Testing eyewitness data against the Block-Marschak inequalities

Kym McCormick

3 May 2019

## Demographics

## vars n mean sd median trimmed mad min max range skew kurtosis  
## X1 1 2718 38.37 11.65 35 37.18 10.38 18 81 63 0.87 0.14  
## se  
## X1 0.22

## $demographics\_gender  
## .  
## female male other   
## 0.000000000 0.494849154 0.502943341 0.002207506   
##   
## $demographics\_country  
## .  
## American Samoa Australia Brazil Canada   
## 0 0 0 0 0   
## China Colombia India Indonesia Nepal   
## 0 0 0 0 0   
## Pakistan Philippines Puerto Rico Uruguay USA   
## 0 0 0 0 1   
## Uzbekistan Bangladesh Germany Italy Jamaica   
## 0 0 0 0 0   
## Netherlands Romania Venezuela   
## 0 0 0

## m-AFC Data

NB that each lineup size (m = 2:8) has a different number of observations.

Vector of correct and incorrect response counts for each lineup size.

## [1] 296 38 262 82 223 108 209 113 185 145 182 149 365 361

Vector of CIDs for each lineup size

## [1] 0.8862275 0.7616279 0.6737160 0.6490683 0.5606061 0.5498489 0.5027548

## Fit Block-Marschak

### inequality matrix

## max 2AFC 3AFC 4AFC 5AFC 6AFC 7AFC 8AFC RHS  
## [1,] 2 1 0 0 0 0 0 0 0.5000000  
## [2,] 3 0 1 0 0 0 0 0 0.3333333  
## [3,] 4 0 0 1 0 0 0 0 0.2500000  
## [4,] 5 0 0 0 1 0 0 0 0.2000000  
## [5,] 6 0 0 0 0 1 0 0 0.1666667  
## [6,] 7 0 0 0 0 0 1 0 0.1428571  
## [7,] 8 0 0 0 0 0 0 1 0.1250000  
## [8,] 2 -1 0 0 0 0 0 0 -1.0000000  
## [9,] 3 0 -1 0 0 0 0 0 -1.0000000  
## [10,] 4 0 0 -1 0 0 0 0 -1.0000000  
## [11,] 5 0 0 0 -1 0 0 0 -1.0000000  
## [12,] 6 0 0 0 0 -1 0 0 -1.0000000  
## [13,] 7 0 0 0 0 0 -1 0 -1.0000000  
## [14,] 8 0 0 0 0 0 0 -1 -1.0000000  
## [15,] 3 1 -1 0 0 0 0 0 0.0000000  
## [16,] 4 0 1 -1 0 0 0 0 0.0000000  
## [17,] 5 0 0 1 -1 0 0 0 0.0000000  
## [18,] 6 0 0 0 1 -1 0 0 0.0000000  
## [19,] 7 0 0 0 0 1 -1 0 0.0000000  
## [20,] 8 0 0 0 0 0 1 -1 0.0000000  
## [21,] 4 1 -2 1 0 0 0 0 0.0000000  
## [22,] 5 0 1 -2 1 0 0 0 0.0000000  
## [23,] 6 0 0 1 -2 1 0 0 0.0000000  
## [24,] 7 0 0 0 1 -2 1 0 0.0000000  
## [25,] 8 0 0 0 0 1 -2 1 0.0000000  
## [26,] 5 1 -3 3 -1 0 0 0 0.0000000  
## [27,] 6 0 1 -3 3 -1 0 0 0.0000000  
## [28,] 7 0 0 1 -3 3 -1 0 0.0000000  
## [29,] 8 0 0 0 1 -3 3 -1 0.0000000  
## [30,] 6 1 -4 6 -4 1 0 0 0.0000000  
## [31,] 7 0 1 -4 6 -4 1 0 0.0000000  
## [32,] 8 0 0 1 -4 6 -4 1 0.0000000  
## [33,] 7 1 -5 10 -10 5 -1 0 0.0000000  
## [34,] 8 0 1 -5 10 -10 5 -1 0.0000000  
## [35,] 8 1 -6 15 -20 15 -6 1 0.0000000  
## [36,] 3 -2 1 0 0 0 0 0 -1.0000000  
## [37,] 4 -3 3 -1 0 0 0 0 -1.0000000  
## [38,] 5 -4 6 -4 1 0 0 0 -1.0000000  
## [39,] 6 -5 10 -10 5 -1 0 0 -1.0000000  
## [40,] 7 -6 15 -20 15 -6 1 0 -1.0000000  
## [41,] 8 -7 21 -35 35 -21 7 -1 -1.0000000  
## [42,] -1 0 0 0 0 0 -7 8 0.0000000  
## [43,] -1 0 0 0 0 -21 49 -28 0.0000000  
## [44,] -1 0 0 0 -35 126 -147 56 0.0000000  
## [45,] -1 0 0 -35 175 -315 245 -70 0.0000000  
## [46,] -1 0 -21 140 -350 420 -245 56 0.0000000  
## [47,] -1 -7 63 -210 350 -315 147 -28 0.0000000  
## [48,] -1 14 -63 140 -175 126 -49 8 1.0000000

