    9        10        11        12        13        14        15
## mixture:1 0.4463912 0.2423531 0.5947535 0.5805655 0.5653926 0.4703928 0.4924582
## mixture:2 0.0136423 0.0054569 0.0245562 0.0231920 0.0218278 0.0150066 0.0163708
##                   16        17
## mixture:1 0.6080488 0.0737670
## mixture:2 0.0259205 0.0013642
##
##
## Real Parameter f0
##
##        1
##  572.011
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c(~1)f0(~1)
##
## Npar :  21  (unadjusted=17)
## -2lnL:  -266.7386
```

```
## AICc :  -224.3982  (unadjusted=-232.51347)
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept)  -4.7070521  149.9743000  -298.6566800  289.2425800
## p:(Intercept)   -0.4319296    0.0000000    -0.4319296   -0.4319296
## p:time2          3.1142812  148.4900500  -287.9262300  294.1547900
## p:time3          1.9999570  168.5840800  -328.4248600  332.4247700
## p:time4          3.3916791  172.2221200  -334.1636900  340.9470500
## p:time5          3.5718583  172.3751600  -334.2834600  341.4271800
## p:time6          3.4736552  172.3803500  -334.3918400  341.3391500
## p:time7          3.7672023  172.3804700  -334.0985200  341.6329300
## p:time8          3.6880678  172.3805100  -334.1777400  341.5538800
## p:time9          3.4105290  172.3806600  -334.4555800  341.2766400
## p:time10         2.5991628  172.3812000  -335.2680000  340.4663200
## p:time11         4.4902073  172.3804300  -333.3754300  342.3558500
## p:time12         4.7678402  172.3804400  -333.0978200  342.6335000
## p:time13         4.9628107  172.3804800  -332.9029400  342.8285600
## p:time14         5.0862855  172.3805600  -332.7796200  342.9521900
## p:time15         5.1534990  172.3807100  -332.7127000  343.0197000
## p:time16         8.6799135  172.3832900  -329.1913400  346.5511700
## p:time17        22.2457040 3819.9668000 -7464.8893000 7509.3807000
## p:mixture2      -5.4753412    0.0000000    -5.4753412   -5.4753412
## c:(Intercept)   -4.1203191    0.2312709    -4.5736101   -3.6670281
## f0:(Intercept) -18.5456170 2506.6848000 -4931.6479000 4894.5567000
##
##
## Real Parameter pi
##
##
## mixture:1 0.0089505
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.3936657 0.9359772 0.8275022 0.9507223 0.9585100 0.9544239 0.9656192
## mixture:2 0.0027122 0.0577042 0.0196986 0.0747723 0.0882323 0.0806450 0.1052629
##                    8         9        10        11        12        13        14
## mixture:1 0.9628931 0.9515979 0.8972682 0.9830147 0.9870792 0.9893436 0.9905697
## mixture:2 0.0980393 0.0760869 0.0352941 0.1951223 0.2424249 0.2800003 0.3055545
##                   15        16        17
## mixture:1 0.9911773 0.9997383 1.0000000
## mixture:2 0.3200000 0.9411795 0.9999999
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
## mixture:2 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
##                    9        10        11        12        13        14        15
## mixture:1 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
## mixture:2 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
```

```
##                   16        17
## mixture:1 0.0159798 0.0159798
## mixture:2 0.0159798 0.0159798
##
##
## Real Parameter f0
##
##             1
##  8.825531e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  19  (unadjusted=18)
## -2lnL:  -260.1053
## AICc :  -221.8256  (unadjusted=-223.85369)
##
## Beta
##                       estimate        se           lcl           ucl
## pi:(Intercept) -8.121852e-04 0.0000000 -0.0008121852 -0.0008121852
## p:(Intercept)  -6.595771e+00 0.5293767 -7.6333489000 -5.5581923000
## p:time2         2.314931e+00 0.5792631  1.1795749000  3.4502861000
## p:time3         1.390375e+00 0.6968101  0.0246268000  2.7561224000
## p:time4         2.411625e+00 0.5713632  1.2917529000  3.5314967000
## p:time5         2.500023e+00 0.3996285  1.7167508000  3.2832945000
## p:time6         2.411624e+00 0.6975777  1.0443716000  3.7788761000
## p:time7         2.581453e+00 0.5589921  1.4858283000  3.6770774000
## p:time8         2.314932e+00 0.5792631  1.1795765000  3.4502880000
## p:time9         2.314932e+00 0.5792631  1.1795763000  3.4502878000
## p:time10        1.390375e+00 0.6968091  0.0246293000  2.7561208000
## p:time11        2.913844e+00 0.5395497  1.8563264000  3.9713613000
## p:time12        2.855289e+00 0.5425676  1.7918560000  3.9187212000
## p:time13        2.793268e+00 0.5459434  1.7232189000  3.8633169000
## p:time14        2.411625e+00 0.5713630  1.2917539000  3.5314967000
## p:time15        2.500022e+00 0.5646956  1.3932187000  3.6068254000
## p:time16        2.969311e+00 0.4477944  2.0916337000  3.8469879000
## p:time17       -4.086547e-05 1.1115426 -2.1786644000  2.1785827000
## f0:(Intercept)  6.349159e+00 0.2690977  5.8217271000  6.8765903000
##
##
## Real Parameter pi
##
##
## mixture:1 0.499797
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0013643 0.0136424 0.0054569 0.0150066 0.0163708 0.0150066 0.0177351
## mixture:2 0.0013643 0.0136424 0.0054569 0.0150066 0.0163708 0.0150066 0.0177351
##                    8         9        10        11        12        13        14
## mixture:1 0.0136424 0.0136424 0.0054569 0.0245562 0.023192 0.0218278 0.0150066
## mixture:2 0.0136424 0.0136424 0.0054569 0.0245562 0.023192 0.0218278 0.0150066
```

```
##                  15        16        17
## mixture:1 0.0163708 0.0259205 0.0013642
## mixture:2 0.0163708 0.0259205 0.0013642
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0136424 0.0054569 0.0150066 0.0163708 0.0150066 0.0177351 0.0136424
## mixture:2 0.0136424 0.0054569 0.0150066 0.0163708 0.0150066 0.0177351 0.0136424
##                   9        10        11        12        13        14        15
## mixture:1 0.0136424 0.0054569 0.0245562 0.023192 0.0218278 0.0150066 0.0163708
## mixture:2 0.0136424 0.0054569 0.0245562 0.023192 0.0218278 0.0150066 0.0163708
##                  16        17
## mixture:1 0.0259205 0.0013642
## mixture:2 0.0259205 0.0013642
##
##
## Real Parameter f0
##
##         1
##  572.0113
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  20  (unadjusted=17)
## -2lnL:  -266.7386
## AICc :  -226.4293  (unadjusted=-232.51348)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept)  6.286813e-06    0.0000000  6.286813e-06  6.286813e-06
## p:(Intercept)  -5.075171e+00    1.0031263 -7.041299e+00 -3.109043e+00
## p:time2         2.367120e+00    1.0549547  2.994085e-01  4.434831e+00
## p:time3         1.183348e+00    1.1603453 -1.090929e+00  3.457625e+00
## p:time4         2.560410e+00    1.0509638  5.005209e-01  4.620299e+00
## p:time5         2.739796e+00    1.0476930  6.863180e-01  4.793274e+00
## p:time6         2.641558e+00    1.0559518  5.718925e-01  4.711224e+00
## p:time7         2.935105e+00    1.0485227  8.800006e-01  4.990210e+00
## p:time8         2.855969e+00    1.0569446  7.843573e-01  4.927580e+00
## p:time9         2.578431e+00    1.0774437  4.666408e-01  4.690220e+00
## p:time10        1.767066e+00    1.1626650 -5.117570e-01  4.045890e+00
## p:time11        3.658104e+00    1.0411119  1.617525e+00  5.698683e+00
## p:time12        3.935736e+00    1.0434379  1.890598e+00  5.980874e+00
## p:time13        4.130709e+00    1.0514128  2.069940e+00  6.191478e+00
## p:time14        4.254193e+00    1.0663823  2.164084e+00  6.344303e+00
## p:time15        4.321401e+00    1.0909106  2.183216e+00  6.459586e+00
## p:time16        7.847749e+00    1.4383159  5.028650e+00  1.066685e+01
## p:time17        2.216913e+01 4713.0343000 -9.215378e+03  9.259717e+03
## c:(Intercept)  -4.120319e+00    0.2312709 -4.573610e+00 -3.667028e+00
## f0:(Intercept) -1.873190e+01 4844.0228000 -9.513017e+03  9.475553e+03
##
##
```

```
## Real Parameter pi
##
##
## mixture:1 0.5000016
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0062112 0.0624999 0.0199999 0.0748298 0.0882353 0.0806452 0.1052632
## mixture:2 0.0062112 0.0624999 0.0199999 0.0748298 0.0882353 0.0806452 0.1052632
##                   8        9        10        11        12        13        14
## mixture:1 0.0980393 0.076087 0.0352942 0.1951218 0.2424241 0.2799999 0.3055561
## mixture:2 0.0980393 0.076087 0.0352942 0.1951218 0.2424241 0.2799999 0.3055561
##                  15        16 17
## mixture:1 0.3200004 0.9411759  1
## mixture:2 0.3200004 0.9411759  1
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
## mixture:2 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
##                   9        10        11        12        13        14        15
## mixture:1 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
## mixture:2 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
##                  16        17
## mixture:1 0.0159798 0.0159798
## mixture:2 0.0159798 0.0159798
##
##
## Real Parameter f0
##
##             1
##  7.325529e-09
```

Examine model-selection table

```
iguane.results
```

```
##                                 model npar      AICc DeltaAICc       weight
## 8           pi(~1)p(~time)c(~1)f0(~1)   20 -226.4293  0.000000 6.673047e-01
## 6 pi(~1)p(~time + mixture)c(~1)f0(~1)   21 -224.3982  2.031053 2.417055e-01
## 7             pi(~1)p(~time)c()f0(~1)   19 -221.8256  4.603652 6.678114e-02
## 5   pi(~1)p(~time + mixture)c()f0(~1)   20 -219.7961  6.633210 2.420700e-02
## 2              pi(~1)p(~1)c(~1)f0(~1)    4 -199.0191 27.410143 7.452247e-07
## 1                pi(~1)p(~1)c()f0(~1)    3 -197.3926 29.036673 3.304385e-07
## 3          pi(~1)p(~mixture)c()f0(~1)    4 -197.2132 29.216033 3.020948e-07
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 -196.9987 29.430562 2.713682e-07
##    Deviance
## 8  92.83873
## 6  92.83873
```

```
## 7  99.47194
## 5  99.47194
## 2 152.54351
## 1 156.17590
## 3 154.34940
## 4 152.55660
```

examine model names and find the name of the top model

```
names(iguane.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"
```

examine the output from top-ranked model (#8)

```
iguane.results$p.time.behav$results$real
```

```
##                 estimate           se           lcl          ucl fixed note
## pi g1 m1    5.000016e-01 0.000000e+00  5.000016e-01 5.000016e-01
## p g1 t1 m1  6.211200e-03 6.191900e-03  8.742244e-04 4.273580e-02
## p g1 t2 m1  6.249990e-02 1.913660e-02  3.395460e-02 1.122544e-01
## p g1 t3 m1  1.999990e-02 1.143090e-02  6.464700e-03 6.015860e-02
## p g1 t4 m1  7.482980e-02 2.170150e-02  4.192040e-02 1.300673e-01
## p g1 t5 m1  8.823530e-02 2.432170e-02  5.079030e-02 1.489543e-01
## p g1 t6 m1  8.064520e-02 2.445230e-02  4.393850e-02 1.434171e-01
## p g1 t7 m1  1.052632e-01 2.874310e-02  6.075500e-02 1.762585e-01
## p g1 t8 m1  9.803930e-02 2.944380e-02  5.356410e-02 1.727045e-01
## p g1 t9 m1  7.608700e-02 2.764250e-02  3.670480e-02 1.510961e-01
## p g1 t10 m1 3.529420e-02 2.001430e-02  1.142770e-02 1.037733e-01
## p g1 t11 m1 1.951218e-01 4.376340e-02  1.231167e-01 2.950685e-01
## p g1 t12 m1 2.424241e-01 5.275080e-02  1.541518e-01 3.597457e-01
## p g1 t13 m1 2.799999e-01 6.349800e-02  1.733879e-01 4.189416e-01
## p g1 t14 m1 3.055561e-01 7.677380e-02  1.779743e-01 4.720732e-01
## p g1 t15 m1 3.200004e-01 9.329530e-02  1.688060e-01 5.216297e-01
## p g1 t16 m1 9.411759e-01 5.706750e-02  6.796722e-01 9.917797e-01
## p g1 t17 m1 1.000000e+00 1.776188e-04 1.476033e-301 1.000000e+00
## c g1 t2 m1  1.597980e-02 3.636600e-03  1.021520e-02 2.491560e-02
## f0 g1 a0 t1 7.325529e-09 3.548503e-05  2.281262e-12 2.352355e-05
```

