Erratum for Listings 7.3 - 7.4

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Listings 7.3 and 7.4 contain an error. Instead of `g*dunif(data, -180, 180)` in Listing 7.3, line 35, and Listing 7.4, lines 6-7, it should be `g*rep(1,length(data))/(2*pi)`. We thank Grant Shields of UC Davis for drawing our attention to this error.

The source code below contains the fix and the new figures that result when the code is run.

Preamble for code

```r
set.seed(23)

knitr::opts_chunk$set(warning = FALSE, error = FALSE, message = FALSE, fig.align = "center")
library(knitr)
library(tidyverse)
library(broom)
```

Listing 7.3

```r
#mixture model set of functions (Listing 7.4)
library(circular)

#pdf for mixture model (Suchow et al., 2013)
logmixturepdf <- function(data,g,sdv) {
  data4vm <- mkcirc(data)
  return(sum(log((1-g)*dvonmises(data4vm,mkcirc(0),sd2k(sdv))
                 + g*rep(1,length(data))/(2*pi) ))) # <--- note change here ****************
}

#convert SD into Kappa (Suchow et al., 2013)
sd2k<-function (d) { #input is in degrees
  S <- (d/180)*pi  #go to radians
  R <- exp(-S^2/2)
  K = 1/(R^3 - 4*R^2 + 3*R)
  if (R < 0.85) {K <- -0.4 + 1.39*R + 0.43/(1-R)}
  if (R < 0.53) {K <- 2*R + R^3 + (5*R^5)/6}
  return(K)
}

#jeffreys prior for precision (Suchow et al., 2013)
jp4kappa <- function(K) {
  z <- exp((log(besselI(K,1,TRUE)) + K) -
             (log(besselI(K,0,TRUE)) + K))
  return(z * (K - z - K*z^2))
}
```

```
#jeffreys prior for a proportion
jp4prop <- function(p) {p^-0.5 * (1-p)^-0.5}

#get overall prior for model parameters
logprior<- function(g,sdv) {
  return(log(jp4kappa(sd2k(sdv)))+log(jp4prop(g)))
}

#make it circular in degrees
mkcirc<-function(td)
{as.circular(td,control.circular=list(units="degrees"))}
```

Listing 7.4

```
#main function that fits mixture model to data being passed as argument (Listing 7.3)
getMixtmodel <-function(data,svalues) {
  chain <- matrix(0,5000,2)
  burnin<-500
  set.seed(1234)
  propsd <- svalues*.05
  lb <- c(0,4)
  ub <- c(1,360)

  chain[1,] <- svalues #starting values for parameters
  for (i in c(2:dim(chain)[1])) {
    cur <- chain[i-1,]
    doitagain <- TRUE
    while (doitagain) {
      propl <- cur + rnorm(2,0,propsd)
      doitagain <- any(propl<lb) || any(propl>ub)
    }

    lpropval <- logmixturepdf(data,propl[1],propl[2])
                +logprior(propl[1],propl[2])
    lcurval  <- logmixturepdf(data,cur[1],cur[2])
                +logprior(cur[1],cur[2])
    llratio  <- exp(lpropval-lcurval)
    if (runif(1) < llratio) {
      chain[i,] <- propl
    } else {
      chain[i,] <- cur
    }
  }
  finparm<-apply(chain[-c(1:burnin),],2,mean)
  print(finparm)

  td<-c(-180:180)
  pred<-(1-finparm[1])*
    dvonmises(mkcirc(td),mkcirc(0),sd2k(finparm[2]))+
    (finparm[1]*rep(1,length(td))/(2*pi))   #<---- Note change here ****************
  posterior<-chain[-c(1:burnin),]
  return(list(preds=pred,posteriors=posterior))
}
```

Program to run the functions in Listings 7.3 and 7.4

This program generates Figures 7.4 and 7.5 but is not itself shown in the book. The revised figures are reproduced below together with the code.

```
# Now run the other listings and plot results
fn <- "memtoolboxMixtureModels/zhl08subj1.dat"
vwmerrors <- read.table(fn,sep=",",col.names=c("setsize","errors"))
vwmerrors$errdiscrete<-cut(vwmerrors$error,breaks=seq(from=-180,to=180,by=20),labels=FALSE)
npss <- mean(as.numeric(table(vwmerrors$setsize)))
vwmmeans <- aggregate(errors~setsize+errdiscrete,data=vwmerrors,FUN=function(x) length(x)/npss)
p2f<-1

#get predictions
svalues<-c(0.5,20)
preds<-posteriors<-vector("list",2)
ssz<-c(3,6)
for (s in c(1,2)) {
  cp<-getMixtmodel(subset(vwmerrors,setsize==ssz[s])$errors,svalues)
  preds[[s]] <- cp$preds
  posteriors[[s]] <- cp$posterior
  preds[[s]] <- preds[[s]]/sum(preds[[s]])  #normalize
}
```

```
## [1]  0.1879279 21.9868297
## [1]  0.6039159 30.8851707
```

