R Codes for Preliminary Checks (Bayesian Method)

SSHPA / AISDL
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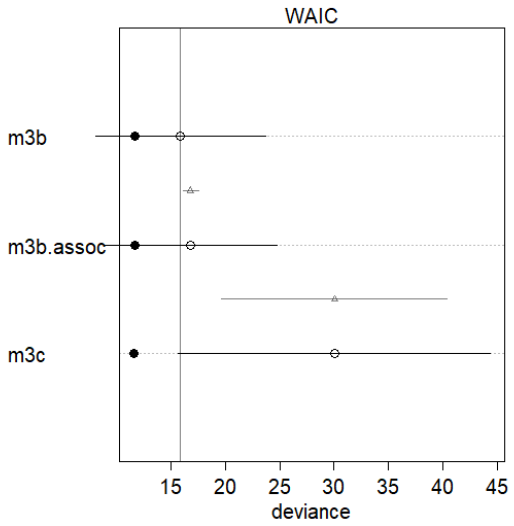
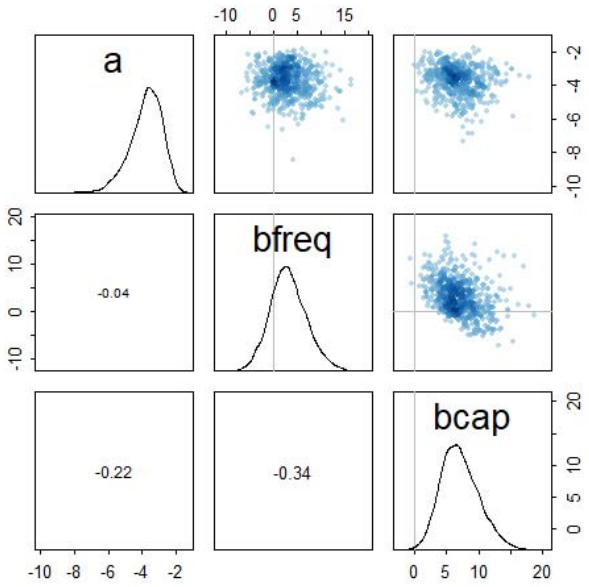
```
## column names (variables): scid, bmattitude, bmuse, freqstillgood, capab,
bmdiff,
## theodiff, moddiff, resdiff, codediff, plan, trysoft, learntime
## the following codes run well with the hypothetical data set btestdata.csv
## bmdat <- read.table("c://dr.vuong/BMSurvey/btestdata.csv", sep=",",
header=T)

m1 <- map(
 alist(
 bmuse ~ dbinom(1,p) ,
 logit(p) <- a + bfreq*freqstillgood,
 a ~ dnorm(0,10),
 bfreq ~ dnorm(0,10)
 ),
data=bmdat)

m3 <- map(
 alist(
 bmuse ~ dbinom(1,p) ,
 logit(p) <- a + bfreq*freqstillgood + bcap*capab,
 a ~ dnorm(0,10),
 bfreq ~ dnorm(0,10),
 bcap ~ dnorm(0,10)
 ),
data=bmdat)

## Note for m1: a model with the suspicion that when one considers the old
way of
## analysis is still good, one is hesitant to adop the Bayesian method

m2 <- map(
 alist(
 bmattitude ~ dbinom(1,p) ,
 logit(p) <- a + bfreq*freqstillgood + bcap*capab,
 a ~ dnorm(0,10),
 bfreq ~ dnorm(0,10),
 bcap ~ dnorm(0,10)
 ),
data=bmdat)

## Note for m2: a model with the suspicion that when one considers the old
way
## of analysis is inadequate and one's capability is good enough,
## one will tend to learn and use Bayesian method

> compare(m1,m2,m3)
   WAIC pWAIC dWAIC weight    SE   dSE
m3 28.6   8.6   0.0   0.90 13.79    NA
m1 33.1   2.4   4.5   0.09  9.99 10.31
m2 42.3   9.2  13.7   0.00 14.75  8.33

> precis(m3)
```

