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)
```

On utilise “share = TRUE” pour une seule probabilité de capture.

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

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

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

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

  return(mouse.results)
}
```

Run the models and examine the output, and examine model-selection table

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

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3
## -2lnL:  109.5069
## AICc :  115.614
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept)  1.377735e-04 1.254312e+03 -2.458450e+03 2.458451e+03
## p:(Intercept)   1.053605e-01 1.326371e-01 -1.546082e-01 3.653292e-01
## f0:(Intercept) -2.358467e+01 1.541629e+04 -3.023952e+04 3.019235e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000344
##
##
```

```
## 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
##  5.718847e-11
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  97.98748
## AICc :  106.1668  (unadjusted=104.09462)
##
## Beta
##                      estimate          se           lcl          ucl
## pi:(Intercept)  9.795060e-07 658.7066000 -1291.0650000 1291.0650000
## p:(Intercept)  -6.525621e-01   0.3230646    -1.2857687   -0.0193555
## c:(Intercept)   4.554755e-01   0.1772735     0.1080195    0.8029316
## f0:(Intercept)  1.040116e+00   1.0904375    -1.0971411    3.1773740
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000002
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.3424124 0.3424124 0.3424124 0.3424124 0.3424124 0.3424124
## mixture:2 0.3424124 0.3424124 0.3424124 0.3424124 0.3424124 0.3424124
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
```

```
## Real Parameter f0
##
##         1
##  2.829547
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=1)
## -2lnL:  1
## AICc :  NA  (unadjusted=Not a Number                )
##
## Beta
##                estimate se lcl ucl
## pi:(Intercept)      Inf  0 Inf Inf
## p:(Intercept)       Inf  0 Inf Inf
## p:mixture2          Inf  0 Inf Inf
## f0:(Intercept)      Inf  0 Inf Inf
##
##
## Real Parameter pi
##
##
## mixture:1 5.562685e-309
##
##
## Real Parameter p
##
##                        1             2             3             4             5
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
##                        6
## mixture:1 5.562685e-309
## mixture:2 5.562685e-309
##
##
## Real Parameter c
##
##                        2             3             4             5             6
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
##
##
## Real Parameter f0
##
##   1
##  NA
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6  (unadjusted=5)
## -2lnL:  85.72969
## AICc :  98.10978  (unadjusted=95.999961)
```

```
##
## Beta
##                   estimate           se           lcl          ucl
## pi:(Intercept)  1.2784178    0.4930487     0.3120424    2.2447932
## p:(Intercept)  -1.5107136    0.7093409    -2.9010217   -0.1204055
## p:mixture2     20.3565810 4495.3461000 -8790.5220000 8831.2351000
## c:(Intercept)  -0.1529381    0.2659580    -0.6742157    0.3683395
## c:mixture2      1.7873845    0.4787060     0.8491208    2.7256482
## f0:(Intercept)  2.4209133    1.1756239     0.1166904    4.7251361
##
##
## Real Parameter pi
##
##
## mixture:1 0.7821803
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.1808331 0.1808331 0.1808331 0.1808331 0.1808331 0.1808331
## mixture:2 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.4618398 0.4618398 0.4618398 0.4618398 0.4618398
## mixture:2 0.8367778 0.8367778 0.8367778 0.8367778 0.8367778
##
##
## Real Parameter f0
##
##         1
##  11.25613
##
## 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) -0.3007797 0.5739914 -1.4258028  0.8242435
## p:(Intercept)   0.6308276 0.5695651 -0.4855200  1.7471753
## p:time2         0.6813489 0.5269159 -0.3514063  1.7141041
## p:time3         0.1400697 0.5295160 -0.8977817  1.1779210
## p:time4         0.5482069 0.5267875 -0.4842966  1.5807103
## p:time5         1.3410904 0.5353028  0.2918969  2.3902839
## p:time6         1.3410904 0.5353028  0.2918969  2.3902838
## p:mixture2     -2.2472085 0.3887934 -3.0092435 -1.4851734
## f0:(Intercept)  0.8024615 1.2065515 -1.5623795  3.1673025
```

```
##
##
## Real Parameter pi
##
##
## mixture:1 0.4253669
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.6526771 0.7878771 0.6837150 0.7647742 0.8778170 0.8778170
## mixture:2 0.1657046 0.2819050 0.1859852 0.2557505 0.4316088 0.4316088
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.7878771 0.6837150 0.7647742 0.8778170 0.8778170
## mixture:2 0.2819050 0.1859852 0.2557505 0.4316088 0.4316088
##
##
## Real Parameter f0
##
##         1
##  2.231026
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  15  (unadjusted=12)
## -2lnL:  68.98024
## AICc :  101.2444  (unadjusted=94.431404)
##
## Beta
##                    estimate           se           lcl           ucl
## pi:(Intercept)    0.5724616 3.633269e-01 -1.396591e-01  1.284582e+00
## p:(Intercept)    -2.8773102 1.278713e+00 -5.383587e+00 -3.710333e-01
## p:mixture2       22.2769580 5.363431e+03 -1.049005e+04  1.053460e+04
## p:time2           2.2487015 1.351582e+00 -4.003987e-01  4.897802e+00
## p:time3           2.4718451 1.383070e+00 -2.389728e-01  5.182663e+00
## p:time4           2.1841630 1.461200e+00 -6.797896e-01  5.048116e+00
## p:time5           2.8773103 1.517159e+00 -9.632240e-02  5.850943e+00
## p:time6          29.4327190 6.232634e+04 -1.221302e+05  1.221891e+05
## c:(Intercept)    -0.3391262 8.083493e-01 -1.923491e+00  1.245238e+00
## c:mixture2        1.9698551 4.916155e-01  1.006289e+00  2.933421e+00
## c:time3          -1.1887879 8.298533e-01 -2.815300e+00  4.377246e-01
## c:time4          -0.3216306 8.302085e-01 -1.948839e+00  1.305578e+00
## c:time5           0.4774516 8.549630e-01 -1.198276e+00  2.153179e+00
## c:time6           0.2405308 8.399627e-01 -1.405796e+00  1.886858e+00
## f0:(Intercept) -40.5111670 1.580387e+05 -3.097963e+05  3.097153e+05
##
##
## Real Parameter pi
```

```
##
##
## mixture:1 0.639331
##
##
## Real Parameter p
##
##                   1         2   3         4   5 6
## mixture:1 0.0532867 0.3478261 0.4 0.3333333 0.5 1
## mixture:2 1.0000000 1.0000000 1.0 1.0000000 1.0 1
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.4160217 0.1782991 0.3405696 0.5345263 0.4753711
## mixture:2 0.8362695 0.6087214 0.7873622 0.8916957 0.8666040
##
##
## Real Parameter f0
##
##             1
##  2.548144e-18
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  8  (unadjusted=6)
## -2lnL:  99.67496
## AICc :  116.3325  (unadjusted=112.05505)
##
## Beta
##                       estimate           se           lcl         ucl
## pi:(Intercept)  3.004841e-06 2508.2857000 -4916.2402000 4916.240200
## p:(Intercept)  -4.274436e-01    0.3318809    -1.0779302    0.223043
## p:time2         5.328045e-01    0.4644357    -0.3774895    1.443099
## p:time3         1.089890e-01    0.4670113    -0.8063532    1.024331
## p:time4         4.274433e-01    0.4641207    -0.4822334    1.337120
## p:time5         1.081370e+00    0.4765165     0.1473977    2.015343
## p:time6         1.081370e+00    0.4765165     0.1473976    2.015343
## f0:(Intercept) -1.487190e+01 2533.1224000 -4979.7919000 4950.048100
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000008
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.3947369 0.5263159 0.4210524 0.4999999 0.6578948 0.6578947
## mixture:2 0.3947369 0.5263159 0.4210524 0.4999999 0.6578948 0.6578947
```

```
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.5263159 0.4210524 0.4999999 0.6578948 0.6578947
## mixture:2 0.5263159 0.4210524 0.4999999 0.6578948 0.6578947
##
##
## Real Parameter f0
##
##             1
##  3.477074e-07
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~time)f0(~1)
##
## Npar :  13  (unadjusted=10)
## -2lnL:  87.05684
## AICc :  114.7578  (unadjusted=108.07067)
##
## Beta
##                       estimate           se           lcl          ucl
## pi:(Intercept) -2.412736e-04 2048.4948000 -4015.0502000 4015.0497000
## p:(Intercept)  -4.274441e-01    0.3318811    -1.0779311    0.2230429
## p:time2        -2.011647e-01    0.5493743    -1.2779383    0.8756088
## p:time3         2.197910e-02    0.6228349    -1.1987773    1.2427354
## p:time4        -2.657031e-01    0.7811190    -1.7966963    1.2652902
## p:time5         4.274440e-01    0.8813700    -1.3000413    2.1549293
## p:time6         2.265870e+01    0.0000000    22.6587010   22.6587010
## c:(Intercept)   1.386294e+00    0.6454975     0.1211193    2.6514697
## c:time3        -1.648659e+00    0.7704481    -3.1587371   -0.1385806
## c:time4        -1.178655e+00    0.7457146    -2.6402557    0.2829454
## c:time5        -5.978372e-01    0.7497477    -2.0673428    0.8716684
## c:time6        -8.602014e-01    0.7341967    -2.2992269    0.5788241
## f0:(Intercept) -2.337383e+01    0.0000000   -23.3738250  -23.3738250
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999397
##
##
## Real Parameter p
##
##                   1         2   3         4   5 6
## mixture:1 0.3947368 0.3478261 0.4 0.3333333 0.5 1
## mixture:2 0.3947368 0.3478261 0.4 0.3333333 0.5 1
##
##
## Real Parameter c
##
##             2         3         4      5         6
```

```
## mixture:1 0.8 0.4347826 0.5517241 0.6875 0.6285714
## mixture:2 0.8 0.4347826 0.5517241 0.6875 0.6285714
##
##
## Real Parameter f0
##
##             1
##  7.061171e-11
```

```
mouse.results
```

```
##                                                model npar      AICc DeltaAICc
## 1                               pi(~1)p(~1)c()f0(~1)    3 115.61399        NA
## 2                             pi(~1)p(~1)c(~1)f0(~1)    4 106.16685        NA
## 3                          pi(~1)p(~mixture)c()f0(~1)    4        NA        NA
## 4                 pi(~1)p(~mixture)c(~mixture)f0(~1)    6  98.10978        NA
## 5                  pi(~1)p(~time + mixture)c()f0(~1)    9  99.58481        NA
## 6 pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   15 101.24439        NA
## 7                            pi(~1)p(~time)c()f0(~1)    8 116.33249        NA
## 8                       pi(~1)p(~time)c(~time)f0(~1)   13 114.75778        NA
##   weight Deviance
## 1     NA 85.44111
## 2     NA 73.92174
## 3     NA  2.00000
## 4     NA 61.66395
## 5     NA 56.69338
## 6     NA 44.91450
## 7     NA 75.60922
## 8     NA 62.99110
```

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

```
##               estimate           se       lcl        ucl fixed note
## pi g1 m1     0.7821803 8.400280e-02 0.5773837  0.9042005
## p g1 t1 m1   0.1808331 1.050764e-01 0.0521031  0.4699349
## p g1 t1 m2   1.0000000 2.938374e-05 0.9999424  1.0000576
## c g1 t2 m1   0.4618398 6.610220e-02 0.3375535  0.5910577
## c g1 t2 m2   0.8367778 6.128260e-02 0.6802697  0.9251092
## f0 g1 a0 t1 11.2561340 1.323298e+01 1.8127983 69.8922550
```

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

```
## $`N Population Size`
##   estimate     lcl      ucl
## 1 49.25613 39.8128 107.8923
```

Comme dans les diapos.

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

```
##              estimate          se           lcl        ucl fixed note
## pi g1 m1    0.5000002 164.6766500 5.562690e-309  1.0000000
## p g1 t1 m1  0.3424124   0.0727432  2.165699e-01  0.4951613
## c g1 t2 m1  0.6119403   0.0420970  5.269786e-01  0.6906012
## f0 g1 a0 t1 2.8295465   3.0854436  4.991971e-01 16.0384210
```

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

```
## $`N Population Size`
##   estimate     lcl      ucl
## 1 40.82955 38.4992 54.03842
```

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.

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

On formate les données.

```r
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
```

```r
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.

```r
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() {

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

  # avec l'effet sexe
  p.sex <- list(formula =  ~ sex, share = TRUE)
```

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

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

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

  return(mouse.results)
}
```

Run the models and examine the output, and examine model-selection table.

```
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)  -0.000388857  424.1411500 -8.313170e+02 8.313163e+02
## p:(Intercept)    0.105360500    0.1326371 -1.546082e-01 3.653292e-01
## f0:(Intercept) -20.178984000 7667.6112000 -1.504870e+04 1.500834e+04
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999028
##
## Group:sexM
##
## mixture:1 0.4999028
##
##
## Real Parameter p
## Group:sexF
##                    1         2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
```

```
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
##
## Real Parameter f0
## Group:sexF
##             1
##  1.723371e-09
##
## Group:sexM
##             1
##  1.723371e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  147.5555
## AICc :  155.7349  (unadjusted=153.66264)
##
## Beta
##                      estimate se           lcl           ucl
## pi:(Intercept)  7.897412e-06  0  7.897412e-06  7.897412e-06
## p:(Intercept)  -5.331229e-01  0 -5.331229e-01 -5.331229e-01
## c:(Intercept)   4.554755e-01  0  4.554755e-01  4.554755e-01
## f0:(Intercept) -3.145563e-01  0 -3.145563e-01 -3.145563e-01
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.500002
##
## Group:sexM
##
## mixture:1 0.500002
##
##
```

```
## 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
##  0.7301128
##
## Group:sexM
##          1
##  0.7301128
##
## 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)  0.4152352 0.6397354 -0.8386463 1.6691167
## p:(Intercept)  -0.7271250 0.4231265 -1.5564529 0.1022029
## p:mixture2      2.0499901 0.3936867  1.2783641 2.8216161
## f0:(Intercept) -0.5151984 1.9306874 -4.2993459 3.2689490
##
##
## 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
##  0.597382
##
## Group:sexM
##         1
##  0.597382
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6  (unadjusted=5)
## -2lnL:  136.4229
## AICc :  148.803  (unadjusted=146.69321)
##
## Beta
##                   estimate           se           lcl          ucl
## pi:(Intercept)  1.1917187    0.4726021     0.2654186    2.1180188
## p:(Intercept)  -1.2293209    0.5677758    -2.3421615   -0.1164802
## p:mixture2     19.7737680 4198.8513000 -8209.9750000 8249.5226000
## c:(Intercept)  -0.1304582    0.2667012    -0.6531926    0.3922761
## c:mixture2      1.8012061    0.4932497     0.8344366    2.7679756
## f0:(Intercept)  1.1667425    1.2033300    -1.1917843    3.5252693
##
##
```

```
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.7670483
##
## Group:sexM
##
## mixture:1 0.7670483
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.2263003 0.2263003 0.2263003 0.2263003 0.2263003 0.2263003
## mixture:2 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.2263003 0.2263003 0.2263003 0.2263003 0.2263003 0.2263003
## mixture:2 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.4674316 0.4674316 0.4674316 0.4674316 0.4674316
## mixture:2 0.8416755 0.8416755 0.8416755 0.8416755 0.8416755
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.4674316 0.4674316 0.4674316 0.4674316 0.4674316
## mixture:2 0.8416755 0.8416755 0.8416755 0.8416755 0.8416755
##
##
## Real Parameter f0
## Group:sexF
##         1
##  3.211514
##
## Group:sexM
##         1
##  3.211514
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex + mixture)c(~sex + mixture)f0(~1)
##
## Npar :  8
## -2lnL:  132.8003
## AICc :  149.4578
##
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept) -0.3408873 1.4377271 -3.1588326  2.4770580
## p:(Intercept)   0.0978060 0.9975012 -1.8572965  2.0529085
```

```
## p:sexM          0.6131545 0.7385336 -0.8343714  2.0606803
## p:mixture2     -1.7710111 1.3346438 -4.3869130  0.8448908
## c:(Intercept)   0.4071785 1.0197302 -1.5914928  2.4058497
## c:sexM          1.2375518 0.5228711  0.2127245  2.2623792
## c:mixture2     -1.4345907 0.5668534 -2.5456234 -0.3235581
## f0:(Intercept)  0.9898888 2.1297608 -3.1844425  5.1642200
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.415594
##
## Group:sexM
##
## mixture:1 0.415594
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.5244320 0.5244320 0.5244320 0.5244320 0.5244320 0.5244320
## mixture:2 0.1579973 0.1579973 0.1579973 0.1579973 0.1579973 0.1579973
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.6706134 0.6706134 0.6706134 0.6706134 0.6706134 0.6706134
## mixture:2 0.2572998 0.2572998 0.2572998 0.2572998 0.2572998 0.2572998
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.6004111 0.6004111 0.6004111 0.6004111 0.6004111
## mixture:2 0.2635861 0.2635861 0.2635861 0.2635861 0.2635861
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.8381776 0.8381776 0.8381776 0.8381776 0.8381776
## mixture:2 0.5523424 0.5523424 0.5523424 0.5523424 0.5523424
##
##
## Real Parameter f0
## Group:sexF
##         1
##  2.690935
##
## Group:sexM
##         1
##  2.690935
##
## 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)  0.8595296 0.6488544 -0.412225 2.1312843
## p:(Intercept)  -0.2402765 0.3895825 -1.003858 0.5233052
## p:mixture2     -2.6445004 1.5398772 -5.662660 0.3736589
## p:sexM          1.3318665 0.4291946  0.490645 2.1730880
## f0:(Intercept)  1.0300675 1.9350658 -2.762662 4.8227965
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.7025624
##
## Group:sexM
##
## mixture:1 0.7025624
##
##
## Real Parameter p
## Group:sexF
##                    1         2         3         4         5         6
## mixture:1 0.4402182 0.4402182 0.4402182 0.4402182 0.4402182 0.4402182
## mixture:2 0.0529112 0.0529112 0.0529112 0.0529112 0.0529112 0.0529112
##
## Group:sexM
##                    1         2         3         4         5         6
## mixture:1 0.7486810 0.7486810 0.7486810 0.7486810 0.7486810 0.7486810
## mixture:2 0.1746663 0.1746663 0.1746663 0.1746663 0.1746663 0.1746663
##
##
## Real Parameter c
## Group:sexF
##                    2         3         4         5         6
## mixture:1 0.4402182 0.4402182 0.4402182 0.4402182 0.4402182
## mixture:2 0.0529112 0.0529112 0.0529112 0.0529112 0.0529112
##
## Group:sexM
##                    2         3         4         5         6
## mixture:1 0.7486810 0.7486810 0.7486810 0.7486810 0.7486810
## mixture:2 0.1746663 0.1746663 0.1746663 0.1746663 0.1746663
##
##
## Real Parameter f0
## Group:sexF
##         1
##  2.801255
##
## Group:sexM
##         1
```

```
##  2.801255
##
## 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) -0.3904000 0.5954134 -1.5574103  0.7766103
## p:(Intercept)   0.7291672 0.5906036 -0.4284158  1.8867502
## p:time2         0.6856500 0.5287544 -0.3507087  1.7220087
## p:time3         0.1412199 0.5316898 -0.9008921  1.1833319
## p:time4         0.5517952 0.5286141 -0.4842885  1.5878788
## p:time5         1.3531222 0.5386833  0.2973030  2.4089415
## p:time6         1.3531223 0.5386833  0.2973031  2.4089415
## p:mixture2     -2.1869352 0.4019846 -2.9748250 -1.3990454
## f0:(Intercept) -0.7217356 2.2059036 -5.0453068  3.6018356
##
##
## 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 0.6746225 0.8045246 0.7048262 0.7826135 0.8891699 0.8891699
## mixture:2 0.1888089 0.3160211 0.2113932 0.2878246 0.4738624 0.4738624
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.6746225 0.8045246 0.7048262 0.7826135 0.8891699 0.8891699
## mixture:2 0.1888089 0.3160211 0.2113932 0.2878246 0.4738624 0.4738624
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.8045246 0.7048262 0.7826135 0.8891699 0.8891699
## mixture:2 0.3160211 0.2113932 0.2878246 0.4738624 0.4738624
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.8045246 0.7048262 0.7826135 0.8891699 0.8891699
## mixture:2 0.3160211 0.2113932 0.2878246 0.4738624 0.4738624
```

```
##
##
## Real Parameter f0
## Group:sexF
##         1
##  0.4859082
##
## Group:sexM
##         1
##  0.4859082
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  15  (unadjusted=12)
## -2lnL:  117.1462
## AICc :  149.4104  (unadjusted=142.59738)
##
## Beta
##                     estimate           se           lcl           ucl
## pi:(Intercept)   0.5724615    0.3633270 -1.396594e-01     1.2845824
## p:(Intercept)   -2.8773116    1.2787152 -5.383593e+00    -0.3710298
## p:mixture2      23.7868080 9955.5185000 -1.948903e+04 19536.6030000
## p:time2          2.2487033    1.3515840 -4.004014e-01     4.8978079
## p:time3          2.4718462    1.3830728 -2.389765e-01     5.1826689
## p:time4          2.1841643    1.4612027 -6.797930e-01     5.0481215
## p:time5          2.8773113    1.5171618 -9.632580e-02     5.8509485
## p:time6         41.0892550    0.0000000  4.108926e+01    41.0892550
## c:(Intercept)   -0.3391263    0.8083493 -1.923491e+00     1.2452383
## c:mixture2       1.9698545    0.4916156  1.006288e+00     2.9334211
## c:time3         -1.1887873    0.8298527 -2.815299e+00     0.4377241
## c:time4         -0.3216302    0.8302082 -1.948838e+00     1.3055780
## c:time5          0.4774515    0.8549632 -1.198276e+00     2.1531794
## c:time6          0.2405309    0.8399626 -1.405796e+00     1.8868575
## f0:(Intercept) -55.3910930    0.0000000 -5.539109e+01   -55.3910930
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.639331
##
## Group:sexM
##
## mixture:1 0.639331
##
##
## Real Parameter p
## Group:sexF
##                    1         2         3         4         5 6
## mixture:1 0.0532866 0.3478262 0.3999999 0.3333333 0.4999999 1
## mixture:2 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1
##
## Group:sexM
```

```
##                    1         2         3         4         5 6
## mixture:1 0.0532866 0.3478262 0.3999999 0.3333333 0.4999999 1
## mixture:2 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1
##
##
## Real Parameter c
## Group:sexF
##                    2         3         4         5         6
## mixture:1 0.4160217 0.1782992 0.3405697 0.5345263 0.4753711
## mixture:2 0.8362694 0.6087214 0.7873622 0.8916957 0.8666039
##
## Group:sexM
##                    2         3         4         5         6
## mixture:1 0.4160217 0.1782992 0.3405697 0.5345263 0.4753711
## mixture:2 0.8362694 0.6087214 0.7873622 0.8916957 0.8666039
##
##
## Real Parameter f0
## Group:sexF
##             1
##  8.789295e-25
##
## Group:sexM
##             1
##  8.789295e-25
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex + mixture + time)c(~sex + mixture + time)f0(~1)
##
## Npar :  17  (unadjusted=12)
## -2lnL:  108.3403
## AICc :  145.2546  (unadjusted=133.7915)
##
## Beta
##                     estimate           se           lcl           ucl
## pi:(Intercept)    1.6739835 4.448793e-01  8.020200e-01     2.5459469
## p:(Intercept)    -0.9923468 5.125942e-01 -1.997032e+00     0.0123380
## p:sexM            1.5838831 6.015671e-01  4.048115e-01     2.7629547
## p:mixture2      -56.4594590 2.648917e+02 -5.756472e+02   462.7283100
## p:time2           0.4213628 6.686070e-01 -8.891070e-01     1.7318327
## p:time3           1.5591950 8.712073e-01 -1.483714e-01     3.2667613
## p:time4          18.6306450 6.794897e+03 -1.329937e+04 13336.6290000
## p:time5          56.3714350 2.648917e+02 -4.628163e+02   575.5592000
## p:time6         119.6158100 0.000000e+00  1.196158e+02   119.6158100
## c:(Intercept)     0.3482720 7.244578e-01 -1.071665e+00     1.7682093
## c:sexM            1.4135532 4.097312e-01  6.104800e-01     2.2166263
## c:mixture2      -20.9680680 8.681345e+03 -1.703640e+04 16994.4680000
## c:time3          -1.6391461 8.023337e-01 -3.211720e+00    -0.0665721
## c:time4          -0.8999483 7.808448e-01 -2.430404e+00     0.6305075
## c:time5          -0.2173822 7.891836e-01 -1.764182e+00     1.3294177
## c:time6          -0.2173718 7.891840e-01 -1.764172e+00     1.3294290
## f0:(Intercept) -33.4366480 1.414166e+04 -2.775108e+04 27684.2080000
##
##
```

```
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.8421062
##
## Group:sexM
##
## mixture:1 0.8421062
##
##
## Real Parameter p
## Group:sexF
##                       1            2            3            4         5 6
## mixture:1 2.704488e-01 3.610098e-01 6.380356e-01 1.000000e+00 1.0000000 1
## mixture:2 1.119432e-25 1.706055e-25 5.322888e-25 1.380969e-17 0.2534357 1
##
## Group:sexM
##                       1            2            3            4         5 6
## mixture:1 6.437176e-01 7.335871e-01 8.957371e-01 1.000000e+00 1.0000000 1
## mixture:2 5.455936e-25 8.315049e-25 2.594293e-24 6.730631e-17 0.6232842 1
##
##
## Real Parameter c
## Group:sexF
##                       2            3            4            5            6
## mixture:1 5.861985e-01 2.157049e-01 3.654756e-01 5.326758e-01 5.326784e-01
## mixture:2 1.109012e-09 2.153100e-10 4.509141e-10 8.923361e-10 8.923454e-10
##
## Group:sexM
##                       2            3            4            5            6
## mixture:1 8.534381e-01 5.306314e-01 7.030526e-01 8.241097e-01 8.241112e-01
## mixture:2 4.558634e-09 8.850394e-10 1.853498e-09 3.667979e-09 3.668017e-09
##
##
## Real Parameter f0
## Group:sexF
##             1
##  3.010567e-15
##
## Group:sexM
##             1
##  3.010567e-15
##
## 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)  0.8562571 0.6675072 -0.4520570 2.1645712
## p:(Intercept)  -0.8381400 0.6738118 -2.1588111 0.4825312
```

```
## p:time2         0.6470858 0.5129320 -0.3582610 1.6524326
## p:time3         0.1318703 0.5137405 -0.8750610 1.1388017
## p:time4         0.5190744 0.5121577 -0.4847547 1.5229034
## p:time5         1.3006932 0.5277911  0.2662226 2.3351638
## p:time6         1.3006931 0.5277911  0.2662226 2.3351636
## p:mixture2     -2.5544267 1.9136019 -6.3050864 1.1962331
## p:sexM          1.3736220 0.5177307  0.3588697 2.3883742
## f0:(Intercept)  0.7154281 2.5700947 -4.3219577 5.7528139
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.7018781
##
## Group:sexM
##
## mixture:1 0.7018781
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.3019267 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 0.1172282 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)  3.269212e-04 1586.8926000 -3110.3092000 3110.3099000
## p:(Intercept)  -3.973019e-01    0.2019497    -0.7931234   -0.0014805
## p:sexM          9.166022e-01    0.2733469     0.3808423    1.4523620
## f0:(Intercept) -1.582782e+01 1996.4099000 -3928.7913000 3897.1356000
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.5000817
##
## Group:sexM
##
## mixture:1 0.5000817
##
##
## 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
##  1.336795e-07
##
## Group:sexM
```

```
##             1
##  1.336795e-07
##
## 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) -6.337972e-05 2508.4365000 -4916.5356000 4916.5355000
## p:(Intercept)  -7.198819e-01    0.3614794    -1.4283816   -0.0113822
## p:sexM          3.998279e-01    0.4141435    -0.4118933    1.2115491
## c:(Intercept)   4.554755e-01    0.1772735     0.1080195    0.8029316
## f0:(Intercept) -4.253515e-01    1.8511775    -4.0536596    3.2029565
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999842
##
## Group:sexM
##
## mixture:1 0.4999842
##
##
## Real Parameter p
## Group:sexF
##                   1        2        3        4        5        6
## mixture:1 0.327419 0.327419 0.327419 0.327419 0.327419 0.327419
## mixture:2 0.327419 0.327419 0.327419 0.327419 0.327419 0.327419
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.4206626 0.4206626 0.4206626 0.4206626 0.4206626 0.4206626
## mixture:2 0.4206626 0.4206626 0.4206626 0.4206626 0.4206626 0.4206626
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.6119403 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
##  0.65354
##
## Group:sexM
##        1
##  0.65354
##
## 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) -2.992061e-04 2509.0282000 -4917.6957000 4917.6951000
## p:(Intercept)  -4.274429e-01    0.3318807    -1.0779290    0.2230432
## p:time2         5.328032e-01    0.4644354    -0.3774902    1.4430965
## p:time3         1.089900e-01    0.4670111    -0.8063517    1.0243317
## p:time4         4.274428e-01    0.4641205    -0.4822334    1.3371190
## p:time5         1.081369e+00    0.4765163     0.1473971    2.0153410
## p:time6         1.081369e+00    0.4765163     0.1473968    2.0153407
## f0:(Intercept) -2.122267e+01    0.0000000   -21.2226680  -21.2226680
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999252
##
## Group:sexM
##
## mixture:1 0.4999252
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3   4         5         6
## mixture:1 0.3947371 0.5263157 0.4210528 0.5 0.6578947 0.6578946
## mixture:2 0.3947371 0.5263157 0.4210528 0.5 0.6578947 0.6578946
##
## Group:sexM
##                   1         2         3   4         5         6
## mixture:1 0.3947371 0.5263157 0.4210528 0.5 0.6578947 0.6578946
## mixture:2 0.3947371 0.5263157 0.4210528 0.5 0.6578947 0.6578946
##
##
## Real Parameter c
## Group:sexF
##                   2         3   4         5         6
## mixture:1 0.5263157 0.4210528 0.5 0.6578947 0.6578946
## mixture:2 0.5263157 0.4210528 0.5 0.6578947 0.6578946
```

```
##
## Group:sexM
##                   2         3   4         5         6
## mixture:1 0.5263157 0.4210528 0.5 0.6578947 0.6578946
## mixture:2 0.5263157 0.4210528 0.5 0.6578947 0.6578946
##
##
## Real Parameter f0
## Group:sexF
##             1
##  6.068936e-10
##
## Group:sexM
##             1
##  6.068936e-10
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~time)f0(~1)
##
## Npar :  13  (unadjusted=10)
## -2lnL:  135.2228
## AICc :  162.9238  (unadjusted=156.23664)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept) -2.492119e-04 0.000000e+00 -2.492119e-04 -2.492119e-04
## p:(Intercept)  -4.274443e-01 3.318810e-01 -1.077931e+00  2.230425e-01
## p:time2        -2.011643e-01 5.493742e-01 -1.277938e+00  8.756091e-01
## p:time3         2.197970e-02 6.228347e-01 -1.198776e+00  1.242736e+00
## p:time4        -2.657030e-01 7.811183e-01 -1.796695e+00  1.265289e+00
## p:time5         4.274454e-01 8.813698e-01 -1.300039e+00  2.154930e+00
## p:time6         2.527510e+01 4.210537e+04 -8.250125e+04  8.255180e+04
## c:(Intercept)   1.386294e+00 6.454971e-01  1.211200e-01  2.651469e+00
## c:time3        -1.648659e+00 7.704477e-01 -3.158736e+00 -1.385811e-01
## c:time4        -1.178655e+00 7.457142e-01 -2.640255e+00  2.829448e-01
## c:time5        -5.978369e-01 7.497475e-01 -2.067342e+00  8.716681e-01
## c:time6        -8.602013e-01 7.341962e-01 -2.299226e+00  5.788233e-01
## f0:(Intercept) -2.350024e+01 0.000000e+00 -2.350024e+01 -2.350024e+01
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999377
##
## Group:sexM
##
## mixture:1 0.4999377
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5 6
## mixture:1 0.3947368 0.3478261 0.4000001 0.3333333 0.5000003 1
```

```
## mixture:2 0.3947368 0.3478261 0.4000001 0.3333333 0.5000003 1
##
## Group:sexM
##                   1         2         3         4         5 6
## mixture:1 0.3947368 0.3478261 0.4000001 0.3333333 0.5000003 1
## mixture:2 0.3947368 0.3478261 0.4000001 0.3333333 0.5000003 1
##
##
## Real Parameter c
## Group:sexF
##             2         3         4      5         6
## mixture:1 0.8 0.4347826 0.5517241 0.6875 0.6285714
## mixture:2 0.8 0.4347826 0.5517241 0.6875 0.6285714
##
## Group:sexM
##             2         3         4      5         6
## mixture:1 0.8 0.4347826 0.5517241 0.6875 0.6285714
## mixture:2 0.8 0.4347826 0.5517241 0.6875 0.6285714
##
##
## Real Parameter f0
## Group:sexF
##             1
##  6.222632e-11
##
## Group:sexM
##             1
##  6.222632e-11
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex + time)c(~sex + time)f0(~1)
##
## Npar :  15  (unadjusted=12)
## -2lnL:  123.0009
## AICc :  155.2651  (unadjusted=148.45211)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept)  1.501464e-04 2.048308e+03 -4.014684e+03  4014.6846000
## p:(Intercept)  -6.382240e-01 4.191039e-01 -1.459667e+00     0.1832196
## p:sexM          3.745886e-01 4.435508e-01 -4.947710e-01     1.2439482
## p:time2        -1.418830e-01 5.558621e-01 -1.231373e+00     0.9476067
## p:time3         1.050816e-01 6.332031e-01 -1.135997e+00     1.3461598
## p:time4        -2.688741e-01 7.841442e-01 -1.805797e+00     1.2680485
## p:time5         3.882674e-01 8.858544e-01 -1.348007e+00     2.1245420
## p:time6         2.264753e+01 0.000000e+00  2.264753e+01    22.6475300
## c:(Intercept)   4.237149e-01 7.181362e-01 -9.838321e-01     1.8312619
## c:sexM          1.302281e+00 3.949170e-01  5.282433e-01     2.0763179
## c:time3        -1.629269e+00 7.970518e-01 -3.191491e+00    -0.0670479
## c:time4        -9.168276e-01 7.755285e-01 -2.436863e+00     0.6032083
## c:time5        -2.479463e-01 7.834232e-01 -1.783456e+00     1.2875632
## c:time6        -5.521342e-01 7.652545e-01 -2.052033e+00     0.9477647
## f0:(Intercept) -2.422597e+01 2.115522e+04 -4.148846e+04 41440.0040000
##
```

