RunLMEM.R

roohac

Wed Mar 28 09:56:07 2018

source("C:/Users/roohac/Documents/GitHub/ONR-Spectral-Sensitivity-Function-/EEG-LMEM-functions.R")

## Warning: package 'reshape2' was built under R version 3.3.3

## Warning: package 'MuMIn' was built under R version 3.3.3

library(ggsignif)

## Warning: package 'ggsignif' was built under R version 3.3.3

library(readr)  
library(Rmisc)

## Loading required package: lattice

## Loading required package: plyr

library(ggplot2)

## Warning: package 'ggplot2' was built under R version 3.3.3

library(dplyr)

## Warning: package 'dplyr' was built under R version 3.3.3

##   
## Attaching package: 'dplyr'

## The following objects are masked from 'package:plyr':  
##   
## arrange, count, desc, failwith, id, mutate, rename, summarise,  
## summarize

## The following object is masked from 'package:nlme':  
##   
## collapse

## The following objects are masked from 'package:stats':  
##   
## filter, lag

## The following objects are masked from 'package:base':  
##   
## intersect, setdiff, setequal, union

library(reshape2)  
library(readxl)

## Warning: package 'readxl' was built under R version 3.3.3

if(FALSE){  
 EEG\_dataCropped\_1\_29\_18 <- read\_csv("//root/projects/EEG-Nighttime-ONR-2017/data-sets-EEGpower/EEG-dataCropped-1-29-18.csv")  
   
   
 month5\_EEG\_data <- read\_excel("//root/projects/ONR-EEG-BAA16\_001/PROCESSED\_DATA/Month5normalised.xlsx")  
 month5\_EEG\_data$norm\_t1 <- as.numeric(month5\_EEG\_data$norm\_t1 )  
 colnames(month5\_EEG\_data)[4] <- "light\_level"  
 month5\_EEG\_data$light\_level <- ifelse(month5\_EEG\_data$light\_level =="d", "dim", ifelse(month5\_EEG\_data$light\_level =="m", "medium", ifelse(month5\_EEG\_data$light\_level =="l", "low","high" )) )  
 month5\_EEG\_data$color <- as.factor(month5\_EEG\_data$color)  
 month5\_EEG\_data$sub\_trial\_id <- paste(month5\_EEG\_data$subject, month5\_EEG\_data$light\_level, month5\_EEG\_data$trial, sep = "\_")  
 month5\_EEG\_data$sub\_session\_id <- paste(month5\_EEG\_data$subject, month5\_EEG\_data$light\_level, sep = "\_")  
 month5\_EEG\_data$TimeOfDay <- "night"  
   
 UpdatedEEG\_3\_11\_18 <- rbind(EEG\_dataCropped\_1\_29\_18, month5\_EEG\_data[month5\_EEG\_data$trial != 1,])  
   
}  
  
UpdatedEEG\_3\_11\_18 <- read\_excel("//root/projects/ONR-EEG-BAA16\_001/PROCESSED\_DATA/EEG/month5/UpdatedEEG\_3\_11\_18.xlsx")  
  
  
  
UpdatedEEG\_3\_11\_18$light\_level <- factor(UpdatedEEG\_3\_11\_18$light\_level, levels = c("high", "medium", "low", "dim"))  
UpdatedEEG\_3\_11\_18$Channel <- factor(UpdatedEEG\_3\_11\_18$Channel, levels = c("theta", "atheta", "alpha", "halpha", "beta", "hbeta"))  
UpdatedEEG\_3\_11\_18$subject <- as.factor(UpdatedEEG\_3\_11\_18$subject)  
UpdatedEEG\_3\_11\_18$color <- as.factor(UpdatedEEG\_3\_11\_18$color)  
UpdatedEEG\_3\_11\_18$Channel <- as.factor(UpdatedEEG\_3\_11\_18$Channel)  
UpdatedEEG\_3\_11\_18$trial <- as.factor(UpdatedEEG\_3\_11\_18$trial)  
UpdatedEEG\_3\_11\_18$TimeOfDay <- as.factor("night")  
  
  
  
  
model\_list1 <- output\_mixed\_model1(UpdatedEEG\_3\_11\_18, "night")

## [1] "All data: nighttime"

model\_list2 <- output\_mixed\_model2(UpdatedEEG\_3\_11\_18, "night")