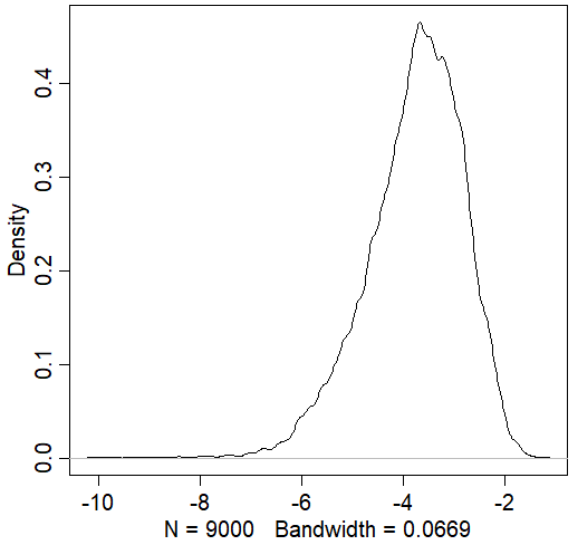
```
       Mean StdDev   5.5% 94.5%
a     -1.71   6.60 -12.26  8.84
bfreq -2.01   6.59 -12.54  8.53
bcap   7.43   3.58   1.71 13.16

> logistic(-1.71)
[1] 0.1531637
> logistic(-1.71+7.43)
[1] 0.996731

> compare(m3b,m3b.assoc,m3c)
          WAIC pWAIC dWAIC weight    SE   dSE
m3b       15.3   1.9   0.0   0.61  7.86    NA
m3b.assoc 16.2   2.3   0.9   0.39  7.80  0.45
m3c       30.5   9.4  15.1   0.00 14.44 10.58

> plot(compare(m3b,m3b.assoc,m3c))
```



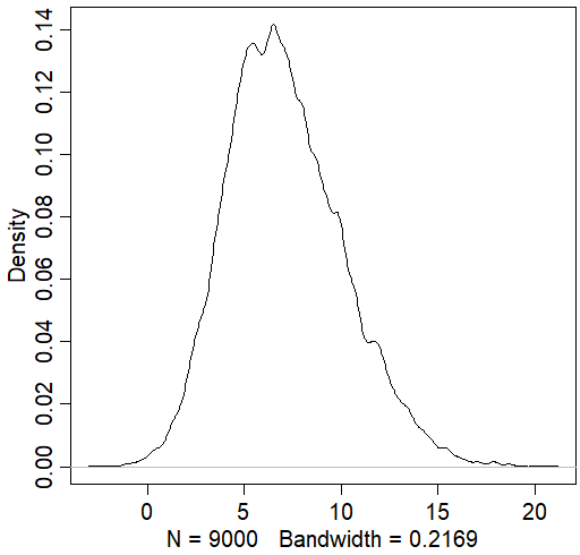

```
> precis(m3b.assoc)
       Mean StdDev  5.5% 94.5%
a     -3.50   0.85 -4.85 -2.14
bfreq  1.85   3.34 -3.49  7.19
bcap   5.32   2.42  1.46  9.18

# HMC Stan
m3b.assoc.stan <- map2stan(m3b.assoc, data=bmdat, iter=10000, warmup=1000)
# check Gaussian
pairs(m3b.assoc.stan)
```