```
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.5000375
##
## Group:sexM
##
## mixture:1 0.5000375
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3        4         5 6
## mixture:1 0.3456481 0.3142968 0.3697843 0.287594 0.4378342 1
## mixture:2 0.3456481 0.3142968 0.3697843 0.287594 0.4378342 1
##
## Group:sexM
##                   1         2         3         4         5 6
## mixture:1 0.4344703 0.3999872 0.4604444 0.3699318 0.5311177 1
## mixture:2 0.4344703 0.3999872 0.4604444 0.3699318 0.5311177 1
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.6043718 0.2304886 0.3791606 0.5438294 0.4679392
## mixture:2 0.6043718 0.2304886 0.3791606 0.5438294 0.4679392
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.8488995 0.5241627 0.6919322 0.8142777 0.7638422
## mixture:2 0.8488995 0.5241627 0.6919322 0.8142777 0.7638422
##
##
## Real Parameter f0
## Group:sexF
##             1
##  3.011577e-11
##
## Group:sexM
##             1
##  3.011577e-11
##
## 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)  2.391124e-04    0.0000000  2.391124e-04  2.391124e-04
```

```
## p:(Intercept)  -9.848622e-01    0.3813510 -1.732310e+00 -2.374142e-01
## p:time2         5.630712e-01    0.4776015 -3.730277e-01  1.499170e+00
## p:time3         1.149510e-01    0.4796139 -8.250922e-01  1.054994e+00
## p:time4         4.515752e-01    0.4771379 -4.836152e-01  1.386766e+00
## p:time5         1.142639e+00    0.4904565  1.813445e-01  2.103934e+00
## p:time6         1.142639e+00    0.4904564  1.813442e-01  2.103934e+00
## p:sexM          9.614724e-01    0.2811732  4.103729e-01  1.512572e+00
## f0:(Intercept) -1.705618e+01 3385.1276000 -6.651906e+03  6.617794e+03
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.5000598
##
## Group:sexM
##
## mixture:1 0.5000598
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.2719281 0.3960882 0.2952728 0.3697506 0.5393626 0.5393625
## mixture:2 0.2719281 0.3960882 0.2952728 0.3697506 0.5393626 0.5393625
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.4941528 0.6317383 0.5228743 0.6054403 0.7538495 0.7538494
## mixture:2 0.4941528 0.6317383 0.5228743 0.6054403 0.7538495 0.7538494
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.3960882 0.2952728 0.3697506 0.5393626 0.5393625
## mixture:2 0.3960882 0.2952728 0.3697506 0.5393626 0.5393625
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6317383 0.5228743 0.6054403 0.7538495 0.7538494
## mixture:2 0.6317383 0.5228743 0.6054403 0.7538495 0.7538494
##
##
## Real Parameter f0
## Group:sexF
##             1
##  3.913753e-08
##
## Group:sexM
##             1
##  3.913753e-08
```

```
mouse.results
```

```
##                                                          model npar     AICc
## 9  pi(~1)p(~sex + mixture + time)c(~sex + mixture + time)f0(~1)   17 145.2546
## 10                      pi(~1)p(~time + mixture + sex)c()f0(~1)   10 146.3169
## 6                             pi(~1)p(~mixture + sex)c()f0(~1)    5 147.2589
## 4                           pi(~1)p(~mixture)c(~mixture)f0(~1)    6 148.8030
## 7                            pi(~1)p(~time + mixture)c()f0(~1)    9 148.9379
## 8              pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   15 149.4104
## 5                pi(~1)p(~sex + mixture)c(~sex + mixture)f0(~1)    8 149.4578
## 3                                   pi(~1)p(~mixture)c()f0(~1)    4 150.4044
## 11                                      pi(~1)p(~sex)c()f0(~1)    4 154.3203
## 16                                pi(~1)p(~time + sex)c()f0(~1)    9 154.5961
## 15                     pi(~1)p(~sex + time)c(~sex + time)f0(~1)   15 155.2651
## 2                                       pi(~1)p(~1)c(~1)f0(~1)    4 155.7349
## 12                                   pi(~1)p(~sex)c(~1)f0(~1)    5 156.8823
## 14                                 pi(~1)p(~time)c(~time)f0(~1)   13 162.9238
## 1                                         pi(~1)p(~1)c()f0(~1)    3 163.7800
## 13                                     pi(~1)p(~time)c()f0(~1)    8 164.4985
##    DeltaAICc       weight  Deviance
## 9   0.000000 3.784686e-01  75.18263
## 10  1.062299 2.225126e-01  92.14539
## 6   2.004305 1.389315e-01 103.83095
## 4   3.548405 6.419535e-02 103.26524
## 7   3.683282 6.000884e-02  96.95452
## 8   4.155735 4.738310e-02  83.98851
## 5   4.203169 4.627255e-02  99.64255
## 3   5.149726 2.882577e-02 109.06727
## 11  9.065656 4.068624e-03 112.98321
## 16  9.341522 3.544411e-03 102.61275
## 15 10.010465 2.536793e-03  89.84324
## 2  10.480246 2.005734e-03 114.39780
## 12 11.627695 1.130077e-03 113.45435
## 14 17.669129 5.510960e-05 102.06511
## 1  18.525337 3.591733e-05 124.51511
## 13 19.243839 2.507745e-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 (#9)

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

```
##                  estimate           se            lcl          ucl fixed note
## pi gF m1    8.421062e-01 5.915260e-02   6.904064e-01 9.273008e-01
## p gF t1 m1  2.704488e-01 1.011380e-01   1.195149e-01 5.030845e-01
## p gF t2 m1  3.610098e-01 1.245746e-01   1.639072e-01 6.195106e-01
## p gF t3 m1  6.380356e-01 1.659034e-01   3.012937e-01 8.781302e-01
## p gF t4 m1  1.000000e+00 1.485823e-04  2.543901e-301 1.000000e+00
## p gF t5 m1  1.000000e+00 0.000000e+00   1.000000e+00 1.000000e+00
## p gF t6 m1  1.000000e+00 0.000000e+00   1.000000e+00 1.000000e+00
## p gF t1 m2  1.119432e-25 2.965285e-23  -5.800764e-23 5.823152e-23
## p gF t2 m2  1.706055e-25 4.519209e-23  -8.840590e-23 8.874711e-23
## p gF t3 m2  5.322888e-25 1.409994e-22  -2.758266e-22 2.768911e-22
## p gF t4 m2  1.380969e-17 9.390647e-14  -1.840429e-13 1.840705e-13
## p gF t5 m2  2.534357e-01 1.837168e-01   4.817650e-02 6.948230e-01
## p gF t6 m2  1.000000e+00 0.000000e+00   1.000000e+00 1.000000e+00
## p gM t1 m1  6.437176e-01 1.058951e-01   4.222728e-01 8.170553e-01
## p gM t2 m1  7.335871e-01 1.332243e-01   4.199006e-01 9.128531e-01
## p gM t3 m1  8.957371e-01 8.575330e-02   5.868710e-01 9.811168e-01
## p gM t4 m1  1.000000e+00 3.048565e-05   9.999402e-01 1.000060e+00
## p gM t5 m1  1.000000e+00 0.000000e+00   1.000000e+00 1.000000e+00
## p gM t6 m1  1.000000e+00 0.000000e+00   1.000000e+00 1.000000e+00
## p gM t1 m2  5.455936e-25 1.445233e-22  -2.827200e-22 2.838112e-22
## p gM t2 m2  8.315049e-25 2.202594e-22  -4.308770e-22 4.325400e-22
## p gM t3 m2  2.594293e-24 6.872106e-22  -1.344338e-21 1.349527e-21
## p gM t4 m2  6.730631e-17 4.576855e-13  -8.969963e-13 8.971310e-13
## p gM t5 m2  6.232842e-01 2.085367e-01   2.249154e-01 9.041552e-01
## p gM t6 m2  1.000000e+00 0.000000e+00   1.000000e+00 1.000000e+00
## c gF t2 m1  5.861985e-01 1.757316e-01   2.550865e-01 8.542348e-01
## c gF t3 m1  2.157049e-01 9.160910e-02   8.688980e-02 4.428675e-01
## c gF t4 m1  3.654756e-01 1.046743e-01   1.921093e-01 5.824916e-01
## c gF t5 m1  5.326758e-01 1.078979e-01   3.276885e-01 7.271951e-01
## c gF t6 m1  5.326784e-01 1.078979e-01   3.276907e-01 7.271973e-01
## c gF t2 m2  1.109012e-09 9.627718e-06  -1.886922e-05 1.887144e-05
## c gF t3 m2  2.153100e-10 1.869181e-06  -3.663379e-06 3.663809e-06
## c gF t4 m2  4.509141e-10 3.914540e-06  -7.672048e-06 7.672950e-06
## c gF t5 m2  8.923361e-10 7.746677e-06  -1.518260e-05 1.518438e-05
## c gF t6 m2  8.923454e-10 7.746758e-06  -1.518275e-05 1.518454e-05
## c gM t2 m1  8.534381e-01 8.544010e-02   6.042004e-01 9.569197e-01
## c gM t3 m1  5.306314e-01 1.120124e-01   3.189055e-01 7.318765e-01
## c gM t4 m1  7.030526e-01 9.222200e-02   4.990163e-01 8.491165e-01
## c gM t5 m1  8.241097e-01 6.833810e-02   6.503097e-01 9.219028e-01
## c gM t6 m1  8.241112e-01 6.833770e-02   6.503117e-01 9.219036e-01
## c gM t2 m2  4.558634e-09 3.957507e-05  -7.756258e-05 7.757170e-05
## c gM t3 m2  8.850394e-10 7.683332e-06  -1.505845e-05 1.506022e-05
## c gM t4 m2  1.853498e-09 1.609085e-05  -3.153622e-05 3.153993e-05
## c gM t5 m2  3.667979e-09 3.184299e-05  -6.240859e-05 6.241592e-05
## c gM t6 m2  3.668017e-09 3.184332e-05  -6.240924e-05 6.241658e-05
## f0 gF a0 t1 3.010567e-15 4.257439e-11   5.717252e-19 1.585291e-11
```

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

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

Comme dans les diapos.

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

```
##              estimate se       lcl       ucl fixed note
## pi gF m1    0.5000020  0 0.5000020 0.5000020
## p gF t1 m1  0.3697888  0 0.3697888 0.3697888
## c gF t2 m1  0.6119403  0 0.6119403 0.6119403
## f0 gF a0 t1 0.7301128  0 0.7301128 0.7301128
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 17.73011 17.73011 17.73011
## 2 21.73011 21.73011 21.73011
```

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() {

  # sans l'effet age
  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)

  # avec l'effet age
  p.age <- list(formula =  ~ age, share = TRUE)
  p.age.behav <- list(formula =  ~ age)
  p.time.age <- list(formula =  ~ time + age, share = TRUE)
```

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

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

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

  return(mouse.results)
}
```

Run the models and examine the output, and examine model-selection table

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

```
## Error in make.mark.model(data.proc, title = title, parameters = model.parameters,  :
##
## Error: Variable age used in formula is not defined in data
##
## Error in mark(model.parameters = model.parameters, initial = initial,  :
##   Misspecification of model or internal error in code
## Error in make.mark.model(data.proc, title = title, parameters = model.parameters,  :
##
## Error: Variable age used in formula is not defined in data
##
## Error in mark(model.parameters = model.parameters, initial = initial,  :
##   Misspecification of model or internal error in code
##
## 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) -1.737188e-04    0.0000000 -1.737188e-04 -1.737188e-04
## p:(Intercept)   1.053605e-01    0.1326371 -1.546082e-01  3.653292e-01
## f0:(Intercept) -2.173710e+01 9709.5933000 -1.905254e+04  1.900907e+04
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.4999566
```

```
##
## Group:agesSA
##
## mixture:1 0.4999566
##
## Group:agesY
##
## mixture:1 0.4999566
##
##
## 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
##  3.628265e-10
##
## Group:agesSA
##             1
##  3.628265e-10
##
## Group:agesY
```

```
##             1
##  3.628265e-10
##
## 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=161.72899)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept) -5.407641e-05    0.0000000 -5.407641e-05 -5.407641e-05
## p:(Intercept)  -3.877715e-01    0.2101739 -7.997123e-01  2.416940e-02
## c:(Intercept)   4.554762e-01    0.1772735  1.080201e-01  8.029323e-01
## f0:(Intercept) -1.442229e+01 1651.7201000 -3.251794e+03  3.222949e+03
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.4999865
##
## Group:agesSA
##
## mixture:1 0.4999865
##
## Group:agesY
##
## mixture:1 0.4999865
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5         6
## mixture:1 0.4042539 0.4042539 0.4042539 0.4042539 0.4042539 0.4042539
## mixture:2 0.4042539 0.4042539 0.4042539 0.4042539 0.4042539 0.4042539
##
## Group:agesSA
##                   1         2         3         4         5         6
## mixture:1 0.4042539 0.4042539 0.4042539 0.4042539 0.4042539 0.4042539
## mixture:2 0.4042539 0.4042539 0.4042539 0.4042539 0.4042539 0.4042539
##
## Group:agesY
##                   1         2         3         4         5         6
## mixture:1 0.4042539 0.4042539 0.4042539 0.4042539 0.4042539 0.4042539
## mixture:2 0.4042539 0.4042539 0.4042539 0.4042539 0.4042539 0.4042539
##
##
## Real Parameter c
## Group:agesA
##                   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:agesSA
##                   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:agesY
##                   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:agesA
##             1
##  5.451053e-07
##
## Group:agesSA
##             1
##  5.451053e-07
##
## Group:agesY
##             1
##  5.451053e-07
##
## 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)  -0.5353038    0.6426070    -1.7948136    0.724206
## p:(Intercept)    1.4386162    0.5278226     0.4040838    2.473149
## p:mixture2      -2.0085529    0.4285278    -2.8484674   -1.168638
## f0:(Intercept) -15.9628140 3282.6071000 -6449.8729000 6417.947300
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.3692807
##
## Group:agesSA
##
## mixture:1 0.3692807
##
## Group:agesY
##
## mixture:1 0.3692807
##
##
```

```
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5         6
## mixture:1 0.8082403 0.8082403 0.8082403 0.8082403 0.8082403 0.8082403
## mixture:2 0.3612514 0.3612514 0.3612514 0.3612514 0.3612514 0.3612514
##
## Group:agesSA
##                   1         2         3         4         5         6
## mixture:1 0.8082403 0.8082403 0.8082403 0.8082403 0.8082403 0.8082403
## mixture:2 0.3612514 0.3612514 0.3612514 0.3612514 0.3612514 0.3612514
##
## Group:agesY
##                   1         2         3         4         5         6
## mixture:1 0.8082403 0.8082403 0.8082403 0.8082403 0.8082403 0.8082403
## mixture:2 0.3612514 0.3612514 0.3612514 0.3612514 0.3612514 0.3612514
##
##
## Real Parameter c
## Group:agesA
##                   2         3         4         5         6
## mixture:1 0.8082403 0.8082403 0.8082403 0.8082403 0.8082403
## mixture:2 0.3612514 0.3612514 0.3612514 0.3612514 0.3612514
##
## Group:agesSA
##                   2         3         4         5         6
## mixture:1 0.8082403 0.8082403 0.8082403 0.8082403 0.8082403
## mixture:2 0.3612514 0.3612514 0.3612514 0.3612514 0.3612514
##
## Group:agesY
##                   2         3         4         5         6
## mixture:1 0.8082403 0.8082403 0.8082403 0.8082403 0.8082403
## mixture:2 0.3612514 0.3612514 0.3612514 0.3612514 0.3612514
##
##
## Real Parameter f0
## Group:agesA
##             1
##  1.167987e-07
##
## Group:agesSA
##             1
##  1.167987e-07
##
## Group:agesY
##             1
##  1.167987e-07
## Error in make.mark.model(data.proc, title = title, parameters = model.parameters,  :
##
## Error: Variable age used in formula is not defined in data
##
## Error in mark(model.parameters = model.parameters, initial = initial,  :
##   Misspecification of model or internal error in code
##
## 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)  4.600757e+00 4084.4781000 -8.000976e+03 8.010178e+03
## p:(Intercept)  -3.877657e-01    0.2138852 -8.069806e-01 3.144920e-02
## p:mixture2     -3.777328e-06    3.9895289 -7.819481e+00 7.819473e+00
## c:(Intercept)   4.554757e-01    0.1772735  1.080196e-01 8.029317e-01
## f0:(Intercept) -2.528561e+01 9121.1702000 -1.790278e+04 1.785221e+04
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.9900556
##
## Group:agesSA
##
## mixture:1 0.9900556
##
## Group:agesY
##
## mixture:1 0.9900556
##
##
## 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 0.4042544 0.4042544 0.4042544 0.4042544 0.4042544 0.4042544
##
## Group:agesSA
##                   1         2         3         4         5         6
## mixture:1 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553
## mixture:2 0.4042544 0.4042544 0.4042544 0.4042544 0.4042544 0.4042544
##
## Group:agesY
##                   1         2         3         4         5         6
## mixture:1 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553 0.4042553
## mixture:2 0.4042544 0.4042544 0.4042544 0.4042544 0.4042544 0.4042544
##
##
## 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
##  1.043761e-11
##
## Group:agesSA
##             1
##  1.043761e-11
##
## Group:agesY
##             1
##  1.043761e-11
## Error in make.mark.model(data.proc, title = title, parameters = model.parameters,  :
##
## Error: Variable age used in formula is not defined in data
##
## Error in mark(model.parameters = model.parameters, initial = initial,  :
##   Misspecification of model or internal error in code
##
## 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)  -0.4756492    0.5967551 -1.645289e+00     0.6939907
## p:(Intercept)    0.8167776    0.5935129 -3.465077e-01     1.9800630
## p:time2          0.6887710    0.5301039 -3.502327e-01     1.7277747
## p:time3          0.1419959    0.5331546 -9.029872e-01     1.1869790
## p:time4          0.5542951    0.5299029 -4.843146e-01     1.5929047
## p:time5          1.3641787    0.5413319  3.031681e-01     2.4251893
## p:time6          1.3641788    0.5413319  3.031682e-01     2.4251893
## p:mixture2      -2.1475666    0.4197036 -2.970186e+00    -1.3249475
## f0:(Intercept) -17.8350520 6203.3805000 -1.217646e+04 12140.7910000
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.38328
##
## Group:agesSA
```

```
##
## mixture:1 0.38328
##
## Group:agesY
##
## mixture:1 0.38328
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5         6
## mixture:1 0.6935519 0.8184006 0.7228762 0.7975534 0.8985263 0.8985263
## mixture:2 0.2090289 0.3447905 0.2334749 0.3150760 0.5083466 0.5083467
##
## Group:agesSA
##                   1         2         3         4         5         6
## mixture:1 0.6935519 0.8184006 0.7228762 0.7975534 0.8985263 0.8985263
## mixture:2 0.2090289 0.3447905 0.2334749 0.3150760 0.5083466 0.5083467
##
## Group:agesY
##                   1         2         3         4         5         6
## mixture:1 0.6935519 0.8184006 0.7228762 0.7975534 0.8985263 0.8985263
## mixture:2 0.2090289 0.3447905 0.2334749 0.3150760 0.5083466 0.5083467
##
##
## Real Parameter c
## Group:agesA
##                   2         3         4         5         6
## mixture:1 0.8184006 0.7228762 0.7975534 0.8985263 0.8985263
## mixture:2 0.3447905 0.2334749 0.3150760 0.5083466 0.5083467
##
## Group:agesSA
##                   2         3         4         5         6
## mixture:1 0.8184006 0.7228762 0.7975534 0.8985263 0.8985263
## mixture:2 0.3447905 0.2334749 0.3150760 0.5083466 0.5083467
##
## Group:agesY
##                   2         3         4         5         6
## mixture:1 0.8184006 0.7228762 0.7975534 0.8985263 0.8985263
## mixture:2 0.3447905 0.2334749 0.3150760 0.5083466 0.5083467
##
##
## Real Parameter f0
## Group:agesA
##             1
##  1.796121e-08
##
## Group:agesSA
##             1
##  1.796121e-08
##
## Group:agesY
##             1
##  1.796121e-08
```

```
## Error in make.mark.model(data.proc, title = title, parameters = model.parameters,  :
##
## Error: Variable age used in formula is not defined in data
##
## Error in mark(model.parameters = model.parameters, initial = initial,  :
##   Misspecification of model or internal error in code
##
## 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)    0.7964588 0.000000e+00  7.964588e-01  7.964588e-01
## p:(Intercept)    -0.8288587 0.000000e+00 -8.288587e-01 -8.288587e-01
## p:time2          -0.0774509 8.054970e+00 -1.586519e+01  1.571029e+01
## p:time3           0.2547815 6.533970e+00 -1.255180e+01  1.306136e+01
## p:time4           0.0321378 0.000000e+00  3.213780e-02  3.213780e-02
## p:time5           0.7783906 0.000000e+00  7.783906e-01  7.783906e-01
## p:time6          20.7513410 9.624921e+04 -1.886277e+05  1.886692e+05
## p:mixture2        1.2184062 5.697379e+01 -1.104502e+02  1.128870e+02
## c:(Intercept)     0.4554771 1.772735e-01  1.080210e-01  8.029332e-01
## f0:(Intercept) -20.1855510 6.905139e+03 -1.355426e+04  1.351389e+04
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.6892165
##
## Group:agesSA
##
## mixture:1 0.6892165
##
## Group:agesY
##
## mixture:1 0.6892165
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3         4         5 6
## mixture:1 0.3038864 0.2877556 0.3602966 0.3107274 0.4873856 1
## mixture:2 0.5961738 0.5773969 0.6557314 0.6038865 0.7627721 1
##
## Group:agesSA
##                   1         2         3         4         5 6
## mixture:1 0.3038864 0.2877556 0.3602966 0.3107274 0.4873856 1
## mixture:2 0.5961738 0.5773969 0.6557314 0.6038865 0.7627721 1
##
## Group:agesY
```

```
##                    1         2         3         4         5 6
## mixture:1 0.3038864 0.2877556 0.3602966 0.3107274 0.4873856 1
## mixture:2 0.5961738 0.5773969 0.6557314 0.6038865 0.7627721 1
##
##
## Real Parameter c
## Group:agesA
##                    2         3         4         5         6
## mixture:1 0.6119407 0.6119407 0.6119407 0.6119407 0.6119407
## mixture:2 0.6119407 0.6119407 0.6119407 0.6119407 0.6119407
##
## Group:agesSA
##                    2         3         4         5         6
## mixture:1 0.6119407 0.6119407 0.6119407 0.6119407 0.6119407
## mixture:2 0.6119407 0.6119407 0.6119407 0.6119407 0.6119407
##
## Group:agesY
##                    2         3         4         5         6
## mixture:1 0.6119407 0.6119407 0.6119407 0.6119407 0.6119407
## mixture:2 0.6119407 0.6119407 0.6119407 0.6119407 0.6119407
##
##
## Real Parameter f0
## Group:agesA
##            1
##  1.71209e-09
##
## Group:agesSA
##            1
##  1.71209e-09
##
## Group:agesY
##            1
##  1.71209e-09
## Error in make.mark.model(data.proc, title = title, parameters = model.parameters,  :
##
## Error: Variable age used in formula is not defined in data
##
## Error in mark(model.parameters = model.parameters, initial = initial,  :
##   Misspecification of model or internal error in code
##
## 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) -1.597814e-04 2071.5608000 -4060.2594000 4060.2591000
## p:(Intercept)  -4.274438e-01    0.3318811    -1.0779308    0.2230433
## p:time2         5.328041e-01    0.4644359    -0.3774903    1.4430985
## p:time3         1.089897e-01    0.4670116    -0.8063530    1.0243325
```

```
## p:time4         4.274436e-01    0.4641210    -0.4822336    1.3371209
## p:time5         1.081370e+00    0.4765167     0.1473974    2.0153428
## p:time6         1.081370e+00    0.4765168     0.1473973    2.0153430
## f0:(Intercept) -1.756914e+01 2872.0340000 -5646.7558000 5611.6175000
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.4999601
##
## Group:agesSA
##
## mixture:1 0.4999601
##
## Group:agesY
##
## mixture:1 0.4999601
##
##
## Real Parameter p
## Group:agesA
##                   1         2         3   4         5         6
## mixture:1 0.3947369 0.5263157 0.4210526 0.5 0.6578947 0.6578947
## mixture:2 0.3947369 0.5263157 0.4210526 0.5 0.6578947 0.6578947
##
## Group:agesSA
##                   1         2         3   4         5         6
## mixture:1 0.3947369 0.5263157 0.4210526 0.5 0.6578947 0.6578947
## mixture:2 0.3947369 0.5263157 0.4210526 0.5 0.6578947 0.6578947
##
## Group:agesY
##                   1         2         3   4         5         6
## mixture:1 0.3947369 0.5263157 0.4210526 0.5 0.6578947 0.6578947
## mixture:2 0.3947369 0.5263157 0.4210526 0.5 0.6578947 0.6578947
##
##
## Real Parameter c
## Group:agesA
##                   2         3   4         5         6
## mixture:1 0.5263157 0.4210526 0.5 0.6578947 0.6578947
## mixture:2 0.5263157 0.4210526 0.5 0.6578947 0.6578947
##
## Group:agesSA
##                   2         3   4         5         6
## mixture:1 0.5263157 0.4210526 0.5 0.6578947 0.6578947
## mixture:2 0.5263157 0.4210526 0.5 0.6578947 0.6578947
##
## Group:agesY
##                   2         3   4         5         6
## mixture:1 0.5263157 0.4210526 0.5 0.6578947 0.6578947
## mixture:2 0.5263157 0.4210526 0.5 0.6578947 0.6578947
##
##
```

```
## Real Parameter f0
## Group:agesA
##             1
##  2.343247e-08
##
## Group:agesSA
##             1
##  2.343247e-08
##
## Group:agesY
##             1
##  2.343247e-08
## Error in make.mark.model(data.proc, title = title, parameters = model.parameters,  :
##
## Error: Variable age used in formula is not defined in data
##
## Error in mark(model.parameters = model.parameters, initial = initial,  :
##   Misspecification of model or internal error in code
##
## 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) -3.115013e-05  608.3656300 -1.192397e+03 1.192397e+03
## p:(Intercept)  -4.274441e-01    0.3318801 -1.077929e+00 2.230409e-01
## p:time2        -2.011649e-01    0.5493728 -1.277936e+00 8.756059e-01
## p:time3         2.197910e-02    0.6228327 -1.198773e+00 1.242731e+00
## p:time4        -2.657037e-01    0.7811157 -1.796690e+00 1.265283e+00
## p:time5         4.274443e-01    0.8813671 -1.300035e+00 2.154924e+00
## p:time6         2.174356e+01 6378.0654000 -1.247926e+04 1.252275e+04
## c:(Intercept)   4.554754e-01    0.1772735  1.080193e-01 8.029314e-01
## f0:(Intercept) -2.264049e+01 5482.0005000 -1.076736e+04 1.072208e+04
##
##
## Real Parameter pi
## Group:agesA
##
## mixture:1 0.4999922
##
## Group:agesSA
##
## mixture:1 0.4999922
##
## Group:agesY
##
## mixture:1 0.4999922
##
##
## Real Parameter p
```

```
## Group:agesA
##                   1        2   3         4   5 6
## mixture:1 0.3947368 0.347826 0.4 0.3333332 0.5 1
## mixture:2 0.3947368 0.347826 0.4 0.3333332 0.5 1
##
## Group:agesSA
##                   1        2   3         4   5 6
## mixture:1 0.3947368 0.347826 0.4 0.3333332 0.5 1
## mixture:2 0.3947368 0.347826 0.4 0.3333332 0.5 1
##
## Group:agesY
##                   1        2   3         4   5 6
## mixture:1 0.3947368 0.347826 0.4 0.3333332 0.5 1
## mixture:2 0.3947368 0.347826 0.4 0.3333332 0.5 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
##  1.470149e-10
##
## Group:agesSA
##             1
##  1.470149e-10
##
## Group:agesY
##             1
##  1.470149e-10
## Error in make.mark.model(data.proc, title = title, parameters = model.parameters,  :
##
## Error: Variable age used in formula is not defined in data
##
## Error in mark(model.parameters = model.parameters, initial = initial,  :
##   Misspecification of model or internal error in code
```

```
mouse.results
```

```
##                                 model npar     AICc DeltaAICc       weight
## 5   pi(~1)p(~time + mixture)c()f0(~1)    9 158.8302  0.000000 0.6662192982
## 3          pi(~1)p(~mixture)c()f0(~1)    4 160.4039  1.573724 0.3033104386
## 2              pi(~1)p(~1)c(~1)f0(~1)    4 165.8550  7.024834 0.0198698167
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 167.9459  9.115732 0.0069849148
## 8           pi(~1)p(~time)c(~1)f0(~1)    9 170.3257 11.495510 0.0021251957
## 6 pi(~1)p(~time + mixture)c(~1)f0(~1)   10 172.5138 13.683647 0.0007116248
## 1               pi(~1)p(~1)c()f0(~1)    3 173.3928 14.562605 0.0004585511
## 7             pi(~1)p(~time)c()f0(~1)    8 174.1113 15.281106 0.0003201601
##    Deviance
## 5  96.72476
## 3 108.94480
## 2 114.39591
## 4 114.39591
## 8 108.22027
## 6 108.22027
## 1 124.00591
## 7 114.17402
```

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 gA aA m1   3.832800e-01 0.1410588000 1.617466e-01 6.668541e-01
## p gA aA t1 m1 6.935519e-01 0.1261439000 4.142295e-01 8.786879e-01
## p gA aA t2 m1 8.184006e-01 0.0905450000 5.772390e-01 9.370059e-01
## p gA aA t3 m1 7.228762e-01 0.1197422000 4.470026e-01 8.938169e-01
## p gA aA t4 m1 7.975534e-01 0.0980249000 5.451618e-01 9.283093e-01
## p gA aA t5 m1 8.985263e-01 0.0563509000 7.250392e-01 9.674635e-01
## p gA aA t6 m1 8.985263e-01 0.0563509000 7.250392e-01 9.674635e-01
## p gA aA t1 m2 2.090289e-01 0.0786982000 9.417170e-02 4.018294e-01
## p gA aA t2 m2 3.447905e-01 0.1011387000 1.795352e-01 5.585955e-01
## p gA aA t3 m2 2.334749e-01 0.0840821000 1.081622e-01 4.334143e-01
## p gA aA t4 m2 3.150760e-01 0.0976969000 1.592510e-01 5.276775e-01
## p gA aA t5 m2 5.083466e-01 0.1084041000 3.064571e-01 7.075500e-01
## p gA aA t6 m2 5.083467e-01 0.1084041000 3.064571e-01 7.075501e-01
## f0 gA a0 t1   1.796121e-08 0.0001114202 4.976568e-12 6.482479e-05
```

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

```
## $`N Population Size`
##   estimate lcl       ucl
## 1       11  11 11.000065
## 2        3   3  3.000065
## 3       24  24 24.000065
```

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 :  3  (unadjusted=2)
## -2lnL:  75.81818
## AICc :  81.99465  (unadjusted=79.90577)
##
## Beta
##                     estimate        se           lcl           ucl
## pi:(Intercept)  1.021361e-06 0.0000000  1.021361e-06  1.021361e-06
## p:(Intercept)  -2.129389e+00 0.3383854 -2.792624e+00 -1.466153e+00
## f0:(Intercept)  7.410867e-01 1.1789777 -1.569710e+00  3.051883e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000003
##
##
## 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) -15.0810180 9120.429300 -17891.123000 17860.961000
## p:(Intercept)   -2.3121077  734.086630  -1441.121900  1436.497700
## p:mixture2       0.1827173  734.086560  -1438.627000  1438.992400
## f0:(Intercept)   0.7410817    1.178987     -1.569733     3.051897
##
##
## Real Parameter pi
##
##
## mixture:1 2.820961e-07
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0901252 0.0901252 0.0901252 0.0901252 0.0901252 0.0901252 0.0901252
## mixture:2 0.1062729 0.1062729 0.1062729 0.1062729 0.1062729 0.1062729 0.1062729
##                   8         9        10        11        12        13        14
## mixture:1 0.0901252 0.0901252 0.0901252 0.0901252 0.0901252 0.0901252 0.0901252
## mixture:2 0.1062729 0.1062729 0.1062729 0.1062729 0.1062729 0.1062729 0.1062729
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0901252 0.0901252 0.0901252 0.0901252 0.0901252 0.0901252 0.0901252
## mixture:2 0.1062729 0.1062729 0.1062729 0.1062729 0.1062729 0.1062729 0.1062729
##                   9        10        11        12        13        14
## mixture:1 0.0901252 0.0901252 0.0901252 0.0901252 0.0901252 0.0901252
## mixture:2 0.1062729 0.1062729 0.1062729 0.1062729 0.1062729 0.1062729
##
##
## Real Parameter f0
```

```
##
##         1
##  2.098204
##
## 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) -15.6338390  750.82010  -1487.24130  1455.973600
## p:(Intercept)   -7.9327752 1937.25110  -3804.94500  3789.079400
## p:time2         18.8841410 3009.73070  -5880.18810  5917.956400
## p:time3         -9.8150317 9592.02970 -18810.19400 18790.564000
## p:time4         -9.8150264 9590.65140 -18807.49200 18787.862000
## p:time5         -9.8150267 9591.03460 -18808.24300 18788.613000
## p:time6         18.8841410 3009.73070  -5880.18810  5917.956400
## p:time7         18.8841390 3009.73070  -5880.18810  5917.956400
## p:time8         18.8841150 3009.73070  -5880.18810  5917.956300
## p:time9         -9.8150327 9755.20100 -19130.00900 19110.379000
## p:time10        18.8841350 3009.73070  -5880.18810  5917.956400
## p:time11        18.8841310 3009.73070  -5880.18810  5917.956400
## p:time12        21.0129480 3009.72650  -5878.05110  5920.077000
## p:time13        18.8841430 3009.73070  -5880.18810  5917.956400
## p:time14        21.3818900 3009.72650  -5877.68220  5920.445900
## p:mixture2     -13.2412630    0.00000    -13.24126   -13.241263
## f0:(Intercept)  -0.1347615    1.91881     -3.89563     3.626107
##
##
## Real Parameter pi
##
##
## mixture:1 1.622967e-07
##
##
## Real Parameter p
##
##                       1         2            3            4            5
## mixture:1 3.586606e-04 0.9999825 1.959862e-08 1.959872e-08 1.959871e-08
## mixture:2 6.371360e-10 0.0919631 3.480311e-14 3.480329e-14 3.480328e-14
##                     6         7         8            9        10        11
## mixture:1 0.9999825 0.9999825 0.9999825 1.959860e-08 0.9999825 0.9999825
## mixture:2 0.0919632 0.0919630 0.0919609 3.480307e-14 0.0919626 0.0919624
##                    12        13        14
## mixture:1 0.9999979 0.9999825 0.9999986
## mixture:2 0.4598145 0.0919633 0.5517766
##
##
## Real Parameter c
##
##                    2            3            4            5         6         7
```

```
## mixture:1 0.9999825 1.959862e-08 1.959872e-08 1.959871e-08 0.9999825 0.9999825
## mixture:2 0.0919631 3.480311e-14 3.480329e-14 3.480328e-14 0.0919632 0.0919630
##                   8            9        10        11        12        13
## mixture:1 0.9999825 1.959860e-08 0.9999825 0.9999825 0.9999979 0.9999825
## mixture:2 0.0919609 3.480307e-14 0.0919626 0.0919624 0.4598145 0.0919633
##                  14
## mixture:1 0.9999986
## mixture:2 0.5517766
##
##
## Real Parameter f0
##
##          1
##  0.8739243
##
## 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)  1.698528e-04     0.000000  1.698528e-04  1.698528e-04
## p:(Intercept)  -2.229976e+01     0.000000 -2.229976e+01 -2.229976e+01
## p:time2         2.000987e+01     0.000000  2.000987e+01  2.000987e+01
## p:time3        -1.198448e+01 79850.246000 -1.565185e+05  1.564945e+05
## p:time4        -1.198451e+01 88131.761000 -1.727502e+05  1.727263e+05
## p:time5        -1.198449e+01     0.000000 -1.198449e+01 -1.198449e+01
## p:time6         2.000987e+01     0.000000  2.000987e+01  2.000987e+01
## p:time7         2.000987e+01     0.000000  2.000987e+01  2.000987e+01
## p:time8         2.000987e+01     0.000000  2.000987e+01  2.000987e+01
## p:time9        -1.198451e+01 33621.311000 -6.590976e+04  6.588579e+04
## p:time10        2.000987e+01     0.000000  2.000987e+01  2.000987e+01
## p:time11        2.000987e+01     0.000000  2.000987e+01  2.000987e+01
## p:time12        2.213869e+01     0.000000  2.213869e+01  2.213869e+01
## p:time13        2.000987e+01     0.000000  2.000987e+01  2.000987e+01
## p:time14        2.250764e+01     0.000000  2.250764e+01  2.250764e+01
## f0:(Intercept) -1.349129e-01     1.919082 -3.896314e+00  3.626488e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000425
##
##
## Real Parameter p
##
##                       1         2            3            4            5
## mixture:1 2.066992e-10 0.0919642 1.289866e-15 1.289826e-15 1.289861e-15
## mixture:2 2.066992e-10 0.0919642 1.289866e-15 1.289826e-15 1.289861e-15
##                   6         7         8            9        10        11
```

```
## mixture:1 0.0919642 0.0919642 0.0919642 1.289833e-15 0.0919642 0.0919643
## mixture:2 0.0919642 0.0919642 0.0919642 1.289833e-15 0.0919642 0.0919643
##                  12        13        14
## mixture:1 0.4598212 0.0919642 0.5517854
## mixture:2 0.4598212 0.0919642 0.5517854
##
##
## Real Parameter c
##
##                   2            3            4            5         6         7
## mixture:1 0.0919642 1.289866e-15 1.289826e-15 1.289861e-15 0.0919642 0.0919642
## mixture:2 0.0919642 1.289866e-15 1.289826e-15 1.289861e-15 0.0919642 0.0919642
##                   8            9        10        11        12        13
## mixture:1 0.0919642 1.289833e-15 0.0919642 0.0919643 0.4598212 0.0919642
## mixture:2 0.0919642 1.289833e-15 0.0919642 0.0919643 0.4598212 0.0919642
##                  14
## mixture:1 0.5517854
## mixture:2 0.5517854
##
##
## Real Parameter f0
##
##         1
##  0.873792
```