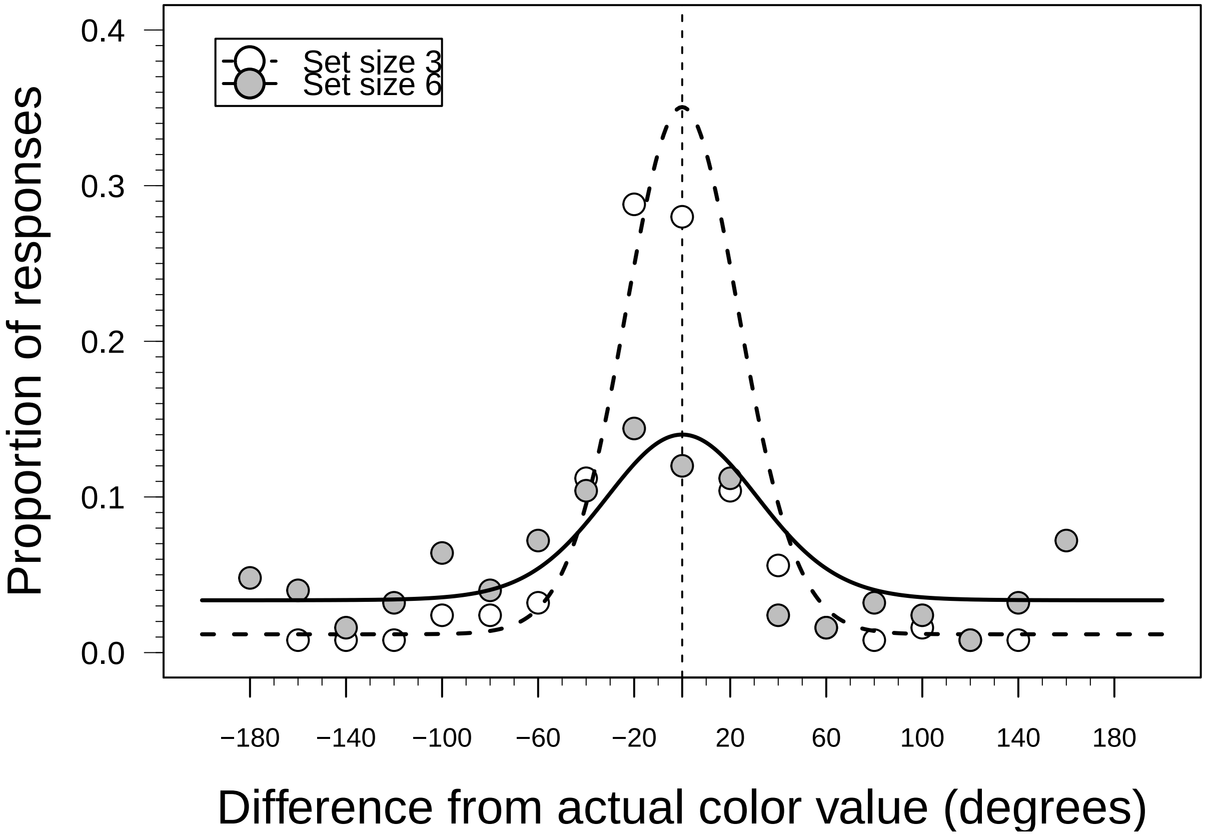
```
x4preds <- seq(from=0,to=20,length.out=length(preds[[1]]))

#now start plotting
x11(7,7)
par(mar=c(4, 5, 1, 0.5),cex.lab=1.5)
ylimits <- c(0,0.4)
plot(vwmmeans$errdiscrete,vwmmeans$errors,
     type="n",
     ylab="Proportion of responses",
     yaxt="n",
     ylim=ylimits,
     xlab="Difference from actual color value (degrees)",
     xaxt="n",
     xlim=c(0,20),
     las=1)
abline(v=10,lty="dashed")
#plots for different setsizes superimposed with pdf of mixture model
with(subset(vwmmeans,setsize==ssz[1]),{
  points(errdiscrete,errors,pch=21, cex=1.5, col="black",bg="white")
  print(length(errdiscrete))
  lines(x4preds,preds[[1]]*(length(preds[[1]])/length(errdiscrete)),lty="dashed",lwd=2)
})
```

```
## [1] 16
```