```
iguane.results$p.time.behav$results$derived
```

```
## $`N Population Size`
##   estimate lcl ucl
## 1      161 161 161
```

En séparant les sexes. Femelles, puis mâles.

Process data

```
iguane.proc <- process.data(iguaneF, begin.time = 1, model = "FullHet")
```

Create default design data

```
iguane.ddl <- make.design.data(iguane.proc)
```

Liste des modèles.

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

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

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

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

  return(iguane.results)
}
```

Run the models and examine the output

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3
## -2lnL:  -28.86054
## AICc :  -24.8526
##
## Beta
##                      estimate se           lcl           ucl
## pi:(Intercept) -0.0004682359  0 -0.0004682359 -0.0004682359
## p:(Intercept)  -4.4985787000  0 -4.4985787000 -4.4985787000
## f0:(Intercept)  6.0628628000  0  6.0628628000  6.0628628000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4998829
##
```

```
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
## mixture:2 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
##                    8         9        10        11        12        13        14
## mixture:1 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
## mixture:2 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
##                   15        16        17
## mixture:1 0.0110024 0.0110024 0.0110024
## mixture:2 0.0110024 0.0110024 0.0110024
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
## mixture:2 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
##                    9        10        11        12        13        14        15
## mixture:1 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
## mixture:2 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
##                   16        17
## mixture:1 0.0110024 0.0110024
## mixture:2 0.0110024 0.0110024
##
##
## Real Parameter f0
##
##         1
##  429.6036
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  -31.21468
## AICc :  -23.18816  (unadjusted=-25.198778)
##
## Beta
##                    estimate se         lcl         ucl
## pi:(Intercept)  -0.0029689  0  -0.0029689  -0.0029689
## p:(Intercept)  -16.5924140  0 -16.5924140 -16.5924140
## c:(Intercept)   -4.3445808  0  -4.3445808  -4.3445808
## f0:(Intercept)  18.2511650  0  18.2511650  18.2511650
##
##
## Real Parameter pi
##
##
## mixture:1 0.4992578
##
##
## Real Parameter p
```

```
##
##                       1            2            3            4            5
## mixture:1 6.223089e-08 6.223089e-08 6.223089e-08 6.223089e-08 6.223089e-08
## mixture:2 6.223089e-08 6.223089e-08 6.223089e-08 6.223089e-08 6.223089e-08
##                       6            7            8            9           10
## mixture:1 6.223089e-08 6.223089e-08 6.223089e-08 6.223089e-08 6.223089e-08
## mixture:2 6.223089e-08 6.223089e-08 6.223089e-08 6.223089e-08 6.223089e-08
##                      11           12           13           14           15
## mixture:1 6.223089e-08 6.223089e-08 6.223089e-08 6.223089e-08 6.223089e-08
## mixture:2 6.223089e-08 6.223089e-08 6.223089e-08 6.223089e-08 6.223089e-08
##                      16           17
## mixture:1 6.223089e-08 6.223089e-08
## mixture:2 6.223089e-08 6.223089e-08
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0128107 0.0128107 0.0128107 0.0128107 0.0128107 0.0128107 0.0128107
## mixture:2 0.0128107 0.0128107 0.0128107 0.0128107 0.0128107 0.0128107 0.0128107
##                    9        10        11        12        13        14        15
## mixture:1 0.0128107 0.0128107 0.0128107 0.0128107 0.0128107 0.0128107 0.0128107
## mixture:2 0.0128107 0.0128107 0.0128107 0.0128107 0.0128107 0.0128107 0.0128107
##                   16        17
## mixture:1 0.0128107 0.0128107
## mixture:2 0.0128107 0.0128107
##
##
## Real Parameter f0
##
##         1
##  84407327
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  -32.69302
## AICc :  -24.66649  (unadjusted=-26.677115)
##
## Beta
##                  estimate         se         lcl       ucl
## pi:(Intercept) -8.513124 53.9520450 -114.259130  97.23289
## p:(Intercept)  -2.815019  0.6865202   -4.160599  -1.46944
## p:mixture2     -7.405560 54.2374160 -113.710900  98.89978
## f0:(Intercept) 11.690545 54.3178260  -94.772395 118.15349
##
##
## Real Parameter pi
##
##
## mixture:1 0.0002007751
##
##
```

```
## Real Parameter p
##
##                      1            2            3            4            5
## mixture:1 5.651790e-02 5.651790e-02 5.651790e-02 5.651790e-02 5.651790e-02
## mixture:2 3.641187e-05 3.641187e-05 3.641187e-05 3.641187e-05 3.641187e-05
##                      6            7            8            9           10
## mixture:1 5.651790e-02 5.651790e-02 5.651790e-02 5.651790e-02 5.651790e-02
## mixture:2 3.641187e-05 3.641187e-05 3.641187e-05 3.641187e-05 3.641187e-05
##                     11           12           13           14           15
## mixture:1 5.651790e-02 5.651790e-02 5.651790e-02 5.651790e-02 5.651790e-02
## mixture:2 3.641187e-05 3.641187e-05 3.641187e-05 3.641187e-05 3.641187e-05
##                     16           17
## mixture:1 5.651790e-02 5.651790e-02
## mixture:2 3.641187e-05 3.641187e-05
##
##
## Real Parameter c
##
##                      2            3            4            5            6
## mixture:1 5.651790e-02 5.651790e-02 5.651790e-02 5.651790e-02 5.651790e-02
## mixture:2 3.641187e-05 3.641187e-05 3.641187e-05 3.641187e-05 3.641187e-05
##                      7            8            9           10           11
## mixture:1 5.651790e-02 5.651790e-02 5.651790e-02 5.651790e-02 5.651790e-02
## mixture:2 3.641187e-05 3.641187e-05 3.641187e-05 3.641187e-05 3.641187e-05
##                     12           13           14           15           16
## mixture:1 5.651790e-02 5.651790e-02 5.651790e-02 5.651790e-02 5.651790e-02
## mixture:2 3.641187e-05 3.641187e-05 3.641187e-05 3.641187e-05 3.641187e-05
##                     17
## mixture:1 5.651790e-02
## mixture:2 3.641187e-05
##
##
## Real Parameter f0
##
##         1
##  119437.1
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5
## -2lnL:  -64
## AICc :  -61.99735
##
## Beta
##                   estimate se        lcl        ucl
## pi:(Intercept) -51.499849  0 -51.499849 -51.499849
## p:(Intercept)   -1.294573  0  -1.294573  -1.294573
## p:mixture2     -33.058014  0 -33.058014 -33.058014
## c:(Intercept)   -4.066545  0  -4.066545  -4.066545
## f0:(Intercept)  36.007250  0  36.007250  36.007250
##
##
## Real Parameter pi
```

```
##
##
## mixture:1 4.304273e-23
##
##
## Real Parameter p
##
##                      1            2            3            4            5
## mixture:1 2.150798e-01 2.150798e-01 2.150798e-01 2.150798e-01 2.150798e-01
## mixture:2 1.204651e-15 1.204651e-15 1.204651e-15 1.204651e-15 1.204651e-15
##                      6            7            8            9           10
## mixture:1 2.150798e-01 2.150798e-01 2.150798e-01 2.150798e-01 2.150798e-01
## mixture:2 1.204651e-15 1.204651e-15 1.204651e-15 1.204651e-15 1.204651e-15
##                     11           12           13           14           15
## mixture:1 2.150798e-01 2.150798e-01 2.150798e-01 2.150798e-01 2.150798e-01
## mixture:2 1.204651e-15 1.204651e-15 1.204651e-15 1.204651e-15 1.204651e-15
##                     16           17
## mixture:1 2.150798e-01 2.150798e-01
## mixture:2 1.204651e-15 1.204651e-15
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0168478 0.0168478 0.0168478 0.0168478 0.0168478 0.0168478 0.0168478
## mixture:2 0.0168478 0.0168478 0.0168478 0.0168478 0.0168478 0.0168478 0.0168478
##                   9        10        11        12        13        14        15
## mixture:1 0.0168478 0.0168478 0.0168478 0.0168478 0.0168478 0.0168478 0.0168478
## mixture:2 0.0168478 0.0168478 0.0168478 0.0168478 0.0168478 0.0168478 0.0168478
##                  16        17
## mixture:1 0.0168478 0.0168478
## mixture:2 0.0168478 0.0168478
##
##
## Real Parameter f0
##
##             1
##  4.342602e+15
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  20  (unadjusted=18)
## -2lnL:  -81.40789
## AICc :  -40.84489  (unadjusted=-46.998528)
##
## Beta
##                    estimate         se         lcl        ucl
## pi:(Intercept)  -9.0953142 24.5035210 -57.1222150  38.931587
## p:(Intercept)   -4.4974990  1.1451382  -6.7419699  -2.253028
## p:time2         -0.0258598  1.3363986  -2.6452011   2.593482
## p:time3         -0.0299601  1.3428270  -2.6619010   2.601981
## p:time4          1.9398339  1.0012892  -0.0226930   3.902361
## p:time5          1.3717357  1.0525804  -0.6913219   3.434793
```

```
## p:time6          1.5991894  1.0288231  -0.4173039   3.615683
## p:time7          1.9398845  1.0001730  -0.0204547   3.900224
## p:time8          2.0754400  0.9919176   0.1312814   4.019599
## p:time9          1.5977441  1.0286655  -0.4184403   3.613929
## p:time10         1.0806041  1.0868324  -1.0495874   3.210796
## p:time11         2.5734867  0.9679421   0.6763201   4.470653
## p:time12         2.4909258  0.9709234   0.5879160   4.393936
## p:time13         1.9389317  1.0019096  -0.0248112   3.902675
## p:time14         1.9383463  1.0005343  -0.0227010   3.899394
## p:time15         1.7830948  1.0122202  -0.2008569   3.767046
## p:time16         2.3037491  0.9792149   0.3844879   4.223010
## p:time17       -71.1303180  0.0000000 -71.1303180 -71.130318
## p:mixture2      -8.0100698 24.5656100 -56.1586660  40.138527
## f0:(Intercept)  12.2415920 24.5841830 -35.9434080  60.426591
##
##
## Real Parameter pi
##
##
## mixture:1 0.0001121777
##
##
## Real Parameter p
##
##                      1            2            3            4            5
## mixture:1 1.10142e-02 1.073600e-02 1.069250e-02 7.191320e-02 4.205700e-02
## mixture:2 3.69854e-06 3.604123e-06 3.589375e-06 2.573237e-05 1.458018e-05
##                      6            7           8            9           10
## mixture:1 5.223720e-02 7.191660e-02 8.15060e-02 5.216570e-02 3.177160e-02
## mixture:2 1.830388e-05 2.573368e-05 2.94694e-05 1.827744e-05 1.089752e-05
##                     11           12           13           14           15
## mixture:1 1.274148e-01 0.1185145000 7.185300e-02 7.181400e-02 6.212870e-02
## mixture:2 4.849109e-05 0.0000446486 2.570917e-05 2.569413e-05 2.199939e-05
##                     16           17
## mixture:1 1.003132e-01 1.429738e-33
## mixture:2 3.702724e-05 4.748183e-37
##
##
## Real Parameter c
##
##                      2            3            4            5            6
## mixture:1 1.073600e-02 1.069250e-02 7.191320e-02 4.205700e-02 5.223720e-02
## mixture:2 3.604123e-06 3.589375e-06 2.573237e-05 1.458018e-05 1.830388e-05
##                      7           8            9           10           11
## mixture:1 7.191660e-02 8.15060e-02 5.216570e-02 3.177160e-02 1.274148e-01
## mixture:2 2.573368e-05 2.94694e-05 1.827744e-05 1.089752e-05 4.849109e-05
##                     12           13           14           15           16
## mixture:1 0.1185145000 7.185300e-02 7.181400e-02 6.212870e-02 1.003132e-01
## mixture:2 0.0000446486 2.570917e-05 2.569413e-05 2.199939e-05 3.702724e-05
##                     17
## mixture:1 1.429738e-33
## mixture:2 4.748183e-37
##
##
```