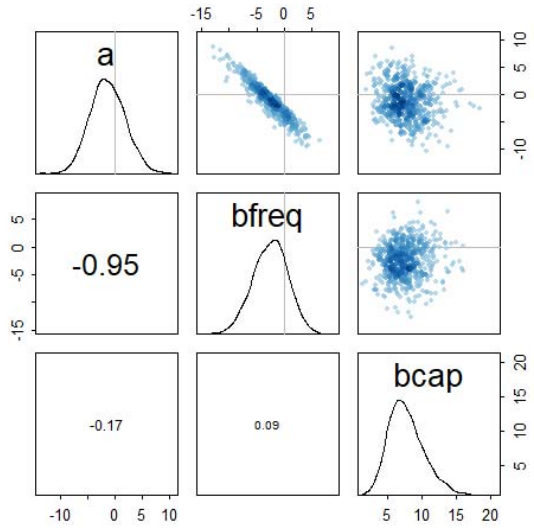

```
> precis(m3b.assoc.stan)
       Mean StdDev lower 0.89 upper 0.89 n_eff Rhat
a     -3.78   0.94       -5.24       -2.31  4728    1
bfreq  3.02   3.89       -2.91        9.54  4114    1
bcap   7.11   2.98        2.36       11.77  3652    1
> post <- extract.samples(m3b.assoc.stan)
> str(post)
List of 3
 $ a    : num [1:9000(1d)] -4.42 -4.6 -2.95 -3.94 -2.11 ...
 $ bfreq: num [1:9000(1d)] 0.298 4.228 4.957 5.496 3.666 ...
 $ bcap : num [1:9000(1d)] 6.41 5.34 3.91 3.98 3.93 ...
> dens(post$a)
```



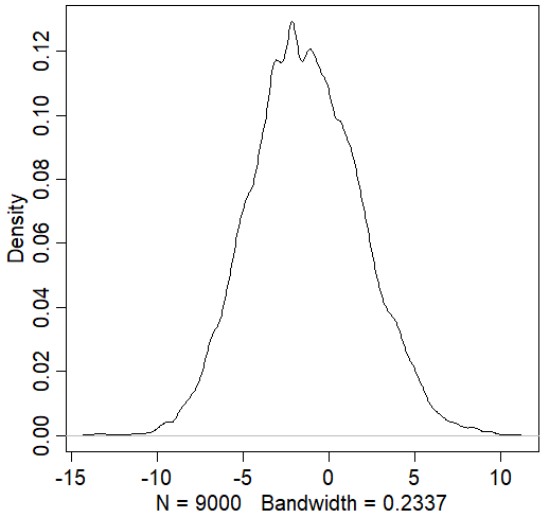
```
> dens(post$bcap)
```



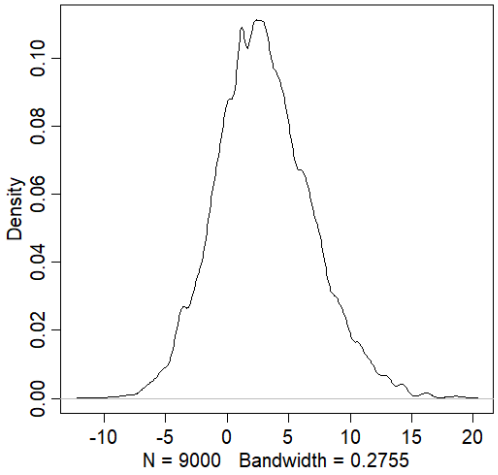

```
# MCMC Stan for m3b model
> m3b.stan <- map2stan(m3b, data=bmdat, iter=10000, warmup=1000)
> precis(m3b.stan)
       Mean StdDev lower 0.89 upper 0.89 n_eff Rhat
a     -1.33   3.21      -6.24       4.01  2489    1
bfreq -2.55   3.20      -7.88       2.29  2480    1
bcap   7.78   2.61       3.55      11.61  2511    1

> pairs(m3b.stan)
```




```
> post2 <- extract.samples(m3b.stan)
> dens(post2$a)
```




```
> dens(post$bfreq)
```



Stan MCMC performs quite well.

References

McElreath R. (2018). Statistical Rethinking: A Bayesian Course with Examples in R and Stan. New York: Chapman and Hall/CRC.

Vuong QH. (2018). The (ir)rational consideration of the cost of science in transition economies. Nature Human Behaviour, 2(1), 5.

Vuong QH, La VP, Vuong TT,... & Ho MT. (2018). Cultural additivity: Behavioural insights from the interaction of Confucianism, Buddhism, and Taoism in folktales. Palgrave Communications, 4(1), 143.