Experiments on Recognition and the Signal Detection Theory (SDT)

The most important formulas:

Example :

Hit Rate : $H = .8$ False Alarm Rate : $F = .4$

Sensitivity indicators :

$d' = z(H) - z(F) = z(.8) - z(.4) = .842 - (-.253) = 1.095$

[SPSS : `COMPUTE dprime = (PROBIT(h))-(PROBIT(f)) .`]

$\log(\alpha) = .5*\log[H/(1-H)] - .5*\log[F/(1-F)] = .5*\log[.8/(1-.8)] - .5*\log[.4/(1-.4)] = .90$

[SPSS : `COMPUTE logalpha = (.5*ln(h/(1-h)))-(.5*ln(f/(1-f))) .`]

Response bias indicators :

$c = -.5[z(H)+ z(F)] = -.5[z(.8)+ z(.4)] = -.5[.842+(-.253)] = -.295$

[SPSS : `COMPUTE c = -.5*((PROBIT(h))+(PROBIT(f))) .`]

$\beta = e^{cd'} = e^{(1.095*(-.295))} = e^{-.323} = .72$

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[SPSS : COMPUTE beta = EXP(dprime*c) . ]
[or:    COMPUTE beta = EXP(((PROBIT(h))-(PROBIT(f)))*
                          (-.5*((PROBIT(h))+(PROBIT(f))))) . ]
```

$\log(\beta) = cd' = 1.095*(-.295) = -.32$

```
[SPSS : COMPUTE logbeta = dprime*c . ]
[or:    COMPUTE logbeta = ((PROBIT(h))-(PROBIT(f)))*
                          (-.5*((PROBIT(h))+(PROBIT(f)))) . ]
```

Sensitivity indicator d' in same-different experiments :

if $H>F$: $d' = 2z\{.5[1+(2\Phi\{.5[z(H)-z(F)]\}-1)^{1/2}]\} = \ldots = 1.85$

if $H<F$: $d' = -2z\{.5[1+(2\Phi\{.5[z(F)-z(H)]\}-1)^{1/2}]\}$

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[SPSS : IF (h>f) dprime = 2*PROBIT(.5*(1+((2*(CDFNORM(((PROBIT(h))-
                          (PROBIT(f)))/2)) -1))**.5)) .
        IF (h<f) dprime = -2*PROBIT(.5*(1+((2*(CDFNORM(((PROBIT(f))-
                          (PROBIT(h)))/2)) -1))**.5)) . ]
```

Adjustments for hit rates or false alarm rates of 1.0 and 0 :

Adjustment for P=1.0 : $P_{adj} = 1 - 1 / (2N)$

Adjustment for P=0 : $P_{adj} = 1 / (2N)$

[where N = number of words in that category]

Note: All logarithms are natural, i.e., to the base of *e* (not to the base of 10). In SPSS, SAS, and on most pocket calculators, the natural logarithms is referred to with "ln" (and not "log").

Different Sensitivities and Response Biases

Response Bias

	Say "Yes"	**None**	**Say "No"**
high sensitivity	"Yes" "No" Old 90 10 New 40 60 $d' = 1.53$ $c = -.51$	"Yes" "No" Old 78 22 New 22 78 $d' = 1.54$ $c = 0$	"Yes" "No" Old 60 40 New 10 90 $d' = 1.53$ $c = .51$
medium sensitivity	"Yes" "No" Old 81 19 New 55 45 $d' = .75$ $c = -.50$	"Yes" "No" Old 65 35 New 35 65 $d' = .77$ $c = 0$	"Yes" "No" Old 45 55 New 19 81 $d' = .75$ $c = .50$
low sensitivity	"Yes" "No" Old 71 29 New 68 32 $d' = .09$ $c = -.51$	"Yes" "No" Old 52 48 New 48 52 $d' = .10$ $c = 0$	"Yes" "No" Old 32 68 New 29 71 $d' = .09$ $c = .51$