```
## Real Parameter f0
##
##         1
##  207231.5
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c(~1)f0(~1)
##
## Npar :  21  (unadjusted=16)
## -2lnL:  -81.57954
## AICc :  -38.95982  (unadjusted=-49.215904)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept)  -6.3453077    0.0000000    -6.3453077   -6.3453077
## p:(Intercept)    0.4556517  104.3066000  -203.9852900  204.8965900
## p:time2          0.0724592    0.0000000     0.0724592    0.0724592
## p:time3          0.1082537    0.0000000     0.1082537    0.1082537
## p:time4          2.1523005    0.0000000     2.1523005    2.1523005
## p:time5          1.6456145    0.0000000     1.6456145    1.6456145
## p:time6          1.9378551    0.0000000     1.9378551    1.9378551
## p:time7          2.3796960    0.0000000     2.3796960    2.3796960
## p:time8          2.6490331    0.0000000     2.6490331    2.6490331
## p:time9          2.2743341    0.0000000     2.2743341    2.2743341
## p:time10         1.3988719    0.0000000     1.3988719    1.3988719
## p:time11         3.3639049    0.0000000     3.3639049    3.3639049
## p:time12         3.7167282    0.0000000     3.7167282    3.7167282
## p:time13         3.3729461    0.0000000     3.3729461    3.3729461
## p:time14         3.9578875    0.0000000     3.9578875    3.9578875
## p:time15         3.7659915    0.0000000     3.7659915    3.7659915
## p:time16        36.6736860  213.1089600  -381.0198800  454.3672500
## p:time17        -0.5396811 3538.7062000 -6936.4040000 6935.3246000
## p:mixture2      -5.0325781   85.6328150  -172.8729000  162.8077400
## c:(Intercept)   -4.3340146    0.3558638    -5.0315076   -3.6365217
## f0:(Intercept) -19.0321010 2577.9783000 -5071.8696000 5033.8054000
##
##
## Real Parameter pi
##
##
## mixture:1 0.0017519
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.6119821 0.6290424 0.6373557 0.9313716 0.8910262 0.9163308 0.9445563
## mixture:2 0.0101817 0.0109385 0.0113326 0.0813140 0.0506272 0.0666658 0.0999995
##                    8         9        10        11        12        13        14
## mixture:1 0.9570856 0.9387730 0.8646574 0.9785334 0.9848185 0.9787225 0.9880327
## mixture:2 0.1269839 0.0909085 0.0400000 0.2291669 0.2972979 0.2307679 0.3500001
##                   15 16        17
## mixture:1 0.9855377  1 0.4790050
## mixture:2 0.3076913  1 0.0059606
```

```
##
##
## Real Parameter c
##
##                   2        3        4        5        6        7        8
## mixture:1 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945
## mixture:2 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945
##                   9       10       11       12       13       14       15
## mixture:1 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945
## mixture:2 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945
##                  16       17
## mixture:1 0.012945 0.012945
## mixture:2 0.012945 0.012945
##
##
## Real Parameter f0
##
##             1
##  5.425795e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  19  (unadjusted=17)
## -2lnL:  -77.46358
## AICc :  -38.95454  (unadjusted=-43.054214)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  4.466500e-03    0.0000000     0.0044665    0.0044665
## p:(Intercept)  -6.223732e+00    0.4828292    -7.1700772   -5.2773867
## p:time2         7.351640e-05    1.0604018    -2.0783140    2.0784611
## p:time3         5.192239e-05    1.0604091    -2.0783500    2.0784538
## p:time4         1.957933e+00    0.5170812     0.9444538    2.9714120
## p:time5         1.392317e+00    0.6119654     0.1928647    2.5917690
## p:time6         1.617457e+00    0.5696533     0.5009368    2.7339776
## p:time7         1.957932e+00    0.3981671     1.1775250    2.7383399
## p:time8         2.093472e+00    0.4995231     1.1144066    3.0725370
## p:time9         1.617457e+00    0.5696534     0.5009367    2.7339781
## p:time10        1.102643e+00    0.2830366     0.5478909    1.6573943
## p:time11        2.589079e+00    0.4488824     1.7092697    3.4688886
## p:time12        2.507008e+00    0.4559539     1.6133386    3.4006779
## p:time13        1.957932e+00    0.5170815     0.9444525    2.9714119
## p:time14        1.957933e+00    0.5170816     0.9444528    2.9714127
## p:time15        1.801778e+00    0.5396081     0.7441464    2.8594100
## p:time16        2.320644e+00    0.4738563     1.3918853    3.2494020
## p:time17       -1.376846e+01 1022.6895000 -2018.2400000 1990.7031000
## f0:(Intercept)  6.032014e+00    0.4002788     5.2474677    6.8165604
##
##
## Real Parameter pi
##
##
## mixture:1 0.5011166
```

```
##
##
## Real Parameter p
##
##                    1         2        3         4         5         6         7
## mixture:1 0.0019779 0.0019781 0.001978 0.0138462 0.0079121 0.0098902 0.0138462
## mixture:2 0.0019779 0.0019781 0.001978 0.0138462 0.0079121 0.0098902 0.0138462
##                    8         9        10        11        12        13        14
## mixture:1 0.0158243 0.0098902 0.0059341 0.0257144 0.0237364 0.0138462 0.0138462
## mixture:2 0.0158243 0.0098902 0.0059341 0.0257144 0.0237364 0.0138462 0.0138462
##                   15        16           17
## mixture:1 0.0118682 0.0197803 2.077318e-09
## mixture:2 0.0118682 0.0197803 2.077318e-09
##
##
## Real Parameter c
##
##                    2        3         4         5         6         7         8
## mixture:1 0.0019781 0.001978 0.0138462 0.0079121 0.0098902 0.0138462 0.0158243
## mixture:2 0.0019781 0.001978 0.0138462 0.0079121 0.0098902 0.0138462 0.0158243
##                    9        10        11        12        13        14        15
## mixture:1 0.0098902 0.0059341 0.0257144 0.0237364 0.0138462 0.0138462 0.0118682
## mixture:2 0.0098902 0.0059341 0.0257144 0.0237364 0.0138462 0.0138462 0.0118682
##                   16           17
## mixture:1 0.0197803 2.077318e-09
## mixture:2 0.0197803 2.077318e-09
##
##
## Real Parameter f0
##
##         1
##  416.5531
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  20  (unadjusted=16)
## -2lnL:  -81.57954
## AICc :  -41.01654  (unadjusted=-49.215904)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept)   0.0020361  444.8686300 -8.719405e+02   871.944580
## p:(Intercept)   -4.4773777    1.0056880 -6.448526e+00    -2.506229
## p:time2          0.0113930    1.4223266 -2.776367e+00     2.799153
## p:time3          0.0229819    1.4223431 -2.764811e+00     2.810774
## p:time4          2.0538422    1.0802421 -6.343240e-02     4.171117
## p:time5          1.5461787    1.1290454 -6.667503e-01     3.759108
## p:time6          1.8383370    1.1071093 -3.315972e-01     4.008271
## p:time7          2.2801630    1.0817290  1.599741e-01     4.400352
## p:time8          2.5494631    1.0745197  4.434045e-01     4.655522
## p:time9          2.1747815    1.1096893 -2.095856e-04     4.349773
## p:time10         1.2993225    1.2378378 -1.126839e+00     3.725485
## p:time11         3.2643686    1.0627058  1.181465e+00     5.347272
```

```
## p:time12         3.6171748    1.0680726  1.523753e+00     5.710597
## p:time13         3.2734123    1.1081851  1.101369e+00     5.445455
## p:time14         3.8583347    1.1095895  1.683539e+00     6.033130
## p:time15         3.6664527    1.1715454  1.370224e+00     5.962682
## p:time16        22.4952860 2792.5063000 -5.450817e+03  5495.807700
## p:time17         4.1266177    0.0000000  4.126618e+00     4.126618
## c:(Intercept)   -4.3339943    0.3558602 -5.031480e+00    -3.636508
## f0:(Intercept) -20.1069960 8287.9988000 -1.626458e+04 16224.371000
##
##
## Real Parameter pi
##
##
## mixture:1 0.500509
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0112355 0.0113628 0.0114937 0.0813955 0.0506327 0.0666677 0.1000009
## mixture:2 0.0112355 0.0113628 0.0114937 0.0813955 0.0506327 0.0666677 0.1000009
##                    8         9        10        11       12        13        14
## mixture:1 0.1269816 0.0909082 0.0399999 0.2291691 0.297297 0.2307705 0.3499991
## mixture:2 0.1269816 0.0909082 0.0399999 0.2291691 0.297297 0.2307705 0.3499991
##                   15 16        17
## mixture:1 0.3076934  1 0.4131981
## mixture:2 0.3076934  1 0.4131981
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453
## mixture:2 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453
##                    9        10        11        12        13        14        15
## mixture:1 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453
## mixture:2 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453
##                   16        17
## mixture:1 0.0129453 0.0129453
## mixture:2 0.0129453 0.0129453
##
##
## Real Parameter f0
##
##             1
##  1.852006e-09
```

Examine model-selection table

```
iguane.results
```

```
##                                 model npar      AICc DeltaAICc       weight
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 -53.96019   0.00000 9.959456e-01
```

```
## 8           pi(~1)p(~time)c(~1)f0(~1)   20 -41.01654  12.94365 1.540132e-03
## 5   pi(~1)p(~time + mixture)c()f0(~1)   20 -40.84489  13.11530 1.413465e-03
## 6 pi(~1)p(~time + mixture)c(~1)f0(~1)   21 -38.95982  15.00036 5.507416e-04
## 7             pi(~1)p(~time)c()f0(~1)   19 -38.95454  15.00565 5.492883e-04
## 3          pi(~1)p(~mixture)c()f0(~1)    4 -24.66649  29.29369 4.337020e-07
## 2              pi(~1)p(~1)c(~1)f0(~1)    4 -23.18816  30.77203 2.070973e-07
## 1                pi(~1)p(~1)c()f0(~1)    3 -22.84464  31.11555 1.744137e-07
##    Deviance
## 4  71.03809
## 8  53.45855
## 5  53.63020
## 6  53.45855
## 7  57.57452
## 3 102.34508
## 2 103.82341
## 1 106.17755
```

examine model names and find the name of the top model

```
names(iguane.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"
```

examine the output from top-ranked model (#8)

```
iguane.results$p.time.behav$results$real
```

```
##                  estimate           se           lcl          ucl fixed note
## pi g1 m1    5.005090e-01 1.112170e+02 5.574022e-309 1.000000e+00
## p g1 t1 m1  1.123550e-02 1.117250e-02  1.580400e-03 7.542260e-02
## p g1 t2 m1  1.136280e-02 1.129850e-02  1.598200e-03 7.623280e-02
## p g1 t3 m1  1.149370e-02 1.142770e-02  1.616600e-03 7.705890e-02
## p g1 t4 m1  8.139550e-02 2.948600e-02  3.929880e-02 1.610277e-01
## p g1 t5 m1  5.063270e-02 2.466710e-02  1.913350e-02 1.272603e-01
## p g1 t6 m1  6.666770e-02 2.880350e-02  2.802210e-02 1.503647e-01
## p g1 t7 m1  1.000009e-01 3.585700e-02  4.842540e-02 1.952368e-01
## p g1 t8 m1  1.269816e-01 4.194810e-02  6.479290e-02 2.339291e-01
## p g1 t9 m1  9.090820e-02 3.876360e-02  3.834900e-02 2.004842e-01
## p g1 t10 m1 3.999990e-02 2.771280e-02  1.002530e-02 1.463468e-01
## p g1 t11 m1 2.291691e-01 6.066480e-02  1.316890e-01 3.682081e-01
## p g1 t12 m1 2.972970e-01 7.514160e-02  1.729048e-01 4.612709e-01
## p g1 t13 m1 2.307705e-01 8.262880e-02  1.075232e-01 4.276032e-01
## p g1 t14 m1 3.499991e-01 1.066536e-01  1.768399e-01 5.743985e-01
## p g1 t15 m1 3.076934e-01 1.280079e-01  1.203905e-01 5.907066e-01
## p g1 t16 m1 1.000000e+00 4.177494e-05 3.718457e-301 1.000000e+00
## p g1 t17 m1 4.131981e-01 0.000000e+00  4.131981e-01 4.131981e-01
## c g1 t2 m1  1.294530e-02 4.547100e-03  6.486800e-03 2.566800e-02
## f0 g1 a0 t1 1.852006e-09 1.534943e-05  4.484453e-13 7.648485e-06
```

```
iguane.results$p.time.behav$results$derived
```

```
## $`N Population Size`
##   estimate lcl      ucl
## 1       89  89 89.00001
```

Process data

```
iguane.proc <- process.data(iguaneM, begin.time = 1, model = "FullHet")
```

Create default design data

```
iguane.ddl <- make.design.data(iguane.proc)
```

Liste des modèles.

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

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

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

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

  return(iguane.results)
}
```

Run the models and examine the output

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3
## -2lnL:  45.30694
## AICc :  49.31676
##
## Beta
##                     estimate se           lcl           ucl
## pi:(Intercept)  0.0002263297  0  0.0002263297  0.0002263297
```