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 0.65555972 34.69523
## 3 pi(~1)p(~time + mixture)c()f0(~1)   17 81.23674  2.593633 0.17923052 34.69523
## 1              pi(~1)p(~1)c()f0(~1)    3 81.99465  3.351543 0.12269698 68.29307
## 2        pi(~1)p(~mixture)c()f0(~1)    4 84.11447  5.471369 0.04251279 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    5.000425e-01 0.000000e+00  5.000425e-01 5.000425e-01
## p g1 t1 m1  2.066992e-10 0.000000e+00  2.066992e-10 2.066992e-10
## p g1 t2 m1  9.196420e-02 8.877370e-02  1.245000e-02 4.486159e-01
## p g1 t3 m1  1.289866e-15 1.030729e-10 -2.020216e-10 2.020242e-10
## p g1 t4 m1  1.289826e-15 1.135726e-10 -2.226009e-10 2.226035e-10
```

```
## p g1 t5 m1  1.289861e-15 0.000000e+00  1.289861e-15 1.289861e-15
## p g1 t6 m1  9.196420e-02 8.877370e-02  1.245000e-02 4.486159e-01
## p g1 t7 m1  9.196420e-02 8.877370e-02  1.245000e-02 4.486159e-01
## p g1 t8 m1  9.196420e-02 8.877370e-02  1.245000e-02 4.486159e-01
## p g1 t9 m1  1.289833e-15 4.338545e-11 -8.503419e-11 8.503677e-11
## p g1 t10 m1 9.196420e-02 8.877370e-02  1.245000e-02 4.486159e-01
## p g1 t11 m1 9.196430e-02 8.877370e-02  1.245000e-02 4.486159e-01
## p g1 t12 m1 4.598212e-01 1.669454e-01  1.856660e-01 7.606590e-01
## p g1 t13 m1 9.196420e-02 8.877370e-02  1.245000e-02 4.486159e-01
## p g1 t14 m1 5.517854e-01 1.731619e-01  2.378646e-01 8.292324e-01
## f0 g1 a0 t1 8.737920e-01 1.676879e+00  7.651280e-02 9.978881e+00
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 10.87379 10.07651 19.97888
```

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
## -2lnL:  144.0227
## AICc :  150.1576
##
## Beta
##                     estimate          se           lcl           ucl
## pi:(Intercept)  4.087959e-05    0.000000  4.087959e-05  4.087959e-05
## p:(Intercept)  -1.299283e+00    0.180649 -1.653355e+00 -9.452110e-01
## f0:(Intercept) -1.515001e+01 4601.482000 -9.034055e+03  9.003755e+03
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000102
##
##
## 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
##  2.632888e-07
##
## 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) -1.4323791 1.0430917 -3.476839  0.6120806
## p:(Intercept)  -0.3699150 0.4896269 -1.329584  0.5897537
## p:mixture2     -1.2980385 0.5502852 -2.376597 -0.2194795
## f0:(Intercept) -0.7611841 2.8777463 -6.401567  4.8791987
##
##
## Real Parameter pi
##
##
## mixture:1 0.1927283
##
##
## 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
##  0.467113
##
## 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 7.703678e-01     -2.806194     0.2136476
## p:(Intercept)  -1.231722e+00 1.133740e+00     -3.453852     0.9904072
## p:time2         8.801832e-01 1.370183e+00     -1.805376     3.5657421
## p:time3         2.421564e-06 1.539390e+00     -3.017202     3.0172073
## p:time4        -2.044509e+01 1.417391e+04 -27801.304000 27760.4140000
## p:time5        -2.044511e+01 1.125408e+04 -22078.435000 22037.5450000
## p:time6         8.801836e-01 1.370184e+00     -1.805377     3.5657439
## p:time7         8.801835e-01 1.370184e+00     -1.805377     3.5657441
## p:time8         1.473603e+00 1.312096e+00     -1.098106     4.0453110
## p:time9         8.801833e-01 1.370183e+00     -1.805376     3.5657427
## p:time10        3.575163e-06 1.539392e+00     -3.017206     3.0172128
## p:time11        8.801833e-01 1.370183e+00     -1.805376     3.5657423
## p:time12        3.431841e+00 1.276384e+00      0.930128     5.9335546
## p:time13        2.726653e+00 1.267437e+00      0.242476     5.2108304
## p:time14        3.802121e+00 1.293823e+00      1.266229     6.3380137
## p:mixture2     -2.057456e+00 5.946385e-01     -3.222947    -0.8919642
## f0:(Intercept) -3.480650e+00 3.189096e+01    -65.986932    59.0256310
##
##
## Real Parameter pi
##
##
## mixture:1 0.2147929
##
##
## Real Parameter p
##
##                    1         2         3            4            5         6
## mixture:1 0.2258801 0.4130092 0.2258805 3.853698e-10 3.853657e-10 0.4130093
## mixture:2 0.0359443 0.0824894 0.0359444 4.924204e-11 4.924151e-11 0.0824894
##                    7         8         9        10        11        12        13
```

```
## mixture:1 0.4130093 0.5601770 0.4130092 0.2258807 0.4130092 0.9002602 0.8168172
## mixture:2 0.0824894 0.1399656 0.0824894 0.0359444 0.0824894 0.5356054 0.3629634
##                  14
## mixture:1 0.9289320
## mixture:2 0.6254961
##
##
## Real Parameter c
##
##                   2         3            4            5         6         7
## mixture:1 0.4130092 0.2258805 3.853698e-10 3.853657e-10 0.4130093 0.4130093
## mixture:2 0.0824894 0.0359444 4.924204e-11 4.924151e-11 0.0824894 0.0824894
##                   8         9        10        11        12        13        14
## mixture:1 0.5601770 0.4130092 0.2258807 0.4130092 0.9002602 0.8168172 0.9289320
## mixture:2 0.1399656 0.0824894 0.0359444 0.0824894 0.5356054 0.3629634 0.6254961
##
##
## Real Parameter f0
##
##          1
##  0.0307874
##
## 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)  1.380829e-04   677.758970 -1.328408e+03  1328.4077000
## p:(Intercept)  -2.484940e+00     1.040842 -4.524990e+00    -0.4448892
## p:time2         7.801919e-01     1.293932 -1.755915e+00     3.3162989
## p:time3         3.250472e-05     1.471963 -2.885016e+00     2.8850809
## p:time4        -4.570599e+01 43243.542000 -8.480305e+04 84711.6380000
## p:time5        -4.570602e+01     0.000000 -4.570602e+01   -45.7060220
## p:time6         7.801826e-01     1.293934 -1.755928e+00     3.3162927
## p:time7         7.801914e-01     1.293932 -1.755916e+00     3.3162985
## p:time8         1.280967e+00     1.231538 -1.132847e+00     3.6947803
## p:time9         7.802021e-01     1.293931 -1.755902e+00     3.3163064
## p:time10        3.387015e-05     1.471963 -2.885015e+00     2.8850824
## p:time11        7.801911e-01     1.293932 -1.755915e+00     3.3162974
## p:time12        2.954944e+00     1.186740  6.289336e-01     5.2809551
## p:time13        2.330791e+00     1.180202  1.759550e-02     4.6439860
## p:time14        3.295869e+00     1.201858  9.402265e-01     5.6515107
## f0:(Intercept) -1.751003e+01  6070.223600 -1.191515e+04 11880.1280000
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000345
##
```

```
##
## Real Parameter p
##
##                   1         2        3            4            5        6
## mixture:1 0.0769207 0.1538462 0.076923 1.177457e-21 1.177419e-21 0.153845
## mixture:2 0.0769207 0.1538462 0.076923 1.177457e-21 1.177419e-21 0.153845
##                   7         8         9        10        11        12        13
## mixture:1 0.1538461 0.2307692 0.1538475 0.0769231 0.1538461 0.6153848 0.4615389
## mixture:2 0.1538461 0.2307692 0.1538475 0.0769231 0.1538461 0.6153848 0.4615389
##                  14
## mixture:1 0.6923074
## mixture:2 0.6923074
##
##
## Real Parameter c
##
##                   2        3            4            5        6         7
## mixture:1 0.1538462 0.076923 1.177457e-21 1.177419e-21 0.153845 0.1538461
## mixture:2 0.1538462 0.076923 1.177457e-21 1.177419e-21 0.153845 0.1538461
##                   8         9        10        11        12        13        14
## mixture:1 0.2307692 0.1538475 0.0769231 0.1538461 0.6153848 0.4615389 0.6923074
## mixture:2 0.2307692 0.1538475 0.0769231 0.1538461 0.6153848 0.4615389 0.6923074
##
##
## Real Parameter f0
##
##             1
##  2.485949e-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 5.532097e-01
## p g1 t1 m1  2.258801e-01 1.982438e-01  3.065420e-02 7.291683e-01
## p g1 t2 m1  4.130092e-01 2.205405e-01  1.057840e-01 8.071301e-01
## p g1 t3 m1  2.258805e-01 1.982446e-01  3.065410e-02 7.291701e-01
## p g1 t4 m1  3.853698e-10 5.462196e-06 -1.070552e-05 1.070629e-05
## p g1 t5 m1  3.853657e-10 4.336935e-06 -8.500007e-06 8.500778e-06
## p g1 t6 m1  4.130093e-01 2.205405e-01  1.057841e-01 8.071302e-01
## p g1 t7 m1  4.130093e-01 2.205405e-01  1.057840e-01 8.071302e-01
## p g1 t8 m1  5.601770e-01 2.062996e-01  1.979302e-01 8.679601e-01
## p g1 t9 m1  4.130092e-01 2.205405e-01  1.057840e-01 8.071301e-01
## p g1 t10 m1 2.258807e-01 1.982448e-01  3.065410e-02 7.291705e-01
## p g1 t11 m1 4.130092e-01 2.205405e-01  1.057841e-01 8.071301e-01
## p g1 t12 m1 9.002602e-01 7.305470e-02  6.469047e-01 9.780067e-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  7.149340e-01 9.855332e-01
## p g1 t1 m2  3.594430e-02 4.018390e-02  3.826200e-03 2.657487e-01
## p g1 t2 m2  8.248940e-02 6.815300e-02  1.515820e-02 3.443322e-01
## p g1 t3 m2  3.594440e-02 4.018410e-02  3.826200e-03 2.657500e-01
## p g1 t4 m2  4.924204e-11 6.979522e-07 -1.367937e-06 1.368035e-06
## p g1 t5 m2  4.924151e-11 5.541677e-07 -1.086120e-06 1.086218e-06
## p g1 t6 m2  8.248940e-02 6.815300e-02  1.515820e-02 3.443323e-01
## p g1 t7 m2  8.248940e-02 6.815300e-02  1.515820e-02 3.443323e-01
## p g1 t8 m2  1.399656e-01 9.422500e-02  3.390220e-02 4.301193e-01
## p g1 t9 m2  8.248940e-02 6.815300e-02  1.515820e-02 3.443323e-01
## p g1 t10 m2 3.594440e-02 4.018420e-02  3.826200e-03 2.657506e-01
## p g1 t11 m2 8.248940e-02 6.815300e-02  1.515820e-02 3.443322e-01
## p g1 t12 m2 5.356054e-01 1.610049e-01  2.448910e-01 8.039827e-01
## p g1 t13 m2 3.629634e-01 1.484665e-01  1.393095e-01 6.672974e-01
## p g1 t14 m2 6.254961e-01 1.602370e-01  3.041154e-01 8.645566e-01
## f0 g1 a0 t1 3.078740e-02 9.818391e-01  1.771167e-04 5.351628e+00
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 13.03079 13.00018 18.35163
```

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) -1.255065e-05 670.3738000 -1313.9327000 1313.932700
## p:(Intercept)  -1.776719e+00   0.1734308    -2.1166428   -1.436794
## f0:(Intercept)  9.714294e-01   0.8583839    -0.7110032    2.653862
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999969
##
##
## 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
##  2.641718
##
## 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) -12.5012550 0.0000000 -12.5012550 -12.5012550
## p:(Intercept)   -1.6839349 0.0000000  -1.6839349  -1.6839349
## p:mixture2      -0.0927833 0.0000000  -0.0927833  -0.0927833
## f0:(Intercept)   0.9714266 0.8583857  -0.7110095   2.6538627
##
##
## Real Parameter pi
##
##
## mixture:1 3.721964e-06
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1565751 0.1565751 0.1565751 0.1565751 0.1565751 0.1565751 0.1565751
## 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 0.1565751 0.1565751 0.1565751 0.1565751 0.1565751 0.1565751 0.1565751
## 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 0.1565751 0.1565751 0.1565751 0.1565751 0.1565751 0.1565751 0.1565751
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##                    9        10        11        12        13        14
## mixture:1 0.1565751 0.1565751 0.1565751 0.1565751 0.1565751 0.1565751
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##
##
## Real Parameter f0
##
##        1
##  2.64171
##
## 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=138.06422)
##
## Beta
##                    estimate         se         lcl        ucl
## pi:(Intercept) -13.3625060 154.520140 -316.221980 289.496970
## p:(Intercept)  -21.0960590 258.559900 -527.873470 485.681350
## p:time2         37.6480410 162.021920 -279.914940 355.211020
## p:time3         -4.6303197   0.000000   -4.630320  -4.630320
## p:time4         36.9150080 162.023600 -280.651250 354.481270
## p:time5         38.0947840 162.021280 -279.466930 355.656500
## p:time6         37.6479360 162.021920 -279.915040 355.210920
## p:time7         38.4258370 162.020900 -279.135140 355.986810
```

```
## p:time8         -4.6304254   0.000000   -4.630425  -4.630425
## p:time9         38.6942080 162.020640 -278.866240 356.254660
## p:time10        -4.6307048   0.000000   -4.630705  -4.630705
## p:time11        39.3135740 162.020150 -278.245920 356.873070
## p:time12        39.6504330 162.019970 -277.908720 357.209590
## p:time13        40.1119270 162.019880 -277.447030 357.670890
## p:time14        39.3137400 162.020150 -278.245760 356.873240
## p:mixture2     -19.0622150 263.342230 -535.212990 497.088560
## f0:(Intercept)   0.4803123   1.113031   -1.701228   2.661853
##
##
## Real Parameter pi
##
##
## mixture:1 1.57303e-06
##
##
## Real Parameter p
##
##                       1         2            3         4         5         6
## mixture:1 6.888080e-10 0.9999999 6.717008e-12 0.9999999 1.0000000 0.9999999
## mixture:2 3.626465e-18 0.0751439 3.536398e-20 0.0375697 0.1126964 0.0751367
##                     7            8         9           10       11     12
## mixture:1 1.0000000 6.716298e-12 1.0000000 6.714422e-12 1.000000 1.0000
## mixture:2 0.1502762 3.536025e-20 0.1878463 3.535037e-20 0.300546 0.3757
##                    13        14
## mixture:1 1.0000000 1.0000000
## mixture:2 0.4884156 0.3005808
##
##
## Real Parameter c
##
##                     2            3         4         5         6         7
## mixture:1 0.9999999 6.717008e-12 0.9999999 1.0000000 0.9999999 1.0000000
## mixture:2 0.0751439 3.536398e-20 0.0375697 0.1126964 0.0751367 0.1502762
##                       8         9           10       11     12        13
## mixture:1 6.716298e-12 1.0000000 6.714422e-12 1.000000 1.0000 1.0000000
## mixture:2 3.536025e-20 0.1878463 3.535037e-20 0.300546 0.3757 0.4884156
##                    14
## mixture:1 1.0000000
## mixture:2 0.3005808
##
##
## Real Parameter f0
##
##         1
##  1.616579
##
## 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)  1.494431e-04  651.921750  -1277.766500  1277.766800
## p:(Intercept)  -1.898908e+01  247.929800   -504.931490   466.953340
## p:time2         1.647880e+01  247.931120   -469.466210   502.423820
## p:time3        -5.235289e+00 7091.343700 -13904.269000 13893.799000
## p:time4         1.574583e+01  247.932200   -470.201290   501.692960
## p:time5         1.692574e+01  247.930710   -469.018470   502.869950
## p:time6         1.647881e+01  247.931120   -469.466200   502.423820
## p:time7         1.725669e+01  247.930480   -468.687060   503.200440
## p:time8        -5.235284e+00 2768.585900  -5431.663700  5421.193100
## p:time9         1.752506e+01  247.930320   -468.418370   503.468490
## p:time10       -5.235333e+00    0.000000     -5.235333    -5.235333
## p:time11        1.814447e+01  247.930020   -467.798380   504.087310
## p:time12        1.848126e+01  247.929910   -467.461370   504.423890
## p:time13        1.894274e+01  247.929840   -466.999760   504.885240
## p:time14        1.814446e+01  247.930020   -467.798380   504.087300
## f0:(Intercept)  4.803235e-01    1.112969     -1.701096     2.661743
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000374
##
##
## Real Parameter p
##
##                        1         2            3         4         5         6
## mixture:1 5.664328e-09 0.0751411 3.016417e-11 0.0375705 0.1127118 0.0751413
## mixture:2 5.664328e-09 0.0751411 3.016417e-11 0.0375705 0.1127118 0.0751413
##                     7            8         9           10        11       12
## mixture:1 0.1502822 3.016431e-11 0.1878533 3.016283e-11 0.3005643 0.375705
## mixture:2 0.1502822 3.016431e-11 0.1878533 3.016283e-11 0.3005643 0.375705
##                    13       14
## mixture:1 0.4884173 0.300563
## mixture:2 0.4884173 0.300563
##
##
## Real Parameter c
##
##                     2            3         4         5         6         7
## mixture:1 0.0751411 3.016417e-11 0.0375705 0.1127118 0.0751413 0.1502822
## mixture:2 0.0751411 3.016417e-11 0.0375705 0.1127118 0.0751413 0.1502822
##                       8         9            10        11       12        13
## mixture:1 3.016431e-11 0.1878533 3.016283e-11 0.3005643 0.375705 0.4884173
## mixture:2 3.016431e-11 0.1878533 3.016283e-11 0.3005643 0.375705 0.4884173
##                   14
## mixture:1 0.300563
## mixture:2 0.300563
##
##
## Real Parameter f0
```

```
##
##         1
##  1.616597
```

Examine model-selection table

```
cigogne.results
```

```
##                                model npar     AICc DeltaAICc       weight
## 4           pi(~1)p(~time)c()f0(~1)   16 148.9167   0.00000 7.511799e-01
## 3 pi(~1)p(~time + mixture)c()f0(~1)   17 151.1265   2.20983 2.488201e-01
## 1              pi(~1)p(~1)c()f0(~1)    3 195.3809  46.46424 6.111704e-11
## 2        pi(~1)p(~mixture)c()f0(~1)    4 197.4275  48.51082 2.196613e-11
##    Deviance
## 4  91.84761
## 3  91.84769
## 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)
```

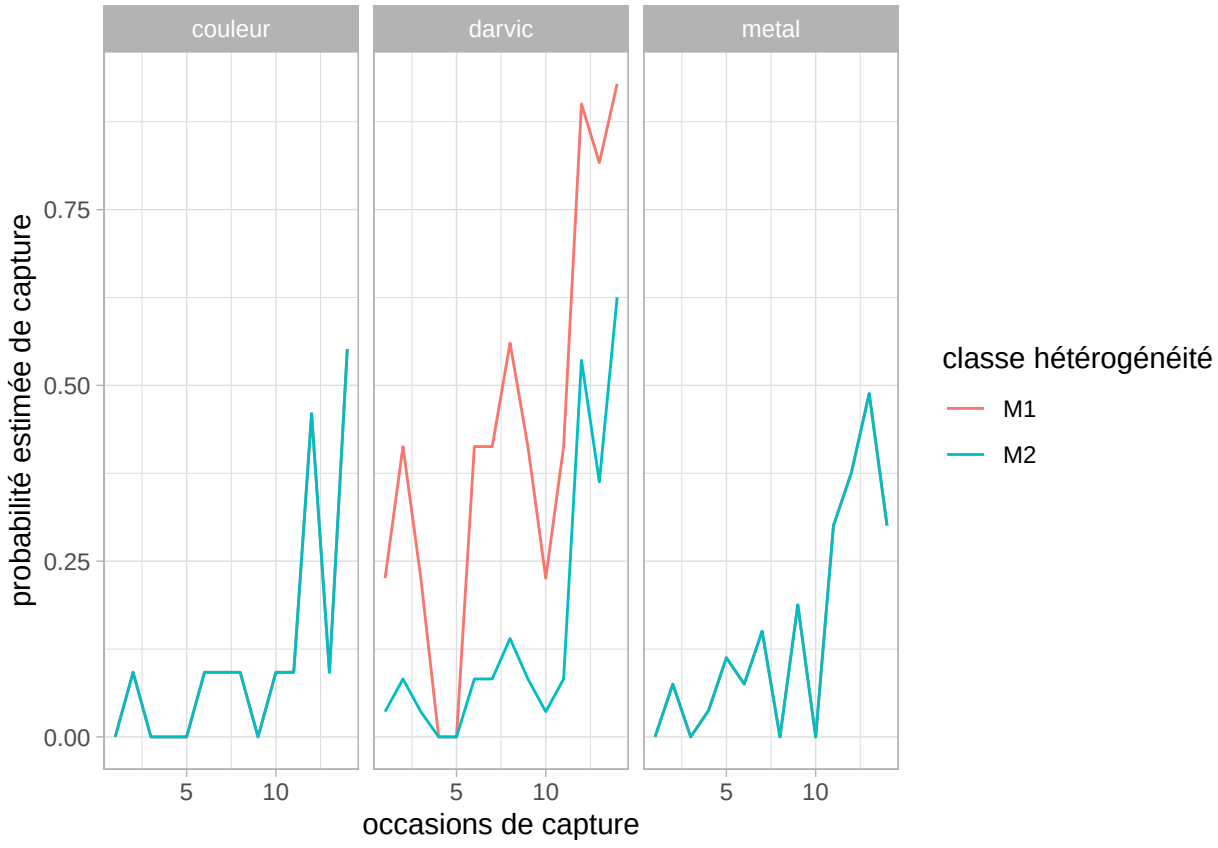
```
##                  estimate           se            lcl          ucl fixed note
## pi g1 m1    5.000374e-01 1.629804e+02  5.563516e-309 1.000000e+00
## p g1 t1 m1  5.664328e-09 1.404356e-06  -2.746873e-06 2.758202e-06
## p g1 t2 m1  7.514110e-02 5.134940e-02   1.873390e-02 2.569198e-01
## p g1 t3 m1  3.016417e-11 2.141185e-07  -4.196420e-07 4.197024e-07
## p g1 t4 m1  3.757050e-02 3.694540e-02   5.241600e-03 2.243293e-01
## p g1 t5 m1  1.127118e-01 6.176890e-02   3.647710e-02 2.988542e-01
## p g1 t6 m1  7.514130e-02 5.134950e-02   1.873400e-02 2.569200e-01
## p g1 t7 m1  1.502822e-01 7.000620e-02   5.695250e-02 3.412159e-01
## p g1 t8 m1  3.016431e-11 8.397301e-08  -1.645569e-07 1.646173e-07
## p g1 t9 m1  1.878533e-01 7.676710e-02   7.942040e-02 3.827739e-01
## p g1 t10 m1 3.016283e-11 0.000000e+00   3.016283e-11 3.016283e-11
## p g1 t11 m1 3.005643e-01 9.116510e-02   1.551752e-01 5.013375e-01
## p g1 t12 m1 3.757050e-01 9.724810e-02   2.107413e-01 5.756218e-01
## p g1 t13 m1 4.884173e-01 1.023604e-01   2.995848e-01 6.806145e-01
## p g1 t14 m1 3.005630e-01 9.116500e-02   1.551743e-01 5.013363e-01
## f0 g1 a0 t1 1.616597e+00 1.799223e+00   2.782594e-01 9.391907e+00
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1  26.6166 25.27826 34.39191
```

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)
  p.time <- list(formula =  ~ time, share = TRUE)
```

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

  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 :  53.0185
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept) -0.0001736599 0.000000e+00 -0.0001736599 -0.0001736599
## p:(Intercept)  -4.6171079000 1.286679e-01 -4.8692970000 -4.3649187000
## f0:(Intercept)  5.6062385000 3.064716e-07  5.6062379000  5.6062391000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999566
##
##
## 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) -2.745026e-05 450.5123000 -883.004160 883.004100
## p:(Intercept)  -2.376334e+00   0.3075741   -2.979179  -1.773488
## c:(Intercept)  -4.839452e+00   0.4489792   -5.719451  -3.959452
## f0:(Intercept)  2.501696e+00   0.7124751    1.105244   3.898147
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999931
##
##
## 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
##  12.20317
##
## 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) -18.470645 2294.4800000 -4515.65160 4478.710300
## p:(Intercept)   -2.941608  266.3824000  -525.05113  519.167910
## p:mixture2      -1.675517  266.3822700  -523.78477  520.433740
## f0:(Intercept)   5.606257    0.5052744     4.61592    6.596595
##
##
## Real Parameter pi
##
##
## mixture:1 9.512639e-09
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0501346 0.0501346 0.0501346 0.0501346 0.0501346 0.0501346 0.0501346
## mixture:2 0.0097845 0.0097845 0.0097845 0.0097845 0.0097845 0.0097845 0.0097845
##                   8         9        10        11        12        13        14
## mixture:1 0.0501346 0.0501346 0.0501346 0.0501346 0.0501346 0.0501346 0.0501346
## mixture:2 0.0097845 0.0097845 0.0097845 0.0097845 0.0097845 0.0097845 0.0097845
##                  15        16        17        18        19
## mixture:1 0.0501346 0.0501346 0.0501346 0.0501346 0.0501346
## mixture:2 0.0097845 0.0097845 0.0097845 0.0097845 0.0097845
##
##
## Real Parameter c
```

```
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0501346 0.0501346 0.0501346 0.0501346 0.0501346 0.0501346 0.0501346
## mixture:2 0.0097845 0.0097845 0.0097845 0.0097845 0.0097845 0.0097845 0.0097845
##                    9        10        11        12        13        14        15
## mixture:1 0.0501346 0.0501346 0.0501346 0.0501346 0.0501346 0.0501346 0.0501346
## mixture:2 0.0097845 0.0097845 0.0097845 0.0097845 0.0097845 0.0097845 0.0097845
##                   16        17        18        19
## mixture:1 0.0501346 0.0501346 0.0501346 0.0501346
## mixture:2 0.0097845 0.0097845 0.0097845 0.0097845
##
##
## Real Parameter f0
##
##         1
##  272.1239
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6  (unadjusted=3)
## -2lnL:  37.00433
## AICc :  49.0838  (unadjusted=43.026975)
##
## Beta
##                     estimate           se            lcl          ucl
## pi:(Intercept) -19.2226670 4255.7029000 -8360.4006000 8321.9552000
## p:(Intercept)   -0.5956816    0.0000000    -0.5956816   -0.5956816
## p:mixture2      -1.7806652    0.0000000    -1.7806652   -1.7806652
## c:(Intercept)   -3.8223794  475.2056000  -935.2253600  927.5806100
## c:mixture2      -1.0171073  475.2054400  -932.4197900  930.3855700
## f0:(Intercept)   2.5017108    0.7124894     1.1052316    3.8981899
##
##
## Real Parameter pi
##
##
## mixture:1 4.484375e-09
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.3553323 0.3553323 0.3553323 0.3553323 0.3553323 0.3553323 0.3553323
## mixture:2 0.0849942 0.0849942 0.0849942 0.0849942 0.0849942 0.0849942 0.0849942
##                    8         9        10        11        12        13        14
## mixture:1 0.3553323 0.3553323 0.3553323 0.3553323 0.3553323 0.3553323 0.3553323
## mixture:2 0.0849942 0.0849942 0.0849942 0.0849942 0.0849942 0.0849942 0.0849942
##                   15        16        17        18        19
## mixture:1 0.3553323 0.3553323 0.3553323 0.3553323 0.3553323
## mixture:2 0.0849942 0.0849942 0.0849942 0.0849942 0.0849942
##
##
## Real Parameter c
```

```
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0214074 0.0214074 0.0214074 0.0214074 0.0214074 0.0214074 0.0214074
## mixture:2 0.0078490 0.0078490 0.0078490 0.0078490 0.0078490 0.0078490 0.0078490
##                    9        10        11        12        13        14        15
## mixture:1 0.0214074 0.0214074 0.0214074 0.0214074 0.0214074 0.0214074 0.0214074
## mixture:2 0.0078490 0.0078490 0.0078490 0.0078490 0.0078490 0.0078490 0.0078490
##                   16        17        18        19
## mixture:1 0.0214074 0.0214074 0.0214074 0.0214074
## mixture:2 0.0078490 0.0078490 0.0078490 0.0078490
##
##
## Real Parameter f0
##
##         1
##  12.20335
##
## 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=56.927927)
##
## Beta
##                       estimate           se           lcl         ucl
## pi:(Intercept) -1.867422e+01 1967.9142000 -3875.7862000 3838.437800
## p:(Intercept)  -3.787161e+00    0.0000000    -3.7871608   -3.787161
## p:time2         2.222849e+00    1.0573420     0.1504585    4.295239
## p:time3         1.807744e+00    1.0832465    -0.3154194    3.930907
## p:time4         1.807744e+00    1.0832468    -0.3154195    3.930908
## p:time5         1.965096e+00    1.0722145    -0.1364447    4.066636
## p:time6         1.622234e+00    1.0985129    -0.5308516    3.775319
## p:time7         5.317090e-05    1.4166374    -2.7765561    2.776662
## p:time8         1.105060e+00    1.1575951    -1.1638269    3.373946
## p:time9         1.622223e+00    1.0985146    -0.5308660    3.775311
## p:time10        2.263470e-04    1.4165619    -2.7762350    2.776688
## p:time11        1.105035e+00    1.1575986    -1.1638579    3.373929
## p:time12       -1.225099e-04    1.4166932    -2.7768413    2.776596
## p:time13        6.964066e-01    1.2274776    -1.7094496    3.102263
## p:time14        3.512754e-04    1.4165090    -2.7760064    2.776709
## p:time15        6.964630e-01    1.2274676    -1.7093736    3.102299
## p:time16        1.105050e+00    1.1575944    -1.1638352    3.373935
## p:time17        6.964274e-01    1.2274665    -1.7094070    3.102262
## p:time18        1.485635e-04    1.4165881    -2.7763642    2.776661
## p:time19        6.964239e-01    1.2274679    -1.7094133    3.102261
## p:mixture2     -1.974022e+00    0.0000000    -1.9740222   -1.974022
## f0:(Intercept)  5.570958e+00    0.5064079     4.5783981    6.563517
##
##
## Real Parameter pi
##
##
## mixture:1 7.760533e-09
```

```
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0221578 0.1730288 0.1213810 0.1213810 0.1391863 0.1029446 0.0221589
## mixture:2 0.0031375 0.0282410 0.0188273 0.0188273 0.0219652 0.0156895 0.0031377
##                    8         9        10        11        12        13        14
## mixture:1 0.0640378 0.1029435 0.0221627 0.0640364 0.0221551 0.0434903 0.0221654
## mixture:2 0.0094138 0.0156893 0.0031382 0.0094135 0.0031371 0.0062757 0.0031386
##                   15        16        17       18        19
## mixture:1 0.0434926 0.0640372 0.0434911 0.022161 0.0434910
## mixture:2 0.0062760 0.0094137 0.0062758 0.003138 0.0062758
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1730288 0.1213810 0.1213810 0.1391863 0.1029446 0.0221589 0.0640378
## mixture:2 0.0282410 0.0188273 0.0188273 0.0219652 0.0156895 0.0031377 0.0094138
##                    9        10        11        12        13        14        15
## mixture:1 0.1029435 0.0221627 0.0640364 0.0221551 0.0434903 0.0221654 0.0434926
## mixture:2 0.0156893 0.0031382 0.0094135 0.0031371 0.0062757 0.0031386 0.0062760
##                   16        17       18        19
## mixture:1 0.0640372 0.0434911 0.022161 0.0434910
## mixture:2 0.0094137 0.0062758 0.003138 0.0062758
##
##
## Real Parameter f0
##
##         1
##  262.6855
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  41  (unadjusted=20)
## -2lnL:  -7.910774
## AICc :  77.45909  (unadjusted=32.894596)
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept) -65.3180520     0.000000 -6.531805e+01   -65.318052
## p:(Intercept)   76.0215520     0.000000  7.602155e+01    76.021552
## p:mixture2     -80.0293050     0.000000 -8.002930e+01   -80.029305
## p:time2          2.3760771     1.073127  2.727475e-01     4.479407
## p:time3          2.1105897     1.100184 -4.577200e-02     4.266951
## p:time4          2.2731265     1.102185  1.128439e-01     4.433409
## p:time5          2.2499260     1.119469  5.576740e-02     4.444085
## p:time6          2.4392488     1.122666  2.388244e-01     4.639673
## p:time7          0.8718625     1.436176 -1.943043e+00     3.686768
## p:time8          2.1105748     1.184097 -2.102558e-01     4.431405
## p:time9          2.2731593     1.187807 -5.494210e-02     4.601261
## p:time10       -17.1156780  8655.083200 -1.698108e+04 16946.848000
```