## Warning: package 'tidyr' was built under R version 3.3.3

##   
## Attaching package: 'tidyr'

## The following object is masked from 'package:reshape2':  
##   
## smiths

## [1] "All data: nighttime"

print("All data: nighttime, specifed to look at light level")

## [1] "All data: nighttime, specifed to look at light level"

print\_mixed\_model(model\_list1)

## [1] "Theta----------------"  
## [[1]]  
## R2m R2c   
## 0.009774311 0.928968197   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 185 3081.3351 <.0001  
## light\_level 3 144 0.6329 0.5950  
## trial 1 185 0.3125 0.5769  
## light\_level:trial 3 185 0.9338 0.4255  
##   
## [1] "Alpha-theta----------"  
## [[1]]  
## R2m R2c   
## 0.05115607 0.93325790   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 185 2163.6310 <.0001  
## light\_level 3 144 4.5249 0.0046  
## trial 1 185 11.2601 0.0010  
## light\_level:trial 3 185 0.3105 0.8177  
##   
## [1] "Alpha----------------"  
## [[1]]  
## R2m R2c   
## 0.1088873 0.9449744   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 185 562.4032 <.0001  
## light\_level 3 144 11.3959 <.0001  
## trial 1 185 8.7587 0.0035  
## light\_level:trial 3 185 0.3324 0.8020  
##   
## [1] "High Alpha-----------"  
## [[1]]  
## R2m R2c   
## 0.09673045 0.94530807   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 185 272.74474 <.0001  
## light\_level 3 144 13.06193 <.0001  
## trial 1 185 1.01473 0.3151  
## light\_level:trial 3 185 1.55887 0.2009  
##   
## [1] "Beta-----------------"  
## [[1]]  
## R2m R2c   
## 0.02243759 0.92665715   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 185 2911.6724 <.0001  
## light\_level 3 144 2.5520 0.0579  
## trial 1 185 0.1574 0.6921  
## light\_level:trial 3 185 0.3107 0.8176  
##   
## [1] "High Beta------------"  
## [[1]]  
## R2m R2c   
## 0.0251189 0.9302943   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 185 2451.5216 <.0001  
## light\_level 3 144 3.0356 0.0312  
## trial 1 185 0.0169 0.8966  
## light\_level:trial 3 185 0.3136 0.8155

print("All data: nighttime, specifed to look at spectra")

## [1] "All data: nighttime, specifed to look at spectra"

print\_mixed\_model(model\_list2)

## [1] "Theta----------------"  
## [[1]]  
## R2m R2c   
## 0.05720302 0.96496518   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 118 1187.6357 <.0001  
## color 4 45 0.4868 0.7454  
## light\_level 2 87 0.3638 0.6961  
## trial 1 118 0.5416 0.4632  
## color:light\_level 8 87 1.5124 0.1646  
## color:trial 4 118 0.7015 0.5924  
## light\_level:trial 2 118 0.1292 0.8789  
## color:light\_level:trial 8 118 0.2259 0.9856  
##   
## [1] "Alpha-theta----------"  
## [[1]]  
## R2m R2c   
## 0.07529801 0.96489104   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 118 925.7284 <.0001  
## color 4 45 0.8905 0.4775  
## light\_level 2 87 1.0232 0.3637  
## trial 1 118 0.3114 0.5779  
## color:light\_level 8 87 1.0310 0.4192  
## color:trial 4 118 0.5177 0.7228  
## light\_level:trial 2 118 0.2649 0.7678  
## color:light\_level:trial 8 118 0.8287 0.5790  
##   
## [1] "Alpha----------------"  
## [[1]]  
## R2m R2c   
## 0.0980461 0.9978991   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 118 166.43130 <.0001  
## color 4 45 1.17124 0.3362  
## light\_level 2 87 1.71719 0.1856  
## trial 1 118 1.12609 0.2908  
## color:light\_level 8 87 0.76286 0.6362  
## color:trial 4 118 3.33008 0.0127  
## light\_level:trial 2 118 1.46120 0.2361  
## color:light\_level:trial 8 118 0.27312 0.9735  
##   
## [1] "High Alpha-----------"  
## [[1]]  
## R2m R2c   
## 0.08266238 0.99302130   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 118 170.64569 <.0001  
## color 4 45 0.61801 0.6520  
## light\_level 2 87 3.62987 0.0306  
## trial 1 118 1.33445 0.2503  
## color:light\_level 8 87 0.67093 0.7157  
## color:trial 4 118 1.24506 0.2957  
## light\_level:trial 2 118 2.15091 0.1209  
## color:light\_level:trial 8 118 0.54120 0.8234  
##   
## [1] "Beta-----------------"  
## [[1]]  
## R2m R2c   
## 0.07113884 0.94053137   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 118 1898.7875 <.0001  
## color 4 45 0.6797 0.6096  
## light\_level 2 87 2.3384 0.1025  
## trial 1 118 0.0069 0.9341  
## color:light\_level 8 87 0.7642 0.6350  
## color:trial 4 118 1.3037 0.2727  
## light\_level:trial 2 118 0.4515 0.6378  
## color:light\_level:trial 8 118 0.2879 0.9688  
##   
## [1] "High Beta------------"  
## [[1]]  
## R2m R2c   
## 0.09713863 0.94364460   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 118 1701.9719 <.0001  
## color 4 45 1.5345 0.2084  
## light\_level 2 87 2.5424 0.0845  
## trial 1 118 0.1377 0.7113  
## color:light\_level 8 87 0.8842 0.5332  
## color:trial 4 118 1.2292 0.3022  
## light\_level:trial 2 118 0.4538 0.6363  
## color:light\_level:trial 8 118 0.3439 0.9469