```
## p:(Intercept)  -3.9795879000  0 -3.9795879000 -3.9795879000
## f0:(Intercept)  5.2681866000  0  5.2681866000  5.2681866000
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000566
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                    8         9        10        11        12        13        14
## mixture:1 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                   15        16        17
## mixture:1 0.0183503 0.0183503 0.0183503
## mixture:2 0.0183503 0.0183503 0.0183503
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                    9        10        11        12        13        14        15
## mixture:1 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                   16        17
## mixture:1 0.0183503 0.0183503
## mixture:2 0.0183503 0.0183503
##
##
## Real Parameter f0
##
##         1
##  194.0637
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  44.81129
## AICc :  52.84411  (unadjusted=50.830966)
##
## Beta
##                      estimate se           lcl           ucl
## pi:(Intercept)  4.669427e-05  0  4.669427e-05  4.669427e-05
## p:(Intercept)  -6.200729e+00  0 -6.200729e+00 -6.200729e+00
## c:(Intercept)  -3.930040e+00  0 -3.930040e+00 -3.930040e+00
## f0:(Intercept)  7.627682e+00  0  7.627682e+00  7.627682e+00
```

```
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000117
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0020238 0.0020238 0.0020238 0.0020238 0.0020238 0.0020238 0.0020238
## mixture:2 0.0020238 0.0020238 0.0020238 0.0020238 0.0020238 0.0020238 0.0020238
##                    8         9        10        11        12        13        14
## mixture:1 0.0020238 0.0020238 0.0020238 0.0020238 0.0020238 0.0020238 0.0020238
## mixture:2 0.0020238 0.0020238 0.0020238 0.0020238 0.0020238 0.0020238 0.0020238
##                   15        16        17
## mixture:1 0.0020238 0.0020238 0.0020238
## mixture:2 0.0020238 0.0020238 0.0020238
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0192645 0.0192645 0.0192645 0.0192645 0.0192645 0.0192645 0.0192645
## mixture:2 0.0192645 0.0192645 0.0192645 0.0192645 0.0192645 0.0192645 0.0192645
##                    9        10        11        12        13        14        15
## mixture:1 0.0192645 0.0192645 0.0192645 0.0192645 0.0192645 0.0192645 0.0192645
## mixture:2 0.0192645 0.0192645 0.0192645 0.0192645 0.0192645 0.0192645 0.0192645
##                   16        17
## mixture:1 0.0192645 0.0192645
## mixture:2 0.0192645 0.0192645
##
##
## Real Parameter f0
##
##         1
##  2054.284
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  45.30694
## AICc :  53.33975  (unadjusted=49.316766)
##
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept) -16.226478 0.0000000 -16.226478 -16.226478
## p:(Intercept)   -2.471390 0.0000000  -2.471390  -2.471390
## p:mixture2      -1.508198 0.0000000  -1.508198  -1.508198
## f0:(Intercept)   5.268187 0.3701061   4.542779   5.993595
##
##
```

```
## Real Parameter pi
##
##
## mixture:1 8.972843e-08
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0778884 0.0778884 0.0778884 0.0778884 0.0778884 0.0778884 0.0778884
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                   8         9        10        11        12        13        14
## mixture:1 0.0778884 0.0778884 0.0778884 0.0778884 0.0778884 0.0778884 0.0778884
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                  15        16        17
## mixture:1 0.0778884 0.0778884 0.0778884
## mixture:2 0.0183503 0.0183503 0.0183503
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0778884 0.0778884 0.0778884 0.0778884 0.0778884 0.0778884 0.0778884
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                   9        10        11        12        13        14        15
## mixture:1 0.0778884 0.0778884 0.0778884 0.0778884 0.0778884 0.0778884 0.0778884
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                  16        17
## mixture:1 0.0778884 0.0778884
## mixture:2 0.0183503 0.0183503
##
##
## Real Parameter f0
##
##         1
##  194.0637
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=2)
## -2lnL:  44.81842
## AICc :  54.86768  (unadjusted=48.828249)
##
## Beta
##                    estimate         se        lcl        ucl
## pi:(Intercept) -18.454540  8.1525492 -34.433536  -2.475543
## p:(Intercept)    1.983307 30.0178540 -56.851688  60.818303
## p:mixture2     -11.253233  0.0000000 -11.253233 -11.253233
## c:(Intercept)   -3.930689  0.3045532  -4.527613  -3.333764
## f0:(Intercept)  10.712983  0.0000000  10.712983  10.712983
##
##
## Real Parameter pi
```

```
##
##
## mixture:1 9.667079e-09
##
##
## Real Parameter p
##
##                      1            2            3            4            5
## mixture:1 8.790333e-01 8.790333e-01 8.790333e-01 8.790333e-01 8.790333e-01
## mixture:2 9.420662e-05 9.420662e-05 9.420662e-05 9.420662e-05 9.420662e-05
##                      6            7            8            9           10
## mixture:1 8.790333e-01 8.790333e-01 8.790333e-01 8.790333e-01 8.790333e-01
## mixture:2 9.420662e-05 9.420662e-05 9.420662e-05 9.420662e-05 9.420662e-05
##                     11           12           13           14           15
## mixture:1 8.790333e-01 8.790333e-01 8.790333e-01 8.790333e-01 8.790333e-01
## mixture:2 9.420662e-05 9.420662e-05 9.420662e-05 9.420662e-05 9.420662e-05
##                     16           17
## mixture:1 8.790333e-01 8.790333e-01
## mixture:2 9.420662e-05 9.420662e-05
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0192522 0.0192522 0.0192522 0.0192522 0.0192522 0.0192522 0.0192522
## mixture:2 0.0192522 0.0192522 0.0192522 0.0192522 0.0192522 0.0192522 0.0192522
##                   9        10        11        12        13        14        15
## mixture:1 0.0192522 0.0192522 0.0192522 0.0192522 0.0192522 0.0192522 0.0192522
## mixture:2 0.0192522 0.0192522 0.0192522 0.0192522 0.0192522 0.0192522 0.0192522
##                  16        17
## mixture:1 0.0192522 0.0192522
## mixture:2 0.0192522 0.0192522
##
##
## Real Parameter f0
##
##        1
##  44935.5
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  20  (unadjusted=17)
## -2lnL:  11.75915
## AICc :  52.45741  (unadjusted=46.266616)
##
## Beta
##                    estimate           se          lcl         ucl
## pi:(Intercept) -19.799791 2708.5922000 -5328.640700 5289.041100
## p:(Intercept)  -19.668114    0.0000000   -19.668114  -19.668114
## p:time2         18.652983    0.0000000    18.652983   18.652983
## p:time3         17.530892    0.0000000    17.530892   17.530892
## p:time4         17.822476    0.0000000    17.822476   17.822476
## p:time5         18.531235    0.0000000    18.531235   18.531235
```

```
## p:time6         18.235764    0.0000000    18.235764   18.235764
## p:time7         18.235649    0.0000000    18.235649   18.235649
## p:time8         17.121526    0.0000000    17.121526   17.121526
## p:time9         18.049547    0.0000000    18.049547   18.049547
## p:time10        16.424459    0.0000000    16.424459   16.424459
## p:time11        18.049558    0.0000000    18.049558   18.049558
## p:time12        18.049477    0.0000000    18.049477   18.049477
## p:time13        18.652943    0.0000000    18.652943   18.652943
## p:time14        17.822452    0.0000000    17.822452   17.822452
## p:time15        18.235787    0.0000000    18.235787   18.235787
## p:time16        18.652966    0.0000000    18.652966   18.652966
## p:time17        16.424310    0.0000000    16.424310   16.424310
## p:mixture2      -2.317495    0.0000000    -2.317495   -2.317495
## f0:(Intercept)   5.242285    0.3710652     4.514997    5.969572
##
##
## Real Parameter pi
##
##
## mixture:1 2.518026e-09
##
##
## Real Parameter p
##
##                        1         2         3         4         5         6
## mixture:1 2.872412e-09 0.2659769 0.1055313 0.1363859 0.2428940 0.1927329
## mixture:2 2.829902e-10 0.0344687 0.0114901 0.0153204 0.0306387 0.0229809
##                    7         8         9        10        11        12        13
## mixture:1 0.1927149 0.0726561 0.1654027 0.0375556 0.1654042 0.1653930 0.2659691
## mixture:2 0.0229783 0.0076598 0.0191510 0.0038296 0.0191512 0.0191497 0.0344674
##                   14        15        16        17
## mixture:1 0.1363831 0.1927364 0.2659736 0.0375502
## mixture:2 0.0153200 0.0229814 0.0344682 0.0038291
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.2659769 0.1055313 0.1363859 0.2428940 0.1927329 0.1927149 0.0726561
## mixture:2 0.0344687 0.0114901 0.0153204 0.0306387 0.0229809 0.0229783 0.0076598
##                    9        10        11        12        13        14        15
## mixture:1 0.1654027 0.0375556 0.1654042 0.1653930 0.2659691 0.1363831 0.1927364
## mixture:2 0.0191510 0.0038296 0.0191512 0.0191497 0.0344674 0.0153200 0.0229814
##                   16        17
## mixture:1 0.2659736 0.0375502
## mixture:2 0.0344682 0.0038291
##
##
## Real Parameter f0
##
##         1
##  189.1016
##
## Output summary for FullHet model
```

```
## Name : pi(~1)p(~time + mixture)c(~1)f0(~1)
##
## Npar :  21  (unadjusted=16)
## -2lnL:  7.257468
## AICc :  50.02619  (unadjusted=39.708172)
##
## Beta
##                   estimate           se           lcl          ucl
## pi:(Intercept) -14.498532 2.884710e+04 -56554.823000 56525.826000
## p:(Intercept)  -11.576966 0.000000e+00    -11.576966   -11.576966
## p:time2         15.719930 0.000000e+00     15.719930    15.719930
## p:time3         14.248211 0.000000e+00     14.248211    14.248211
## p:time4         15.009100 0.000000e+00     15.009100    15.009100
## p:time5         15.853479 0.000000e+00     15.853479    15.853479
## p:time6         15.491156 0.000000e+00     15.491156    15.491156
## p:time7         15.611870 0.000000e+00     15.611870    15.611870
## p:time8         14.748193 0.000000e+00     14.748193    14.748193
## p:time9         14.803670 0.000000e+00     14.803670    14.803670
## p:time10        14.139731 0.000000e+00     14.139731    14.139731
## p:time11        15.907975 0.000000e+00     15.907975    15.907975
## p:time12        16.097197 0.000000e+00     16.097197    16.097197
## p:time13        16.972713 0.000000e+00     16.972713    16.972713
## p:time14        16.567266 0.000000e+00     16.567266    16.567266
## p:time15        16.972764 0.000000e+00     16.972764    16.972764
## p:time16        19.611714 0.000000e+00     19.611714    19.611714
## p:time17        38.118042 0.000000e+00     38.118042    38.118042
## p:mixture2      -6.088896 0.000000e+00     -6.088896    -6.088896
## c:(Intercept)   -3.930005 3.044529e-01     -4.526733    -3.333277
## f0:(Intercept) -20.322336 4.653919e+03  -9142.004100  9101.359500
##
##
## Real Parameter pi
##
##
## mixture:1 5.050882e-07
##
##
## Real Parameter p
##
##                       1         2         3         4         5         6
## mixture:1 9.379586e-06 0.9843724 0.9353084 0.9686939 0.9862993 0.9804338
## mixture:2 2.127227e-08 0.1249976 0.0317484 0.0655735 0.1403504 0.1020451
##                    7         8         9        10        11        12        13
## mixture:1 0.9826200 0.959737 0.9618269 0.9284264 0.9870165 0.9892307 0.9954847
## mixture:2 0.1136497 0.051287 0.0540545 0.0285778 0.1470553 0.1724068 0.3333330
##                   14        15        16 17
## mixture:1 0.9932424 0.9954849 0.9996761  1
## mixture:2 0.2500031 0.3333443 0.8749937  1
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0192651 0.0192651 0.0192651 0.0192651 0.0192651 0.0192651 0.0192651
```