```
## p:time11         2.4673026     1.193100  1.288265e-01     4.805779
## p:time12         1.4428809     1.447614 -1.394442e+00     4.280204
## p:time13         2.3029250     1.268729 -1.837831e-01     4.789633
## p:time14         1.7051005     1.455609 -1.147893e+00     4.558094
## p:time15         2.6215481     1.282066  1.086991e-01     5.134397
## p:time16         3.4969632     1.245809  1.055177e+00     5.938749
## p:time17         3.6017658     1.360929  9.343448e-01     6.269187
## p:time18         3.3147281     1.587028  2.041528e-01     6.425303
## p:time19        57.6182400 48979.002000 -9.594123e+04 96056.464000
## c:(Intercept)  -44.9232320     0.000000 -4.492323e+01   -44.923232
## c:mixture2      16.3806270     0.000000  1.638063e+01    16.380627
## c:time3         -7.0981100  5459.701500 -1.070811e+04 10693.917000
## c:time4         -8.2243415 12525.582000 -2.455837e+04 24541.916000
## c:time5         26.2399550     0.000000  2.623995e+01    26.239955
## c:time6         -8.3191945 14097.743000 -2.763990e+04 27623.257000
## c:time7         -8.2070080     0.000000 -8.207008e+00    -8.207008
## c:time8         -8.1879246  4157.027000 -8.155961e+03  8139.585100
## c:time9         25.7094570     0.000000  2.570946e+01    25.709457
## c:time10        24.9046660     0.000000  2.490467e+01    24.904666
## c:time11        -8.1694782 10196.209000 -1.999274e+04 19976.401000
## c:time12        -8.2206160  9454.974700 -1.853997e+04 18523.530000
## c:time13        -8.2394995 12624.269000 -2.475181e+04 24735.329000
## c:time14        -8.2662570  8801.994900 -1.726018e+04 17243.644000
## c:time15        -8.2714304  9531.859300 -1.869072e+04 18674.173000
## c:time16        -8.2521325     0.000000 -8.252133e+00    -8.252133
## c:time17        -8.1327002 10305.173000 -2.020627e+04 20190.008000
## c:time18        -7.9822770 29140.504000 -5.712337e+04 57107.407000
## c:time19        -7.8828933 11833.253000 -2.320106e+04 23185.294000
## f0:(Intercept) -37.6158060     0.000000 -3.761581e+01   -37.615806
##
##
## Real Parameter pi
##
##
## mixture:1 4.292699e-29
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 1.0000000 1.000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## mixture:2 0.0178498 0.163601 0.1304299 0.1499968 0.1470628 0.1724298 0.0416509
##                    8         9           10        11        12        13
## mixture:1 1.0000000 1.000000 1.000000e+00 1.0000000 1.0000000 1.0000000
## mixture:2 0.1304283 0.150001 6.702098e-10 0.1764699 0.0714337 0.1538358
##                   14        15        16        17        18 19
## mixture:1 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000  1
## mixture:2 0.0909036 0.2000144 0.3750085 0.3998749 0.3333606  1
##
##
## Real Parameter c
##
##                       2            3            4            5           6
## mixture:1 3.090924e-20 2.555161e-23 8.285185e-24 7.690528e-09 7.53543e-24
```

```
## mixture:2 4.018874e-13 3.322266e-16 1.077254e-16 9.090380e-02 9.79770e-17
##                      7            8            9           10           11
## mixture:1 8.430048e-24 8.592467e-24 4.524428e-09 2.023239e-09 8.752438e-24
## mixture:2 1.096090e-16 1.117208e-16 5.555900e-02 2.563220e-02 1.138007e-16
##                     12           13           14           15           16
## mixture:1 8.316109e-24 8.160545e-24 7.945085e-24 7.904088e-24 8.058102e-24
## mixture:2 1.081275e-16 1.061049e-16 1.033034e-16 1.027703e-16 1.047729e-16
##                     17           18           19
## mixture:1 9.080328e-24 1.055430e-23 1.165712e-23
## mixture:2 1.180640e-16 1.372289e-16 1.515679e-16
##
##
## Real Parameter f0
##
##             1
##  4.609599e-17
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  21  (unadjusted=20)
## -2lnL:  16.12256
## AICc :  59.00931  (unadjusted=56.927926)
##
## Beta
##                       estimate        se           lcl           ucl
## pi:(Intercept) -5.999173e-05 0.0000000 -5.999173e-05 -5.999173e-05
## p:(Intercept)  -5.761074e+00 0.7228341 -7.177828e+00 -4.344319e+00
## p:time2         2.222717e+00 0.6783135  8.932222e-01  3.552211e+00
## p:time3         1.807612e+00 0.5814207  6.680273e-01  2.947196e+00
## p:time4         1.807613e+00 0.8197007  2.010000e-01  3.414227e+00
## p:time5         1.964970e+00 0.7012784  5.904641e-01  3.339475e+00
## p:time6         1.622098e+00 0.7408688  1.699949e-01  3.074201e+00
## p:time7        -9.708843e-06 1.1614038 -2.276361e+00  2.276342e+00
## p:time8         1.104915e+00 0.8259474 -5.139416e-01  2.723772e+00
## p:time9         1.622098e+00 0.7408695  1.699938e-01  3.074202e+00
## p:time10       -1.589034e-05 1.1613996 -2.276359e+00  2.276327e+00
## p:time11        1.104918e+00 0.8259468 -5.139377e-01  2.723774e+00
## p:time12       -1.276614e-05 1.1613940 -2.276345e+00  2.276320e+00
## p:time13        6.962872e-01 0.9213274 -1.109514e+00  2.502089e+00
## p:time14       -1.216468e-05 1.1613897 -2.276336e+00  2.276312e+00
## p:time15        6.962883e-01 0.9213264 -1.109511e+00  2.502088e+00
## p:time16        1.104916e+00 0.4088159  3.036367e-01  1.906195e+00
## p:time17        6.962865e-01 0.9213295 -1.109519e+00  2.502092e+00
## p:time18       -3.933118e-06 1.1613778 -2.276305e+00  2.276297e+00
## p:time19        6.962880e-01 0.9213249 -1.109509e+00  2.502085e+00
## f0:(Intercept)  5.570984e+00 0.5064104  4.578420e+00  6.563548e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.499985
##
```

```
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0031379 0.0282403 0.0188269 0.0188269 0.0219648 0.0156891 0.0031378
## mixture:2 0.0031379 0.0282403 0.0188269 0.0188269 0.0219648 0.0156891 0.0031378
##                   8         9        10        11        12        13        14
## mixture:1 0.0094134 0.0156891 0.0031378 0.0094135 0.0031378 0.0062756 0.0031378
## mixture:2 0.0094134 0.0156891 0.0031378 0.0094135 0.0031378 0.0062756 0.0031378
##                  15        16        17        18        19
## mixture:1 0.0062756 0.0094135 0.0062756 0.0031378 0.0062756
## mixture:2 0.0062756 0.0094135 0.0062756 0.0031378 0.0062756
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0282403 0.0188269 0.0188269 0.0219648 0.0156891 0.0031378 0.0094134
## mixture:2 0.0282403 0.0188269 0.0188269 0.0219648 0.0156891 0.0031378 0.0094134
##                   9        10        11        12        13        14        15
## mixture:1 0.0156891 0.0031378 0.0094135 0.0031378 0.0062756 0.0031378 0.0062756
## mixture:2 0.0156891 0.0031378 0.0094135 0.0031378 0.0062756 0.0031378 0.0062756
##                  16        17        18        19
## mixture:1 0.0094135 0.0062756 0.0031378 0.0062756
## mixture:2 0.0094135 0.0062756 0.0031378 0.0062756
##
##
## Real Parameter f0
##
##         1
##  262.6925
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~time)f0(~1)
##
## Npar :  39  (unadjusted=20)
## -2lnL:  -7.910775
## AICc :  73.1361  (unadjusted=32.894594)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept)  1.761254e-04     0.000000  1.761254e-04  1.761254e-04
## p:(Intercept)  -4.007259e+00     1.009002 -5.984903e+00 -2.029616e+00
## p:time2         2.375766e+00     1.072819  2.730405e-01  4.478491e+00
## p:time3         2.110116e+00     1.099888 -4.566450e-02  4.265897e+00
## p:time4         2.272597e+00     1.101894  1.128859e-01  4.432309e+00
## p:time5         2.249353e+00     1.119185  5.574960e-02  4.442956e+00
## p:time6         2.438601e+00     1.122388  2.387201e-01  4.638481e+00
## p:time7         8.718130e-01     1.435797 -1.942349e+00  3.685975e+00
## p:time8         2.110138e+00     1.183815 -2.101389e-01  4.430415e+00
## p:time9         2.272658e+00     1.187536 -5.491200e-02  4.600229e+00
## p:time10       -8.758906e+01     0.000000 -8.758906e+01 -8.758906e+01
## p:time11        2.466819e+00     1.192830  1.288733e-01  4.804765e+00
## p:time12        1.442225e+00     1.447440 -1.394757e+00  4.279207e+00
```

```
## p:time13        2.302500e+00     1.268462 -1.836860e-01  4.788686e+00
## p:time14        1.704664e+00     1.455364 -1.147848e+00  4.557177e+00
## p:time15        2.620898e+00     1.281838  1.084949e-01  5.133301e+00
## p:time16        3.496366e+00     1.245563  1.055063e+00  5.937669e+00
## p:time17        3.601693e+00     1.360674  9.347726e-01  6.268614e+00
## p:time18        3.314173e+00     1.586839  2.039689e-01  6.424377e+00
## p:time19        2.505185e+01 11269.557000 -2.206328e+04  2.211338e+04
## c:(Intercept)  -4.774466e+01     0.000000 -4.774466e+01 -4.774466e+01
## c:time3        -1.458989e+01     0.000000 -1.458989e+01 -1.458989e+01
## c:time4        -1.795620e+01  6891.257200 -1.352482e+04  1.348891e+04
## c:time5         4.544205e+01     0.000000  4.544205e+01  4.544205e+01
## c:time6        -1.281099e+01     0.000000 -1.281099e+01 -1.281099e+01
## c:time7        -6.262775e+00     0.000000 -6.262775e+00 -6.262775e+00
## c:time8        -5.588407e+00     0.000000 -5.588407e+00 -5.588407e+00
## c:time9         4.491136e+01     0.000000  4.491136e+01  4.491136e+01
## c:time10        4.410692e+01     0.000000  4.410692e+01  4.410692e+01
## c:time11       -6.678772e+00     0.000000 -6.678772e+00 -6.678772e+00
## c:time12       -9.527696e+00     0.000000 -9.527696e+00 -9.527696e+00
## c:time13       -1.057774e+01     0.000000 -1.057774e+01 -1.057774e+01
## c:time14       -1.258522e+01     0.000000 -1.258522e+01 -1.258522e+01
## c:time15       -1.347018e+01     0.000000 -1.347018e+01 -1.347018e+01
## c:time16       -1.485106e+01     0.000000 -1.485106e+01 -1.485106e+01
## c:time17       -1.565112e+01     0.000000 -1.565112e+01 -1.565112e+01
## c:time18       -1.522380e+01  6915.653600 -1.356991e+04  1.353946e+04
## c:time19       -1.471969e+01  2821.729100 -5.545309e+03  5.515869e+03
## f0:(Intercept) -2.125313e+01 11200.570000 -2.197437e+04  2.193187e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.500044
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0178584 0.1636259 0.1304321 0.1499922 0.1470527 0.1724077 0.0416686
## mixture:2 0.0178584 0.1636259 0.1304321 0.1499922 0.1470527 0.1724077 0.0416686
##                   8    9           10        11        12        13        14
## mixture:1 0.1304347 0.15 1.660441e-40 0.1764713 0.0714229 0.1538447 0.0909083
## mixture:2 0.1304347 0.15 1.660441e-40 0.1764713 0.0714229 0.1538447 0.0909083
##                  15        16        17        18 19
## mixture:1 0.1999893 0.3749841 0.3999757 0.3333469  1
## mixture:2 0.1999893 0.3749841 0.3999757 0.3333469  1
##
##
## Real Parameter c
##
##                       2            3            4         5           6
## mixture:1 1.839743e-21 8.480995e-28 2.927375e-29 0.0909067 5.02362e-27
## mixture:2 1.839743e-21 8.480995e-28 2.927375e-29 0.0909067 5.02362e-27
##                       7            8         9        10           11
## mixture:1 3.506457e-24 6.882446e-24 0.0555508 0.0256371 2.313148e-24
```

```
## mixture:2 3.506457e-24 6.882446e-24 0.0555508 0.0256371 2.313148e-24
##                      12           13          14           15           16
## mixture:1 1.339464e-25 4.687068e-26 6.29602e-27 2.598565e-27 6.531655e-28
## mixture:2 1.339464e-25 4.687068e-26 6.29602e-27 2.598565e-27 6.531655e-28
##                      17           18           19
## mixture:1 2.934692e-28 4.499314e-28 7.448601e-28
## mixture:2 2.934692e-28 4.499314e-28 7.448601e-28
##
##
## Real Parameter f0
##
##             1
##  5.886865e-10
```

Examine model-selection table

```
cistude.results
```

```
##                                                model npar     AICc DeltaAICc
## 2                              pi(~1)p(~1)c(~1)f0(~1)    4 45.04211  0.000000
## 4                 pi(~1)p(~mixture)c(~mixture)f0(~1)    6 49.08380  4.041699
## 1                                pi(~1)p(~1)c()f0(~1)    3 53.01850  7.976392
## 3                         pi(~1)p(~mixture)c()f0(~1)    4 55.03363  9.991523
## 7                            pi(~1)p(~time)c()f0(~1)   21 59.00931 13.967208
## 5                  pi(~1)p(~time + mixture)c()f0(~1)   22 61.09470 16.052595
## 8                       pi(~1)p(~time)c(~time)f0(~1)   39 73.13610 28.093995
## 6 pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   41 77.45909 32.416984
##         weight Deviance
## 2 8.627405e-01 57.15306
## 4 1.143501e-01 57.15306
## 1 1.598927e-02 67.14458
## 3 5.837791e-03 67.14458
## 7 7.997229e-04 36.27128
## 5 2.819055e-04 36.27128
## 8 6.844579e-07 12.23795
## 6 7.881730e-08 12.23795
```

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

```
##               estimate          se           lcl        ucl fixed note
## pi g1 m1     0.4999931 112.6280800 5.562532e-309  1.0000000
## p g1 t1 m1   0.0849953   0.0239204  4.837540e-02  0.1451091
## c g1 t2 m1   0.0078493   0.0034965  3.270800e-03  0.0187166
## f0 g1 a0 t1 12.2031700   8.6944547  3.475951e+00 42.8421850
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 68.20317 59.47595 98.84219
```

Idem avec 2007.

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

```
##                        ch freq
## 1 10000000000000000000    1
## 2 01111000000000000000    1
## 3 00000100000000000000    1
## 4 00000010000000000000    1
## 5 00000001000000000000    1
## 6 00000100000000000000    1
```

```
tail(cistude)
```

```
##                         ch freq
## 64 00000001000000000000    1
## 65 00000000100000000000    1
## 66 00000000011000000000    1
## 67 10000000000000000000    1
## 68 10000000000000000000    1
## 69 10000000000000000100    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
```

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

  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)  3.476151e-05 886.8408400 -1738.208000 1738.208100
## p:(Intercept)  -4.304987e+00   0.3107246    -4.914008   -3.695967
## f0:(Intercept)  5.301130e+00   0.3837083     4.549062    6.053199
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000087
##
##
## 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
## -2lnL:  83.46629
## AICc :  91.49273
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept) -0.0001536381 0.0000000 -0.0001536381 -0.0001536381
## p:(Intercept)  -3.1173552000 0.0794960 -3.2731673000 -2.9615431000
## c:(Intercept)  -4.4091553000 0.3133123 -5.0232475000 -3.7950632000
## f0:(Intercept)  3.7564030000 0.2310477  3.3035495000  4.2092566000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999616
##
##
## 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
##  42.79422
##
## 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) -5.259831 1.6095996 -8.414646 -2.1050154
## p:(Intercept)  -1.956463 1.0035257 -3.923373  0.0104478
## p:mixture2     -2.720607 0.9669078 -4.615747 -0.8254682
## f0:(Intercept)  5.693510 0.4901403  4.732835  6.6541854
##
##
## Real Parameter pi
##
##
## mixture:1 0.0051693
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504
## 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 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504
## 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 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
##                   22
## mixture:1 0.1238504
## mixture:2 0.0092204
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504
## 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 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504
## 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 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504 0.1238504
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
##
```

```
##
## Real Parameter f0
##
##         1
##  296.9341
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6
## -2lnL:  79.38652
## AICc :  91.44211
##
## Beta
##                   estimate        se       lcl        ucl
## pi:(Intercept) -4.0815247 1.3215272 -6.671718 -1.4913314
## p:(Intercept)   0.1591027 1.5312260 -2.842100  3.1603058
## p:mixture2     -3.4314313 1.6905959 -6.744999 -0.1178634
## c:(Intercept)  -2.3016274 1.0099922 -4.281212 -0.3220427
## c:mixture2     -2.5224573 0.9763915 -4.436185 -0.6087299
## f0:(Intercept)  3.9576137 0.8412513  2.308761  5.6064663
##
##
## Real Parameter pi
##
##
## mixture:1 0.0166014
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.5396920 0.5396920 0.5396920 0.5396920 0.5396920 0.5396920 0.5396920
## mixture:2 0.0365328 0.0365328 0.0365328 0.0365328 0.0365328 0.0365328 0.0365328
##                    8         9        10        11        12        13        14
## mixture:1 0.5396920 0.5396920 0.5396920 0.5396920 0.5396920 0.5396920 0.5396920
## mixture:2 0.0365328 0.0365328 0.0365328 0.0365328 0.0365328 0.0365328 0.0365328
##                   15        16        17        18        19        20        21
## mixture:1 0.5396920 0.5396920 0.5396920 0.5396920 0.5396920 0.5396920 0.5396920
## mixture:2 0.0365328 0.0365328 0.0365328 0.0365328 0.0365328 0.0365328 0.0365328
##                   22
## mixture:1 0.5396920
## mixture:2 0.0365328
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0909883 0.0909883 0.0909883 0.0909883 0.0909883 0.0909883 0.0909883
## mixture:2 0.0079699 0.0079699 0.0079699 0.0079699 0.0079699 0.0079699 0.0079699
##                    9        10        11        12        13        14        15
## mixture:1 0.0909883 0.0909883 0.0909883 0.0909883 0.0909883 0.0909883 0.0909883
## mixture:2 0.0079699 0.0079699 0.0079699 0.0079699 0.0079699 0.0079699 0.0079699
##                   16        17        18        19        20        21        22
```

```
## mixture:1 0.0909883 0.0909883 0.0909883 0.0909883 0.0909883 0.0909883 0.0909883
## mixture:2 0.0079699 0.0079699 0.0079699 0.0079699 0.0079699 0.0079699 0.0079699
##
##
## Real Parameter f0
##
##        1
##  52.3323
##
## 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) -5.283657e+00 1.5634159 -8.3479527 -2.2193620
## p:(Intercept)  -1.205610e+00 1.0756961 -3.3139739  0.9027548
## p:time2        -8.664591e-01 0.6970408 -2.2326591  0.4997410
## p:time3        -1.975413e+00 1.0737513 -4.0799651  0.1291401
## p:time4        -5.738140e-01 0.6343260 -1.8170930  0.6694651
## p:time5        -3.458301e-01 0.5934926 -1.5090755  0.8174154
## p:time6        -1.587801e-01 0.5646089 -1.2654135  0.9478534
## p:time7        -5.738129e-01 0.6343270 -1.8170939  0.6694681
## p:time8         1.380658e-01 0.5262422 -0.8933689  1.1695005
## p:time9        -8.664589e-01 0.6970396 -2.2326565  0.4997387
## p:time10       -8.664588e-01 0.6970403 -2.2326578  0.4997403
## p:time11       -8.664587e-01 0.6970398 -2.2326567  0.4997394
## p:time12       -8.664576e-01 0.6970403 -2.2326565  0.4997414
## p:time13       -1.975411e+00 1.0737516 -4.0799638  0.1291427
## p:time14       -1.587804e-01 0.5646093 -1.2654146  0.9478538
## p:time15       -1.277018e+00 0.8079105 -2.8605229  0.3064862
## p:time16       -5.752789e-07 0.5430227 -1.0643251  1.0643240
## p:time17       -5.738149e-01 0.6343269 -1.8170957  0.6694659
## p:time18       -1.975410e+00 1.0737512 -4.0799628  0.1291419
## p:time19       -8.664574e-01 0.6970404 -2.2326566  0.4997419
## p:time20       -1.277022e+00 0.8079115 -2.8605284  0.3064847
## p:time21       -1.975410e+00 1.0737517 -4.0799636  0.1291433
## p:time22       -1.277021e+00 0.8079109 -2.8605261  0.3064848
## p:mixture2     -2.772614e+00 0.9754416 -4.6844801 -0.8607488
## f0:(Intercept)  5.673248e+00 0.4870528  4.7186243  6.6278714
##
##
## Real Parameter pi
##
##
## mixture:1 0.0050482
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
```

```
## mixture:1 0.2304788 0.1118414 0.0398862 0.1443743 0.1748784 0.2035278 0.1443745
## mixture:2 0.0183749 0.0078087 0.0025897 0.0104356 0.0130729 0.0157196 0.0104357
##                   8         9        10        11        12        13        14
## mixture:1 0.2558705 0.1118414 0.1118414 0.1118414 0.1118415 0.0398862 0.2035277
## mixture:2 0.0210381 0.0078087 0.0078087 0.0078087 0.0078087 0.0025897 0.0157196
##                  15        16        17        18        19        20        21
## mixture:1 0.077085 0.2304787 0.1443742 0.0398863 0.1118416 0.0770848 0.0398863
## mixture:2 0.005193 0.0183749 0.0104356 0.0025897 0.0078087 0.0051930 0.0025897
##                  22
## mixture:1 0.0770849
## mixture:2 0.0051930
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.1118414 0.0398862 0.1443743 0.1748784 0.2035278 0.1443745 0.2558705
## mixture:2 0.0078087 0.0025897 0.0104356 0.0130729 0.0157196 0.0104357 0.0210381
##                   9        10        11        12        13        14        15
## mixture:1 0.1118414 0.1118414 0.1118414 0.1118415 0.0398862 0.2035277 0.077085
## mixture:2 0.0078087 0.0078087 0.0078087 0.0078087 0.0025897 0.0157196 0.005193
##                  16        17        18        19        20        21        22
## mixture:1 0.2304787 0.1443742 0.0398863 0.1118416 0.0770848 0.0398863 0.0770849
## 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(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  47  (unadjusted=33)
## -2lnL:  29.49561
## AICc :  126.565  (unadjusted=97.007739)
##
## Beta
##                     estimate           se           lcl           ucl
## pi:(Intercept)   -3.8196315 1.512663e+00 -6.784451e+00 -8.548120e-01
## p:(Intercept)     0.0346017 2.189137e+00 -4.256106e+00  4.325309e+00
## p:mixture2       -2.3178829 2.233103e+00 -6.694766e+00  2.059000e+00
## p:time2          -0.8261523 7.299627e-01 -2.256879e+00  6.045747e-01
## p:time3         -16.8647930 1.861344e+03 -3.665098e+03  3.631369e+03
## p:time4          -0.6673797 7.347108e-01 -2.107413e+00  7.726534e-01
## p:time5          -0.3000862 6.779579e-01 -1.628884e+00  1.028711e+00
## p:time6           0.2345293 6.156803e-01 -9.722042e-01  1.441263e+00
## p:time7          -0.0795153 6.824484e-01 -1.417114e+00  1.258083e+00
## p:time8           0.8343594 5.848878e-01 -3.120207e-01  1.980740e+00
## p:time9          -0.0544045 7.443789e-01 -1.513387e+00  1.404578e+00
## p:time10         -0.3921234 8.498226e-01 -2.057776e+00  1.273529e+00
## p:time11         -0.3205212 8.512665e-01 -1.989004e+00  1.347961e+00
## p:time12         -0.2427034 8.523694e-01 -1.913347e+00  1.427941e+00
```

```
## p:time13         -0.8949710 1.108220e+00 -3.067082e+00  1.277140e+00
## p:time14          0.9482081 6.624847e-01 -3.502619e-01  2.246678e+00
## p:time15          0.1431760 8.631547e-01 -1.548607e+00  1.834959e+00
## p:time16          1.6771351 6.661264e-01  3.715273e-01  2.982743e+00
## p:time17          1.3024484 8.027877e-01 -2.710156e-01  2.875912e+00
## p:time18          0.3373671 1.152820e+00 -1.922160e+00  2.596894e+00
## p:time19          1.9955984 8.771884e-01  2.763091e-01  3.714888e+00
## p:time20          1.1846677 1.232668e+00 -1.231361e+00  3.600696e+00
## p:time21          1.5901340 1.298510e+00 -9.549452e-01  4.135213e+00
## p:time22        156.8593100 0.000000e+00  1.568593e+02  1.568593e+02
## c:(Intercept)   -16.9363330 0.000000e+00 -1.693633e+01 -1.693633e+01
## c:mixture2       -2.4080863 1.135943e+00 -4.634534e+00 -1.816381e-01
## c:time3          16.5351560 0.000000e+00  1.653516e+01  1.653516e+01
## c:time4          16.5351570 0.000000e+00  1.653516e+01  1.653516e+01
## c:time5          16.3246140 0.000000e+00  1.632461e+01  1.632461e+01
## c:time6         -20.9330720 1.354885e+04 -2.657668e+04  2.653482e+04
## c:time7         -13.3457920 0.000000e+00 -1.334579e+01 -1.334579e+01
## c:time8          -9.7203389 0.000000e+00 -9.720339e+00 -9.720339e+00
## c:time9          -5.5259684 3.801245e+03 -7.455967e+03  7.444915e+03
## c:time10         15.4493300 0.000000e+00  1.544933e+01  1.544933e+01
## c:time11         15.4074790 0.000000e+00  1.540748e+01  1.540748e+01
## c:time12         15.3668590 0.000000e+00  1.536686e+01  1.536686e+01
## c:time13         -4.2474352 0.000000e+00 -4.247435e+00 -4.247435e+00
## c:time14         15.3099690 0.000000e+00  1.530997e+01  1.530997e+01
## c:time15         -4.1529646 0.000000e+00 -4.152965e+00 -4.152965e+00
## c:time16         15.1893890 0.000000e+00  1.518939e+01  1.518939e+01
## c:time17         15.0970150 0.000000e+00  1.509702e+01  1.509702e+01
## c:time18         -4.3755611 4.931667e+03 -9.670443e+03  9.661692e+03
## c:time19         -4.3780672 3.792441e+02 -7.476966e+02  7.389405e+02
## c:time20         14.9994370 0.000000e+00  1.499944e+01  1.499944e+01
## c:time21         -4.3295755 2.895685e+03 -5.679873e+03  5.671214e+03
## c:time22         -4.3022218 4.938343e+03 -9.683454e+03  9.674850e+03
## f0:(Intercept) -154.1880900 3.294904e+05 -6.459553e+05  6.456469e+05
##
##
## Real Parameter pi
##
##
## mixture:1 0.021465
##
##
## Real Parameter p
##
##                    1         2            3         4         5         6
## mixture:1 0.5086496 0.3118358 4.906149e-08 0.3468809 0.4340160 0.5668796
## mixture:2 0.0925171 0.0427198 4.831667e-09 0.0497053 0.0702166 0.1141786
##                    7         8         9        10        11        12        13
## mixture:1 0.4887735 0.7045295 0.4950495 0.4115596 0.4290031 0.4481615 0.2972622
## mixture:2 0.0860540 0.1901676 0.0880496 0.0644404 0.0688941 0.0740565 0.0399924
##                   14        15        16        17        18        19        20
## mixture:1 0.7276654 0.5443277 0.8470614 0.7920044 0.5919346 0.8839316 0.7719350
## mixture:2 0.2083215 0.1052595 0.3529388 0.2727266 0.1249996 0.4285713 0.2499998
##                   21 22
## mixture:1 0.8354472  1
```

```
## mixture:2 0.3333333  1
##
##
## Real Parameter c
##
##                      2         3         4         5            6            7
## mixture:1 4.412085e-08 0.4010296 0.4010296 0.3516670 3.577060e-17 7.057327e-14
## mixture:2 3.970318e-09 0.0568257 0.0568257 0.0465391 3.218901e-18 6.350701e-15
##                      8            9        10        11        12           13
## mixture:1 2.649441e-12 1.756897e-10 0.1843719 0.1781614 0.1722914 6.309664e-10
## mixture:2 2.384162e-13 1.580985e-11 0.0199360 0.0191345 0.0183869 5.677899e-11
##                   14           15        16        17           18           19
## mixture:1 0.1643291 6.934805e-10 0.1484330 0.1371319 5.550880e-10 5.536987e-10
## mixture:2 0.0173877 6.240447e-11 0.0154431 0.0140997 4.995089e-11 4.982587e-11
##                   20           21           22
## mixture:1 0.1259892 5.812101e-10 5.973278e-10
## mixture:2 0.0128056 5.230155e-11 5.375194e-11
##
##
## Real Parameter f0
##
##             1
##  1.088836e-67
##
## 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) -7.006898e-05 0.0000000 -7.006898e-05 -7.006898e-05
## p:(Intercept)  -3.609598e+00 0.4818168 -4.553959e+00 -2.665237e+00
## p:time2        -8.626373e-01 0.6956082 -2.226030e+00  5.007549e-01
## p:time3        -1.968831e+00 1.0726272 -4.071181e+00  1.335178e-01
## p:time4        -5.711413e-01 0.5377263 -1.625085e+00  4.828022e-01
## p:time5        -3.441672e-01 0.5920744 -1.504633e+00  8.162986e-01
## p:time6        -1.580011e-01 0.4701718 -1.079538e+00  7.635356e-01
## p:time7        -5.711406e-01 0.6328850 -1.811595e+00  6.693139e-01
## p:time8         1.374111e-01 0.5249692 -8.915285e-01  1.166351e+00
## p:time9        -8.626372e-01 0.6956091 -2.226031e+00  5.007567e-01
## p:time10       -8.626374e-01 0.6956078 -2.226029e+00  5.007538e-01
## p:time11       -8.626372e-01 0.6956093 -2.226031e+00  5.007570e-01
## p:time12       -8.626379e-01 0.6956082 -2.226030e+00  5.007542e-01
## p:time13       -1.968834e+00 1.0726280 -4.071185e+00  1.335172e-01
## p:time14       -1.580027e-01 0.5632324 -1.261938e+00  9.459328e-01
## p:time15       -1.271902e+00 0.8065572 -2.852754e+00  3.089500e-01
## p:time16        7.591850e-06 0.5416954 -1.061715e+00  1.061731e+00
## p:time17       -5.711408e-01 0.6328855 -1.811596e+00  6.693147e-01
## p:time18       -1.968834e+00 1.0726275 -4.071184e+00  1.335160e-01
## p:time19       -8.626371e-01 0.6956082 -2.226029e+00  5.007550e-01
## p:time20       -1.271903e+00 0.8065575 -2.852756e+00  3.089499e-01
```

```
## p:time21       -1.968835e+00 1.0726284 -4.071187e+00  1.335165e-01
## p:time22       -1.271902e+00 0.8065579 -2.852756e+00  3.089512e-01
## f0:(Intercept)  5.281459e+00 0.3844165  4.528003e+00  6.034916e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999825
##
##
## Real Parameter p
##
##                   1         2         3        4         5         6        7
## mixture:1 0.0263496 0.0112928 0.0037643 0.015057 0.0188213 0.0225856 0.015057
## mixture:2 0.0263496 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(~time)f0(~1)
##
## Npar :  45  (unadjusted=30)
## -2lnL:  31.33084
## AICc :  124.1433  (unadjusted=92.581683)
##
## Beta
##                   estimate           se           lcl           ucl
```

```
## pi:(Intercept)   0.0023825 4.532757e+02 -8.884180e+02  8.884228e+02
## p:(Intercept)   -2.1812309 3.987334e-01 -2.962748e+00 -1.399713e+00
## p:time2         -0.7976777 7.136292e-01 -2.196391e+00  6.010355e-01
## p:time3        -43.9558340 7.518792e+04 -1.474123e+05  1.473244e+05
## p:time4         -0.7456087 7.142901e-01 -2.145617e+00  6.543999e-01
## p:time5         -0.3837529 6.543904e-01 -1.666358e+00  8.988522e-01
## p:time6          0.1441387 5.894280e-01 -1.011140e+00  1.299418e+00
## p:time7         -0.1701371 6.578726e-01 -1.459567e+00  1.119293e+00
## p:time8          0.7343522 5.598183e-01 -3.628916e-01  1.831596e+00
## p:time9         -0.1541568 7.242809e-01 -1.573747e+00  1.265434e+00
## p:time10        -0.4929855 8.327681e-01 -2.125211e+00  1.139240e+00
## p:time11        -0.4214492 8.342804e-01 -2.056639e+00  1.213741e+00
## p:time12        -0.3445277 8.360635e-01 -1.983212e+00  1.294157e+00
## p:time13        -0.9968543 1.095758e+00 -3.144541e+00  1.150832e+00
## p:time14         0.8461297 6.415879e-01 -4.113826e-01  2.103642e+00
## p:time15         0.0412268 8.472229e-01 -1.619330e+00  1.701784e+00
## p:time16         1.5751342 6.454157e-01  3.101194e-01  2.840149e+00
## p:time17         1.2004056 7.856977e-01 -3.395618e-01  2.740373e+00
## p:time18         0.2353933 1.140960e+00 -2.000889e+00  2.471676e+00
## p:time19         1.8935934 8.615789e-01  2.048987e-01  3.582288e+00
## p:time20         1.0823806 1.221675e+00 -1.312102e+00  3.476863e+00
## p:time21         1.4880812 1.288018e+00 -1.036434e+00  4.012597e+00
## p:time22        24.4199660 0.000000e+00  2.441997e+01  2.441997e+01
## c:(Intercept)  -24.4416160 0.000000e+00 -2.444162e+01 -2.444162e+01
## c:time3         22.2442700 0.000000e+00  2.224427e+01  2.224427e+01
## c:time4         22.2442700 0.000000e+00  2.224427e+01  2.224427e+01
## c:time5         21.9569540 0.000000e+00  2.195695e+01  2.195695e+01
## c:time6        -13.3650990 0.000000e+00 -1.336510e+01 -1.336510e+01
## c:time7        -15.1429830 0.000000e+00 -1.514298e+01 -1.514298e+01
## c:time8        -16.2784000 1.358376e+04 -2.664046e+04  2.660790e+04
## c:time9        -18.7459730 1.070115e+04 -2.099300e+04  2.095551e+04
## c:time10        20.8308520 0.000000e+00  2.083085e+01  2.083085e+01
## c:time11        20.7780470 0.000000e+00  2.077805e+01  2.077805e+01
## c:time12        20.7279840 0.000000e+00  2.072798e+01  2.072798e+01
## c:time13       -19.8433560 0.000000e+00 -1.984336e+01 -1.984336e+01
## c:time14        20.6573990 0.000000e+00  2.065740e+01  2.065740e+01
## c:time15       -20.2248250 0.000000e+00 -2.022482e+01 -2.022482e+01
## c:time16        20.5098610 0.000000e+00  2.050986e+01  2.050986e+01
## c:time17        20.3985510 0.000000e+00  2.039855e+01  2.039855e+01
## c:time18       -14.6591220 8.751308e+03 -1.716722e+04  1.713791e+04
## c:time19       -14.5314750 5.404804e+03 -1.060795e+04  1.057888e+04
## c:time20        20.2825280 0.000000e+00  2.028253e+01  2.028253e+01
## c:time21       -16.5066130 4.159934e+03 -8.169977e+03  8.136963e+03
## c:time22       -17.4650710 0.000000e+00 -1.746507e+01 -1.746507e+01
## f0:(Intercept) -18.1542960 1.757302e+03 -3.462467e+03  3.426158e+03
##
##
## Real Parameter pi
##
##
## mixture:1 0.5005956
##
##
## Real Parameter p
```

```
##
##                    1         2            3         4         5         6
## mixture:1 0.1014487 0.0483879 9.181792e-21 0.0508426 0.0714263 0.1153632
## mixture:2 0.1014487 0.0483879 9.181792e-21 0.0508426 0.0714263 0.1153632
##                    7         8         9       10        11       12        13
## mixture:1 0.0869571 0.1904824 0.0882343 0.064512 0.0689661 0.074072 0.0399988
## mixture:2 0.0869571 0.1904824 0.0882343 0.064512 0.0689661 0.074072 0.0399988
##                   14       15        16        17        18        19        20
## mixture:1 0.2083168 0.105269 0.3529501 0.2727281 0.1250079 0.4285823 0.2499554
## mixture:2 0.2083168 0.105269 0.3529501 0.2727281 0.1250079 0.4285823 0.2499554
##                   21 22
## mixture:1 0.3333328  1
## mixture:2 0.3333328  1
##
##
## Real Parameter c
##
##                        2         3        4         5            6            7
## mixture:1 2.427398e-11 0.0999891 0.099989 0.0769404 3.808484e-17 6.436164e-18
## mixture:2 2.427398e-11 0.0999891 0.099989 0.0769404 3.808484e-17 6.436164e-18
##                        8            9        10        11        12           13
## mixture:1 2.067862e-18 1.753349e-19 0.0263197 0.0249998 0.0238081 5.851688e-20
## mixture:2 2.067862e-18 1.753349e-19 0.0263197 0.0249998 0.0238081 5.851688e-20
##                   14           15        16        17           18          19
## mixture:1 0.0222216 3.995867e-20 0.0192321 0.0172411 1.044155e-17 1.18632e-17
## mixture:2 0.0222216 3.995867e-20 0.0192321 0.0172411 1.044155e-17 1.18632e-17
##                   20           21           22
## mixture:1 0.0153815 1.645926e-18 6.311853e-19
## mixture:2 0.0153815 1.645926e-18 6.311853e-19
##
##
## Real Parameter f0
##
##             1
##  1.305236e-08
```