##Looking at each indivudual spectra  
model\_list5 <- output\_mixed\_model\_single\_spectrum(UpdatedEEG\_3\_11\_18, "night", "red")

## [1] "All data: nighttime"

model\_list6 <- output\_mixed\_model\_single\_spectrum(UpdatedEEG\_3\_11\_18, "night", "green")

## [1] "All data: nighttime"

model\_list7 <- output\_mixed\_model\_single\_spectrum(UpdatedEEG\_3\_11\_18, "night", "blue")

## [1] "All data: nighttime"

model\_list8 <- output\_mixed\_model\_single\_spectrum(UpdatedEEG\_3\_11\_18, "night", "cyan")

## [1] "All data: nighttime"

model\_list9 <- output\_mixed\_model\_single\_spectrum(UpdatedEEG\_3\_11\_18, "night", "amber")

## [1] "All data: nighttime"

print("Red: nighttime 3min")

## [1] "Red: nighttime 3min"

print\_mixed\_model(model\_list5)

## [1] "Theta----------------"  
## [[1]]  
## R2m R2c   
## 0.06762979 0.93173554   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 46 1162.2997 <.0001  
## light\_level 3 36 1.1226 0.3528  
## trial 1 46 3.4526 0.0696  
## light\_level:trial 3 46 0.9717 0.4143  
##   
## [1] "Alpha-theta----------"  
## [[1]]  
## R2m R2c   
## 0.1087304 0.9388697   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 46 522.4672 <.0001  
## light\_level 3 36 2.2443 0.0998  
## trial 1 46 11.5749 0.0014  
## light\_level:trial 3 46 0.1990 0.8965  
##   
## [1] "Alpha----------------"  
## [[1]]  
## R2m R2c   
## 0.1610025 0.9481500   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 46 120.36999 <.0001  
## light\_level 3 36 7.21774 0.0006  
## trial 1 46 2.15918 0.1485  
## light\_level:trial 3 46 0.13225 0.9404  
##   
## [1] "High Alpha-----------"  
## [[1]]  
## R2m R2c   
## 0.1638152 0.9627336   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 46 59.64740 <.0001  
## light\_level 3 36 7.93718 0.0003  
## trial 1 46 0.01367 0.9074  
## light\_level:trial 3 46 0.90482 0.4461  
##   
## [1] "Beta-----------------"  
## [[1]]  
## R2m R2c   
## 0.0238588 0.9453274   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 46 691.2694 <.0001  
## light\_level 3 36 0.7386 0.5360  
## trial 1 46 1.2716 0.2653  
## light\_level:trial 3 46 0.1568 0.9248  
##   
## [1] "High Beta------------"  
## [[1]]  
## R2m R2c   
## 0.03114614 0.93922353   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 46 573.2270 <.0001  
## light\_level 3 36 1.0740 0.3723  
## trial 1 46 0.9621 0.3318  
## light\_level:trial 3 46 0.0784 0.9714

print("Green: nighttime 3min")