```
## mixture:2 0.0192651 0.0192651 0.0192651 0.0192651 0.0192651 0.0192651 0.0192651
##                   9        10        11        12        13        14        15
## mixture:1 0.0192651 0.0192651 0.0192651 0.0192651 0.0192651 0.0192651 0.0192651
## mixture:2 0.0192651 0.0192651 0.0192651 0.0192651 0.0192651 0.0192651 0.0192651
##                  16        17
## mixture:1 0.0192651 0.0192651
## mixture:2 0.0192651 0.0192651
##
##
## Real Parameter f0
##
##             1
##  1.493213e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  19  (unadjusted=17)
## -2lnL:  11.75916
## AICc :  50.39039  (unadjusted=46.266627)
##
## Beta
##                      estimate          se         lcl       ucl
## pi:(Intercept)  5.622480e-05 228.9770500 -448.794970 448.79508
## p:(Intercept)  -1.778834e+01   0.0000000  -17.788337 -17.78834
## p:time2         1.445550e+01   0.0000000   14.455504  14.45550
## p:time3         1.333321e+01   0.0000000   13.333210  13.33321
## p:time4         1.362528e+01   0.0000000   13.625283  13.62528
## p:time5         1.433370e+01   0.0000000   14.333701  14.33370
## p:time6         1.403834e+01   0.0000000   14.038335  14.03834
## p:time7         1.403845e+01   0.0000000   14.038453  14.03845
## p:time8         1.292439e+01   0.0000000   12.924387  12.92439
## p:time9         1.385222e+01   0.0000000   13.852223  13.85222
## p:time10        1.222653e+01   0.0000000   12.226528  12.22653
## p:time11        1.385225e+01   0.0000000   13.852252  13.85225
## p:time12        1.385224e+01   0.0000000   13.852238  13.85224
## p:time13        1.445550e+01   0.0000000   14.455495  14.45550
## p:time14        1.362520e+01   0.0000000   13.625199  13.62520
## p:time15        1.403821e+01   0.0000000   14.038210  14.03821
## p:time16        1.445550e+01   0.0000000   14.455499  14.45550
## p:time17        1.222702e+01   0.0000000   12.227020  12.22702
## f0:(Intercept)  5.242426e+00   0.3710841    4.515101   5.96975
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000141
##
##
## Real Parameter p
##
##                       1         2         3         4         5         6
## mixture:1 1.882017e-08 0.0344618 0.0114854 0.0153216 0.0306309 0.0229773
```

```
## mixture:2 1.882017e-08 0.0344618 0.0114854 0.0153216 0.0306309 0.0229773
##                 7         8         9        10        11        12        13
## mixture:1 0.02298 0.0076608 0.0191501 0.0038271 0.0191506 0.0191503 0.0344616
## mixture:2 0.02298 0.0076608 0.0191501 0.0038271 0.0191506 0.0191503 0.0344616
##                  14        15        16       17
## mixture:1 0.0153203 0.0229745 0.0344617 0.003829
## mixture:2 0.0153203 0.0229745 0.0344617 0.003829
##
##
## Real Parameter c
##
##                   2         3         4         5         6       7         8
## mixture:1 0.0344618 0.0114854 0.0153216 0.0306309 0.0229773 0.02298 0.0076608
## mixture:2 0.0344618 0.0114854 0.0153216 0.0306309 0.0229773 0.02298 0.0076608
##                   9        10        11        12        13        14        15
## mixture:1 0.0191501 0.0038271 0.0191506 0.0191503 0.0344616 0.0153203 0.0229745
## mixture:2 0.0191501 0.0038271 0.0191506 0.0191503 0.0344616 0.0153203 0.0229745
##                  16       17
## mixture:1 0.0344617 0.003829
## mixture:2 0.0344617 0.003829
##
##
## Real Parameter f0
##
##         1
##  189.1283
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  20  (unadjusted=18)
## -2lnL:  7.257573
## AICc :  47.95583  (unadjusted=43.825208)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept)  2.877896e-04 5.572891e+05 -1.092287e+06  1.092287e+06
## p:(Intercept)  -4.491425e+01 1.632656e-01 -4.523425e+01 -4.459424e+01
## p:time2         4.296860e+01 3.914516e-01  4.220135e+01  4.373584e+01
## p:time3         4.149656e+01 7.369036e-01  4.005223e+01  4.294090e+01
## p:time4         4.225742e+01 5.431807e-01  4.119279e+01  4.332206e+01
## p:time5         4.310190e+01 4.148016e-01  4.228889e+01  4.391491e+01
## p:time6         4.273961e+01 5.007395e-01  4.175816e+01  4.372106e+01
## p:time7         4.286015e+01 5.029725e-01  4.187432e+01  4.384597e+01
## p:time8         4.199678e+01 7.451199e-01  4.053635e+01  4.345722e+01
## p:time9         4.205234e+01 7.450417e-01  4.059206e+01  4.351262e+01
## p:time10        4.138932e+01 1.026973e+00  3.937645e+01  4.340219e+01
## p:time11        4.315637e+01 5.110194e-01  4.215477e+01  4.415797e+01
## p:time12        4.334550e+01 5.187220e-01  4.232881e+01  4.436220e+01
## p:time13        4.422077e+01 4.624953e-01  4.331428e+01  4.512726e+01
## p:time14        4.381533e+01 5.996255e-01  4.264006e+01  4.499059e+01
## p:time15        4.422102e+01 6.342068e-01  4.297798e+01  4.546407e+01
## p:time16        4.685970e+01 1.081258e+00  4.474044e+01  4.897897e+01
## p:time17        8.165104e+01 2.917085e-01  8.107929e+01  8.222279e+01
```

```
## c:(Intercept)  -3.929533e+00 3.045476e-01 -4.526447e+00 -3.332620e+00
## f0:(Intercept) -1.345523e+01 2.155063e+00 -1.767915e+01 -9.231305e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000719
##
##
## Real Parameter p
##
##                      1        2         3         4         5         6
## mixture:1 3.118827e-20 0.125029 0.0317475 0.0655697 0.1403548 0.1020519
## mixture:2 3.118827e-20 0.125029 0.0317475 0.0655697 0.1403548 0.1020519
##                    7        8         9        10        11        12        13
## mixture:1 0.1136389 0.051297 0.0540693 0.0286114 0.1470569 0.1723958 0.3332609
## mixture:2 0.1136389 0.051297 0.0540693 0.0286114 0.1470569 0.1723958 0.3332609
##                   14        15        16 17
## mixture:1 0.2499423 0.3333162 0.8749507  1
## mixture:2 0.2499423 0.3333162 0.8749507  1
##
##
## Real Parameter c
##
##                   2        3        4        5        6        7        8
## mixture:1 0.019274 0.019274 0.019274 0.019274 0.019274 0.019274 0.019274
## mixture:2 0.019274 0.019274 0.019274 0.019274 0.019274 0.019274 0.019274
##                   9       10       11       12       13       14       15
## mixture:1 0.019274 0.019274 0.019274 0.019274 0.019274 0.019274 0.019274
## mixture:2 0.019274 0.019274 0.019274 0.019274 0.019274 0.019274 0.019274
##                  16       17
## mixture:1 0.019274 0.019274
## mixture:2 0.019274 0.019274
##
##
## Real Parameter f0
##
##             1
##  1.433734e-06
```

Examine model-selection table

```
iguane.results
```

```
##                                 model npar     AICc DeltaAICc     weight
## 8           pi(~1)p(~time)c(~1)f0(~1)   20 47.95583  0.000000 0.46992689
## 6 pi(~1)p(~time + mixture)c(~1)f0(~1)   21 50.02619  2.070359 0.16690045
## 7             pi(~1)p(~time)c()f0(~1)   19 50.39039  2.434567 0.13911400
## 1                pi(~1)p(~1)c()f0(~1)    3 51.32661  3.370781 0.08711132
## 5   pi(~1)p(~time + mixture)c()f0(~1)   20 52.45741  4.501580 0.04949082
## 2              pi(~1)p(~1)c(~1)f0(~1)    4 52.84411  4.888279 0.04079002
## 3          pi(~1)p(~mixture)c()f0(~1)    4 53.33975  5.383924 0.03183655
```

```
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 54.86768  6.911855 0.01482997
##   Deviance
## 8 56.79212
## 6 56.79201
## 7 61.29371
## 1 94.84148
## 5 61.29370
## 2 94.34584
## 3 94.84148
## 4 94.35297
```

examine model names and find the name of the top model

```
names(iguane.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"
```

examine the output from top-ranked model (#8)

```
iguane.results$p.time.behav$results$real
```

```
##                 estimate           se           lcl          ucl fixed note
## pi g1 m1    5.000719e-01 1.393223e+05 5.564286e-309 1.000000e+00
## p g1 t1 m1  3.118827e-20 5.091972e-21  2.120801e-20 4.116854e-20
## p g1 t2 m1  1.250290e-01 3.897980e-02  6.635820e-02 2.231739e-01
## p g1 t3 m1  3.174750e-02 2.208910e-02  7.953800e-03 1.182357e-01
## p g1 t4 m1  6.556970e-02 3.169340e-02  2.482720e-02 1.620613e-01
## p g1 t5 m1  1.403548e-01 4.600830e-02  7.177530e-02 2.563628e-01
## p g1 t6 m1  1.020519e-01 4.324810e-02  4.312170e-02 2.227672e-01
## p g1 t7 m1  1.136389e-01 4.784650e-02  4.810180e-02 2.454443e-01
## p g1 t8 m1  5.129700e-02 3.532610e-02  1.286600e-02 1.832160e-01
## p g1 t9 m1  5.406930e-02 3.717950e-02  1.356380e-02 1.919925e-01
## p g1 t10 m1 2.861140e-02 2.817940e-02  4.021000e-03 1.768764e-01
## p g1 t11 m1 1.470569e-01 6.073840e-02  6.256290e-02 3.081528e-01
## p g1 t12 m1 1.723958e-01 7.014280e-02  7.362280e-02 3.531647e-01
## p g1 t13 m1 3.332609e-01 9.622010e-02  1.762118e-01 5.387423e-01
## p g1 t14 m1 2.499423e-01 1.082455e-01  9.703430e-02 5.081943e-01
## p g1 t15 m1 3.333162e-01 1.360819e-01  1.308462e-01 6.241144e-01
## p g1 t16 m1 8.749507e-01 1.169465e-01  4.626909e-01 9.827142e-01
## p g1 t17 m1 1.000000e+00 7.448942e-17  1.000000e+00 1.000000e+00
## c g1 t2 m1  1.927400e-02 5.756700e-03  1.070330e-02 3.446890e-02
## f0 g1 a0 t1 1.433734e-06 3.089787e-06  1.088074e-07 1.889204e-05
```

```
iguane.results$p.time.behav$results$derived
```

```
## $`N Population Size`
##   estimate lcl      ucl
## 1       72  72 72.00002
```

Données 2010

Les données

```
iguane <- convert.inp("dat/iguanes-2010-2sexes-FM.inp",
                      group.df = data.frame(sex = c("F","M")),
                      covariates = NULL)
head(iguane)
```

```
##           ch freq sex
## 1:1 00000010    1   F
## 1:2 00000010    1   F
## 1:3 00000001    1   F
## 1:4 01000000    1   F
## 1:5 00010000    1   F
## 1:6 00100000    1   F
```

```
tail(iguane)
```

```
##             ch freq sex
## 2:119 00000010    1   M
## 2:120 10010000    1   M
## 2:121 01000000    1   M
## 2:122 00000100    1   M
## 2:123 01000000    1   M
## 2:124 00000001    1   M
```

On sépare mâles et femelles.

```
iguaneM <- iguane[iguane$sex == "M", ]
iguaneF <- iguane[iguane$sex == "F", ]
```

On formate les données.

```
iguane_secr <- unRMarkInput(iguane) # on convertit au bon format
summary(iguane_secr) # resumes
```

```
## Object class       capthist
##
## Counts by occasion
##              1  2  3  4  5  6   7   8 Total
## n           14 17 18 22 21 14  16  14   136
## u           14 17 18 16 19 13  15  12   124
## f          113 10  1  0  0  0   0   0   124
## M(t+1)      14 31 49 65 84 97 112 124   124
## losses       0  0  0  0  0  0   0   0     0
## detections  14 17 18 22 21 14  16  14   136
##
## Individual covariates
##  sex
##  F:50
##  M:74
```

Les deux sexes ensemble.

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

```
## $Otis
##   statistic         p
##  -0.5636019 0.2865126
##
## $Xc
##  statistic df          p
##   13.61476  7 0.05847307
##
## $NRvsJS
##  statistic df           p
##   8.542874  1 0.003468775
##
## $NMvsJS
##  statistic df       p
##   3.203634  2 0.20153
##
## $MtvsNR
##  statistic df         p
##   5.071888  6 0.5346266
##
## $MtvsNM
##  statistic df          p
##   10.41113  5 0.06438979
##
## $compNRvsJS
##   Occasion Chisquare df           p
## 1        2        NA NA          NA
## 2        3        NA NA          NA
## 3        4  8.542874  1 0.003468775
## 4        5        NA NA          NA
## 5        6        NA NA          NA
## 6        7        NA NA          NA
##
## $compNMvsJS
##   Occasion Chisquare df          p
## 1        2 2.9216548  1 0.08739819
## 2        3 0.2819793  1 0.59540684
## 3        4        NA NA         NA
## 4        5        NA NA         NA
## 5        6        NA NA         NA
## 6        7        NA NA         NA
```

Les modèles maintenant. On commence par le jeu de données avec les deux sexes ensemble.

Process data

```
iguane.proc <- process.data(iguane, begin.time = 1, model = "FullHet")
```

Create default design data

```
iguane.ddl <- make.design.data(iguane.proc)
```

Liste des modèles.

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

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

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

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

  return(iguane.results)
}
```