Examine model-selection table

```
cistude.results
```

```
##                                                model npar      AICc  DeltaAICc
## 3                        pi(~1)p(~mixture)c()f0(~1)    4  91.24373  0.0000000
## 4                pi(~1)p(~mixture)c(~mixture)f0(~1)    6  91.44211  0.1983808
## 2                            pi(~1)p(~1)c(~1)f0(~1)    4  91.49273  0.2489940
## 1                              pi(~1)p(~1)c()f0(~1)    3  92.00888  0.7651525
## 5                 pi(~1)p(~time + mixture)c()f0(~1)   25 107.63693 16.3932001
## 7                           pi(~1)p(~time)c()f0(~1)   24 108.43880 17.1950653
## 8                       pi(~1)p(~time)c(~time)f0(~1)   45 124.14334 32.8996105
## 6 pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   47 126.56500 35.3212662
##         weight  Deviance
## 3 2.880953e-01 112.66139
## 4 2.608906e-01 108.83061
## 2 2.543712e-01 112.91038
## 1 1.965104e-01 115.43712
```

```
## 5 7.939589e-05  86.20971
## 7 5.317105e-05  89.07914
## 8 2.067648e-08  60.77493
## 6 6.160567e-09  58.93970
```

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 (#3)

```
cistude.results$p.h$results$real
```

```
##                 estimate          se          lcl         ucl fixed note
## pi g1 m1       0.0051693   0.0082775 2.215489e-04   0.1086103
## p g1 t1 m1     0.1238504   0.1088940 1.939080e-02   0.5026119
## p g1 t1 m2     0.0092204   0.0040212 3.911900e-03   0.0215766
## f0 g1 a0 t1 296.9341300 145.5393900 1.195884e+02 737.2779600
```

```
cistude.results$p.h$results$derived
```

```
## $`N Population Size`
##   estimate      lcl     ucl
## 1 365.9341 188.5884 806.278
```

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 histoires 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
```

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

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

```r
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.

```r
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.

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

  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 :  3
## -2lnL:  -896.4989
## AICc :  -892.4829
##
## Beta
##                     estimate se           lcl           ucl
## pi:(Intercept)  5.360733e-05  0  5.360733e-05  5.360733e-05
## p:(Intercept)  -2.359285e+00  0 -2.359285e+00 -2.359285e+00
## f0:(Intercept)  6.067756e+00  0  6.067756e+00  6.067756e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000134
##
##
## 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 :  4
## -2lnL:  -928
## AICc :  -925.9947
##
## Beta
##                      estimate se           lcl           ucl
## pi:(Intercept) -5.536202e-04  0 -5.536202e-04 -5.536202e-04
## p:(Intercept)  -3.145049e+01  0 -3.145049e+01 -3.145049e+01
## c:(Intercept)  -2.246195e+00  0 -2.246195e+00 -2.246195e+00
## f0:(Intercept)  3.528600e+01  0  3.528600e+01  3.528600e+01
##
##
## Real Parameter pi
##
##
```

```
## mixture:1 0.4998616
##
##
## Real Parameter p
##
##                      1           2           3           4
## mixture:1 2.19395e-14 2.19395e-14 2.19395e-14 2.19395e-14
## mixture:2 2.19395e-14 2.19395e-14 2.19395e-14 2.19395e-14
##
##
## Real Parameter c
##
##                    2         3         4
## mixture:1 0.0956782 0.0956782 0.0956782
## mixture:2 0.0956782 0.0956782 0.0956782
##
##
## Real Parameter f0
##
##             1
##  2.111133e+15
##
## 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) -2.584651 2.016946 -6.537866  1.368564
## p:(Intercept)  -1.325727 1.550183 -4.364085  1.712631
## p:mixture2     -2.086671 2.369155 -6.730215  2.556873
## f0:(Intercept)  6.924813 2.777694  1.480533 12.369093
##
##
## Real Parameter pi
##
##
## mixture:1 0.0701328
##
##
## Real Parameter p
##
##                    1         2         3         4
## mixture:1 0.2098670 0.2098670 0.2098670 0.2098670
## mixture:2 0.0319102 0.0319102 0.0319102 0.0319102
##
##
## Real Parameter c
##
##                    2         3         4
## mixture:1 0.2098670 0.2098670 0.2098670
```

```
## mixture:2 0.0319102 0.0319102 0.0319102
##
##
## Real Parameter f0
##
##         1
##  1017.204
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6  (unadjusted=2)
## -2lnL:  -900.3414
## AICc :  -888.2286  (unadjusted=-896.32533)
##
## Beta
##                   estimate se        lcl        ucl
## pi:(Intercept) -31.792131  0 -31.792131 -31.792131
## p:(Intercept)    4.302169  0   4.302169   4.302169
## p:mixture2     -12.913454  0 -12.913454 -12.913454
## c:(Intercept)   -8.004497  0  -8.004497  -8.004497
## c:mixture2       5.761266  0   5.761266   5.761266
## f0:(Intercept)  12.461146  0  12.461146  12.461146
##
##
## Real Parameter pi
##
##
## mixture:1 1.559025e-14
##
##
## Real Parameter p
##
##                       1            2            3            4
## mixture:1 0.9866417000 0.9866417000 0.9866417000 0.9866417000
## mixture:2 0.0001820067 0.0001820067 0.0001820067 0.0001820067
##
##
## Real Parameter c
##
##                       2            3            4
## mixture:1 0.0003338459 0.0003338459 0.0003338459
## mixture:2 0.0959350000 0.0959350000 0.0959350000
##
##
## Real Parameter f0
##
##         1
##  258111.2
##
## 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) -2.7264774 1.9678515 -6.5834663  1.1305116
## p:(Intercept)  -1.8555357 1.6061617 -5.0036128  1.2925413
## p:time2         1.2126236 0.2287283  0.7643161  1.6609310
## p:time3         0.2979854 0.2589403 -0.2095376  0.8055083
## p:time4         0.9190348 0.2357519  0.4569610  1.3811086
## p:mixture2     -2.1759510 2.0978357 -6.2877090  1.9358071
## f0:(Intercept)  6.8530896 2.6722559  1.6154679 12.0907110
##
##
## Real Parameter pi
##
##
## mixture:1 0.0614289
##
##
## Real Parameter p
##
##                    1         2         3         4
## mixture:1 0.1352242 0.3445885 0.1739984 0.2816077
## mixture:2 0.0174384 0.0563133 0.0233507 0.0425965
##
##
## Real Parameter c
##
##                    2         3         4
## mixture:1 0.3445885 0.1739984 0.2816077
## mixture:2 0.0563133 0.0233507 0.0425965
##
##
## Real Parameter f0
##
##         1
##  946.8016
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  11  (unadjusted=8)
## -2lnL:  -950.5049
## AICc :  -928.1481  (unadjusted=-934.31106)
##
## Beta
##                    estimate          se          lcl         ucl
## pi:(Intercept)  -3.2417677   0.9818437   -5.1661813  -1.3173540
## p:(Intercept)   16.7817280 122.8857800 -224.0744100 257.6378700
## p:mixture2     -18.8158690 122.8857000 -259.6718500 222.0401100
## p:time2          2.0341377   0.4068087    1.2367925   2.8314828
## p:time3          1.3596961   0.4431684    0.4910861   2.2283061
## p:time4         69.3940720   0.0000000   69.3940720  69.3940720
```

```
## c:(Intercept)   -0.5752528   1.1213911   -2.7731795   1.6226739
## c:mixture2      -2.0197506   0.9843505   -3.9490777  -0.0904236
## c:time3          0.0532936   0.7344617   -1.3862513   1.4928384
## c:time4          0.0561488   0.7324523   -1.3794578   1.4917554
## f0:(Intercept) -87.1453830   0.0000000  -87.1453830 -87.1453830
##
##
## Real Parameter pi
##
##
## mixture:1 0.0376238
##
##
## Real Parameter p
##
##                    1         2         3 4
## mixture:1 0.9999999 1.0000000 1.0000000 1
## mixture:2 0.1156647 0.4999991 0.3375022 1
##
##
## Real Parameter c
##
##                    2         3         4
## mixture:1 0.3600257 0.3723942 0.3730618
## mixture:2 0.0694607 0.0729854 0.0731788
##
##
## Real Parameter f0
##
##             1
##  1.423118e-38
##
## 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)  6.333044e-05 0.000000e+00  6.333044e-05  6.333044e-05
## p:(Intercept)  -2.992043e+00 4.114718e-08 -2.992043e+00 -2.992043e+00
## p:time2         1.204384e+00 1.862222e-01  8.393887e-01  1.569380e+00
## p:time3         2.949766e-01 2.149978e-01 -1.264191e-01  7.163723e-01
## p:time4         9.108002e-01 1.913051e-01  5.358422e-01  1.285758e+00
## f0:(Intercept)  5.986295e+00 1.818340e-01  5.629900e+00  6.342690e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000158
##
```

```
##
## Real Parameter p
##
##                    1       2         3         4
## mixture:1 0.0477866 0.14336 0.0631467 0.1109333
## mixture:2 0.0477866 0.14336 0.0631467 0.1109333
##
##
## Real Parameter c
##
##                  2         3         4
## mixture:1 0.14336 0.0631467 0.1109333
## mixture:2 0.14336 0.0631467 0.1109333
##
##
## Real Parameter f0
##
##         1
##  397.9375
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~time)f0(~1)
##
## Npar :  9  (unadjusted=6)
## -2lnL:  -947.0384
## AICc :  -928.7959  (unadjusted=-934.92569)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept)  4.759607e-05 0.000000e+00  4.759607e-05  4.759607e-05
## p:(Intercept)  -1.742969e+00 2.048519e-01 -2.144479e+00 -1.341460e+00
## p:time2         1.742969e+00 2.587746e-01  1.235771e+00  2.250167e+00
## p:time3         1.068514e+00 3.128406e-01  4.553466e-01  1.681682e+00
## p:time4         2.338556e+01 1.309833e+04 -2.564934e+04  2.569611e+04
## c:(Intercept)  -1.791759e+00 5.400623e-01 -2.850281e+00 -7.332373e-01
## c:time3        -4.906231e-01 6.339333e-01 -1.733132e+00  7.518862e-01
## c:time4        -5.355184e-01 6.189757e-01 -1.748711e+00  6.776741e-01
## f0:(Intercept) -2.054946e+01 3.980837e+03 -7.822990e+03  7.781891e+03
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000119
##
##
## 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 0.1428572 0.0925926 0.0888889
## mixture:2 0.1428572 0.0925926 0.0888889
##
##
## Real Parameter f0
##
##             1
##  1.189822e-09
```

Examine model-selection table

```
monarque.results
```

```
##                                                 model npar      AICc  DeltaAICc
## 8                      pi(~1)p(~time)c(~time)f0(~1)    9 -928.7959  0.0000000
## 6 pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   11 -928.1481  0.6477392
## 7                            pi(~1)p(~time)c()f0(~1)    6 -925.5675  3.2283441
## 5                 pi(~1)p(~time + mixture)c()f0(~1)    7 -924.9674  3.8284100
## 2                           pi(~1)p(~1)c(~1)f0(~1)    4 -919.9465  8.8493999
## 1                             pi(~1)p(~1)c()f0(~1)    3 -890.4668 38.3290480
## 3                       pi(~1)p(~mixture)c()f0(~1)    4 -889.6412 39.1546499
## 4                 pi(~1)p(~mixture)c(~mixture)f0(~1)    6 -888.2286 40.5672441
##         weight Deviance
## 8 4.803450e-01 18.95105
## 6 3.474550e-01 15.48462
## 7 9.561528e-02 28.30923
## 5 7.083121e-02 26.87151
## 2 5.753479e-03 37.98949
## 1 2.283002e-09 69.49060
## 3 1.510877e-09 68.29474
## 4 7.455696e-10 65.64813
```

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    5.000119e-01 0.000000e+00 5.000119e-01 5.000119e-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 5.223432e-06 9.999898e-01 1.000010e+00
## c g1 t2 m1  1.428572e-01 6.613010e-02 5.466680e-02 3.244847e-01
## c g1 t3 m1  9.259260e-02 2.789190e-02 5.054410e-02 1.635947e-01
## c g1 t4 m1  8.888890e-02 2.449300e-02 5.117180e-02 1.500108e-01
## f0 g1 a0 t1 1.189822e-09 4.736486e-06 4.070113e-13 3.478221e-06
```

```
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    3.762380e-02 3.555090e-02 5.673900e-03 2.112588e-01
## p g1 t1 m1  9.999999e-01 6.328337e-06 4.849756e-98 1.000000e+00
## p g1 t2 m1  1.000000e+00 8.277037e-07 9.999984e-01 1.000002e+00
## p g1 t3 m1  1.000000e+00 1.624731e-06 9.999968e-01 1.000003e+00
## p g1 t4 m1  1.000000e+00 0.000000e+00 1.000000e+00 1.000000e+00
## p g1 t1 m2  1.156647e-01 3.833940e-02 5.903380e-02 2.142517e-01
## p g1 t2 m2  4.999991e-01 3.952850e-02 4.231375e-01 5.768608e-01
## p g1 t3 m2  3.375022e-01 5.286710e-02 2.427114e-01 4.474402e-01
## p g1 t4 m2  1.000000e+00 0.000000e+00 1.000000e+00 1.000000e+00
## c g1 t2 m1  3.600257e-01 2.583766e-01 5.879080e-02 8.351636e-01
## c g1 t3 m1  3.723942e-01 2.368417e-01 7.528770e-02 8.121814e-01
## c g1 t4 m1  3.730618e-01 2.353694e-01 7.645410e-02 8.105091e-01
## c g1 t2 m2  6.946070e-02 4.776450e-02 1.723550e-02 2.411093e-01
## c g1 t3 m2  7.298540e-02 2.578960e-02 3.595710e-02 1.425084e-01
## c g1 t4 m2  7.317880e-02 2.303120e-02 3.899970e-02 1.331616e-01
## f0 g1 a0 t1 1.423118e-38 0.000000e+00 1.423118e-38 1.423118e-38
```

```
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      0.5000158 0.000000e+00   0.5000158   0.5000158
## p g1 t1 m1    0.0477866 1.872323e-09   0.0477866   0.0477866
## p g1 t2 m1    0.1433600 2.286960e-02   0.1040834   0.1942444
## p g1 t3 m1    0.0631467 1.271910e-02   0.0423521   0.0931580
## p g1 t4 m1    0.1109333 1.886790e-02   0.0789863   0.1536462
## f0 g1 a0 t1 397.9375100 7.235856e+01 279.4419900 566.6802800
```

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

```
## $`N Population Size`
##   estimate     lcl      ucl
## 1 585.9375 467.442 754.6803
```

Modèle des diapos

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

```
##                 estimate           se          lcl          ucl fixed note
## pi g1 m1       0.0614289    0.1134573 1.381100e-03 7.559333e-01
## p g1 t1 m1     0.1352242    0.1878224 6.668900e-03 7.845770e-01
## p g1 t2 m1     0.3445885    0.3625993 2.210270e-02 9.244134e-01
## p g1 t3 m1     0.1739984    0.2307691 8.972000e-03 8.305497e-01
## p g1 t4 m1     0.2816077    0.3247946 1.657370e-02 9.011638e-01
## p g1 t1 m2     0.0174384    0.0577971 2.386891e-05 9.295591e-01
## p g1 t2 m2     0.0563133    0.1791514 8.056513e-05 9.778742e-01
## p g1 t3 m2     0.0233507    0.0769097 3.220147e-05 9.466706e-01
## p g1 t4 m2     0.0425965    0.1374774 6.008673e-05 9.705382e-01
## f0 g1 a0 t1 946.8016000 2530.0961000 5.541621e+01 1.617637e+04
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 1134.802 243.4162 16364.37
```

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

  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:  -203.4014
## AICc :  -197.3926  (unadjusted=-199.397)
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept)  0.0004957241 0.0000000  0.0004957241  0.0004957241
## p:(Intercept)  -4.2377902000 0.0000000 -4.2377902000 -4.2377902000
```

```
## f0:(Intercept)  6.3679688000 0.0891008  6.1933311000  6.5426064000
##
##
## Real Parameter pi
##
##
## mixture:1 0.5001239
##
##
## 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
##  582.8727
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  -207.0338
## AICc :  -199.0192  (unadjusted=-203.02942)
##
## Beta
##                    estimate se         lcl         ucl
## pi:(Intercept)  -0.0022463  0  -0.0022463  -0.0022463
## p:(Intercept)  -10.6593170  0 -10.6593170 -10.6593170
## c:(Intercept)   -4.1174351  0  -4.1174351  -4.1174351
## f0:(Intercept)  12.9085290  0  12.9085290  12.9085290
##
```

```
##
## Real Parameter pi
##
##
## mixture:1 0.4994384
##
##
## Real Parameter p
##
##                      1           2           3           4           5
## mixture:1 2.34805e-05 2.34805e-05 2.34805e-05 2.34805e-05 2.34805e-05
## mixture:2 2.34805e-05 2.34805e-05 2.34805e-05 2.34805e-05 2.34805e-05
##                      6           7           8           9          10
## mixture:1 2.34805e-05 2.34805e-05 2.34805e-05 2.34805e-05 2.34805e-05
## mixture:2 2.34805e-05 2.34805e-05 2.34805e-05 2.34805e-05 2.34805e-05
##                     11          12          13          14          15
## mixture:1 2.34805e-05 2.34805e-05 2.34805e-05 2.34805e-05 2.34805e-05
## mixture:2 2.34805e-05 2.34805e-05 2.34805e-05 2.34805e-05 2.34805e-05
##                     16          17
## mixture:1 2.34805e-05 2.34805e-05
## mixture:2 2.34805e-05 2.34805e-05
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0160252 0.0160252 0.0160252 0.0160252 0.0160252 0.0160252 0.0160252
## mixture:2 0.0160252 0.0160252 0.0160252 0.0160252 0.0160252 0.0160252 0.0160252
##                    9        10        11        12        13        14        15
## mixture:1 0.0160252 0.0160252 0.0160252 0.0160252 0.0160252 0.0160252 0.0160252
## mixture:2 0.0160252 0.0160252 0.0160252 0.0160252 0.0160252 0.0160252 0.0160252
##                   16        17
## mixture:1 0.0160252 0.0160252
## mixture:2 0.0160252 0.0160252
##
##
## Real Parameter f0
##
##       1
##  403741
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  -205.2286
## AICc :  -197.2139  (unadjusted=-199.21977)
##
## Beta
##                  estimate        se        lcl       ucl
## pi:(Intercept) -7.108695 40.477115 -86.443842 72.226452
## p:(Intercept)  -3.352496  0.569463  -4.468643 -2.236348
## p:mixture2     -6.983371 40.635617 -86.629181 72.662440
## f0:(Intercept) 12.079197 40.608405 -67.513279 91.671673
```

```
##
##
## Real Parameter pi
##
##
## mixture:1 0.0008172931
##
##
## Real Parameter p
##
##                       1            2            3            4            5
## mixture:1 3.381350e-02 3.381350e-02 3.381350e-02 3.381350e-02 3.381350e-02
## mixture:2 3.244712e-05 3.244712e-05 3.244712e-05 3.244712e-05 3.244712e-05
##                       6            7            8            9           10
## mixture:1 3.381350e-02 3.381350e-02 3.381350e-02 3.381350e-02 3.381350e-02
## mixture:2 3.244712e-05 3.244712e-05 3.244712e-05 3.244712e-05 3.244712e-05
##                      11           12           13           14           15
## mixture:1 3.381350e-02 3.381350e-02 3.381350e-02 3.381350e-02 3.381350e-02
## mixture:2 3.244712e-05 3.244712e-05 3.244712e-05 3.244712e-05 3.244712e-05
##                      16           17
## mixture:1 3.381350e-02 3.381350e-02
## mixture:2 3.244712e-05 3.244712e-05
##
##
## Real Parameter c
##
##                       2            3            4            5            6
## mixture:1 3.381350e-02 3.381350e-02 3.381350e-02 3.381350e-02 3.381350e-02
## mixture:2 3.244712e-05 3.244712e-05 3.244712e-05 3.244712e-05 3.244712e-05
##                       7            8            9           10           11
## mixture:1 3.381350e-02 3.381350e-02 3.381350e-02 3.381350e-02 3.381350e-02
## mixture:2 3.244712e-05 3.244712e-05 3.244712e-05 3.244712e-05 3.244712e-05
##                      12           13           14           15           16
## mixture:1 3.381350e-02 3.381350e-02 3.381350e-02 3.381350e-02 3.381350e-02
## mixture:2 3.244712e-05 3.244712e-05 3.244712e-05 3.244712e-05 3.244712e-05
##                      17
## mixture:1 3.381350e-02
## mixture:2 3.244712e-05
##
##
## Real Parameter f0
##
##         1
##  176168.6
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6  (unadjusted=2)
## -2lnL:  -207.0342
## AICc :  -195.0035  (unadjusted=-203.02984)
##
## Beta
##                  estimate se        lcl        ucl
```

```
## pi:(Intercept) -43.190158  0 -43.190158 -43.190158
## p:(Intercept)   14.114773  0  14.114773  14.114773
## p:mixture2     -25.008068  0 -25.008068 -25.008068
## c:(Intercept)  -10.733254  0 -10.733254 -10.733254
## c:mixture2       6.613189  0   6.613189   6.613189
## f0:(Intercept)  13.139026  0  13.139026  13.139026
##
##
## Real Parameter pi
##
##
## mixture:1 1.748851e-19
##
##
## Real Parameter p
##
##                        1            2            3            4            5
## mixture:1 9.999993e-01 9.999993e-01 9.999993e-01 9.999993e-01 9.999993e-01
## mixture:2 1.858205e-05 1.858205e-05 1.858205e-05 1.858205e-05 1.858205e-05
##                        6            7            8            9           10
## mixture:1 9.999993e-01 9.999993e-01 9.999993e-01 9.999993e-01 9.999993e-01
## mixture:2 1.858205e-05 1.858205e-05 1.858205e-05 1.858205e-05 1.858205e-05
##                       11           12           13           14           15
## mixture:1 9.999993e-01 9.999993e-01 9.999993e-01 9.999993e-01 9.999993e-01
## mixture:2 1.858205e-05 1.858205e-05 1.858205e-05 1.858205e-05 1.858205e-05
##                       16           17
## mixture:1 9.999993e-01 9.999993e-01
## mixture:2 1.858205e-05 1.858205e-05
##
##
## Real Parameter c
##
##                        2            3            4            5            6
## mixture:1 2.180708e-05 2.180708e-05 2.180708e-05 2.180708e-05 2.180708e-05
## mixture:2 1.598380e-02 1.598380e-02 1.598380e-02 1.598380e-02 1.598380e-02
##                        7            8            9           10           11
## mixture:1 2.180708e-05 2.180708e-05 2.180708e-05 2.180708e-05 2.180708e-05
## mixture:2 1.598380e-02 1.598380e-02 1.598380e-02 1.598380e-02 1.598380e-02
##                       12           13           14           15           16
## mixture:1 2.180708e-05 2.180708e-05 2.180708e-05 2.180708e-05 2.180708e-05
## mixture:2 1.598380e-02 1.598380e-02 1.598380e-02 1.598380e-02 1.598380e-02
##                       17
## mixture:1 2.180708e-05
## mixture:2 1.598380e-02
##
##
## Real Parameter f0
##
##         1
##  508401.3
##
## 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) -2.228475e+01 2024.8166000 -3990.9253000 3946.355800
## p:(Intercept)  -2.461217e+00    0.0000000    -2.4612174   -2.461217
## p:time2         2.314366e+00    1.0498398     0.2566802    4.372052
## p:time3         1.389885e+00    1.1189883    -0.8033318    3.583102
## p:time4         2.411079e+00    1.0455018     0.3618956    4.460263
## p:time5         2.499444e+00    1.0418751     0.4573690    4.541520
## p:time6         2.411077e+00    1.0455015     0.3618939    4.460260
## p:time7         2.580983e+00    1.0387924     0.5449494    4.617016
## p:time8         2.314369e+00    1.0498395     0.2566836    4.372054
## p:time9         2.314408e+00    1.0498371     0.2567277    4.372089
## p:time10        1.389661e+00    1.1190117    -0.8036018    3.582924
## p:time11        2.913299e+00    1.0284694     0.8974995    4.929100
## p:time12        2.854747e+00    1.0300547     0.8358400    4.873655
## p:time13        2.792717e+00    1.0318353     0.7703197    4.815114
## p:time14        2.411127e+00    1.0454995     0.3619479    4.460306
## p:time15        2.499487e+00    1.0418736     0.4574146    4.541559
## p:time16        2.968772e+00    1.0270490     0.9557560    4.981788
## p:time17       -6.480904e-04    1.4149854    -2.7740194    2.772723
## p:mixture2     -4.134036e+00    0.0000000    -4.1340356   -4.134036
## f0:(Intercept)  6.349165e+00    0.2691056     5.8217184    6.876613
##
##
## Real Parameter pi
##
##
## mixture:1 2.098238e-10
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0786221 0.4633530 0.2551498 0.4874681 0.5095556 0.4874675 0.5299055
## mixture:2 0.0013650 0.0136417 0.0054571 0.0150062 0.0163698 0.0150061 0.0177359
##                    8         9        10        11        12        13        14
## mixture:1 0.4633537 0.4633635 0.2551072 0.6111342 0.5971322 0.5821242 0.4874800
## mixture:2 0.0136418 0.0136423 0.0054559 0.0245556 0.0231915 0.0218271 0.0150069
##                   15        16        17
## mixture:1 0.5095662 0.6242331 0.0785752
## mixture:2 0.0163705 0.0259199 0.0013641
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.4633530 0.2551498 0.4874681 0.5095556 0.4874675 0.5299055 0.4633537
## mixture:2 0.0136417 0.0054571 0.0150062 0.0163698 0.0150061 0.0177359 0.0136418
##                    9        10        11        12        13        14        15
## mixture:1 0.4633635 0.2551072 0.6111342 0.5971322 0.5821242 0.4874800 0.5095662
```

```
## mixture:2 0.0136423 0.0054559 0.0245556 0.0231915 0.0218271 0.0150069 0.0163705
##                  16        17
## mixture:1 0.6242331 0.0785752
## mixture:2 0.0259199 0.0013641
##
##
## Real Parameter f0
##
##         1
##  572.0151
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  37  (unadjusted=26)
## -2lnL:  -285.6764
## AICc :  -210.6345  (unadjusted=-233.15832)
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept) -21.9014350  3307.343600 -6.504295e+03  6460.492200
## p:(Intercept)    0.0079066   247.428760 -4.849525e+02   484.968290
## p:mixture2      -5.0826268   247.432930 -4.900512e+02   479.885930
## p:time2          2.3666853     1.054725  2.994233e-01     4.433947
## p:time3          1.1828931     1.160136 -1.090974e+00     3.456760
## p:time4          2.5599597     1.050734  5.005199e-01     4.619399
## p:time5          2.7393341     1.047464  6.863056e-01     4.792363
## p:time6          2.6410920     1.055724  5.718719e-01     4.710312
## p:time7          2.9346536     1.048293  8.799991e-01     4.989308
## p:time8          2.8555123     1.056717  7.843471e-01     4.926678
## p:time9          2.5779665     1.077221  4.666137e-01     4.689319
## p:time10         1.7666101     1.162457 -5.118062e-01     4.045026
## p:time11         3.6576537     1.040881  1.617527e+00     5.697780
## p:time12         3.9352808     1.043207  1.890594e+00     5.979967
## p:time13         4.1302533     1.051184  2.069933e+00     6.190574
## p:time14         4.2537033     1.066158  2.164035e+00     6.343372
## p:time15         4.3209350     1.090690  2.183182e+00     6.458688
## p:time16         7.8474968     1.438213  5.028599e+00    10.666395
## p:time17        78.2747440 15788.102000 -3.086641e+04 31022.956000
## c:(Intercept)    1.5824147     0.000000  1.582415e+00     1.582415
## c:mixture2     -16.3224920     0.000000 -1.632249e+01   -16.322492
## c:time3         12.4375330     0.000000  1.243753e+01    12.437533
## c:time4        -19.9762140  3515.906600 -6.911153e+03  6871.200900
## c:time5        -20.8850830  4187.095000 -8.227592e+03  8185.821300
## c:time6         11.1566400     0.000000  1.115664e+01    11.156640
## c:time7         10.9114970     0.000000  1.091150e+01    10.911497
## c:time8        -20.8715920  3648.882600 -7.172682e+03  7130.938400
## c:time9         11.6490400     0.000000  1.164904e+01    11.649040
## c:time10        10.4225480     0.000000  1.042255e+01    10.422548
## c:time11        11.0894230     0.000000  1.108942e+01    11.089423
## c:time12        10.1967430     0.000000  1.019674e+01    10.196743
## c:time13        10.7418850     0.000000  1.074188e+01    10.741885
## c:time14       -19.6100030  5041.972300 -9.901876e+03  9862.656000
## c:time15        11.2435100     0.000000  1.124351e+01    11.243510
```

```
## c:time16        10.8899630     0.000000  1.088996e+01    10.889963
## c:time17       -18.6841130  5029.888000 -9.877265e+03  9839.896700
## f0:(Intercept) -67.1982150     0.000000 -6.719822e+01   -67.198215
##
##
## Real Parameter pi
##
##
## mixture:1 3.078418e-10
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.5019766 0.9148692 0.7668841 0.9287647 0.9397573 0.9339492 0.9499107
## mixture:2 0.0062140 0.0625009 0.0199999 0.0748299 0.0882344 0.0806441 0.1052631
##                    8         9        10        11        12        13        14
## mixture:1 0.9460082 0.9299468 0.8550185 0.9750487 0.9809824 0.9842983 0.9860964
## mixture:2 0.0980388 0.0760861 0.0352940 0.1951219 0.2424233 0.2799989 0.3055478
##                   15        16 17
## mixture:1 0.9869887 0.9996125  1
## mixture:2 0.3199971 0.9411869  1
##
##
## Real Parameter c
##
##                        2         3            4            5         6         7
## mixture:1 8.295462e-01 0.9999992 1.027246e-08 4.139592e-09 0.9999971 0.9999963
## mixture:2 3.967031e-07 0.0909124 8.373484e-16 3.374344e-16 0.0270292 0.0212779
##                        8         9        10        11        12        13
## mixture:1 4.195817e-09 0.9999982 0.9999939 0.9999969 0.9999923 0.9999956
## mixture:2 3.420175e-16 0.0434785 0.0131574 0.0253166 0.0105259 0.0180182
##                       14        15        16           17
## mixture:1 1.481555e-08 0.9999973 0.9999962 3.739615e-08
## mixture:2 1.207674e-15 0.0294101 0.0208340 3.048307e-15
##
##
## Real Parameter f0
##
##             1
##  6.549168e-30
##
## 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)  3.737397e-04 0.0000000  0.0003737397  0.0003737397
## p:(Intercept)  -6.595783e+00 0.4716560 -7.5202286000 -5.6713369000
## p:time2         2.314944e+00 0.5699367  1.1978684000  3.4320203000
```

```
## p:time3         1.390384e+00 0.6887999  0.0403362000  2.7404320000
## p:time4         2.411639e+00 0.5619626  1.3101924000  3.5130858000
## p:time5         2.500037e+00 0.6669359  1.1928425000  3.8072311000
## p:time6         2.411639e+00 0.3842555  1.6584984000  3.1647798000
## p:time7         2.581468e+00 0.5494974  1.5044530000  3.6584827000
## p:time8         2.314945e+00 0.5699365  1.1978696000  3.4320206000
## p:time9         2.314945e+00 0.5699366  1.1978692000  3.4320206000
## p:time10        1.390390e+00 0.6887990  0.0403436000  2.7404355000
## p:time11        2.913858e+00 0.4387860  2.0538380000  3.7738790000
## p:time12        2.855303e+00 0.5330247  1.8105742000  3.9000309000
## p:time13        2.793281e+00 0.5363996  1.7419382000  3.8446245000
## p:time14        2.411640e+00 0.5619624  1.3101938000  3.5130866000
## p:time15        2.500037e+00 0.5552403  1.4117662000  3.5883081000
## p:time16        2.969325e+00 0.5273134  1.9357908000  4.0028593000
## p:time17       -1.996984e-05 1.1064708 -2.1687028000  2.1686628000
## f0:(Intercept)  6.349156e+00 0.2671999  5.8254443000  6.8728681000
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000934
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0013643 0.0136424 0.0054569 0.0150066 0.0163709 0.0150066 0.0177351
## mixture:2 0.0013643 0.0136424 0.0054569 0.0150066 0.0163709 0.0150066 0.0177351
##                    8         9        10        11        12        13        14
## mixture:1 0.0136424 0.0136424 0.005457 0.0245563 0.0231921 0.0218278 0.0150066
## mixture:2 0.0136424 0.0136424 0.005457 0.0245563 0.0231921 0.0218278 0.0150066
##                   15        16        17
## mixture:1 0.0163709 0.0259205 0.0013642
## mixture:2 0.0163709 0.0259205 0.0013642
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0136424 0.0054569 0.0150066 0.0163709 0.0150066 0.0177351 0.0136424
## mixture:2 0.0136424 0.0054569 0.0150066 0.0163709 0.0150066 0.0177351 0.0136424
##                    9        10        11        12        13        14        15
## mixture:1 0.0136424 0.005457 0.0245563 0.0231921 0.0218278 0.0150066 0.0163709
## mixture:2 0.0136424 0.005457 0.0245563 0.0231921 0.0218278 0.0150066 0.0163709
##                   16        17
## mixture:1 0.0259205 0.0013642
## mixture:2 0.0259205 0.0013642
##
##
## Real Parameter f0
##
##         1
##  572.0098
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~time)f0(~1)
##
## Npar :  35  (unadjusted=26)
## -2lnL:  -285.6764
## AICc :  -214.7434  (unadjusted=-233.15832)
##
## Beta
##                       estimate           se           lcl          ucl
## pi:(Intercept) -8.398518e-04   883.488550 -1.731638e+03  1731.636800
## p:(Intercept)  -5.074845e+00     1.002959 -7.040644e+00    -3.109046
## p:time2         2.366797e+00     1.054795  2.993988e-01     4.434195
## p:time3         1.182858e+00     1.160222 -1.091177e+00     3.456892
## p:time4         2.560095e+00     1.050804  5.005197e-01     4.619670
## p:time5         2.739479e+00     1.047532  6.863158e-01     4.792642
## p:time6         2.641222e+00     1.055793  5.718672e-01     4.710577
## p:time7         2.934818e+00     1.048361  8.800309e-01     4.989606
## p:time8         2.855693e+00     1.056784  7.843978e-01     4.926989
## p:time9         2.578136e+00     1.077286  4.666553e-01     4.689616
## p:time10        1.766827e+00     1.162508 -5.116895e-01     4.045343
## p:time11        3.657796e+00     1.040950  1.617534e+00     5.698058
## p:time12        3.935401e+00     1.043277  1.890578e+00     5.980224
## p:time13        4.130377e+00     1.051253  2.069921e+00     6.190833
## p:time14        4.253845e+00     1.066225  2.164044e+00     6.343647
## p:time15        4.321066e+00     1.090757  2.183183e+00     6.458950
## p:time16        7.847558e+00     1.438243  5.028602e+00    10.666514
## p:time17        4.841873e+01 14031.561000 -2.745344e+04 27550.278000
## c:(Intercept)  -1.323277e+01     0.000000 -1.323277e+01   -13.232769
## c:time3         1.093014e+01     0.000000  1.093014e+01    10.930142
## c:time4        -1.606235e+01  7044.440800 -1.382317e+04 13791.042000
## c:time5        -1.630633e+01     0.000000 -1.630633e+01   -16.306328
## c:time6         9.649220e+00     0.000000  9.649220e+00     9.649220
## c:time7         9.404151e+00     0.000000  9.404151e+00     9.404151
## c:time8        -1.439245e+01  5146.314900 -1.010117e+04 10072.385000
## c:time9         1.014167e+01     0.000000  1.014167e+01    10.141670
## c:time10        8.915350e+00     0.000000  8.915350e+00     8.915350
## c:time11        9.582134e+00     0.000000  9.582134e+00     9.582134
## c:time12        8.689430e+00     0.000000  8.689430e+00     8.689430
## c:time13        9.234532e+00     0.000000  9.234532e+00     9.234532
## c:time14       -2.110201e+01 23750.652000 -4.657238e+04 46530.177000
## c:time15        9.736312e+00     0.000000  9.736312e+00     9.736312
## c:time16        9.382739e+00     0.000000  9.382739e+00     9.382739
## c:time17       -2.424896e+01 23877.834000 -4.682480e+04 46776.306000
## f0:(Intercept) -3.360361e+01 35210.885000 -6.904694e+04 68979.733000
##
##
## Real Parameter pi
##
##
## mixture:1 0.49979
##
##
## Real Parameter p
```

```
##
##                    1         2         3         4        5         6         7
## mixture:1 0.0062132 0.0625001 0.0199967 0.0748306 0.088236 0.0806444 0.1052669
## mixture:2 0.0062132 0.0625001 0.0199967 0.0748306 0.088236 0.0806444 0.1052669
##                    8         9        10        11        12        13        14
## mixture:1 0.0980438 0.0760892 0.0352971 0.1951247 0.2424224 0.2799987 0.3055515
## mixture:2 0.0980438 0.0760892 0.0352971 0.1951247 0.2424224 0.2799987 0.3055515
##                   15        16 17
## mixture:1 0.3199986 0.9411834  1
## mixture:2 0.3199986 0.9411834  1
##
##
## Real Parameter c
##
##                        2         3            4            5         6         7
## mixture:1 1.790938e-06 0.0909056 1.893614e-13 1.483656e-13 0.0270262 0.0212771
## mixture:2 1.790938e-06 0.0909056 1.893614e-13 1.483656e-13 0.0270262 0.0212771
##                        8         9        10       11        12        13
## mixture:1 1.005823e-12 0.0434759 0.0131588 0.025317 0.0105259 0.0180174
## mixture:2 1.005823e-12 0.0434759 0.0131588 0.025317 0.0105259 0.0180174
##                       14        15        16           17
## mixture:1 1.226292e-15 0.0294132 0.0208357 5.270994e-17
## mixture:2 1.226292e-15 0.0294132 0.0208357 5.270994e-17
##
##
## Real Parameter f0
##
##             1
##  2.547643e-15
```