## [1] "Green: nighttime 3min"

print\_mixed\_model(model\_list6)

## [1] "Theta----------------"  
## [[1]]  
## R2m R2c   
## 0.05996057 0.93184222   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 48 1069.2021 <.0001  
## light\_level 3 38 1.5438 0.2189  
## trial 1 48 1.2221 0.2745  
## light\_level:trial 3 48 0.3662 0.7777  
##   
## [1] "Alpha-theta----------"  
## [[1]]  
## R2m R2c   
## 0.07701277 0.93602831   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 48 632.1123 <.0001  
## light\_level 3 38 2.5104 0.0732  
## trial 1 48 1.8000 0.1860  
## light\_level:trial 3 48 0.1484 0.9302  
##   
## [1] "Alpha----------------"  
## [[1]]  
## R2m R2c   
## 0.1129418 0.9416610   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 48 194.86239 <.0001  
## light\_level 3 38 4.19318 0.0117  
## trial 1 48 4.14748 0.0472  
## light\_level:trial 3 48 0.19928 0.8964  
##   
## [1] "High Alpha-----------"  
## [[1]]  
## R2m R2c   
## 0.09405087 0.95840895   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 48 115.99718 <.0001  
## light\_level 3 38 4.14782 0.0123  
## trial 1 48 1.76584 0.1902  
## light\_level:trial 3 48 0.24743 0.8628  
##   
## [1] "Beta-----------------"  
## [[1]]  
## R2m R2c   
## 0.04093296 0.94147156   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 48 681.5257 <.0001  
## light\_level 3 38 0.6223 0.6049  
## trial 1 48 3.5509 0.0656  
## light\_level:trial 3 48 0.7799 0.5110  
##   
## [1] "High Beta------------"  
## [[1]]  
## R2m R2c   
## 0.04543487 0.94209377   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 48 681.8585 <.0001  
## light\_level 3 38 1.1559 0.3392  
## trial 1 48 0.6989 0.4073  
## light\_level:trial 3 48 0.7779 0.5121

print("Blue nighttime: 3min")

## [1] "Blue nighttime: 3min"

print\_mixed\_model(model\_list7)

## [1] "Theta----------------"  
## [[1]]  
## R2m R2c   
## 0.04776709 0.98300591   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 39 984.6580 <.0001  
## light\_level 3 31 0.9651 0.4216  
## trial 1 39 0.0516 0.8214  
## light\_level:trial 3 39 0.0945 0.9626  
##   
## [1] "Alpha-theta----------"  
## [[1]]  
## R2m R2c   
## 0.06148026 0.93316689   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 39 533.5301 <.0001  
## light\_level 3 31 1.6801 0.1916  
## trial 1 39 0.3015 0.5861  
## light\_level:trial 3 39 0.2517 0.8597  
##   
## [1] "Alpha----------------"  
## [[1]]  
## R2m R2c   
## 0.1888573 0.9499070   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 39 132.66144 <.0001  
## light\_level 3 31 8.36030 0.0003  
## trial 1 39 0.95037 0.3356  
## light\_level:trial 3 39 0.18852 0.9036  
##   
## [1] "High Alpha-----------"  
## [[1]]  
## R2m R2c   
## 0.09781893 0.94486460   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 39 51.64613 <.0001  
## light\_level 3 31 3.66307 0.0228  
## trial 1 39 0.00015 0.9901  
## light\_level:trial 3 39 0.74489 0.5319  
##   
## [1] "Beta-----------------"  
## [[1]]  
## R2m R2c   
## 0.08337031 0.94919042   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 39 651.0330 <.0001  
## light\_level 3 31 2.5277 0.0755  
## trial 1 39 0.0253 0.8745  
## light\_level:trial 3 39 0.3705 0.7747  
##   
## [1] "High Beta------------"  
## [[1]]  
## R2m R2c   
## 0.07214359 0.93679293   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 39 399.6241 <.0001  
## light\_level 3 31 1.9220 0.1466  
## trial 1 39 0.0825 0.7755  
## light\_level:trial 3 39 0.7718 0.5168

print("Cyan nighttime: 3min")