Run the models and examine the output

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=2)
## -2lnL:  -321.6732
## AICc :  -315.6489  (unadjusted=-317.66102)
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept) -4.280771e-05 0.0000000 -4.280771e-05 -4.280771e-05
## p:(Intercept)  -3.591986e+00 0.0000000 -3.591986e+00 -3.591986e+00
## f0:(Intercept)  6.234810e+00 0.1002111  6.038396e+00  6.431223e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999893
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
```

```
## mixture:1 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053
## mixture:2 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053
##                   8
## mixture:1 0.0268053
## mixture:2 0.0268053
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053
## mixture:2 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053
##
##
## Real Parameter f0
##
##         1
##  510.2035
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4
## -2lnL:  -321.7031
## AICc :  -315.6788
##
## Beta
##                      estimate se           lcl           ucl
## pi:(Intercept)  0.0001450902  0  0.0001450902  0.0001450902
## p:(Intercept)  -3.3691977000  0 -3.3691977000 -3.3691977000
## c:(Intercept)  -3.6018688000  0 -3.6018688000 -3.6018688000
## f0:(Intercept)  5.9873453000  0  5.9873453000  5.9873453000
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000363
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0332721 0.0332721 0.0332721 0.0332721 0.0332721 0.0332721 0.0332721
## mixture:2 0.0332721 0.0332721 0.0332721 0.0332721 0.0332721 0.0332721 0.0332721
##                   8
## mixture:1 0.0332721
## mixture:2 0.0332721
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487
```

```
## mixture:2 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487
##
##
## Real Parameter f0
##
##         1
##  398.3557
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  -321.6732
## AICc :  -313.6326  (unadjusted=-317.66102)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept) -21.2822910 2392.1805000 -4709.9562000 4667.3916000
## p:(Intercept)    0.2794426    0.0000000     0.2794426    0.2794426
## p:mixture2      -3.8714282    0.0000000    -3.8714282   -3.8714282
## f0:(Intercept)   6.2348100    0.3308173     5.5864081    6.8832118
##
##
## Real Parameter pi
##
##
## mixture:1 5.717663e-10
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.5694096 0.5694096 0.5694096 0.5694096 0.5694096 0.5694096 0.5694096
## mixture:2 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053
##                    8
## mixture:1 0.5694096
## mixture:2 0.0268053
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.5694096 0.5694096 0.5694096 0.5694096 0.5694096 0.5694096 0.5694096
## mixture:2 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053
##
##
## Real Parameter f0
##
##         1
##  510.2037
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
```

```
## Npar :  5  (unadjusted=3)
## -2lnL:  -321.7031
## AICc :  -311.6423  (unadjusted=-315.67884)
##
## Beta
##                   estimate           se          lcl         ucl
## pi:(Intercept) 12.3681590 1508.2531000 -2943.807900 2968.544200
## p:(Intercept)  -3.3690765    1.1802247    -5.682317   -1.055836
## p:mixture2      0.7134749  282.4124700  -552.814980  554.241930
## c:(Intercept)  -3.6019232    0.2925928    -4.175405   -3.028441
## f0:(Intercept)  5.9871861    1.3302795     3.379838    8.594534
##
##
## Real Parameter pi
##
##
## mixture:1 0.9999957
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0332760 0.0332760 0.0332760 0.0332760 0.0332760 0.0332760 0.0332760
## mixture:2 0.0656446 0.0656446 0.0656446 0.0656446 0.0656446 0.0656446 0.0656446
##                    8
## mixture:1 0.0332760
## mixture:2 0.0656446
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0265472 0.0265472 0.0265472 0.0265472 0.0265472 0.0265472 0.0265472
## mixture:2 0.0265472 0.0265472 0.0265472 0.0265472 0.0265472 0.0265472 0.0265472
##
##
## Real Parameter f0
##
##         1
##  398.2923
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  11
## -2lnL:  -325.9341
## AICc :  -303.6647
##
## Beta
##                     estimate        se         lcl        ucl
## pi:(Intercept) -2.513885e+00 9.8126411 -21.7466620 16.7188920
## p:(Intercept)  -2.899195e+00 3.2446847  -9.2587772  3.4603869
## p:time2         1.991614e-01 0.3655067  -0.5172317  0.9155546
## p:time3         2.579919e-01 0.3610110  -0.4495898  0.9655735
```

```
## p:time4         4.653417e-01 0.3467559  -0.2142999  1.1449833
## p:time5         4.171532e-01 0.3498581  -0.2685686  1.1028750
## p:time6        -1.436819e-06 0.3823592  -0.7494256  0.7494227
## p:time7         1.368700e-01 0.3704994  -0.5893088  0.8630488
## p:time8        -1.112467e-06 0.3823575  -0.7494218  0.7494195
## p:mixture2     -1.357585e+00 1.9230909  -5.1268428  2.4116735
## f0:(Intercept)  6.562056e+00 1.8511486   2.9338053 10.1903080
##
##
## Real Parameter pi
##
##
## mixture:1 0.0748905
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0521934 0.0629714 0.0665333 0.0806274 0.0771267 0.0521933 0.0593943
## mixture:2 0.0139699 0.0169963 0.0180076 0.0220653 0.0210490 0.0139699 0.0159863
##                    8
## mixture:1 0.0521933
## mixture:2 0.0139699
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0629714 0.0665333 0.0806274 0.0771267 0.0521933 0.0593943 0.0521933
## mixture:2 0.0169963 0.0180076 0.0220653 0.0210490 0.0139699 0.0159863 0.0139699
##
##
## Real Parameter f0
##
##         1
##  707.7256
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c(~1)f0(~1)
##
## Npar :  12  (unadjusted=8)
## -2lnL:  -330.346
## AICc :  -306.0273  (unadjusted=-314.19955)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept)   1.0908175  751.3808400  -1471.615700  1473.797300
## p:(Intercept)   -2.9963508  290.6727200   -572.714900   566.722200
## p:time2          0.5973108  199.2505400   -389.933760   391.128380
## p:time3          1.1480626  364.8791300   -714.015040   716.311170
## p:time4          1.4889228  382.6624400   -748.529470   751.507320
## p:time5          2.1872158  322.0360400   -629.003440   633.377880
## p:time6          2.2465838  299.4484700   -584.672440   589.165600
## p:time7          3.2159444  292.6162800   -570.311980   576.743870
```

```
## p:time8         21.0037570 2300.8565000  -4488.675000  4530.682500
## p:mixture2       2.1836673  711.3759900  -1392.113300  1396.480600
## c:(Intercept)   -3.6018680    0.2925851     -4.175335    -3.028401
## f0:(Intercept) -21.3837920 7335.3929000 -14398.754000 14355.987000
##
##
## Real Parameter pi
##
##
## mixture:1 0.7485356
##
##
## Real Parameter p
##
##                  1         2         3         4         5         6         7
## mixture:1 0.047591 0.0832459 0.1360740 0.1813203 0.3080749 0.3208721 0.5546789
## mixture:2 0.307319 0.4463640 0.5830676 0.6628988 0.7981114 0.8075083 0.9170756
##           8
## mixture:1 1
## mixture:2 1
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487
## mixture:2 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487
##
##
## Real Parameter f0
##
##             1
##  5.165797e-10
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  10  (unadjusted=9)
## -2lnL:  -325.815
## AICc :  -305.5907  (unadjusted=-307.63167)
##
## Beta
##                      estimate          se          lcl         ucl
## pi:(Intercept)  2.645503e-05 161.9129100 -317.3492900 317.3493400
## p:(Intercept)  -3.786758e+00   0.3834470   -4.5383146  -3.0352021
## p:time2         1.990276e-01   0.3653759   -0.5171091   0.9151643
## p:time3         2.578150e-01   0.3608810   -0.4495118   0.9651419
## p:time4         4.650251e-01   0.3466337   -0.2143771   1.1444272
## p:time5         4.168662e-01   0.3497335   -0.2686115   1.1023439
## p:time6         2.410605e-06   0.3822233   -0.7491552   0.7491601
## p:time7         1.367769e-01   0.3703678   -0.5891440   0.8626979
## p:time8         2.025294e-06   0.3822229   -0.7491549   0.7491589
## f0:(Intercept)  6.229661e+00   0.3309465    5.5810055   6.8783159
##
```

```
##
## Real Parameter pi
##
##
## mixture:1 0.5000066
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0221665 0.0269165 0.0284998 0.0348331 0.0332498 0.0221665 0.0253332
## mixture:2 0.0221665 0.0269165 0.0284998 0.0348331 0.0332498 0.0221665 0.0253332
##                   8
## mixture:1 0.0221665
## mixture:2 0.0221665
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0269165 0.0284998 0.0348331 0.0332498 0.0221665 0.0253332 0.0221665
## mixture:2 0.0269165 0.0284998 0.0348331 0.0332498 0.0221665 0.0253332 0.0221665
##
##
## Real Parameter f0
##
##         1
##  507.5832
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  11  (unadjusted=8)
## -2lnL:  -330.346
## AICc :  -308.0767  (unadjusted=-314.19955)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  4.244949e-04 4.742211e+02 -9.294730e+02   929.473820
## p:(Intercept)  -2.061421e+00 2.837591e-01 -2.617589e+00    -1.505253
## p:time2         3.620364e-01 3.874213e-01 -3.973094e-01     1.121382
## p:time3         6.343052e-01 3.865334e-01 -1.233003e-01     1.391911
## p:time4         7.564723e-01 3.999604e-01 -2.745020e-02     1.540395
## p:time5         1.316980e+00 3.976818e-01  5.375236e-01     2.096436
## p:time6         1.330533e+00 4.409981e-01  4.661766e-01     2.194889
## p:time7         2.284564e+00 4.801241e-01  1.343521e+00     3.225607
## p:time8         2.124234e+01 3.984997e+03 -7.789353e+03  7831.837200
## c:(Intercept)  -3.601869e+00 2.925852e-01 -4.175336e+00    -3.028402
## f0:(Intercept) -2.175489e+01 1.647630e+04 -3.231531e+04 32271.797000
##
##
## Real Parameter pi
##
##
```

```
## mixture:1 0.5001061
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.1129034 0.1545456 0.1935485 0.2133333 0.3220338 0.3249999 0.5555554
## mixture:2 0.1129034 0.1545456 0.1935485 0.2133333 0.3220338 0.3249999 0.5555554
##           8
## mixture:1 1
## mixture:2 1
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487
## mixture:2 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487
##
##
## Real Parameter f0
##
##             1
##  3.564274e-10
```

Examine model-selection table

```
iguane.results
```

```
##                                  model npar      AICc DeltaAICc      weight
## 1                pi(~1)p(~1)c()f0(~1)    3 -315.6489  0.000000 0.523537452
## 2              pi(~1)p(~1)c(~1)f0(~1)    4 -313.6626  1.986245 0.193927794
## 3          pi(~1)p(~mixture)c()f0(~1)    4 -313.6326  2.016235 0.191041541
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 -311.6423  4.006580 0.070620351
## 8           pi(~1)p(~time)c(~1)f0(~1)   11 -308.0767  7.572206 0.011875832
## 6 pi(~1)p(~time + mixture)c(~1)f0(~1)   12 -306.0273  9.621511 0.004262488
## 7             pi(~1)p(~time)c()f0(~1)   10 -305.5907 10.058149 0.003426481
## 5   pi(~1)p(~time + mixture)c()f0(~1)   11 -303.6647 11.984126 0.001308060
##   Deviance
## 1 48.31201
## 2 48.28202
## 3 48.31201
## 4 48.28202
## 8 39.63912
## 6 39.63912
## 7 44.17018
## 5 44.05104
```

examine model names and find the name of the top model

```
names(iguane.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"
```

examine the output from top-ranked model (#8)

```
iguane.results$p.dot$results$real
```

```
##                 estimate       se         lcl         ucl fixed note
## pi g1 m1       0.4999893  0.00000   0.4999893   0.4999893
## p g1 t1 m1     0.0268053  0.00000   0.0268053   0.0268053
## f0 g1 a0 t1 510.2035200 51.12805 419.4257100 620.6287000
```

```
iguane.results$p.dot$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 634.2035 543.4257 744.6287
```

En séparant les sexes. Femelles, puis mâles.

Process data

```
iguane.proc <- process.data(iguaneF, begin.time = 1, model = "FullHet")
```

Create default design data

```
iguane.ddl <- make.design.data(iguane.proc)
```

Liste des modèles.

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

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

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

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

  return(iguane.results)
}
```

Run the models and examine the output

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=2)
## -2lnL:  -70.97173
## AICc :  -64.91113  (unadjusted=-66.941506)
##
## Beta
##                     estimate        se           lcl           ucl
## pi:(Intercept) -0.0001908169 0.0000000 -0.0001908169 -0.0001908169
## p:(Intercept)  -5.1447310000 0.0000000 -5.1447310000 -5.1447310000
## f0:(Intercept)  6.9564019000 0.1448172  6.6725602000  7.2402436000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999523
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963
## mixture:2 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963
##                    8
## mixture:1 0.0057963
## mixture:2 0.0057963
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963
## mixture:2 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963
##
##
## Real Parameter f0
##
##         1
##  1049.849
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  -71.17686
## AICc :  -63.07559  (unadjusted=-67.146632)
##
## Beta
```