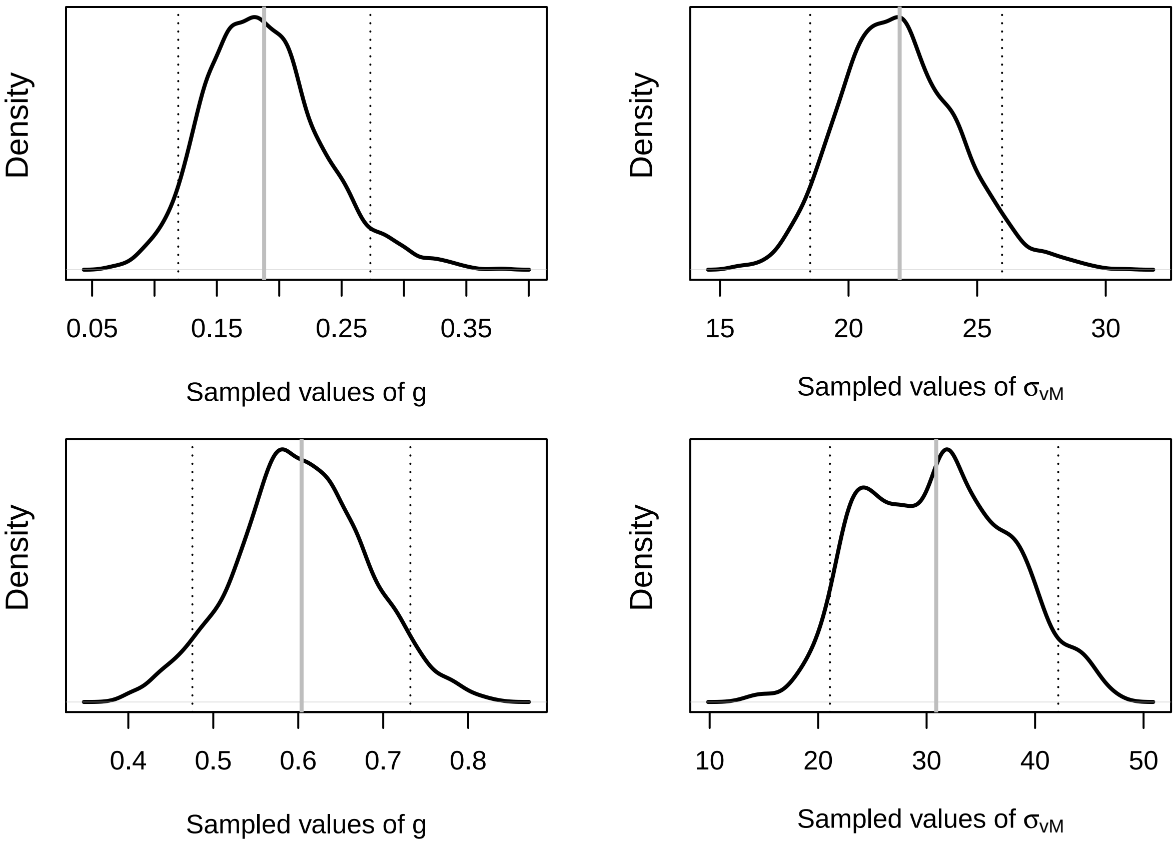
```
with(subset(vwmmeans,setsize==ssz[2]),{
  points(errdiscrete,errors,pch=21, cex=1.5, col="black",bg="gray")
  print(length(errdiscrete))
  lines(x4preds,preds[[2]]*(length(preds[[2]])/length(errdiscrete)),lwd=2)
})
```

```
## [1] 18
```

```
legend("topleft",inset=.05,c("Set size 3","Set size 6"),pch=21,pt.bg=c("white","gray"),
       pt.cex=2,lty=c("dashed","solid"),lwd=1.5)

par(tcl= -0.2)  #minor ticks
axis(1, at=seq(from=1,to=19,by=.5), labels=F, lwd=1, lwd.ticks=0.5)
axis(2, at=seq(from=0,to=ylimits[2],by=.01), labels=F, lwd=1, lwd.ticks=0.5)

par(tcl= -0.5)  #major ticks with labels
axis(1, at=c(1,3,5,7,9,10,11,13,15,17,19), labels=c(-180,-140,-100,-60,-20,0,20,60,100,140,180),
     lwd=0, lwd.ticks=1,cex.axis=0.8)
axis(2, at=seq(from=0,to=ylimits[2],by=.1), labels=TRUE, lwd=1, lwd.ticks=0.5,las=1)
```



```
########plot posteriors
x11(5,5)
xl<- c("Sampled values of g",bquote("Sampled values of "*sigma[vM]))

par(mar=c(4, 4, 1, 0.5))
par(mfrow=c(2,2))
for (s in c(1,2)){
  pe<-apply(posteriors[[s]],2,mean)
  for(p in c(1,2)){
    plot(density(posteriors[[s]][,p]),las=1,xlab=xl[p],
         yaxt="n",lwd=2,lty="solid",
         main="",ylab="")
    mtext("    Density",2,1)
    abline(v=pe[p],lty="solid",lwd=2,col="gray")
    abline(v=quantile(posteriors[[s]][,p],.05),lty="dotted")
    abline(v=quantile(posteriors[[s]][,p],.95),lty="dotted")
  }
}
```


Density
Sampled values of g
Density
Sampled values of σ_{vM}
Density
Sampled values of g
Density
Sampled values of σ_{vM}