

# Signal detection theory

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## A psychological model: Signal detection theory

$$\mathcal{M}_{sdt} : \begin{cases} \delta \sim N(1, 1) & \beta \sim N(0, 1) \\ \phi_h = \Phi(\delta/2 - \beta) & \phi_f = \Phi(-\delta/2 - \beta) \\ h \sim B(\phi_h, n_s) & f \sim B(\phi_f, n_n) \end{cases}$$

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```
model {  
  ## Complete this model  
}
```

## Signal detection theory ~ implementation

```
library(rjags)
data <- list( h = 60 ,  sigtrials  = 100 ,
              f = 11 ,  noistrials = 100 )
modelString = "
  model {
    ## Complete this model
  }
"
```

## Signal detection theory ~ implementation

```
writeLines( modelString , con = "sdt.txt" )

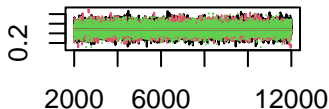
jagsModel = jags.model( file      = "sdt.txt" ,
                        data      =      data ,
                        n.chains =      3 ,
                        n.adapt  =     1000 )

set.seed(0)
update( jagsModel , n.iter = 1000 )  # burn-in

samples = coda.samples( jagsModel ,
                        variable.names = c("d", "b") ,
                        n.iter        =     10000 )
```

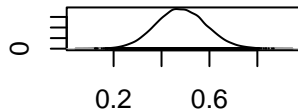
# Signal detection theory ~ results

## Trace of $b$



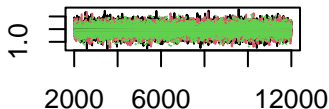
Iterations

## Density of $b$



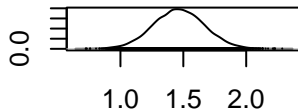
$N = 10000$  Bandwidth = 0.0141

## Trace of $d$



Iterations

## Density of $d$



$N = 10000$  Bandwidth = 0.0273

# Signal detection theory ~ summary statistics

```
summary(samples)$statistics
```

##	Mean	SD	Naive SE	Time-series SE
## b	0.4820656	0.1045568	0.0006036589	0.0008066294
## d	1.4656305	0.2028669	0.0011712528	0.0015759208

```
summary(samples)$quantiles
```

##	2.5%	25%	50%	75%	97.5%
## b	0.2799324	0.4108406	0.4806752	0.5519684	0.691209
## d	1.0701071	1.3272863	1.4645003	1.6013580	1.866794

# Signal detection theory ~ convergence

```
effectiveSize(samples)
```

```
##          b          d  
## 16817.72 16577.89
```

```
gelman.diag(samples)
```

```
## Potential scale reduction factors:
```

```
##
```

```
##   Point est. Upper C.I.
```

```
## b           1           1
```

```
## d           1           1
```

```
##
```

```
## Multivariate psrf
```

```
##
```

```
## 1
```