```
##                      estimate se           lcl           ucl
## pi:(Intercept)  1.395191e-04  0  1.395191e-04  1.395191e-04
## p:(Intercept)  -1.135415e+01  0 -1.135415e+01 -1.135415e+01
## c:(Intercept)  -5.018536e+00  0 -5.018536e+00 -5.018536e+00
## f0:(Intercept)  1.318474e+01  0  1.318474e+01  1.318474e+01
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000349
##
##
## Real Parameter p
##
##                       1            2            3            4            5
## mixture:1 1.172066e-05 1.172066e-05 1.172066e-05 1.172066e-05 1.172066e-05
## mixture:2 1.172066e-05 1.172066e-05 1.172066e-05 1.172066e-05 1.172066e-05
##                       6            7            8
## mixture:1 1.172066e-05 1.172066e-05 1.172066e-05
## mixture:2 1.172066e-05 1.172066e-05 1.172066e-05
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0065707 0.0065707 0.0065707 0.0065707 0.0065707 0.0065707 0.0065707
## mixture:2 0.0065707 0.0065707 0.0065707 0.0065707 0.0065707 0.0065707 0.0065707
##
##
## Real Parameter f0
##
##         1
##  532181.7
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  -70.97173
## AICc :  -62.87047  (unadjusted=-66.941505)
##
## Beta
##                   estimate         se          lcl         ucl
## pi:(Intercept) -20.026976 1686.49900 -3325.565000 3285.511000
## p:(Intercept)   -1.508004  685.71278 -1345.505100 1342.489100
## p:mixture2      -3.636727  685.71552 -1347.639200 1340.365700
## f0:(Intercept)   6.956402    1.02966     4.938269    8.974535
##
##
## Real Parameter pi
##
##
## mixture:1 2.006295e-09
```

```
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.1812348 0.1812348 0.1812348 0.1812348 0.1812348 0.1812348 0.1812348
## mixture:2 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962
##                   8
## mixture:1 0.1812348
## mixture:2 0.0057962
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.1812348 0.1812348 0.1812348 0.1812348 0.1812348 0.1812348 0.1812348
## mixture:2 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962
##
##
## Real Parameter f0
##
##         1
##  1049.849
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5
## -2lnL:  -72
## AICc :  -69.98995
##
## Beta
##                   estimate se        lcl        ucl
## pi:(Intercept) -76.218852  0 -76.218852 -76.218852
## p:(Intercept)   18.631655  0  18.631655  18.631655
## p:mixture2     -50.665145  0 -50.665145 -50.665145
## c:(Intercept)   -5.023417  0  -5.023417  -5.023417
## f0:(Intercept)  33.867304  0  33.867304  33.867304
##
##
## Real Parameter pi
##
##
## mixture:1 7.917229e-34
##
##
## Real Parameter p
##
##                       1            2            3            4            5
## mixture:1 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00
## mixture:2 1.224706e-14 1.224706e-14 1.224706e-14 1.224706e-14 1.224706e-14
##                       6            7            8
## mixture:1 1.000000e+00 1.000000e+00 1.000000e+00
## mixture:2 1.224706e-14 1.224706e-14 1.224706e-14
```

```
##
##
## Real Parameter c
##
##                  2        3        4        5        6        7        8
## mixture:1 0.006539 0.006539 0.006539 0.006539 0.006539 0.006539 0.006539
## mixture:2 0.006539 0.006539 0.006539 0.006539 0.006539 0.006539 0.006539
##
##
## Real Parameter f0
##
##             1
##  5.109555e+14
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  11  (unadjusted=9)
## -2lnL:  -73.53263
## AICc :  -50.85222  (unadjusted=-55.071095)
##
## Beta
##                      estimate          se           lcl         ucl
## pi:(Intercept) -1.927527e+01 790.2268300 -1568.1199000 1529.569400
## p:(Intercept)  -1.268362e+00   0.0000000    -1.2683621   -1.268362
## p:time2         1.832866e-01   0.6070643    -1.0065594    1.373133
## p:time3        -3.166417e-05   0.6339432    -1.2425603    1.242497
## p:time4         1.832867e-01   0.6070688    -1.0065682    1.373142
## p:time5         3.383520e-01   0.5871318    -0.8124264    1.489130
## p:time6         1.832985e-01   0.6070688    -1.0065563    1.373153
## p:time7         1.832881e-01   0.6070665    -1.0065623    1.373139
## p:time8         6.978147e-01   0.5494407    -0.3790890    1.774718
## p:mixture2     -4.112618e+00   0.0000000    -4.1126176   -4.112618
## f0:(Intercept)  6.948066e+00   1.0298316     4.9295960    8.966536
##
##
## Real Parameter pi
##
##
## mixture:1 4.254588e-09
##
##
## Real Parameter p
##
##                   1         2         3         4         5        6         7
## mixture:1 0.2195378 0.2525467 0.2195323 0.2525467 0.2829227 0.252549 0.2525470
## mixture:2 0.0045822 0.0054989 0.0045821 0.0054989 0.0064153 0.005499 0.0054989
##                   8
## mixture:1 0.3611105
## mixture:2 0.0091649
##
##
## Real Parameter c
##
```

```
##                   2         3         4         5        6         7         8
## mixture:1 0.2525467 0.2195323 0.2525467 0.2829227 0.252549 0.2525470 0.3611105
## mixture:2 0.0054989 0.0045821 0.0054989 0.0064153 0.005499 0.0054989 0.0091649
##
##
## Real Parameter f0
##
##         1
##  1041.134
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c(~1)f0(~1)
##
## Npar :  12  (unadjusted=8)
## -2lnL:  -79.75377
## AICc :  -54.94757  (unadjusted=-63.385484)
##
## Beta
##                     estimate           se           lcl           ucl
## pi:(Intercept)  -6.4050714     0.000000 -6.405071e+00    -6.4050714
## p:(Intercept)    3.1071569     0.000000  3.107157e+00     3.1071569
## p:time2          0.3406995     0.000000  3.406995e-01     0.3406995
## p:time3          0.2961260     0.000000  2.961260e-01     0.2961260
## p:time4          0.4552112     0.000000  4.552112e-01     0.4552112
## p:time5          1.0679375     0.000000  1.067937e+00     1.0679375
## p:time6          1.2322405     0.000000  1.232241e+00     1.2322405
## p:time7          1.7022441     0.000000  1.702244e+00     1.7022441
## p:time8         22.1908790  7746.608500 -1.516116e+04 15205.5440000
## p:mixture2      -5.3202267     0.000000 -5.320227e+00    -5.3202267
## c:(Intercept)   -5.0369530     1.003242 -7.003307e+00    -3.0705993
## f0:(Intercept) -21.0565580 15940.581000 -3.126460e+04 31222.4830000
##
##
## Real Parameter pi
##
##
## mixture:1 0.0016504
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.9571870 0.9691671 0.9678070 0.9724112 0.9848590 0.9871236 0.9919132
## mixture:2 0.0985829 0.1332677 0.1282028 0.1470587 0.2413793 0.2727273 0.3750000
##           8
## mixture:1 1
## mixture:2 1
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0064516 0.0064516 0.0064516 0.0064516 0.0064516 0.0064516 0.0064516
## mixture:2 0.0064516 0.0064516 0.0064516 0.0064516 0.0064516 0.0064516 0.0064516
```

```
##
##
## Real Parameter f0
##
##             1
##  7.165611e-10
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  10  (unadjusted=9)
## -2lnL:  -73.53264
## AICc :  -52.96708  (unadjusted=-55.071098)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept)  1.330705e-04 0.000000e+00  0.0001330705  0.0001330705
## p:(Intercept)  -5.380922e+00 1.032866e+00 -7.4053393000 -3.3565044000
## p:time2         1.832542e-01 5.088848e-01 -0.8141601000  1.1806685000
## p:time3         9.666141e-06 5.406507e-01 -1.0596657000  1.0596850000
## p:time4         1.832547e-01 5.088838e-01 -0.8141576000  1.1806670000
## p:time5         3.383275e-01 4.849309e-01 -0.6121372000  1.2887921000
## p:time6         1.832546e-01 1.561070e-07  0.1832542000  0.1832549000
## p:time7         1.832548e-01 5.088888e-01 -0.8141672000  1.1806768000
## p:time8         6.977714e-01 4.385395e-01 -0.1617660000  1.5573088000
## f0:(Intercept)  6.948036e+00 1.029813e+00  4.9296019000  8.9664696000
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000333
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0045825 0.005499 0.0045825 0.005499 0.0064155 0.005499 0.005499
## mixture:2 0.0045825 0.005499 0.0045825 0.005499 0.0064155 0.005499 0.005499
##                    8
## mixture:1 0.0091651
## mixture:2 0.0091651
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.005499 0.0045825 0.005499 0.0064155 0.005499 0.005499 0.0091651
## mixture:2 0.005499 0.0045825 0.005499 0.0064155 0.005499 0.005499 0.0091651
##
##
## Real Parameter f0
##
##         1
```

```
##  1041.103
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  11  (unadjusted=8)
## -2lnL:  -79.75377
## AICc :  -57.07336  (unadjusted=-63.385484)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept)  4.246746e-05    0.0000000  4.246746e-05  4.246746e-05
## p:(Intercept)  -2.197195e+00    0.2737052 -2.733657e+00 -1.660732e+00
## p:time2         3.254055e-01    0.5169335 -6.877842e-01  1.338595e+00
## p:time3         2.802810e-01    0.5516563 -8.009654e-01  1.361527e+00
## p:time4         4.393434e-01    0.2646338 -7.933890e-02  9.580256e-01
## p:time5         1.052036e+00    0.3772625  3.126017e-01  1.791471e+00
## p:time6         1.216396e+00    0.5514326  1.355884e-01  2.297204e+00
## p:time7         1.686369e+00    0.5844495  5.408480e-01  2.831890e+00
## p:time8         2.303740e+01 8457.4241000 -1.655351e+04  1.659959e+04
## c:(Intercept)  -5.036978e+00    1.0032538 -7.003355e+00 -3.070600e+00
## f0:(Intercept) -2.096869e+01 7767.7328000 -1.524573e+04  1.520379e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000106
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6     7 8
## mixture:1 0.1000027 0.1333348 0.1282061 0.1470597 0.2413745 0.2727334 0.375 1
## mixture:2 0.1000027 0.1333348 0.1282061 0.1470597 0.2413745 0.2727334 0.375 1
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0064515 0.0064515 0.0064515 0.0064515 0.0064515 0.0064515 0.0064515
## mixture:2 0.0064515 0.0064515 0.0064515 0.0064515 0.0064515 0.0064515 0.0064515
##
##
## Real Parameter f0
##
##             1
##  7.823695e-10
```

Examine model-selection table

```
iguane.results
```

```
##                                model npar      AICc DeltaAICc       weight
```

```
## 1                pi(~1)p(~1)c()f0(~1)    3 -64.91113  0.000000 0.4984518450
## 2              pi(~1)p(~1)c(~1)f0(~1)    4 -63.07559  1.835535 0.1990865399
## 3          pi(~1)p(~mixture)c()f0(~1)    4 -62.87047  2.040661 0.1796798406
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 -61.84772  3.063411 0.1077486698
## 8           pi(~1)p(~time)c(~1)f0(~1)   11 -57.07336  7.837768 0.0099008720
## 6 pi(~1)p(~time + mixture)c(~1)f0(~1)   12 -54.94757  9.963557 0.0034202999
## 7             pi(~1)p(~time)c()f0(~1)   10 -52.96708 11.944043 0.0012705955
## 5   pi(~1)p(~time + mixture)c()f0(~1)   11 -50.85222 14.058905 0.0004413374
##   Deviance
## 1 15.85840
## 2 15.65327
## 3 15.85840
## 4 14.83013
## 8  7.07636
## 6  7.07636
## 7 13.29749
## 5 13.29750
```

examine model names and find the name of the top model

```
names(iguane.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"
```

examine the output from top-ranked model (#8)

```
iguane.results$p.dot$results$real
```

```
##                  estimate       se         lcl          ucl fixed note
## pi g1 m1        0.4999523   0.0000   0.4999523    0.4999523
## p g1 t1 m1      0.0057963   0.0000   0.0057963    0.0057963
## f0 g1 a0 t1 1049.8493000 152.0362 791.5805900 1392.3833000
```

```
iguane.results$p.dot$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 1099.849 841.5806 1442.383
```

Process data

```
iguane.proc <- process.data(iguaneM, begin.time = 1, model = "FullHet")
```

Create default design data

```
iguane.ddl <- make.design.data(iguane.proc)
```

Liste des modèles.

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

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

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

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

  return(iguane.results)
}
```