Examine model-selection table

```
iguane.results
```

```
##                                                model npar      AICc DeltaAICc
## 7                           pi(~1)p(~time)c()f0(~1)   19 -221.8256  0.000000
## 5                  pi(~1)p(~time + mixture)c()f0(~1)   20 -219.7961  2.029558
## 8                       pi(~1)p(~time)c(~time)f0(~1)   35 -214.7434  7.082218
## 6 pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   37 -210.6345 11.191097
## 2                             pi(~1)p(~1)c(~1)f0(~1)    4 -199.0192 22.806461
## 1                               pi(~1)p(~1)c()f0(~1)    3 -197.3926 24.433021
## 3                         pi(~1)p(~mixture)c()f0(~1)    4 -197.2139 24.611721
## 4                 pi(~1)p(~mixture)c(~mixture)f0(~1)    6 -195.0035 26.822169
##         weight  Deviance
## 7 7.167430e-01  99.47194
## 5 2.598068e-01  99.47194
## 8 2.077206e-02  73.90089
## 6 2.662243e-03  73.90089
## 2 7.998405e-06 152.54347
## 1 3.546503e-06 156.17590
## 3 3.243368e-06 154.34874
## 4 1.073998e-06 152.54306
```

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$p.time$results$real
```

```
##                 estimate           se          lcl         ucl fixed note
## pi g1 m1       0.5000934 0.000000e+00 5.000934e-01   0.5000934
## p g1 t1 m1     0.0013643 6.425805e-04 5.417150e-04   0.0034314
## p g1 t2 m1     0.0136424 5.142900e-03 6.496700e-03   0.0284225
## p g1 t3 m1     0.0054569 2.949300e-03 1.887600e-03   0.0156694
## p g1 t4 m1     0.0150066 5.473200e-03 7.319300e-03   0.0305194
## p g1 t5 m1     0.0163709 5.554100e-03 8.394300e-03   0.0316850
## p g1 t6 m1     0.0150066 5.400200e-03 7.390000e-03   0.0302343
## p g1 t7 m1     0.0177351 6.118900e-03 8.988700e-03   0.0346941
## p g1 t8 m1     0.0136424 5.142900e-03 6.496800e-03   0.0284225
## p g1 t9 m1     0.0136424 5.142900e-03 6.496700e-03   0.0284225
## p g1 t10 m1    0.0054570 2.949300e-03 1.887600e-03   0.0156694
## p g1 t11 m1    0.0245563 7.678500e-03 1.325250e-02   0.0450614
## p g1 t12 m1    0.0231921 7.368200e-03 1.239530e-02   0.0429839
## p g1 t13 m1    0.0218278 7.060000e-03 1.153700e-02   0.0409177
## p g1 t14 m1    0.0150066 5.473200e-03 7.319300e-03   0.0305194
## p g1 t15 m1    0.0163709 5.798300e-03 8.150400e-03   0.0326097
## p g1 t16 m1    0.0259205 7.978500e-03 1.412180e-02   0.0471059
## p g1 t17 m1    0.0013642 1.392700e-03 1.841821e-04   0.0100289
## f0 g1 a0 t1 572.0098400 1.528410e+02 3.418756e+02 957.0593300
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 733.0098 502.8756 1118.059
```

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

  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:  -28.86054
## AICc :  -22.84464  (unadjusted=-24.852597)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept)  0.0001197257 0.000000e+00  0.0001197257  0.0001197257
## p:(Intercept)  -4.4985785000 6.452392e-09 -4.4985785000 -4.4985784000
## f0:(Intercept)  6.0628625000 1.165872e-01  5.8343516000  6.2913735000
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000299
##
##
## 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
##  429.6034
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4
## -2lnL:  -31.5
## AICc :  -29.49735
##
## Beta
##                    estimate se         lcl         ucl
## pi:(Intercept)  -0.0076277  0  -0.0076277  -0.0076277
## p:(Intercept)  -30.2617070  0 -30.2617070 -30.2617070
## c:(Intercept)   -4.3287393  0  -4.3287393  -4.3287393
## f0:(Intercept)  31.9112970  0  31.9112970  31.9112970
##
##
## Real Parameter pi
##
##
## mixture:1 0.4980931
##
##
## Real Parameter p
##
##                        1             2             3             4             5
## mixture:1 7.202907e-14 7.202907e-14 7.202907e-14 7.202907e-14 7.202907e-14
## mixture:2 7.202907e-14 7.202907e-14 7.202907e-14 7.202907e-14 7.202907e-14
##                        6             7             8             9            10
## mixture:1 7.202907e-14 7.202907e-14 7.202907e-14 7.202907e-14 7.202907e-14
```

```
## mixture:2 7.202907e-14 7.202907e-14 7.202907e-14 7.202907e-14 7.202907e-14
##                     11           12           13           14           15
## mixture:1 7.202907e-14 7.202907e-14 7.202907e-14 7.202907e-14 7.202907e-14
## mixture:2 7.202907e-14 7.202907e-14 7.202907e-14 7.202907e-14 7.202907e-14
##                     16           17
## mixture:1 7.202907e-14 7.202907e-14
## mixture:2 7.202907e-14 7.202907e-14
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0130126 0.0130126 0.0130126 0.0130126 0.0130126 0.0130126 0.0130126
## mixture:2 0.0130126 0.0130126 0.0130126 0.0130126 0.0130126 0.0130126 0.0130126
##                   9        10        11        12        13        14        15
## mixture:1 0.0130126 0.0130126 0.0130126 0.0130126 0.0130126 0.0130126 0.0130126
## mixture:2 0.0130126 0.0130126 0.0130126 0.0130126 0.0130126 0.0130126 0.0130126
##                  16        17
## mixture:1 0.0130126 0.0130126
## mixture:2 0.0130126 0.0130126
##
##
## Real Parameter f0
##
##             1
##  7.226037e+13
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  -32.69505
## AICc :  -24.66852  (unadjusted=-26.679141)
##
## Beta
##                   estimate         se       lcl       ucl
## pi:(Intercept) -11.243820 13.8919910 -38.47212 15.984482
## p:(Intercept)   -2.822694  0.6659314  -4.12792 -1.517469
## p:mixture2     -10.132898 13.8861020 -37.34966 17.083863
## f0:(Intercept)  14.424346 13.8976060 -12.81496 41.663654
##
##
## Real Parameter pi
##
##
## mixture:1 1.308776e-05
##
##
## Real Parameter p
##
##                     1            2            3            4            5
## mixture:1 5.611010e-02 5.611010e-02 5.611010e-02 5.611010e-02 5.611010e-02
## mixture:2 2.362963e-06 2.362963e-06 2.362963e-06 2.362963e-06 2.362963e-06
##                     6            7            8            9           10
```

```
## mixture:1 5.611010e-02 5.611010e-02 5.611010e-02 5.611010e-02 5.611010e-02
## mixture:2 2.362963e-06 2.362963e-06 2.362963e-06 2.362963e-06 2.362963e-06
##                      11           12           13           14           15
## mixture:1 5.611010e-02 5.611010e-02 5.611010e-02 5.611010e-02 5.611010e-02
## mixture:2 2.362963e-06 2.362963e-06 2.362963e-06 2.362963e-06 2.362963e-06
##                      16           17
## mixture:1 5.611010e-02 5.611010e-02
## mixture:2 2.362963e-06 2.362963e-06
##
##
## Real Parameter c
##
##                       2            3            4            5            6
## mixture:1 5.611010e-02 5.611010e-02 5.611010e-02 5.611010e-02 5.611010e-02
## mixture:2 2.362963e-06 2.362963e-06 2.362963e-06 2.362963e-06 2.362963e-06
##                       7            8            9           10           11
## mixture:1 5.611010e-02 5.611010e-02 5.611010e-02 5.611010e-02 5.611010e-02
## mixture:2 2.362963e-06 2.362963e-06 2.362963e-06 2.362963e-06 2.362963e-06
##                      12           13           14           15           16
## mixture:1 5.611010e-02 5.611010e-02 5.611010e-02 5.611010e-02 5.611010e-02
## mixture:2 2.362963e-06 2.362963e-06 2.362963e-06 2.362963e-06 2.362963e-06
##                      17
## mixture:1 5.611010e-02
## mixture:2 2.362963e-06
##
##
## Real Parameter f0
##
##        1
##  1838289
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6  (unadjusted=2)
## -2lnL:  -31.21173
## AICc :  -19.15595  (unadjusted=-27.203781)
##
## Beta
##                   estimate       se        lcl        ucl
## pi:(Intercept)  -5.487434  0.00000  -5.487434  -5.487434
## p:(Intercept)  -18.771288  0.00000 -18.771288 -18.771288
## p:mixture2       8.244606  0.00000   8.244606   8.244606
## c:(Intercept)   21.529700  0.00000  21.529700  21.529700
## c:mixture2     -25.861261  0.00000 -25.861261 -25.861261
## f0:(Intercept)  12.185939 20.49358 -27.981483  52.353362
##
##
## Real Parameter pi
##
##
## mixture:1 0.0041214
##
##
```

```
## Real Parameter p
##
##                      1            2            3            4            5
## mixture:1 7.042604e-09 7.042604e-09 7.042604e-09 7.042604e-09 7.042604e-09
## mixture:2 2.681073e-05 2.681073e-05 2.681073e-05 2.681073e-05 2.681073e-05
##                      6            7            8            9           10
## mixture:1 7.042604e-09 7.042604e-09 7.042604e-09 7.042604e-09 7.042604e-09
## mixture:2 2.681073e-05 2.681073e-05 2.681073e-05 2.681073e-05 2.681073e-05
##                     11           12           13           14           15
## mixture:1 7.042604e-09 7.042604e-09 7.042604e-09 7.042604e-09 7.042604e-09
## mixture:2 2.681073e-05 2.681073e-05 2.681073e-05 2.681073e-05 2.681073e-05
##                     16           17
## mixture:1 7.042604e-09 7.042604e-09
## mixture:2 2.681073e-05 2.681073e-05
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## mixture:2 0.0129764 0.0129764 0.0129764 0.0129764 0.0129764 0.0129764 0.0129764
##                   9        10        11        12        13        14        15
## mixture:1 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## mixture:2 0.0129764 0.0129764 0.0129764 0.0129764 0.0129764 0.0129764 0.0129764
##                  16        17
## mixture:1 1.0000000 1.0000000
## mixture:2 0.0129764 0.0129764
##
##
## Real Parameter f0
##
##         1
##  196013.6
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  20  (unadjusted=18)
## -2lnL:  -81.40709
## AICc :  -40.84409  (unadjusted=-44.949258)
##
## Beta
##                    estimate        se         lcl        ucl
## pi:(Intercept)  -8.4417218 22.762372 -53.0559720  36.172528
## p:(Intercept)   -4.4873156  1.173152  -6.7866943  -2.187937
## p:time2         -0.0207908  1.380878  -2.7273112   2.685729
## p:time3         -0.0197748  1.379503  -2.7236011   2.684051
## p:time4          1.9422153  1.039808  -0.0958078   3.980239
## p:time5          1.3742757  1.088836  -0.7598422   3.508394
## p:time6          1.6006807  1.065755  -0.4881987   3.689560
## p:time7          1.9423643  1.038675  -0.0934379   3.978167
## p:time8          2.0778711  1.030614   0.0578675   4.097875
## p:time9          1.6005070  1.066507  -0.4898477   3.690862
## p:time10         1.0842412  1.126221  -1.1231510   3.291633
```

```
## p:time11         2.5754908  1.007287   0.6012085   4.549773
## p:time12         2.4930979  1.010268   0.5129723   4.473224
## p:time13         1.9420147  1.038951  -0.0943298   3.978359
## p:time14         1.9418949  1.039701  -0.0959196   3.979709
## p:time15         1.7851008  1.050615  -0.2741041   3.844306
## p:time16         2.3060729  1.018401   0.3100063   4.302140
## p:time17       -49.7327700  0.000000 -49.7327700 -49.732770
## p:mixture2      -7.3401773 22.893736 -52.2119010  37.531547
## f0:(Intercept)  11.5621170 22.940518 -33.4012990  56.525533
##
##
## Real Parameter pi
##
##
## mixture:1 0.000215632
##
##
## Real Parameter p
##
##                        1            2            3            4            5
## mixture:1 1.112560e-02 1.089920e-02 1.091020e-02 7.275630e-02 4.257260e-02
## mixture:2 7.300993e-06 7.150767e-06 7.158037e-06 5.091625e-05 2.885446e-05
##                        6            7            8            9           10
## mixture:1 5.281820e-02 7.276640e-02 8.245530e-02 5.280950e-02 3.219950e-02
## mixture:2 3.618563e-05 5.092383e-05 5.831331e-05 3.617935e-05 2.159015e-05
##                       11           12           13           14           15
## mixture:1 1.287760e-01 1.198114e-01 7.274280e-02 7.273470e-02 6.284280e-02
## mixture:2 9.591022e-05 8.832536e-05 5.090603e-05 5.089994e-05 4.351366e-05
##                       16           17
## mixture:1 1.014476e-01 2.834758e-24
## mixture:2 7.326019e-05 1.839575e-27
##
##
## Real Parameter c
##
##                        2            3            4            5            6
## mixture:1 1.089920e-02 1.091020e-02 7.275630e-02 4.257260e-02 5.281820e-02
## mixture:2 7.150767e-06 7.158037e-06 5.091625e-05 2.885446e-05 3.618563e-05
##                        7            8            9           10           11
## mixture:1 7.276640e-02 8.245530e-02 5.280950e-02 3.219950e-02 1.287760e-01
## mixture:2 5.092383e-05 5.831331e-05 3.617935e-05 2.159015e-05 9.591022e-05
##                       12           13           14           15           16
## mixture:1 1.198114e-01 7.274280e-02 7.273470e-02 6.284280e-02 1.014476e-01
## mixture:2 8.832536e-05 5.090603e-05 5.089994e-05 4.351366e-05 7.326019e-05
##                       17
## mixture:1 2.834758e-24
## mixture:2 1.839575e-27
##
##
## Real Parameter f0
##
##         1
##  105042.1
##
```

```
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  37  (unadjusted=21)
## -2lnL:  -92.34232
## AICc :  -16.43588  (unadjusted=-49.7226)
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept)  -21.5585420  5538.012200 -1.087606e+04 10832.946000
## p:(Intercept)   -74.8374170     0.000000 -7.483742e+01   -74.837417
## p:mixture2       70.3601110     0.000000  7.036011e+01    70.360111
## p:time2           0.0112518     1.422383 -2.776618e+00     2.799122
## p:time3           0.0228159     1.422426 -2.765139e+00     2.810771
## p:time4           2.0538326     1.080294 -6.354380e-02     4.171209
## p:time5           1.5461671     1.129094 -6.668571e-01     3.759191
## p:time6           1.8383040     1.107161 -3.317325e-01     4.008341
## p:time7           2.2801440     1.081780  1.598548e-01     4.400433
## p:time8           2.5494653     1.074569  4.433095e-01     4.655621
## p:time9           2.1747869     1.109736 -2.960114e-04     4.349870
## p:time10          1.2993009     1.237878 -1.126941e+00     3.725543
## p:time11          3.2642868     1.062755  1.181287e+00     5.347287
## p:time12          3.6170827     1.068119  1.523569e+00     5.710597
## p:time13          3.2733122     1.108233  1.101175e+00     5.445450
## p:time14          3.8582522     1.109633  1.683371e+00     6.033133
## p:time15          3.6663614     1.171589  1.370048e+00     5.962675
## p:time16         40.9847310  9376.958500 -1.833785e+04 18419.824000
## p:time17        -21.9613520 10513.461000 -2.062835e+04 20584.423000
## c:(Intercept)    77.4849020     0.000000  7.748490e+01    77.484902
## c:mixture2     -114.8905100     0.000000 -1.148905e+02  -114.890510
## c:time3          -3.6837343     0.000000 -3.683734e+00    -3.683734
## c:time4          -7.1347998 10246.021000 -2.008933e+04 20075.066000
## c:time5          -9.9985027     0.000000 -9.998503e+00    -9.998503
## c:time6          -3.8141595  6272.721300 -1.229835e+04 12290.720000
## c:time7          -1.3694138     0.000000 -1.369414e+00    -1.369414
## c:time8         -11.2470790  1559.867300 -3.068587e+03  3046.093000
## c:time9         -26.9492880  3560.574500 -7.005675e+03  6951.776800
## c:time10         33.7679680     0.000000  3.376797e+01    33.767968
## c:time11         34.4351850     0.000000  3.443518e+01    34.435185
## c:time12         33.4737500     0.000000  3.347375e+01    33.473750
## c:time13         33.2784200     0.000000  3.327842e+01    33.278420
## c:time14        -31.5681200 29258.230000 -5.737770e+04 57314.564000
## c:time15         33.7947160     0.000000  3.379472e+01    33.794716
## c:time16         33.0364670     0.000000  3.303647e+01    33.036467
## c:time17        -29.2254760 20756.329000 -4.071163e+04 40653.180000
## f0:(Intercept)  -25.3931880     0.000000 -2.539319e+01   -25.393188
##
##
## Real Parameter pi
##
##
## mixture:1 4.337549e-10
##
##
```

```
## Real Parameter p
##
##                     1          2            3            4            5
## mixture:1 3.15154e-33 3.1872e-33 3.224271e-33 2.457485e-32 1.479158e-32
## mixture:2 1.12363e-02 1.1362e-02 1.149260e-02 8.140020e-02 5.063560e-02
##                      6            7            8            9           10
## mixture:1 1.981016e-32 3.081603e-32 4.034052e-32 2.773452e-32 1.155585e-32
## mixture:2 6.667010e-02 1.000057e-01 1.269898e-01 9.091460e-02 4.000190e-02
##                     11           12           13           14           15
## mixture:1 8.244883e-32 1.173280e-31 8.319633e-32 1.493277e-31 1.232546e-31
## mixture:2 2.291674e-01 2.972928e-01 2.307656e-01 3.499968e-01 3.076893e-01
##                     16           17
## mixture:1 1.985936e-15 9.137532e-43
## mixture:2 1.000000e+00 3.294861e-12
##
##
## Real Parameter c
##
##                      2            3            4            5            6
## mixture:1 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00
## mixture:2 5.687889e-17 1.429307e-18 4.532595e-20 2.586167e-21 1.254535e-18
##                     7            8            9        10        11        12
## mixture:1 1.00000e+00 1.000000e+00 1.000000e+00 1.0000000 1.0000000 1.0000000
## mixture:2 1.44618e-17 7.420046e-22 1.124668e-28 0.0256397 0.0487801 0.0192302
##                    13           14        15        16           17
## mixture:1 1.0000000 1.000000e+00 1.0000000 1.0000000 1.00000e+00
## mixture:2 0.0158722 1.109407e-30 0.0263165 0.0125038 1.15475e-29
##
##
## Real Parameter f0
##
##          1
##  9.373e-12
##
## 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)  2.816400e-03    0.0000000     0.0028164    0.0028164
## p:(Intercept)  -6.223733e+00    0.9067529    -8.0009688   -4.4464975
## p:time2         5.414348e-05    0.3448572    -0.6758660    0.6759743
## p:time3         8.734052e-05    1.3097508    -2.5670242    2.5671989
## p:time4         1.957935e+00    0.9264025     0.1421864    3.7736842
## p:time5         1.392319e+00    0.9825195    -0.5334192    3.3180573
## p:time6         1.617461e+00    0.9567389    -0.2577475    3.4926692
## p:time7         1.957938e+00    0.9264032     0.1421881    3.7736885
## p:time8         2.093477e+00    0.9167201     0.2967055    3.8902484
## p:time9         1.617462e+00    0.9567391    -0.2577467    3.4926707
## p:time10        1.102647e+00    1.0240452    -0.9044813    3.1097759
```

```
## p:time11        2.589087e+00    0.8901493     0.8443940    4.3337794
## p:time12        2.507016e+00    0.8937343     0.7552963    4.2587349
## p:time13        1.957939e+00    0.9264026     0.1421897    3.7736881
## p:time14        1.957938e+00    0.9264028     0.1421882    3.7736871
## p:time15        1.801782e+00    0.9661624    -0.0918965    3.6954601
## p:time16        2.320649e+00    0.9029945     0.5507796    4.0905180
## p:time17       -1.401296e+01 1246.9369000 -2458.0093000 2429.9834000
## f0:(Intercept)  6.032009e+00    0.4002792     5.2474617    6.8165564
##
##
## Real Parameter pi
##
##
## mixture:1 0.5007041
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0019779 0.001978 0.0019781 0.0138462 0.0079121 0.0098902 0.0138463
## mixture:2 0.0019779 0.001978 0.0019781 0.0138462 0.0079121 0.0098902 0.0138463
##                    8         9        10        11        12        13        14
## mixture:1 0.0158243 0.0098902 0.0059341 0.0257146 0.0237365 0.0138463 0.0138463
## mixture:2 0.0158243 0.0098902 0.0059341 0.0257146 0.0237365 0.0138463 0.0138463
##                   15        16           17
## mixture:1 0.0118682 0.0197804 1.626735e-09
## mixture:2 0.0118682 0.0197804 1.626735e-09
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.001978 0.0019781 0.0138462 0.0079121 0.0098902 0.0138463 0.0158243
## mixture:2 0.001978 0.0019781 0.0138462 0.0079121 0.0098902 0.0138463 0.0158243
##                    9        10        11        12        13        14        15
## mixture:1 0.0098902 0.0059341 0.0257146 0.0237365 0.0138463 0.0138463 0.0118682
## mixture:2 0.0098902 0.0059341 0.0257146 0.0237365 0.0138463 0.0138463 0.0118682
##                   16           17
## mixture:1 0.0197804 1.626735e-09
## mixture:2 0.0197804 1.626735e-09
##
##
## Real Parameter f0
##
##         1
##  416.5511
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~time)f0(~1)
##
## Npar :  35  (unadjusted=21)
## -2lnL:  -92.34232
## AICc :  -20.63616  (unadjusted=-49.7226)
##
```

```
## Beta
##                       estimate           se           lcl          ucl
## pi:(Intercept) -6.960094e-04   370.809470 -7.267873e+02   726.785880
## p:(Intercept)  -4.477414e+00     1.005699 -6.448584e+00    -2.506245
## p:time2         1.153000e-02     1.422284 -2.776146e+00     2.799206
## p:time3         2.303120e-02     1.422351 -2.764778e+00     2.810840
## p:time4         2.053928e+00     1.080249 -6.336080e-02     4.171217
## p:time5         1.546279e+00     1.129048 -6.666550e-01     3.759212
## p:time6         1.838398e+00     1.107117 -3.315514e-01     4.008347
## p:time7         2.280187e+00     1.081740  1.599779e-01     4.400397
## p:time8         2.549514e+00     1.074529  4.434371e-01     4.655590
## p:time9         2.174819e+00     1.109699 -1.903759e-04     4.349829
## p:time10        1.299342e+00     1.237849 -1.126842e+00     3.725527
## p:time11        3.264379e+00     1.062717  1.181455e+00     5.347304
## p:time12        3.617237e+00     1.068082  1.523796e+00     5.710678
## p:time13        3.273464e+00     1.108194  1.101403e+00     5.445525
## p:time14        3.858387e+00     1.109599  1.683573e+00     6.033200
## p:time15        3.666494e+00     1.171554  1.370248e+00     5.962740
## p:time16        2.243460e+01  2560.288700 -4.995731e+03  5040.600600
## p:time17        4.227415e+00     0.000000  4.227415e+00     4.227415
## c:(Intercept)  -1.565729e+01     0.000000 -1.565729e+01   -15.657291
## c:time3        -5.608804e+00  3589.457300 -7.040945e+03  7029.727700
## c:time4        -6.829623e+00  3988.701500 -7.824685e+03  7811.025400
## c:time5        -7.910256e+00  2925.844200 -5.742565e+03  5726.744500
## c:time6        -8.796218e+00  3511.374000 -6.891089e+03  6873.497000
## c:time7        -1.128517e+01  4323.730400 -8.485797e+03  8463.226500
## c:time8        -1.141821e+01  4093.163700 -8.034019e+03  8011.182800
## c:time9        -6.969814e+00  2228.292700 -4.374424e+03  4360.484000
## c:time10        1.201969e+01     0.000000  1.201969e+01    12.019688
## c:time11        1.268688e+01     0.000000  1.268688e+01    12.686883
## c:time12        1.172545e+01     0.000000  1.172545e+01    11.725450
## c:time13        1.153016e+01     0.000000  1.153016e+01    11.530159
## c:time14       -1.023400e+01  4000.753500 -7.851711e+03  7831.243100
## c:time15        1.204637e+01     0.000000  1.204637e+01    12.046369
## c:time16        1.128782e+01     0.000000  1.128782e+01    11.287815
## c:time17       -1.019283e+01  6162.823100 -1.208933e+04 12068.941000
## f0:(Intercept) -2.885665e+01 15378.646000 -3.017100e+04 30113.290000
##
##
## Real Parameter pi
##
##
## mixture:1 0.499826
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0112351 0.0113639 0.0114938 0.0813992 0.0506357 0.0666692 0.0999998
## mixture:2 0.0112351 0.0113639 0.0114938 0.0813992 0.0506357 0.0666692 0.0999998
##                    8         9        10        11        12        13        14
## mixture:1 0.1269832 0.0909083 0.0399993 0.2291645 0.2973023 0.2307733 0.3500027
## mixture:2 0.1269832 0.0909083 0.0399993 0.2291645 0.2973023 0.2307733 0.3500027
##                   15 16        17
```

```
## mixture:1 0.3076944  1 0.4378238
## mixture:2 0.3076944  1 0.4378238
##
##
## Real Parameter c
##
##                      2            3            4            5          6
## mixture:1 1.585348e-07 5.811015e-10 1.714183e-10 5.817608e-11 2.3987e-11
## mixture:2 1.585348e-07 5.811015e-10 1.714183e-10 5.817608e-11 2.3987e-11
##                      7            8            9        10        11        12
## mixture:1 1.990839e-12 1.742839e-12 1.489955e-10 0.0256406 0.0487808 0.0192305
## mixture:2 1.990839e-12 1.742839e-12 1.489955e-10 0.0256406 0.0487808 0.0192305
##                 13           14        15        16           17
## mixture:1 0.015873 5.695815e-12 0.0263157 0.0124996 5.935214e-12
## mixture:2 0.015873 5.695815e-12 0.0263157 0.0124996 5.935214e-12
##
##
## Real Parameter f0
##
##             1
##  2.935729e-13
```

Examine model-selection table

```
iguane.results
```

```
##                                             model npar      AICc DeltaAICc
## 5                pi(~1)p(~time + mixture)c()f0(~1)   20 -40.84409  0.000000
## 7                          pi(~1)p(~time)c()f0(~1)   19 -38.95454  1.889551
## 3                       pi(~1)p(~mixture)c()f0(~1)    4 -24.66852 16.175568
## 2                           pi(~1)p(~1)c(~1)f0(~1)    4 -23.47347 17.370613
## 1                             pi(~1)p(~1)c()f0(~1)    3 -22.84464 17.999448
## 8                      pi(~1)p(~time)c(~time)f0(~1)   35 -20.63616 20.207930
## 4                 pi(~1)p(~mixture)c(~mixture)f0(~1)    6 -19.15595 21.688136
## 6 pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   37 -16.43588 24.408209
##         weight  Deviance
## 5 7.197185e-01  53.63101
## 7 2.798027e-01  57.57452
## 3 2.211479e-04 102.34305
## 2 1.216696e-04 103.53810
## 1 8.884484e-05 106.17755
## 8 2.944871e-05  42.69578
## 4 1.404895e-05 103.82637
## 6 3.605682e-06  42.69578
```

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

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

```
##                  estimate           se          lcl          ucl fixed note
## pi g1 m1    2.156320e-04 4.907200e-03 9.079967e-24 1.000000e+00
## p g1 t1 m1  1.112560e-02 1.290690e-02 1.127400e-03 1.008390e-01
## p g1 t2 m1  1.089920e-02 1.294820e-02 1.045500e-03 1.039598e-01
## p g1 t3 m1  1.091020e-02 1.295220e-02 1.048200e-03 1.039052e-01
## p g1 t4 m1  7.275630e-02 5.231150e-02 1.687490e-02 2.639976e-01
## p g1 t5 m1  4.257260e-02 3.422080e-02 8.504700e-03 1.873244e-01
## p g1 t6 m1  5.281820e-02 4.051920e-02 1.127220e-02 2.143020e-01
## p g1 t7 m1  7.276640e-02 5.231130e-02 1.688070e-02 2.639881e-01
## p g1 t8 m1  8.245530e-02 5.783820e-02 1.968850e-02 2.867842e-01
## p g1 t9 m1  5.280950e-02 4.051780e-02 1.126810e-02 2.143049e-01
## p g1 t10 m1 3.219950e-02 2.763820e-02 5.815500e-03 1.591255e-01
## p g1 t11 m1 1.287760e-01 8.251050e-02 3.378800e-02 3.845285e-01
## p g1 t12 m1 1.198114e-01 7.795660e-02 3.097510e-02 3.669489e-01
## p g1 t13 m1 7.274280e-02 5.229760e-02 1.687400e-02 2.639308e-01
## p g1 t14 m1 7.273470e-02 5.229830e-02 1.686910e-02 2.639418e-01
## p g1 t15 m1 6.284280e-02 4.651700e-02 1.405920e-02 2.397386e-01
## p g1 t16 m1 1.014476e-01 6.829670e-02 2.533930e-02 3.289908e-01
## p g1 t17 m1 2.834758e-24 0.000000e+00 2.834758e-24 2.834758e-24
## p g1 t1 m2  7.300993e-06 1.674306e-04 2.201056e-25 1.000000e+00
## p g1 t2 m2  7.150767e-06 1.645217e-04 1.861161e-25 1.000000e+00
## p g1 t3 m2  7.158037e-06 1.646881e-04 1.863476e-25 1.000000e+00
## p g1 t4 m2  5.091625e-05 1.169300e-03 1.436296e-24 1.000000e+00
## p g1 t5 m2  2.885446e-05 6.627154e-04 8.115411e-25 1.000000e+00
## p g1 t6 m2  3.618563e-05 8.310503e-04 1.019837e-24 1.000000e+00
## p g1 t7 m2  5.092383e-05 1.169400e-03 1.438878e-24 1.000000e+00
## p g1 t8 m2  5.831331e-05 1.339100e-03 1.647924e-24 1.000000e+00
## p g1 t9 m2  3.617935e-05 8.309211e-04 1.018822e-24 1.000000e+00
## p g1 t10 m2 2.159015e-05 4.959435e-04 6.035114e-25 1.000000e+00
## p g1 t11 m2 9.591022e-05 2.202300e-03 2.717306e-24 1.000000e+00
## p g1 t12 m2 8.832536e-05 2.028200e-03 2.501380e-24 1.000000e+00
## p g1 t13 m2 5.090603e-05 1.169100e-03 1.437765e-24 1.000000e+00
## p g1 t14 m2 5.089994e-05 1.168900e-03 1.436280e-24 1.000000e+00
## p g1 t15 m2 4.351366e-05 9.992742e-04 1.230053e-24 1.000000e+00
## p g1 t16 m2 7.326019e-05 1.682300e-03 2.072753e-24 1.000000e+00
## p g1 t17 m2 1.839575e-27 0.000000e+00 1.839575e-27 1.839575e-27
## f0 g1 a0 t1 1.050421e+05 2.409721e+06 7.767979e+02 1.420427e+07
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 105131.1 865.7979 14204363
```

Autre modèle.