### Fitting to the Block Marschak inequalities

Closest fitting expected data that respect the Block-Marschak inequalities:

## [1] 0.8711353 0.7687420 0.6885933 0.6264624 0.5781227 0.5393473 0.5059095

### Fitting to the Block-Marschak inequalities (with monotonic likelihood constraint applied)

Closest fitting expected data that respect the Block-Marschak inequalities and the monotonic likelihood constraint:

## [1] 0.8719132 0.7694413 0.6887421 0.6259732 0.5772925 0.5388578 0.5068268

### Yields rankings

reconstructing the CID and FID (respectively) from the m-AFC data:

## [1] 0.5068268 0.7310438 0.8655219 1.0000000 1.0000000 1.0000000 1.0000000  
## [8] 1.0000000

## [1] 0.07045331 0.18127946 0.30492544 0.42857143 0.57142857 0.71428571  
## [7] 0.85714286 1.00000000

### G-square:

#### Block- Marschak

## [1] 2.43665

#### Block-Marschak with monotonic likelihood

## [1] 2.421121

### Multiplicative inequalities

## [1] TRUE

Therefore, G-Square equal to 0, p-value equal to 1.

### Bootstrap p-value

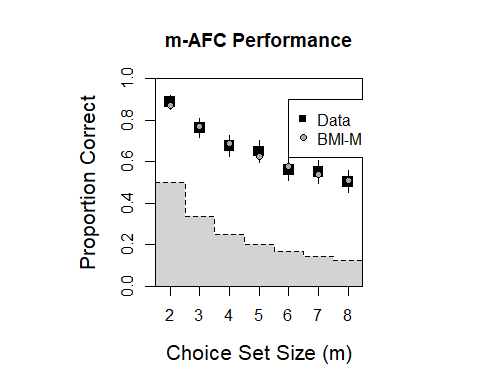
Block-Marschak inequalities:

## [1] 0.65927

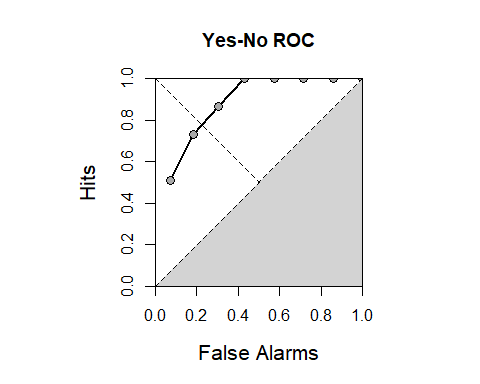
Block-Marschak inequalities with monotonic likelihood constraint:

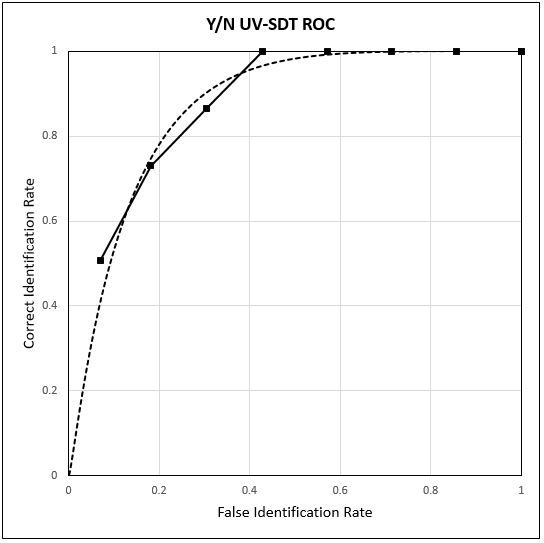
## [1] 0.70868

## Figure



## Reconstructed eyewitness identification ROC





Estimated UV-SDT model parameters: *d'* = 1.33*, s* = 0.63(*G2*(5) = 2.61, *p* = .76)