## [1] "Cyan nighttime: 3min"

print\_mixed\_model(model\_list8)

## [1] "Theta----------------"  
## [[1]]  
## R2m R2c   
## 0.06362348 0.99385631   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 20 249.92790 <.0001  
## light\_level 3 15 1.22308 0.3357  
## trial 1 20 0.03341 0.8568  
## light\_level:trial 3 20 0.30038 0.8247  
##   
## [1] "Alpha-theta----------"  
## [[1]]  
## R2m R2c   
## 0.1214304 0.9409057   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 20 249.15739 <.0001  
## light\_level 3 15 0.89046 0.4686  
## trial 1 20 0.61172 0.4433  
## light\_level:trial 3 20 2.32721 0.1054  
##   
## [1] "Alpha----------------"  
## [[1]]  
## R2m R2c   
## 0.05907561 0.95506459   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 20 86.64632 <.0001  
## light\_level 3 15 0.38882 0.7627  
## trial 1 20 1.82893 0.1913  
## light\_level:trial 3 20 1.50692 0.2433  
##   
## [1] "High Alpha-----------"  
## [[1]]  
## R2m R2c   
## 0.1024875 0.9746597   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 20 26.455451 <.0001  
## light\_level 3 15 1.532698 0.2470  
## trial 1 20 0.179264 0.6765  
## light\_level:trial 3 20 2.208041 0.1187  
##   
## [1] "Beta-----------------"  
## [[1]]  
## R2m R2c   
## 0.07116383 0.93728949   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 20 861.9675 <.0001  
## light\_level 3 15 0.3586 0.7837  
## trial 1 20 0.0194 0.8906  
## light\_level:trial 3 20 1.2229 0.3273  
##   
## [1] "High Beta------------"  
## [[1]]  
## R2m R2c   
## 0.07518283 0.93268963   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 20 563.8661 <.0001  
## light\_level 3 15 0.6287 0.6076  
## trial 1 20 0.0282 0.8684  
## light\_level:trial 3 20 1.0538 0.3907

print("Amber nighttime: 3min")

## [1] "Amber nighttime: 3min"

print\_mixed\_model(model\_list9)

## [1] "Theta----------------"  
## [[1]]  
## R2m R2c   
## 0.04940974 0.96508008   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 16 97.63699 <.0001  
## light\_level 3 12 0.55069 0.6572  
## trial 1 16 1.37964 0.2573  
## light\_level:trial 3 16 0.73130 0.5483  
##   
## [1] "Alpha-theta----------"  
## [[1]]  
## R2m R2c   
## 0.2015521 0.9836814   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 16 389.8966 <.0001  
## light\_level 3 12 1.8272 0.1959  
## trial 1 16 0.9564 0.3426  
## light\_level:trial 3 16 0.8256 0.4988  
##   
## [1] "Alpha----------------"  
## [[1]]  
## R2m R2c   
## 0.1094767 0.9959359   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 16 24.268073 0.0002  
## light\_level 3 12 0.794012 0.5204  
## trial 1 16 0.008299 0.9285  
## light\_level:trial 3 16 0.952352 0.4389  
##   
## [1] "High Alpha-----------"  
## [[1]]  
## R2m R2c   
## 0.06686069 0.99141954   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 16 24.652745 0.0001  
## light\_level 3 12 0.431976 0.7339  
## trial 1 16 0.408243 0.5319  
## light\_level:trial 3 16 1.007278 0.4152  
##   
## [1] "Beta-----------------"  
## [[1]]  
## R2m R2c   
## 0.1171245 0.9552708   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 16 708.8105 <.0001  
## light\_level 3 12 0.8354 0.5000  
## trial 1 16 0.0395 0.8450  
## light\_level:trial 3 16 1.0500 0.3976  
##   
## [1] "High Beta------------"  
## [[1]]  
## R2m R2c   
## 0.2199931 0.9865793   
##   
## [[1]]  
## numDF denDF F-value p-value  
## (Intercept) 1 16 752.9699 <.0001  
## light\_level 3 12 2.4394 0.1148  
## trial 1 16 0.0131 0.9103  
## light\_level:trial 3 16 0.2960 0.8278