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

```
##                  estimate           se           lcl          ucl fixed note
## pi g1 m1    5.007041e-01 0.000000e+00  5.007041e-01 5.007041e-01
## p g1 t1 m1  1.977900e-03 1.789900e-03  3.350255e-04 1.158380e-02
## p g1 t2 m1  1.978000e-03 1.269500e-03  5.616485e-04 6.941400e-03
## p g1 t3 m1  1.978100e-03 2.081100e-03  2.510067e-04 1.540540e-02
## p g1 t4 m1  1.384620e-02 6.918400e-03  5.174300e-03 3.651890e-02
## p g1 t5 m1  7.912100e-03 4.726100e-03  2.444400e-03 2.530020e-02
## p g1 t6 m1  9.890200e-03 5.478100e-03  3.325700e-03 2.903480e-02
## p g1 t7 m1  1.384630e-02 6.918400e-03  5.174300e-03 3.651900e-02
## p g1 t8 m1  1.582430e-02 7.618700e-03  6.125900e-03 4.025500e-02
## p g1 t9 m1  9.890200e-03 5.478100e-03  3.325700e-03 2.903480e-02
## p g1 t10 m1 5.934100e-03 3.936800e-03  1.611200e-03 2.160450e-02
## p g1 t11 m1 2.571460e-02 1.102190e-02  1.102040e-02 5.883590e-02
## p g1 t12 m1 2.373650e-02 1.035010e-02  1.002960e-02 5.513280e-02
## p g1 t13 m1 1.384630e-02 6.918400e-03  5.174300e-03 3.651900e-02
## p g1 t14 m1 1.384630e-02 6.918400e-03  5.174300e-03 3.651890e-02
## p g1 t15 m1 1.186820e-02 6.178000e-03  4.258900e-03 3.262770e-02
## p g1 t16 m1 1.978040e-02 8.995100e-03  8.062900e-03 4.770730e-02
## p g1 t17 m1 1.626735e-09 2.028436e-06 -3.974108e-06 3.977362e-06
## f0 g1 a0 t1 4.165511e+02 1.667367e+02  1.956687e+02 8.867784e+02
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 505.5511 284.6687 975.7784
```

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

  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) -0.0002200546  0 -0.0002200546 -0.0002200546
## p:(Intercept)  -3.9795876000  0 -3.9795876000 -3.9795876000
## f0:(Intercept)  5.2681862000  0  5.2681862000  5.2681862000
##
##
## Real Parameter pi
##
##
## mixture:1 0.499945
##
##
## 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
##  194.0636
##
## 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)  0.0012638  0  0.0012638  0.0012638
## p:(Intercept)  -6.1996050  0 -6.1996050 -6.1996050
## c:(Intercept)  -3.9300430  0 -3.9300430 -3.9300430
## f0:(Intercept)  7.6265388  0  7.6265388  7.6265388
##
##
## Real Parameter pi
##
##
## mixture:1 0.500316
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0020261 0.0020261 0.0020261 0.0020261 0.0020261 0.0020261 0.0020261
## mixture:2 0.0020261 0.0020261 0.0020261 0.0020261 0.0020261 0.0020261 0.0020261
##                    8         9        10        11        12        13        14
## mixture:1 0.0020261 0.0020261 0.0020261 0.0020261 0.0020261 0.0020261 0.0020261
## mixture:2 0.0020261 0.0020261 0.0020261 0.0020261 0.0020261 0.0020261 0.0020261
##                   15        16        17
## mixture:1 0.0020261 0.0020261 0.0020261
## mixture:2 0.0020261 0.0020261 0.0020261
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644
## mixture:2 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644
##                    9        10        11        12        13        14        15
## mixture:1 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644
## mixture:2 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644
##                   16        17
```

```
## mixture:1 0.0192644 0.0192644
## mixture:2 0.0192644 0.0192644
##
##
## Real Parameter f0
##
##         1
##  2051.936
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  45.30694
## AICc :  53.33975  (unadjusted=49.316765)
##
## Beta
##                   estimate           se          lcl         ucl
## pi:(Intercept) -16.961091 1839.2150000 -3621.822500 3587.900300
## p:(Intercept)   -2.558879    0.0000000    -2.558879   -2.558879
## p:mixture2      -1.420709    0.0000000    -1.420709   -1.420709
## f0:(Intercept)   5.268187    0.3701059     4.542780    5.993595
##
##
## Real Parameter pi
##
##
## mixture:1 4.304194e-08
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0718322 0.0718322 0.0718322 0.0718322 0.0718322 0.0718322 0.0718322
## 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 0.0718322 0.0718322 0.0718322 0.0718322 0.0718322 0.0718322 0.0718322
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                   15        16        17
## mixture:1 0.0718322 0.0718322 0.0718322
## mixture:2 0.0183503 0.0183503 0.0183503
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0718322 0.0718322 0.0718322 0.0718322 0.0718322 0.0718322 0.0718322
## 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 0.0718322 0.0718322 0.0718322 0.0718322 0.0718322 0.0718322 0.0718322
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                   16        17
## mixture:1 0.0718322 0.0718322
## mixture:2 0.0183503 0.0183503
```

```
##
##
## Real Parameter f0
##
##         1
##  194.0639
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6  (unadjusted=2)
## -2lnL:  44.81137
## AICc :  56.8804  (unadjusted=48.821203)
##
## Beta
##                   estimate        se        lcl       ucl
## pi:(Intercept)  -6.103775 159.53311 -318.78867 306.58112
## p:(Intercept)  -19.907898   0.00000  -19.90790 -19.90790
## p:mixture2      13.716558   0.00000   13.71656  13.71656
## c:(Intercept)   16.911333   0.00000   16.91133  16.91133
## c:mixture2     -20.841690   0.00000  -20.84169 -20.84169
## f0:(Intercept)   7.620482  11.97765  -15.85570  31.09667
##
##
## Real Parameter pi
##
##
## mixture:1 0.0022294
##
##
## Real Parameter p
##
##                        1            2            3            4            5
## mixture:1 2.260007e-09 2.260007e-09 2.260007e-09 2.260007e-09 2.260007e-09
## mixture:2 2.042900e-03 2.042900e-03 2.042900e-03 2.042900e-03 2.042900e-03
##                        6            7            8            9           10
## mixture:1 2.260007e-09 2.260007e-09 2.260007e-09 2.260007e-09 2.260007e-09
## mixture:2 2.042900e-03 2.042900e-03 2.042900e-03 2.042900e-03 2.042900e-03
##                       11           12           13           14           15
## mixture:1 2.260007e-09 2.260007e-09 2.260007e-09 2.260007e-09 2.260007e-09
## mixture:2 2.042900e-03 2.042900e-03 2.042900e-03 2.042900e-03 2.042900e-03
##                       16           17
## mixture:1 2.260007e-09 2.260007e-09
## mixture:2 2.042900e-03 2.042900e-03
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## mixture:2 0.0192585 0.0192585 0.0192585 0.0192585 0.0192585 0.0192585 0.0192585
##                    9        10        11        12        13        14        15
## mixture:1 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## mixture:2 0.0192585 0.0192585 0.0192585 0.0192585 0.0192585 0.0192585 0.0192585
```

```
##                   16        17
## mixture:1 1.0000000 1.0000000
## mixture:2 0.0192585 0.0192585
##
##
## Real Parameter f0
##
##         1
##  2039.545
##
## 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=46.266615)
##
## Beta
##                   estimate           se           lcl           ucl
## pi:(Intercept) -28.551040 1.379600e+06 -2.704045e+06  2.703988e+06
## p:(Intercept)  -30.849006 0.000000e+00 -3.084901e+01 -3.084901e+01
## p:time2         29.423813 6.364907e-01  2.817629e+01  3.067133e+01
## p:time3         28.301683 7.919900e-01  2.674938e+01  2.985398e+01
## p:time4         28.593209 4.440529e-01  2.772286e+01  2.946355e+01
## p:time5         29.302057 6.472939e-01  2.803336e+01  3.057075e+01
## p:time6         29.006508 6.786902e-01  2.767628e+01  3.033674e+01
## p:time7         29.006503 6.786907e-01  2.767627e+01  3.033674e+01
## p:time8         27.892380 8.910059e-01  2.614601e+01  2.963875e+01
## p:time9         28.820271 7.028089e-01  2.744277e+01  3.019778e+01
## p:time10        27.195435 1.418899e+00  2.441439e+01  2.997648e+01
## p:time11        28.820290 5.964546e-01  2.765124e+01  2.998934e+01
## p:time12        28.820283 7.028072e-01  2.744278e+01  3.019778e+01
## p:time13        29.423800 6.364919e-01  2.817628e+01  3.067132e+01
## p:time14        28.593279 7.375074e-01  2.714776e+01  3.003879e+01
## p:time15        29.006509 5.879929e-01  2.785404e+01  3.015898e+01
## p:time16        29.423813 6.364907e-01  2.817629e+01  3.067133e+01
## p:time17        27.195331 1.137504e+00  2.496582e+01  2.942484e+01
## p:mixture2      -1.907450 0.000000e+00 -1.907450e+00 -1.907450e+00
## f0:(Intercept)   5.242344 3.710669e-01  4.515053e+00  5.969635e+00
##
##
## Real Parameter pi
##
##
## mixture:1 3.985116e-13
##
##
## Real Parameter p
##
##                       1         2         3         4         5         6
## mixture:1 4.003565e-14 0.1938488 0.0726065 0.0948506 0.1755274 0.1367562
## mixture:2 5.943632e-15 0.0344682 0.0114894 0.0153186 0.0306380 0.0229785
##                    7         8         9        10        11        12        13
## mixture:1 0.1367556 0.0494243 0.1162188 0.0252447 0.1162207 0.1162200 0.1938467
```

```
## mixture:2 0.0229784 0.0076598 0.0191487 0.0038301 0.0191491 0.0191489 0.0344677
##                  14        15        16        17
## mixture:1 0.0948566 0.1367562 0.1938488 0.0252421
## mixture:2 0.0153197 0.0229786 0.0344682 0.0038297
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.1938488 0.0726065 0.0948506 0.1755274 0.1367562 0.1367556 0.0494243
## mixture:2 0.0344682 0.0114894 0.0153186 0.0306380 0.0229785 0.0229784 0.0076598
##                   9        10        11        12        13        14        15
## mixture:1 0.1162188 0.0252447 0.1162207 0.1162200 0.1938467 0.0948566 0.1367562
## mixture:2 0.0191487 0.0038301 0.0191491 0.0191489 0.0344677 0.0153197 0.0229786
##                  16        17
## mixture:1 0.1938488 0.0252421
## mixture:2 0.0344682 0.0038297
##
##
## Real Parameter f0
##
##         1
##  189.1129
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  37  (unadjusted=22)
## -2lnL:  -12.74982
## AICc :  63.62118  (unadjusted=32.092813)
##
## Beta
##                  estimate         se          lcl         ucl
## pi:(Intercept) -17.46364   718.1631  -1425.06340  1390.13610
## p:(Intercept)  -88.73055     0.0000    -88.73055   -88.73055
## p:mixture2      57.46481     0.0000     57.46481    57.46481
## p:time2         29.31939     0.0000     29.31939    29.31939
## p:time3         27.84923     0.0000     27.84923    27.84923
## p:time4         28.60935     0.0000     28.60935    28.60935
## p:time5         29.45296     0.0000     29.45296    29.45296
## p:time6         29.09145     0.0000     29.09145    29.09145
## p:time7         29.21206     0.0000     29.21206    29.21206
## p:time8         28.34930     0.0000     28.34930    28.34930
## p:time9         28.40437     0.0000     28.40437    28.40437
## p:time10        27.74175     0.0000     27.74175    27.74175
## p:time11        29.50851     0.0000     29.50851    29.50851
## p:time12        29.69761     0.0000     29.69761    29.69761
## p:time13        30.57264     0.0000     30.57264    30.57264
## p:time14        30.16725     0.0000     30.16725    30.16725
## p:time15        30.57268     0.0000     30.57268    30.57268
## p:time16        33.20996     0.0000     33.20996    33.20996
## p:time17        70.73235 24100.3450 -47165.94400 47307.40900
## c:(Intercept)   54.28718     0.0000     54.28718    54.28718
## c:mixture2     -80.12689     0.0000    -80.12689   -80.12689
```

```
## c:time3         23.76033     0.0000     23.76033    23.76033
## c:time4        -11.54035  2701.8423  -5307.15130  5284.07060
## c:time5        -11.57758  5823.1044 -11424.86200 11401.70700
## c:time6         22.74757     0.0000     22.74757    22.74757
## c:time7         22.54374     0.0000     22.54374    22.54374
## c:time8        -12.12884   453.6652   -901.31270   877.05502
## c:time9         23.47207     0.0000     23.47207    23.47207
## c:time10       -12.64978  7437.2018 -14589.56600 14564.26600
## c:time11       -12.77892     0.0000    -12.77892   -12.77892
## c:time12       -13.40620     0.0000    -13.40620   -13.40620
## c:time13        21.98973     0.0000     21.98973    21.98973
## c:time14       -14.28708     0.0000    -14.28708   -14.28708
## c:time15        22.47246     0.0000     22.47246    22.47246
## c:time16        22.40578     0.0000     22.40578    22.40578
## c:time17       -16.74227     0.0000    -16.74227   -16.74227
## f0:(Intercept) -23.06327     0.0000    -23.06327   -23.06327
##
##
## Real Parameter pi
##
##
## mixture:1 2.603977e-08
##
##
## Real Parameter p
##
##                        1            2            3            4            5
## mixture:1 2.916147e-39 1.577819e-26 3.627224e-27 7.756956e-27 1.803300e-26
## mixture:2 2.639116e-14 1.249507e-01 3.178310e-02 6.559570e-02 1.403017e-01
##                        6            7            8            9           10
## mixture:1 1.256221e-26 1.417242e-26 5.980711e-27 6.319346e-27 3.257611e-27
## mixture:2 1.020825e-01 1.136799e-01 5.134630e-02 5.409640e-02 2.863710e-02
##                       11           12           13           14           15
## mixture:1 1.906315e-26 2.303131e-26 5.525063e-26 3.683667e-26 5.525323e-26
## mixture:2 1.471373e-01 1.724825e-01 3.333416e-01 2.500219e-01 3.333521e-01
##                       16           17
## mixture:1 7.721649e-25 1.525728e-08
## mixture:2 8.748138e-01 1.000000e+00
##
##
## Real Parameter c
##
##                       2         3            4            5         6         7
## mixture:1 1.00000e+00 1.0000000 1.000000e+00 1.000000e+00 1.0000000 1.0000000
## mixture:2 5.99732e-12 0.1111176 5.835083e-17 5.621815e-17 0.0434329 0.0357096
##                        8         9           10           11          12
## mixture:1 1.000000e+00 1.0000000 1.000000e+00 1.000000e+00 1.00000e+00
## mixture:2 3.239431e-17 0.0856737 1.924102e-17 1.691002e-17 9.03068e-18
##                   13          14        15        16          17
## mixture:1 1.0000000 1.00000e+00 1.0000000 1.0000000 1.000000e+00
## mixture:2 0.0208367 3.74245e-18 0.0333349 0.0312518 3.212794e-19
##
##
## Real Parameter f0
```

```
##
##             1
##  9.632713e-11
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  19  (unadjusted=17)
## -2lnL:  11.75916
## AICc :  50.39039  (unadjusted=46.266619)
##
## Beta
##                   estimate           se           lcl           ucl
## pi:(Intercept)  -0.001299 7.218119e+04 -1.414751e+05 141475.140000
## p:(Intercept)  -18.716005 2.062574e+00 -2.275865e+01    -14.673360
## p:time2         15.383390 2.070357e+00  1.132549e+01     19.441290
## p:time3         14.261257 2.123365e+00  1.009946e+01     18.423052
## p:time4         14.552821 2.103646e+00  1.042967e+01     18.675967
## p:time5         15.261649 2.073710e+00  1.119718e+01     19.326121
## p:time6         14.966096 1.985914e+00  1.107370e+01     18.858488
## p:time7         14.966096 1.985914e+00  1.107370e+01     18.858487
## p:time8         13.851925 1.846978e+00  1.023185e+01     17.472002
## p:time9         14.779862 2.091724e+00  1.068008e+01     18.879641
## p:time10        13.154926 2.796124e+00  7.674523e+00     18.635330
## p:time11        14.779862 2.091724e+00  1.068008e+01     18.879641
## p:time12        14.779862 2.203818e+00  1.046038e+01     19.099345
## p:time13        15.383390 2.006154e+00  1.145133e+01     19.315452
## p:time14        14.552821 2.243573e+00  1.015542e+01     18.950224
## p:time15        14.966096 2.177174e+00  1.069883e+01     19.233357
## p:time16        15.383390 2.006154e+00  1.145133e+01     19.315452
## p:time17        13.154926 2.274948e+00  8.696028e+00     17.613823
## f0:(Intercept)   5.242294 3.710687e-01  4.514999e+00      5.969589
##
##
## Real Parameter pi
##
##
## mixture:1 0.4996752
##
##
## Real Parameter p
##
##                     1         2         3         4         5         6
## mixture:1 7.4429e-09 0.0344691 0.0114897 0.0153196 0.0306392 0.0229794
## mixture:2 7.4429e-09 0.0344691 0.0114897 0.0153196 0.0306392 0.0229794
##                     7         8         9        10        11        12        13
## mixture:1 0.0229794 0.0076598 0.0191495 0.0038299 0.0191495 0.0191495 0.0344691
## mixture:2 0.0229794 0.0076598 0.0191495 0.0038299 0.0191495 0.0191495 0.0344691
##                    14        15        16        17
## mixture:1 0.0153196 0.0229794 0.0344691 0.0038299
## mixture:2 0.0153196 0.0229794 0.0344691 0.0038299
##
##
## Real Parameter c
```

```
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0344691 0.0114897 0.0153196 0.0306392 0.0229794 0.0229794 0.0076598
## mixture:2 0.0344691 0.0114897 0.0153196 0.0306392 0.0229794 0.0229794 0.0076598
##                    9        10        11        12        13        14        15
## mixture:1 0.0191495 0.0038299 0.0191495 0.0191495 0.0344691 0.0153196 0.0229794
## mixture:2 0.0191495 0.0038299 0.0191495 0.0191495 0.0344691 0.0153196 0.0229794
##                   16        17
## mixture:1 0.0344691 0.0038299
## mixture:2 0.0344691 0.0038299
##
##
## Real Parameter f0
##
##         1
##  189.1034
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~time)f0(~1)
##
## Npar :  35  (unadjusted=22)
## -2lnL:  -12.74985
## AICc :  59.37137  (unadjusted=32.092785)
##
## Beta
##                     estimate        se           lcl           ucl
## pi:(Intercept)    0.0016055     0.000  1.605500e-03     0.0016055
## p:(Intercept)   -57.5452590     0.000 -5.754526e+01   -57.5452590
## p:time2          55.5993180     0.000  5.559932e+01    55.5993180
## p:time3          54.1274880     0.000  5.412749e+01    54.1274880
## p:time4          54.8885630     0.000  5.488856e+01    54.8885630
## p:time5          55.7329280     0.000  5.573293e+01    55.7329280
## p:time6          55.3705360     0.000  5.537054e+01    55.3705360
## p:time7          55.4912040     0.000  5.549120e+01    55.4912040
## p:time8          54.6276680     0.000  5.462767e+01    54.6276680
## p:time9          54.6830890     0.000  5.468309e+01    54.6830890
## p:time10         54.0188940     0.000  5.401889e+01    54.0188940
## p:time11         55.7875010     0.000  5.578750e+01    55.7875010
## p:time12         55.9765870     0.000  5.597659e+01    55.9765870
## p:time13         56.8520880     0.000  5.685209e+01    56.8520880
## p:time14         56.4465840     0.000  5.644658e+01    56.4465840
## p:time15         56.8520790     0.000  5.685208e+01    56.8520790
## p:time16         59.4911070     0.000  5.949111e+01    59.4911070
## p:time17         78.5744920     0.000  7.857449e+01    78.5744920
## c:(Intercept)   -33.6419580     0.000 -3.364196e+01   -33.6419580
## c:time3          31.5625900     0.000  3.156259e+01    31.5625900
## c:time4         -24.6866640     0.000 -2.468666e+01   -24.6866640
## c:time5         -18.0377230     0.000 -1.803772e+01   -18.0377230
## c:time6          30.5508980     0.000  3.055090e+01    30.5508980
## c:time7          30.3460990     0.000  3.034610e+01    30.3460990
## c:time8         -33.6124750  7423.716 -1.458410e+04 14516.8710000
## c:time9          31.2749040     0.000  3.127490e+01    31.2749040
## c:time10        -32.7067770     0.000 -3.270678e+01   -32.7067770
## c:time11        -32.3479800     0.000 -3.234798e+01   -32.3479800
```

```
## c:time12       -31.6065740     0.000 -3.160657e+01   -31.6065740
## c:time13        29.7918900     0.000  2.979189e+01    29.7918900
## c:time14       -37.2971780     0.000 -3.729718e+01   -37.2971780
## c:time15        30.2746400     0.000  3.027464e+01    30.2746400
## c:time16        30.2080920     0.000  3.020809e+01    30.2080920
## c:time17       -37.3384180 18713.782 -3.671635e+04 36641.6750000
## f0:(Intercept) -20.3765650  5217.200 -1.024609e+04 10205.3370000
##
##
## Real Parameter pi
##
##
## mixture:1 0.5004014
##
##
## Real Parameter p
##
##                      1         2         3         4         5         6
## mixture:1 1.019557e-25 0.1249966 0.0317447 0.0655775 0.1403566 0.1020435
## mixture:2 1.019557e-25 0.1249966 0.0317447 0.0655775 0.1403566 0.1020435
##                    7         8         9        10        11        12        13
## mixture:1 0.1136433 0.0512908 0.0540557 0.0285713 0.1470713 0.1724059 0.3333282
## mixture:2 0.1136433 0.0512908 0.0540557 0.0285713 0.1470713 0.1724059 0.3333282
##                   14        15        16 17
## mixture:1 0.2499882 0.3333262 0.8749932  1
## mixture:2 0.2499882 0.3333262 0.8749932  1
##
##
## Real Parameter c
##
##                      2         3            4            5         6         7
## mixture:1 2.45179e-15 0.1111183 4.658021e-26 3.595835e-23 0.0434775 0.0357135
## mixture:2 2.45179e-15 0.1111183 4.658021e-26 3.595835e-23 0.0434775 0.0357135
##                      8         9           10           11           12
## mixture:1 6.191145e-30 0.0857197 1.531477e-29 2.192472e-29 4.601744e-29
## mixture:2 6.191145e-30 0.0857197 1.531477e-29 2.192472e-29 4.601744e-29
##                    13           14        15        16           17
## mixture:1 0.0208349 1.554264e-31 0.0333326 0.0312537 1.491469e-31
## mixture:2 0.0208349 1.554264e-31 0.0333326 0.0312537 1.491469e-31
##
##
## Real Parameter f0
##
##             1
##  1.414394e-09
```

Examine model-selection table

```
iguane.results
```

```
##                                          model npar     AICc  DeltaAICc
## 7                       pi(~1)p(~time)c()f0(~1)   19 50.39039  0.0000000
## 1                          pi(~1)p(~1)c()f0(~1)    3 51.32661  0.9362219
```

```
## 5                pi(~1)p(~time + mixture)c()f0(~1)   20 52.45741  2.0670211
## 2                          pi(~1)p(~1)c(~1)f0(~1)    4 52.84411  2.4537215
## 3                       pi(~1)p(~mixture)c()f0(~1)    4 53.33975  2.9493645
## 4                pi(~1)p(~mixture)c(~mixture)f0(~1)    6 56.88040  6.4900109
## 8                      pi(~1)p(~time)c(~time)f0(~1)   35 59.37137  8.9809799
## 6 pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   37 63.62118 13.2307907
##         weight Deviance
## 7 0.3913088716 61.29370
## 1 0.2450313725 94.84148
## 5 0.1392104249 61.29370
## 2 0.1147362973 94.34584
## 3 0.0895515940 94.84148
## 4 0.0152486615 94.34592
## 8 0.0043885868 36.78470
## 6 0.0005241915 36.78473
```

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$p.time$results$real
```

```
##                 estimate           se            lcl          ucl fixed note
## pi g1 m1    4.996752e-01 1.804529e+04  5.555463e-309 1.000000e+00
## p g1 t1 m1  7.442900e-09 1.535153e-08 -2.264611e-08 3.753191e-08
## p g1 t2 m1  3.446910e-02 1.460390e-02  1.488100e-02 7.780470e-02
## p g1 t3 m1  1.148970e-02 7.282400e-03  3.296900e-03 3.924020e-02
## p g1 t4 m1  1.531960e-02 8.644300e-03  5.034700e-03 4.565030e-02
## p g1 t5 m1  3.063920e-02 1.347410e-02  1.282380e-02 7.141380e-02
## p g1 t6 m1  2.297940e-02 1.114140e-02  8.814100e-03 5.856510e-02
## p g1 t7 m1  2.297940e-02 1.114140e-02  8.814100e-03 5.856510e-02
## p g1 t8 m1  7.659800e-03 5.775400e-03  1.738000e-03 3.309030e-02
## p g1 t9 m1  1.914950e-02 9.920700e-03  6.885800e-03 5.210880e-02
## p g1 t10 m1 3.829900e-03 3.959400e-03  5.026462e-04 2.855270e-02
## p g1 t11 m1 1.914950e-02 9.920700e-03  6.885800e-03 5.210880e-02
## p g1 t12 m1 1.914950e-02 9.920900e-03  6.885700e-03 5.210950e-02
## p g1 t13 m1 3.446910e-02 1.460410e-02  1.488080e-02 7.780570e-02
## p g1 t14 m1 1.531960e-02 8.644500e-03  5.034600e-03 4.565140e-02
## p g1 t15 m1 2.297940e-02 1.114120e-02  8.814200e-03 5.856420e-02
## p g1 t16 m1 3.446910e-02 1.460410e-02  1.488080e-02 7.780570e-02
## p g1 t17 m1 3.829900e-03 3.958700e-03  5.028145e-04 2.854340e-02
## f0 g1 a0 t1 1.891034e+02 7.017034e+01  9.353397e+01 3.823220e+02
```

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

```
## $`N Population Size`
##   estimate     lcl     ucl
## 1 261.1034 165.534 454.322
```

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

  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:  -321.6732
## AICc :  -317.661
##
## Beta
##                      estimate se           lcl           ucl
## pi:(Intercept) -3.482680e-06  0 -3.482680e-06 -3.482680e-06
## p:(Intercept)  -3.591985e+00  0 -3.591985e+00 -3.591985e+00
## f0:(Intercept)  6.234810e+00  0  6.234810e+00  6.234810e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999991
##
```

```
##
## 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)  9.750138e-05  0  9.750138e-05  9.750138e-05
## p:(Intercept)  -3.369194e+00  0 -3.369194e+00 -3.369194e+00
## c:(Intercept)  -3.601868e+00  0 -3.601868e+00 -3.601868e+00
## f0:(Intercept)  5.987341e+00  0  5.987341e+00  5.987341e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000244
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0332722 0.0332722 0.0332722 0.0332722 0.0332722 0.0332722 0.0332722
## mixture:2 0.0332722 0.0332722 0.0332722 0.0332722 0.0332722 0.0332722 0.0332722
##                   8
## mixture:1 0.0332722
## mixture:2 0.0332722
##
##
```

```
## 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
##  398.354
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  -321.6732
## AICc :  -313.6326  (unadjusted=-317.66101)
##
## Beta
##                   estimate           se          lcl         ucl
## pi:(Intercept) -20.649063 1627.6686000 -3210.879600 3169.581500
## p:(Intercept)    0.264907    0.0000000     0.264907    0.264907
## p:mixture2      -3.856781    0.0000000    -3.856781   -3.856781
## f0:(Intercept)   6.234722    0.3307967     5.586361    6.883084
##
##
## Real Parameter pi
##
##
## mixture:1 1.077025e-09
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.5658422 0.5658422 0.5658422 0.5658422 0.5658422 0.5658422 0.5658422
## mixture:2 0.0268082 0.0268082 0.0268082 0.0268082 0.0268082 0.0268082 0.0268082
##                   8
## mixture:1 0.5658422
## mixture:2 0.0268082
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.5658422 0.5658422 0.5658422 0.5658422 0.5658422 0.5658422 0.5658422
## mixture:2 0.0268082 0.0268082 0.0268082 0.0268082 0.0268082 0.0268082 0.0268082
##
##
## Real Parameter f0
##
##         1
##  510.1589
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6  (unadjusted=5)
## -2lnL:  -322.6272
## AICc :  -310.5419  (unadjusted=-312.56634)
##
## Beta
##                   estimate       se        lcl         ucl
## pi:(Intercept)  -5.995883 1.816729  -9.556671  -2.4350939
## p:(Intercept)   17.467691 0.000000  17.467691  17.4676910
## p:mixture2     -21.128942 0.000000 -21.128942 -21.1289420
## c:(Intercept)   -1.506566 1.026012  -3.517549   0.5044176
## c:mixture2      -2.266243 1.061084  -4.345968  -0.1865187
## f0:(Intercept)   6.297262 1.774960   2.818341   9.7761835
##
##
## Real Parameter pi
##
##
## mixture:1 0.0024828
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## mixture:2 0.0250564 0.0250564 0.0250564 0.0250564 0.0250564 0.0250564 0.0250564
##                    8
## mixture:1 1.0000000
## mixture:2 0.0250564
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1814483 0.1814483 0.1814483 0.1814483 0.1814483 0.1814483 0.1814483
## mixture:2 0.0224709 0.0224709 0.0224709 0.0224709 0.0224709 0.0224709 0.0224709
##
##
## Real Parameter f0
##
##         1
##  543.0831
##
## 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) -2.513724e+00 9.8099531 -21.7412330 16.7137840
## p:(Intercept)  -2.899258e+00 3.2439124  -9.2573259  3.4588108
## p:time2         1.991655e-01 0.3655074  -0.5172289  0.9155600
## p:time3         2.579947e-01 0.3610112  -0.4495872  0.9655766
## p:time4         4.653407e-01 0.3467569  -0.2143028  1.1449843
## p:time5         4.171541e-01 0.3498580  -0.2685676  1.1028758
## p:time6        -8.991418e-07 0.3823590  -0.7494246  0.7494228
## p:time7         1.368720e-01 0.3705017  -0.5893114  0.8630555
## p:time8        -8.980366e-07 0.3823589  -0.7494243  0.7494225
## p:mixture2     -1.357541e+00 1.9233289  -5.1272658  2.4121835
## f0:(Intercept)  6.562059e+00 1.8505750   2.9349321 10.1891860
##
##
## Real Parameter pi
##
##
## mixture:1 0.0749016
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0521903 0.0629679 0.0665296 0.0806227 0.0771224 0.0521902 0.059391
## mixture:2 0.0139697 0.0169960 0.0180073 0.0220648 0.0210487 0.0139697 0.015986
##                    8
## mixture:1 0.0521902
## mixture:2 0.0139697
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0629679 0.0665296 0.0806227 0.0771224 0.0521902 0.059391 0.0521902
## mixture:2 0.0169960 0.0180073 0.0220648 0.0210487 0.0139697 0.015986 0.0139697
##
##
## Real Parameter f0
##
##         1
##  707.7275
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  19  (unadjusted=12)
## -2lnL:  -344.7641
## AICc :  -305.9822  (unadjusted=-320.44544)
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept) -19.1468070 1.301397e+03 -2.569884e+03  2531.590400
## p:(Intercept)    3.2611486 1.236456e+03 -2.420192e+03  2426.714300
## p:mixture2      -5.3225746 1.236456e+03 -2.428776e+03  2418.130700
```