Run the models and examine the output

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3
## -2lnL:  -89.86369
## AICc :  -85.84332
##
## Beta
##                      estimate se           lcl           ucl
## pi:(Intercept) -0.0001220268  0 -0.0001220268 -0.0001220268
## p:(Intercept)  -3.1630237000  0 -3.1630237000 -3.1630237000
## f0:(Intercept)  5.2354892000  0  5.2354892000  5.2354892000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999695
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812
## mixture:2 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812
##                    8
## mixture:1 0.0405812
## mixture:2 0.0405812
```

```
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812
## mixture:2 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812
##
##
## Real Parameter f0
##
##        1
##  187.821
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  -91.71901
## AICc :  -83.65086  (unadjusted=-85.67819)
##
## Beta
##                     estimate           se          lcl         ucl
## pi:(Intercept)  0.000139441 1773.8673000 -3476.779900 3476.780200
## p:(Intercept)  -2.156301100    0.4986274    -3.133611   -1.178991
## c:(Intercept)  -3.258096500    0.3072549    -3.860316   -2.655877
## f0:(Intercept)  3.956745600    0.7386011     2.509088    5.404404
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000349
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.1037439 0.1037439 0.1037439 0.1037439 0.1037439 0.1037439 0.1037439
## mixture:2 0.1037439 0.1037439 0.1037439 0.1037439 0.1037439 0.1037439 0.1037439
##                   8
## mixture:1 0.1037439
## mixture:2 0.1037439
##
##
## Real Parameter c
##
##                   2        3        4        5        6        7        8
## mixture:1 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037
## mixture:2 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037
##
##
## Real Parameter f0
##
```

```
##         1
##  52.28689
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  -89.86369
## AICc :  -81.79555  (unadjusted=-85.843319)
##
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept) -15.828077 0.0000000 -15.828077 -15.828077
## p:(Intercept)   -1.625543 0.0000000  -1.625543  -1.625543
## p:mixture2      -1.537482 0.0000000  -1.537482  -1.537482
## f0:(Intercept)   5.235491 0.3713765   4.507593   5.963388
##
##
## Real Parameter pi
##
##
## mixture:1 1.336452e-07
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1644418 0.1644418 0.1644418 0.1644418 0.1644418 0.1644418 0.1644418
## mixture:2 0.0405811 0.0405811 0.0405811 0.0405811 0.0405811 0.0405811 0.0405811
##                    8
## mixture:1 0.1644418
## mixture:2 0.0405811
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1644418 0.1644418 0.1644418 0.1644418 0.1644418 0.1644418 0.1644418
## mixture:2 0.0405811 0.0405811 0.0405811 0.0405811 0.0405811 0.0405811 0.0405811
##
##
## Real Parameter f0
##
##         1
##  187.8212
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=3)
## -2lnL:  -91.71901
## AICc :  -81.61662  (unadjusted=-85.67819)
##
## Beta
```

```
##                   estimate        se        lcl        ucl
## pi:(Intercept) -21.859164 0.0000000 -21.859164 -21.859164
## p:(Intercept)    3.087161 0.0000000   3.087161   3.087161
## p:mixture2      -5.243464 0.0000000  -5.243464  -5.243464
## c:(Intercept)   -3.258096 0.3072549  -3.860316  -2.655877
## f0:(Intercept)   3.956748 0.7386015   2.509089   5.404407
##
##
## Real Parameter pi
##
##
## mixture:1 3.211336e-10
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.9563600 0.9563600 0.9563600 0.9563600 0.9563600 0.9563600 0.9563600
## mixture:2 0.1037438 0.1037438 0.1037438 0.1037438 0.1037438 0.1037438 0.1037438
##                    8
## mixture:1 0.9563600
## mixture:2 0.1037438
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0370371 0.0370371 0.0370371 0.0370371 0.0370371 0.0370371 0.0370371
## mixture:2 0.0370371 0.0370371 0.0370371 0.0370371 0.0370371 0.0370371 0.0370371
##
##
## Real Parameter f0
##
##       1
##  52.287
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  11  (unadjusted=9)
## -2lnL:  -100.5401
## AICc :  -78.08498  (unadjusted=-82.230875)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept) -17.7474480 3118.3621000 -6129.7373000 6094.2424000
## p:(Intercept)   -1.7723255    0.0000000    -1.7723255   -1.7723255
## p:time2          0.2087446    0.4583564    -0.6896339    1.1071231
## p:time3          0.3839304    0.4428921    -0.4841381    1.2519989
## p:time4          0.6038899    0.4264083    -0.2318703    1.4396501
## p:time5          0.4621283    0.4366773    -0.3937592    1.3180157
## p:time6         -0.1217798    0.4940950    -1.0902060    0.8466465
## p:time7          0.1093956    0.4681470    -0.8081726    1.0269638
## p:time8         -0.8308002    0.6075313    -2.0215616    0.3599611
```

```
## p:mixture2      -1.5478792    0.0000000    -1.5478792   -1.5478792
## f0:(Intercept)   5.2148914    0.3722113     4.4853572    5.9444256
##
##
## Real Parameter pi
##
##
## mixture:1 1.960565e-08
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1452534 0.1731334 0.1996641 0.2371379 0.2124538 0.1307771 0.1593691
## mixture:2 0.0348845 0.0426370 0.0503893 0.0620175 0.0542653 0.0310088 0.0387610
##                    8
## mixture:1 0.0689375
## mixture:2 0.0155044
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1731334 0.1996641 0.2371379 0.2124538 0.1307771 0.1593691 0.0689375
## mixture:2 0.0426370 0.0503893 0.0620175 0.0542653 0.0310088 0.0387610 0.0155044
##
##
## Real Parameter f0
##
##         1
##  183.9918
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c(~1)f0(~1)
##
## Npar :  12  (unadjusted=8)
## -2lnL:  -104.9976
## AICc :  -80.45871  (unadjusted=-88.750568)
##
## Beta
##                    estimate           se           lcl           ucl
## pi:(Intercept)  -5.9753994    0.0000000 -5.975399e+00    -5.9753994
## p:(Intercept)    2.1905482 1134.1495000 -2.220742e+03  2225.1236000
## p:time2          0.4031278    0.0000000  4.031278e-01     0.4031278
## p:time3          0.8470717    0.0000000  8.470717e-01     0.8470717
## p:time4          0.9924819    0.0000000  9.924819e-01     0.9924819
## p:time5          1.5903241    0.0000000  1.590324e+00     1.5903241
## p:time6          1.5438041    0.0000000  1.543804e+00     1.5438041
## p:time7          3.4998666    0.0000000  3.499867e+00     3.4998666
## p:time8         26.0327490    0.0000000  2.603275e+01    26.0327490
## p:mixture2      -4.1863376 1141.1471000 -2.240835e+03  2232.4621000
## c:(Intercept)   -3.2580965    0.3072549 -3.860316e+00    -2.6558769
## f0:(Intercept) -20.3932120 5767.3313000 -1.132436e+04 11283.5760000
##
```

```
##
## Real Parameter pi
##
##
## mixture:1 0.002534
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.8993975 0.9304535 0.9542450 0.9601907 0.9777056 0.9766687 0.9966332
## mixture:2 0.1196457 0.1690098 0.2407234 0.2682916 0.4000000 0.3888888 0.8181818
##           8
## mixture:1 1
## mixture:2 1
##
##
## Real Parameter c
##
##                   2        3        4        5        6        7        8
## mixture:1 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037
## mixture:2 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037
##
##
## Real Parameter f0
##
##              1
##  1.391043e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  10
## -2lnL:  -100.5401
## AICc :  -82.23088
##
## Beta
##                      estimate se           lcl           ucl
## pi:(Intercept)  2.829382e-05  0  2.829382e-05  2.829382e-05
## p:(Intercept)  -3.320194e+00  0 -3.320194e+00 -3.320194e+00
## p:time2         2.087339e-01  0  2.087339e-01  2.087339e-01
## p:time3         3.839187e-01  0  3.839187e-01  3.839187e-01
## p:time4         6.038792e-01  0  6.038792e-01  6.038792e-01
## p:time5         4.621166e-01  0  4.621166e-01  4.621166e-01
## p:time6        -1.217921e-01  0 -1.217921e-01 -1.217921e-01
## p:time7         1.093839e-01  0  1.093839e-01  1.093839e-01
## p:time8        -8.308142e-01  0 -8.308142e-01 -8.308142e-01
## f0:(Intercept)  5.214891e+00  0  5.214891e+00  5.214891e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000071
```

```
##
##
## Real Parameter p
##
##                    1        2         3         4         5         6        7
## mixture:1 0.0348849 0.042637 0.0503892 0.0620175 0.0542653 0.0310088 0.038761
## mixture:2 0.0348849 0.042637 0.0503892 0.0620175 0.0542653 0.0310088 0.038761
##                    8
## mixture:1 0.0155044
## mixture:2 0.0155044
##
##
## Real Parameter c
##
##                   2         3         4         5         6        7         8
## mixture:1 0.042637 0.0503892 0.0620175 0.0542653 0.0310088 0.038761 0.0155044
## mixture:2 0.042637 0.0503892 0.0620175 0.0542653 0.0310088 0.038761 0.0155044
##
##
## Real Parameter f0
##
##         1
##  183.9918
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  11  (unadjusted=8)
## -2lnL:  -104.9976
## AICc :  -82.5424  (unadjusted=-88.750568)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept) -9.711610e-06 0.000000e+00 -9.711610e-06 -9.711610e-06
## p:(Intercept)  -1.977168e+00 3.556630e-01 -2.674268e+00 -1.280069e+00
## p:time2         3.860797e-01 4.857197e-01 -5.659309e-01  1.338090e+00
## p:time3         8.285459e-01 4.772939e-01 -1.069501e-01  1.764042e+00
## p:time4         9.738663e-01 5.007381e-01 -7.580400e-03  1.955313e+00
## p:time5         1.571703e+00 5.151554e-01  5.619988e-01  2.581408e+00
## p:time6         1.525181e+00 6.002188e-01  3.487521e-01  2.701610e+00
## p:time7         3.481243e+00 8.588401e-01  1.797916e+00  5.164570e+00
## p:time8         2.020873e+01 7.307223e+03 -1.430195e+04  1.434237e+04
## c:(Intercept)  -3.258099e+00 3.072553e-01 -3.860320e+00 -2.655879e+00
## f0:(Intercept) -2.124169e+01 3.220940e+04 -6.315167e+04  6.310918e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999976
##
##
## Real Parameter p
##
```

```
##                  1         2         3         4         5         6         7
## mixture:1 0.121621 0.1692308 0.2407408 0.2682927 0.4000001 0.3888884 0.8181815
## mixture:2 0.121621 0.1692308 0.2407408 0.2682927 0.4000001 0.3888884 0.8181815
##           8
## mixture:1 1
## mixture:2 1
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0370369 0.0370369 0.0370369 0.0370369 0.0370369 0.0370369 0.0370369
## mixture:2 0.0370369 0.0370369 0.0370369 0.0370369 0.0370369 0.0370369 0.0370369
##
##
## Real Parameter f0
##
##             1
##  5.954612e-10
```

Examine model-selection table

```
iguane.results
```

```
##                                 model npar      AICc DeltaAICc     weight
## 1               pi(~1)p(~1)c()f0(~1)    3 -83.82288 0.0000000 0.28228499
## 2              pi(~1)p(~1)c(~1)f0(~1)    4 -83.65086 0.1720138 0.25902129
## 8           pi(~1)p(~time)c(~1)f0(~1)   11 -82.54240 1.2804791 0.14881108
## 3          pi(~1)p(~mixture)c()f0(~1)    4 -81.79555 2.0273268 0.10243759
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 -81.61662 2.2062598 0.09367087
## 6 pi(~1)p(~time + mixture)c(~1)f0(~1)   12 -80.45871 3.3641668 0.05250108
## 7             pi(~1)p(~time)c()f0(~1)   10 -80.16149 3.6613842 0.04525101
## 5   pi(~1)p(~time + mixture)c()f0(~1)   11 -78.08498 5.7378991 0.01602208
##   Deviance
## 1 50.25967
## 2 48.40436
## 8 35.12580
## 3 50.25967
## 4 48.40436
## 6 35.12580
## 7 39.58321
## 5 39.58321
```

examine model names and find the name of the top model

```
names(iguane.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"
```

examine the output from top-ranked model (#8)

```
iguane.results$p.dot$results$real
```

```
##                 estimate se         lcl         ucl fixed note
## pi g1 m1       0.4999695  0   0.4999695   0.4999695
## p g1 t1 m1     0.0405812  0   0.0405812   0.0405812
## f0 g1 a0 t1 187.8209700  0 187.8209700 187.8209700
```

```
iguane.results$p.dot$results$derived
```

```
## $`N Population Size`
##   estimate     lcl     ucl
## 1  261.821 261.821 261.821
```

Nettoyage

On supprime les fichiers temporaires.

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