```
## p:time2          0.3620386 3.874221e-01 -3.973086e-01     1.121386
## p:time3          0.6343086 3.865341e-01 -1.232983e-01     1.391916
## p:time4          0.7564799 3.999608e-01 -2.744330e-02     1.540403
## p:time5          1.3169896 3.976821e-01  5.375326e-01     2.096447
## p:time6          1.3305374 4.409986e-01  4.661801e-01     2.194895
## p:time7          2.2845704 4.801246e-01  1.343526e+00     3.225615
## p:time8         49.2179150 2.153970e+04 -4.216859e+04 42267.026000
## c:(Intercept)  -17.4069470 0.000000e+00 -1.740695e+01   -17.406947
## c:mixture2      -7.3681996 0.000000e+00 -7.368200e+00    -7.368200
## c:time3        -26.4398580 0.000000e+00 -2.643986e+01   -26.439858
## c:time4         22.8057040 0.000000e+00  2.280570e+01    22.805704
## c:time5         21.3251570 0.000000e+00  2.132516e+01    21.325157
## c:time6         20.3563070 0.000000e+00  2.035631e+01    20.356307
## c:time7         20.2107960 0.000000e+00  2.021080e+01    20.210796
## c:time8         20.7678110 0.000000e+00  2.076781e+01    20.767811
## f0:(Intercept) -65.7849390 0.000000e+00 -6.578494e+01   -65.784939
##
##
## Real Parameter pi
##
##
## mixture:1 4.837795e-09
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.9630717 0.9739968 0.9800712 0.9823225 0.9898305 0.9899659 0.9961110
## mixture:2 0.1129029 0.1545453 0.1935482 0.2133338 0.3220348 0.3249998 0.5555557
##           8
## mixture:1 1
## mixture:2 1
##
##
## Real Parameter c
##
##                       2            3         4         5         6         7
## mixture:1 2.755871e-08 9.069318e-20 0.9954982 0.9805107 0.9502332 0.9428835
## mixture:2 1.738964e-11 5.722769e-23 0.1224488 0.0307692 0.0119048 0.0103093
##                   8
## mixture:1 0.9664588
## mixture:2 0.0178571
##
##
## Real Parameter f0
##
##             1
##  2.691311e-29
##
## 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)  2.645154e-04 0.0000000  0.0002645154  0.0002645154
## p:(Intercept)  -3.786756e+00 0.3834466 -4.5383113000 -3.0352005000
## p:time2         1.990238e-01 0.3653755 -0.5171122000  0.9151599000
## p:time3         2.578114e-01 0.3608810 -0.4495155000  0.9651383000
## p:time4         4.650220e-01 0.3466332 -0.2143792000  1.1444231000
## p:time5         4.168629e-01 0.3497330 -0.2686139000  1.1023396000
## p:time6        -2.599454e-07 0.3822232 -0.7491578000  0.7491573000
## p:time7         1.367745e-01 0.3703671 -0.5891451000  0.8626941000
## p:time8        -9.243270e-07 0.3822225 -0.7491571000  0.7491553000
## f0:(Intercept)  6.229661e+00 0.3309465  5.5810061000  6.8783164000
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000661
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0221665 0.0269165 0.0284998 0.0348331 0.0332497 0.0221665 0.0253332
## mixture:2 0.0221665 0.0269165 0.0284998 0.0348331 0.0332497 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 0.0332497 0.0221665 0.0253332 0.0221665
## mixture:2 0.0269165 0.0284998 0.0348331 0.0332497 0.0221665 0.0253332 0.0221665
##
##
## Real Parameter f0
##
##         1
##  507.5835
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~time)f0(~1)
##
## Npar :  17  (unadjusted=12)
## -2lnL:  -344.7641
## AICc :  -310.1358  (unadjusted=-320.44544)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept) -4.555828e-04    0.0000000 -4.555828e-04 -4.555828e-04
```

```
## p:(Intercept)  -2.061423e+00    0.2837595 -2.617591e+00 -1.505254e+00
## p:time2         3.620362e-01    0.3874219 -3.973107e-01  1.121383e+00
## p:time3         6.343062e-01    0.3865338 -1.233001e-01  1.391913e+00
## p:time4         7.564742e-01    0.3999607 -2.744880e-02  1.540397e+00
## p:time5         1.316982e+00    0.3976821  5.375250e-01  2.096439e+00
## p:time6         1.330535e+00    0.4409984  4.661784e-01  2.194892e+00
## p:time7         2.284566e+00    0.4801244  1.343522e+00  3.225610e+00
## p:time8         2.118396e+01 4573.8677000 -8.943597e+03  8.985965e+03
## c:(Intercept)  -2.122456e+01    0.0000000 -2.122456e+01 -2.122456e+01
## c:time3        -2.485216e+01    0.0000000 -2.485216e+01 -2.485216e+01
## c:time4         1.925512e+01    0.0000000  1.925512e+01  1.925512e+01
## c:time5         1.777457e+01    0.0000000  1.777457e+01  1.777457e+01
## c:time6         1.680571e+01    0.0000000  1.680571e+01  1.680571e+01
## c:time7         1.666022e+01    0.0000000  1.666022e+01  1.666022e+01
## c:time8         1.721722e+01    0.0000000  1.721722e+01  1.721722e+01
## f0:(Intercept) -3.350733e+01    0.0000000 -3.350733e+01 -3.350733e+01
##
##
## Real Parameter pi
##
##
## mixture:1 0.4998861
##
##
## Real Parameter p
##
##                   1         2         3         4         5     6         7 8
## mixture:1 0.1129033 0.1545454 0.1935484 0.2133334 0.3220339 0.325 0.5555554 1
## mixture:2 0.1129033 0.1545454 0.1935484 0.2133334 0.3220339 0.325 0.5555554 1
##
##
## Real Parameter c
##
##                      2            3         4         5         6         7
## mixture:1 6.057456e-10 9.752862e-21 0.1224493 0.0307691 0.0119047 0.0103093
## mixture:2 6.057456e-10 9.752862e-21 0.1224493 0.0307691 0.0119047 0.0103093
##                   8
## mixture:1 0.0178569
## mixture:2 0.0178569
##
##
## Real Parameter f0
##
##             1
##  2.805115e-15
```

Examine model-selection table

```
iguane.results
```

```
##                                           model npar      AICc DeltaAICc
## 1                          pi(~1)p(~1)c()f0(~1)    3 -315.6489  0.000000
## 2                        pi(~1)p(~1)c(~1)f0(~1)    4 -313.6626  1.986245
```

```
## 3                       pi(~1)p(~mixture)c()f0(~1)    4 -313.6326  2.016235
## 4                pi(~1)p(~mixture)c(~mixture)f0(~1)    6 -310.5419  5.106948
## 8                      pi(~1)p(~time)c(~time)f0(~1)   17 -310.1358  5.513065
## 6 pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   19 -305.9822  9.666622
## 7                          pi(~1)p(~time)c()f0(~1)   10 -305.5907 10.058149
## 5                 pi(~1)p(~time + mixture)c()f0(~1)   11 -303.6647 11.984126
##        weight Deviance
## 1 0.528080864 48.31201
## 2 0.195610756 48.28202
## 3 0.192699455 48.31201
## 4 0.041090444 47.35797
## 8 0.033539263 25.22103
## 6 0.004203589 25.22103
## 7 0.003456217 44.17018
## 5 0.001319412 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       0.4999991  0   0.4999991   0.4999991
## p g1 t1 m1     0.0268053  0   0.0268053   0.0268053
## f0 g1 a0 t1 510.2034600  0 510.2034600 510.2034600
```

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

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

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

  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 :  2
## -2lnL:  -70.97173
## AICc :  -66.94151
##
## Beta
##                  estimate se       lcl       ucl
## pi:(Intercept)  0.000000  0  0.000000  0.000000
## p:(Intercept)  -5.144736  0 -5.144736 -5.144736
## f0:(Intercept)  6.956407  0  6.956407  6.956407
##
##
## Real Parameter pi
##
##
## mixture:1 0.5
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962
## mixture:2 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962
```

```
##                   8
## mixture:1 0.0057962
## mixture:2 0.0057962
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962
## mixture:2 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962
##
##
## Real Parameter f0
##
##         1
##  1049.855
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  -71.17576
## AICc :  -63.07449  (unadjusted=-67.14553)
##
## Beta
##                   estimate se        lcl        ucl
## pi:(Intercept) -0.0017577  0 -0.0017577 -0.0017577
## p:(Intercept)  -9.6803743  0 -9.6803743 -9.6803743
## c:(Intercept)  -5.0378730  0 -5.0378730 -5.0378730
## f0:(Intercept) 11.5129780  0 11.5129780 11.5129780
##
##
## Real Parameter pi
##
##
## mixture:1 0.4995606
##
##
## Real Parameter p
##
##                      1           2           3           4           5
## mixture:1 6.24942e-05 6.24942e-05 6.24942e-05 6.24942e-05 6.24942e-05
## mixture:2 6.24942e-05 6.24942e-05 6.24942e-05 6.24942e-05 6.24942e-05
##                      6           7           8
## mixture:1 6.24942e-05 6.24942e-05 6.24942e-05
## mixture:2 6.24942e-05 6.24942e-05 6.24942e-05
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0064457 0.0064457 0.0064457 0.0064457 0.0064457 0.0064457 0.0064457
## mixture:2 0.0064457 0.0064457 0.0064457 0.0064457 0.0064457 0.0064457 0.0064457
##
```

```
##
## Real Parameter f0
##
##         1
##  100005.3
##
## 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) -19.656588 1191.090100 -2354.193200 2314.880000
## p:(Intercept)   -1.449548  203.616510  -400.537920  397.638830
## p:mixture2      -3.695173  203.618740  -402.787910  395.397560
## f0:(Intercept)   6.956393    1.029651     4.938276    8.974509
##
##
## Real Parameter pi
##
##
## mixture:1 2.905712e-09
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1900712 0.1900712 0.1900712 0.1900712 0.1900712 0.1900712 0.1900712
## mixture:2 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963
##                    8
## mixture:1 0.1900712
## mixture:2 0.0057963
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1900712 0.1900712 0.1900712 0.1900712 0.1900712 0.1900712 0.1900712
## mixture:2 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963 0.0057963
##
##
## Real Parameter f0
##
##        1
##  1049.84
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6  (unadjusted=2)
## -2lnL:  -71.17754
```

```
## AICc :  -58.9638  (unadjusted=-67.147313)
##
## Beta
##                  estimate se       lcl       ucl
## pi:(Intercept) -30.90103  0 -30.90103 -30.90103
## p:(Intercept)   24.54293  0  24.54293  24.54293
## p:mixture2     -38.06925  0 -38.06925 -38.06925
## c:(Intercept)  -34.16109  0 -34.16109 -34.16109
## c:mixture2      29.13385  0  29.13385  29.13385
## f0:(Intercept)  15.36021  0  15.36021  15.36021
##
##
## Real Parameter pi
##
##
## mixture:1 3.800612e-14
##
##
## 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 1.335337e-06 1.335337e-06 1.335337e-06 1.335337e-06 1.335337e-06
##                        6            7            8
## mixture:1 1.000000e+00 1.000000e+00 1.000000e+00
## mixture:2 1.335337e-06 1.335337e-06 1.335337e-06
##
##
## Real Parameter c
##
##                        2            3            4            5            6
## mixture:1 1.458912e-15 1.458912e-15 1.458912e-15 1.458912e-15 1.458912e-15
## mixture:2 6.514200e-03 6.514200e-03 6.514200e-03 6.514200e-03 6.514200e-03
##                        7            8
## mixture:1 1.458912e-15 1.458912e-15
## mixture:2 6.514200e-03 6.514200e-03
##
##
## Real Parameter f0
##
##       1
##  4686555
##
## 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=-55.071094)
##
## Beta
##                      estimate        se         lcl        ucl
## pi:(Intercept) -1.909461e+01 0.0000000 -19.0946080 -19.094608
## p:(Intercept)  -1.241592e+00 0.0000000  -1.2415922  -1.241592
```

```
## p:time2         1.831789e-01 0.6070268  -1.0065937   1.372952
## p:time3         3.603233e-04 0.6338228  -1.2419323   1.242653
## p:time4         1.831907e-01 0.6070247  -1.0065777   1.372959
## p:time5         3.382852e-01 0.5870864  -0.8124041   1.488975
## p:time6         1.832071e-01 0.6070250  -1.0065619   1.372976
## p:time7         1.831741e-01 0.6070258  -1.0065966   1.372945
## p:time8         6.976432e-01 0.5494064  -0.3791933   1.774480
## p:mixture2     -4.139278e+00 0.0000000  -4.1392783  -4.139278
## f0:(Intercept)  6.948031e+00 1.0297851   4.9296522   8.966410
##
##
## Real Parameter pi
##
##
## mixture:1 5.097029e-09
##
##
## Real Parameter p
##
##                    1         2         3        4         5         6         7
## mixture:1 0.2241590 0.2576128 0.2242216 0.257615 0.2883714 0.2576182 0.2576119
## mixture:2 0.0045827 0.0054989 0.0045844 0.005499 0.0064156 0.0054991 0.0054989
##                    8
## mixture:1 0.3672694
## mixture:2 0.0091644
##
##
## Real Parameter c
##
##                    2         3        4         5         6         7         8
## mixture:1 0.2576128 0.2242216 0.257615 0.2883714 0.2576182 0.2576119 0.3672694
## mixture:2 0.0054989 0.0045844 0.005499 0.0064156 0.0054991 0.0054989 0.0091644
##
##
## Real Parameter f0
##
##         1
##  1041.098
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  19  (unadjusted=8)
## -2lnL:  -86.83013
## AICc :  -46.83013  (unadjusted=-70.461845)
##
## Beta
##                     estimate           se           lcl           ucl
## pi:(Intercept)   -3.8917418 1.010114e+00 -5.871566e+00    -1.911917
## p:(Intercept)   192.9494500 0.000000e+00  1.929495e+02   192.949450
## p:mixture2     -195.3697500 0.000000e+00 -1.953698e+02  -195.369750
## p:time2           0.5484764 6.815610e-01 -7.873833e-01     1.884336
## p:time3           0.5033683 7.082578e-01 -8.848170e-01     1.891554
## p:time4           0.6623986 7.118296e-01 -7.327875e-01     2.057585
```

```
## p:time5           1.2751531 6.786068e-01 -5.491620e-02      2.605222
## p:time6           1.4394707 7.080651e-01  5.166310e-02      2.827278
## p:time7           1.9094739 7.340608e-01  4.707148e-01      3.348233
## p:time8         231.2065700 4.448305e+05 -8.716366e+05 872099.040000
## c:(Intercept)   -87.5125710 4.731043e+04 -9.281596e+04  92640.937000
## c:mixture2     -311.2106300 1.459414e+05 -2.863564e+05 285733.990000
## c:time3         -36.4906480 2.873195e+04 -5.635111e+04  56278.124000
## c:time4         247.5441000 1.139592e+05 -2.231124e+05 223607.520000
## c:time5          43.9850420 2.128436e+04 -4.167336e+04  41761.327000
## c:time6          62.3274420 1.095533e+05 -2.146622e+05 214786.830000
## c:time7          65.1460360 6.207865e+04 -1.216090e+05 121739.290000
## c:time8          62.9600790 9.186602e+04 -1.799944e+05 180120.360000
## f0:(Intercept) -279.2446400 2.314400e+05 -4.539016e+05 453343.100000
##
##
## Real Parameter pi
##
##
## mixture:1 0.0200015
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## mixture:2 0.0816382 0.1333315 0.1282047 0.1470541 0.2413776 0.2727283 0.3750012
##           8
## mixture:1 1
## mixture:2 1
##
##
## Real Parameter c
##
##                        2             3            4             5             6
## mixture:1  9.857649e-39  1.399866e-54 1.000000e+00  1.248057e-19  1.154084e-11
## mixture:2 6.866155e-174 9.750495e-190 2.206728e-66 8.693098e-155 8.038548e-147
##                        7             8
## mixture:1  1.933470e-10  2.172642e-11
## mixture:2 1.346721e-145 1.513312e-146
##
##
## Real Parameter f0
##
##             1
##  5.31613e-122
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  10
## -2lnL:  -73.53264
## AICc :  -55.0711
##
## Beta
```

```
##                     estimate se           lcl           ucl
## pi:(Intercept)  1.559673e-04  0  1.559673e-04  1.559673e-04
## p:(Intercept)  -5.380934e+00  0 -5.380934e+00 -5.380934e+00
## p:time2         1.832615e-01  0  1.832615e-01  1.832615e-01
## p:time3         1.761844e-05  0  1.761844e-05  1.761844e-05
## p:time4         1.832593e-01  0  1.832593e-01  1.832593e-01
## p:time5         3.383318e-01  0  3.383318e-01  3.383318e-01
## p:time6         1.832611e-01  0  1.832611e-01  1.832611e-01
## p:time7         1.832591e-01  0  1.832591e-01  1.832591e-01
## p:time8         6.977764e-01  0  6.977764e-01  6.977764e-01
## f0:(Intercept)  6.948042e+00  0  6.948042e+00  6.948042e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.500039
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0045824 0.005499 0.0045825 0.005499 0.0064155 0.005499 0.005499
## mixture:2 0.0045824 0.005499 0.0045825 0.005499 0.0064155 0.005499 0.005499
##                   8
## mixture:1 0.009165
## mixture:2 0.009165
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.005499 0.0045825 0.005499 0.0064155 0.005499 0.005499 0.009165
## mixture:2 0.005499 0.0045825 0.005499 0.0064155 0.005499 0.005499 0.009165
##
##
## Real Parameter f0
##
##         1
##  1041.109
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~time)f0(~1)
##
## Npar :  17  (unadjusted=8)
## -2lnL:  -84.35282
## AICc :  -48.75073  (unadjusted=-67.984536)
##
## Beta
##                     estimate           se           lcl           ucl
## pi:(Intercept)  7.789118e-05 0.000000e+00  7.789118e-05  7.789118e-05
## p:(Intercept)  -2.197223e+00 4.714043e-01 -3.121175e+00 -1.273270e+00
## p:time2         3.254205e-01 6.438399e-01 -9.365057e-01  1.587347e+00
## p:time3         2.802987e-01 6.720376e-01 -1.036895e+00  1.597492e+00
```

```
## p:time4         4.393638e-01 6.757995e-01 -8.852033e-01  1.763931e+00
## p:time5         1.052089e+00 6.407291e-01 -2.037399e-01  2.307918e+00
## p:time6         1.216393e+00 6.718547e-01 -1.004426e-01  2.533228e+00
## p:time7         1.686397e+00 6.992057e-01  3.159538e-01  3.056840e+00
## p:time8         3.227592e+01 0.000000e+00  3.227592e+01  3.227592e+01
## c:(Intercept)  -2.019560e+01 0.000000e+00 -2.019560e+01 -2.019560e+01
## c:time3        -1.289865e+00 4.690794e+03 -9.195247e+03  9.192667e+03
## c:time4         1.748755e+01 0.000000e+00  1.748755e+01  1.748755e+01
## c:time5        -2.838028e+00 5.758458e+03 -1.128942e+04  1.128374e+04
## c:time6        -2.651683e+00 5.482305e+03 -1.074797e+04  1.074267e+04
## c:time7        -2.729122e+00 0.000000e+00 -2.729122e+00 -2.729122e+00
## c:time8        -3.632384e+00 0.000000e+00 -3.632384e+00 -3.632384e+00
## f0:(Intercept) -3.399021e+01 8.711524e+04 -1.707799e+05  1.707119e+05
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000195
##
##
## Real Parameter p
##
##                   1         2        3         4         5         6     7 8
## mixture:1 0.1000002 0.1333333 0.128205 0.1470587 0.2413791 0.2727271 0.375 1
## mixture:2 0.1000002 0.1333333 0.128205 0.1470587 0.2413791 0.2727271 0.375 1
##
##
## Real Parameter c
##
##                      2            3      4            5           6
## mixture:1 1.694979e-09 4.666411e-10 0.0625 9.922579e-11 1.19551e-10
## mixture:2 1.694979e-09 4.666411e-10 0.0625 9.922579e-11 1.19551e-10
##                      7            8
## mixture:1 1.106425e-10 4.483734e-11
## mixture:2 1.106425e-10 4.483734e-11
##
##
## Real Parameter f0
##
##             1
##  1.730763e-15
```

Examine model-selection table

```
iguane.results
```

```
##                                             model npar      AICc DeltaAICc
## 1                            pi(~1)p(~1)c()f0(~1)    2 -66.94151  0.000000
## 2                          pi(~1)p(~1)c(~1)f0(~1)    4 -63.07449  3.867015
## 3                       pi(~1)p(~mixture)c()f0(~1)    4 -62.87047  4.071040
## 4                 pi(~1)p(~mixture)c(~mixture)f0(~1)    6 -58.96380  7.977708
## 7                          pi(~1)p(~time)c()f0(~1)   10 -52.96708 13.974422
```

```
## 5                pi(~1)p(~time + mixture)c()f0(~1)   11 -50.85222 16.089287
## 8                     pi(~1)p(~time)c(~time)f0(~1)   17 -48.75073 18.190779
## 6 pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   19 -46.83013 20.111375
##         weight     Deviance
## 1 7.720976e-01 1.585840e+01
## 2 1.116762e-01 1.565437e+01
## 3 1.008456e-01 1.585840e+01
## 4 1.429997e-02 1.565259e+01
## 7 7.131240e-04 1.329749e+01
## 5 2.477011e-04 1.329750e+01
## 8 8.661535e-05 2.477309e+00
## 6 3.315451e-05 3.459857e-08
```

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       0.5000000  0    0.5000000    0.5000000
## p g1 t1 m1     0.0057962  0    0.0057962    0.0057962
## f0 g1 a0 t1 1049.8551000  0 1049.8551000 1049.8551000
```

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

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 1099.855 1099.855 1099.855
```

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)
```

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


  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 :  -83.82288
##
## Beta
##                     estimate        se           lcl           ucl
## pi:(Intercept)  9.012967e-05 0.0000000  9.012967e-05  9.012967e-05
## p:(Intercept)  -3.163024e+00 0.1107354 -3.380065e+00 -2.945983e+00
## f0:(Intercept)  5.235489e+00 0.0000000  5.235489e+00  5.235489e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000225
##
##
## 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
## -2lnL:  -91.71901
## AICc :  -83.65086
##
## Beta
##                      estimate          se         lcl        ucl
## pi:(Intercept)  0.0001691449 223.4929200 -438.045950 438.046290
## p:(Intercept)  -2.1563005000   0.4986269   -3.133609  -1.178992
## c:(Intercept)  -3.2580966000   0.3072549   -3.860316  -2.655877
## f0:(Intercept)  3.9567447000   0.7386005    2.509088   5.404402
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000423
##
##
## 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
##  52.28684
##
## 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) -16.047621 0.0000000 -16.047621 -16.047621
## p:(Intercept)   -1.663266 0.0000000  -1.663266  -1.663266
## p:mixture2      -1.499757 0.0000000  -1.499757  -1.499757
## f0:(Intercept)   5.235490 0.3713732   4.507599   5.963381
##
##
## Real Parameter pi
##
##
## mixture:1 1.073017e-07
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1593240 0.1593240 0.1593240 0.1593240 0.1593240 0.1593240 0.1593240
## mixture:2 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812
##                    8
## mixture:1 0.1593240
## mixture:2 0.0405812
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1593240 0.1593240 0.1593240 0.1593240 0.1593240 0.1593240 0.1593240
## mixture:2 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812
##
##
## Real Parameter f0
##
##         1
##  187.8211
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~mixture)f0(~1)
##
## Npar :  6  (unadjusted=5)
## -2lnL:  -91.90357
## AICc :  -79.75998  (unadjusted=-81.801179)
##
## Beta
```

```
##                   estimate        se        lcl         ucl
## pi:(Intercept)  -5.265011 2.5833987 -10.328472  -0.2015492
## p:(Intercept)   19.615914 0.0000000  19.615914  19.6159140
## p:mixture2     -21.823842 0.0000000 -21.823842 -21.8238420
## c:(Intercept)   -1.270369 1.4040630  -4.022333   1.4815946
## c:mixture2      -2.072602 1.4412474  -4.897447   0.7522430
## f0:(Intercept)   4.021091 0.7761725   2.499793   5.5423895
##
##
## Real Parameter pi
##
##
## mixture:1 0.0051428
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## mixture:2 0.0990408 0.0990408 0.0990408 0.0990408 0.0990408 0.0990408 0.0990408
##                    8
## mixture:1 1.0000000
## mixture:2 0.0990408
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.2191941 0.2191941 0.2191941 0.2191941 0.2191941 0.2191941 0.2191941
## mixture:2 0.0341261 0.0341261 0.0341261 0.0341261 0.0341261 0.0341261 0.0341261
##
##
## Real Parameter f0
##
##         1
##  55.76192
##
## 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) -16.4231690 0.0000000 -16.4231690 -16.4231690
## p:(Intercept)   -1.5653717 0.0000000  -1.5653717  -1.5653717
## p:time2          0.2087444 0.4583542  -0.6896299   1.1071186
## p:time3          0.3839277 0.4428895  -0.4841358   1.2519911
## p:time4          0.6038887 0.4264060  -0.2318671   1.4396446
## p:time5          0.4621258 0.4366751  -0.3937573   1.3180090
## p:time6         -0.1217818 0.4940919  -1.0902020   0.8466385
## p:time7          0.1093928 0.4681449  -0.8081713   1.0269569
```

```
## p:time8         -0.8308030 0.6075293  -2.0215605   0.3599545
## p:mixture2      -1.7548345 0.0000000  -1.7548345  -1.7548345
## f0:(Intercept)   5.2148958 0.3722117   4.4853607   5.9444308
##
##
## Real Parameter pi
##
##
## mixture:1 7.370695e-08
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.1728772 0.2047890 0.2347926 0.2765814 0.2491322 0.1561505 0.1890831
## mixture:2 0.0348845 0.0426369 0.0503890 0.0620173 0.0542651 0.0310087 0.0387608
##                   8
## mixture:1 0.0834649
## mixture:2 0.0155043
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.2047890 0.2347926 0.2765814 0.2491322 0.1561505 0.1890831 0.0834649
## mixture:2 0.0426369 0.0503890 0.0620173 0.0542651 0.0310087 0.0387608 0.0155043
##
##
## Real Parameter f0
##
##         1
##  183.9926
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)
##
## Npar :  19  (unadjusted=14)
## -2lnL:  -118.1362
## AICc :  -78.80751  (unadjusted=-89.408279)
##
## Beta
##                    estimate          se          lcl         ucl
## pi:(Intercept)  -3.2897059   1.4898930   -6.2098962  -0.3695157
## p:(Intercept)   16.8207420 320.3560800 -611.0771900 644.7186800
## p:mixture2     -19.1480330 320.3559000 -647.0456100 608.7495500
## p:time2          0.7362013   0.7624854   -0.7582700   2.2306727
## p:time3          1.1786606   0.7571460   -0.3053455   2.6626667
## p:time4          1.3239761   0.7721394   -0.1894173   2.8373694
## p:time5          1.9218144   0.7815658    0.3899454   3.4536833
## p:time6          1.8752693   0.8400738    0.2287246   3.5218140
## p:time7          3.8313415   1.0407002    1.7915691   5.8711139
## p:time8         93.5828220   0.0000000   93.5828220  93.5828220
## c:(Intercept)  -43.0562490   0.0000000  -43.0562490 -43.0562490
## c:mixture2      -2.0187854   1.5083877   -4.9752253   0.9376545
```

```
## c:time3        -43.4148450   0.0000000  -43.4148450 -43.4148450
## c:time4         43.0858280   0.0000000   43.0858280  43.0858280
## c:time5         41.7489020   0.0000000   41.7489020  41.7489020
## c:time6         40.8168350   0.0000000   40.8168350  40.8168350
## c:time7         40.7206410   0.0000000   40.7206410  40.7206410
## c:time8         41.3286160   0.0000000   41.3286160  41.3286160
## f0:(Intercept) -99.9187540   0.0000000  -99.9187540 -99.9187540
##
##
## Real Parameter pi
##
##
## mixture:1 0.035926
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## mixture:2 0.0888878 0.1692306 0.2407393 0.2682901 0.3999971 0.3888801 0.8181778
##           8
## mixture:1 1
## mixture:2 1
##
##
## Real Parameter c
##
##                       2            3         4         5         6         7
## mixture:1 1.999441e-19 2.793065e-38 0.5073942 0.2129311 0.0962665 0.0882165
## mixture:2 2.655591e-20 3.709656e-39 0.1203408 0.0346855 0.0139504 0.0126872
##                    8
## mixture:1 0.1508905
## mixture:2 0.0230579
##
##
## Real Parameter f0
##
##              1
##  4.034937e-44
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  10  (unadjusted=9)
## -2lnL:  -100.5401
## AICc :  -80.16149  (unadjusted=-82.230876)
##
## Beta
##                       estimate        se           lcl           ucl
## pi:(Intercept) -0.0002410581 0.0000000 -0.0002410581 -0.0002410581
## p:(Intercept)  -3.3201971000 0.3473112 -4.0009270000 -2.6394671000
## p:time2         0.2087374000 0.3703664 -0.5171807000  0.9346555000
## p:time3         0.3839210000 0.3510139 -0.3040663000  1.0719083000
## p:time4         0.6038822000 0.0000000  0.6038822000  0.6038822000
```

```
## p:time5         0.4621199000 0.3431223 -0.2103997000  1.1346395000
## p:time6        -0.1217893000 0.4138156 -0.9328679000  0.6892893000
## p:time7         0.1093864000 0.3824312 -0.6401787000  0.8589515000
## p:time8        -0.8308110000 0.5442905 -1.8976205000  0.2359984000
## f0:(Intercept)  5.2148914000 0.3721463  4.4854847000  5.9442982000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999397
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0348848 0.042637 0.0503892 0.0620175 0.0542653 0.0310087 0.0387609
## mixture:2 0.0348848 0.042637 0.0503892 0.0620175 0.0542653 0.0310087 0.0387609
##                    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 0.0310087 0.0387609 0.0155044
## mixture:2 0.042637 0.0503892 0.0620175 0.0542653 0.0310087 0.0387609 0.0155044
##
##
## Real Parameter f0
##
##         1
##  183.9918
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~time)f0(~1)
##
## Npar :  17  (unadjusted=12)
## -2lnL:  -116.1689
## AICc :  -81.10268  (unadjusted=-91.630017)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept) -6.508089e-04 0.000000e+00 -6.508089e-04 -6.508089e-04
## p:(Intercept)  -1.977164e+00 3.556626e-01 -2.674263e+00 -1.280066e+00
## p:time2         3.860788e-01 4.857193e-01 -5.659311e-01  1.338089e+00
## p:time3         8.285402e-01 4.772938e-01 -1.069556e-01  1.764036e+00
## p:time4         9.738619e-01 5.007378e-01 -7.584200e-03  1.955308e+00
## p:time5         1.571699e+00 5.151551e-01  5.619950e-01  2.581403e+00
## p:time6         1.525184e+00 6.002183e-01  3.487557e-01  2.701612e+00
## p:time7         3.481264e+00 8.588457e-01  1.797927e+00  5.164602e+00
## p:time8         2.631949e+01 1.830973e+04 -3.586075e+04  3.591338e+04
## c:(Intercept)  -2.215573e+01 0.000000e+00 -2.215573e+01 -2.215573e+01
```

```
## c:time3        -1.061831e+01 0.000000e+00 -1.061831e+01 -1.061831e+01
## c:time4         2.043296e+01 0.000000e+00  2.043296e+01  2.043296e+01
## c:time5         1.911121e+01 0.000000e+00  1.911121e+01  1.911121e+01
## c:time6         1.814837e+01 0.000000e+00  1.814837e+01  1.814837e+01
## c:time7         1.802858e+01 0.000000e+00  1.802858e+01  1.802858e+01
## c:time8         1.860040e+01 0.000000e+00  1.860040e+01  1.860040e+01
## f0:(Intercept) -2.094777e+01 7.147938e+03 -1.403091e+04  1.398901e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.4998373
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.1216214 0.1692312 0.2407405 0.2682926 0.3999999 0.3888899 0.8181852
## mixture:2 0.1216214 0.1692312 0.2407405 0.2682926 0.3999999 0.3888899 0.8181852
##           8
## mixture:1 1
## mixture:2 1
##
##
## Real Parameter c
##
##                       2            3         4         5         6         7
## mixture:1 2.387187e-10 5.839991e-15 0.1515142 0.0454544 0.0178566 0.0158727
## mixture:2 2.387187e-10 5.839991e-15 0.1515142 0.0454544 0.0178566 0.0158727
##                     8
## mixture:1 0.0277781
## mixture:2 0.0277781
##
##
## Real Parameter f0
##
##             1
##  7.989145e-10
```

Examine model-selection table

```
iguane.results
```

```
##                                                model npar      AICc DeltaAICc
## 1                               pi(~1)p(~1)c()f0(~1)    3 -83.82288 0.0000000
## 2                             pi(~1)p(~1)c(~1)f0(~1)    4 -83.65086 0.1720138
## 3                           pi(~1)p(~mixture)c()f0(~1)    4 -81.79555 2.0273268
## 8                         pi(~1)p(~time)c(~time)f0(~1)   17 -81.10268 2.7201988
## 7                             pi(~1)p(~time)c()f0(~1)   10 -80.16149 3.6613842
## 4                  pi(~1)p(~mixture)c(~mixture)f0(~1)    6 -79.75998 4.0628984
## 6 pi(~1)p(~mixture + time)c(~mixture + time)f0(~1)   19 -78.80751 5.0153680
## 5                   pi(~1)p(~time + mixture)c()f0(~1)   11 -78.08498 5.7378991
```

```
##       weight Deviance
## 1 0.33706652 50.25967
## 2 0.30928817 48.40436
## 3 0.12231711 50.25967
## 8 0.08650316 23.95449
## 7 0.05403264 39.58321
## 4 0.04420470 48.21980
## 6 0.02745632 21.98718
## 5 0.01913140 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      0.5000225 0.0000000   0.5000225   0.5000225
## p g1 t1 m1    0.0405812 0.0043114   0.0329243   0.0499267
## f0 g1 a0 t1 187.8210100 0.0000000 187.8210100 187.8210100
```

```
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)
```