THREE-WAY BETWEEN-SUBJECT FACTORIAL

	Hours					Hours			
	6	12	24	72		6	12	24	72
Visual	10 (100)	90 (900)	70 (700)	50 (500)		10 (100)	50 (500)	70 (700)	60 (600)
Audio-Visual	40 (400)	140 (1400)	130 (1300)	100 (1000)		20 (200)	70 (700)	170 (1700)	130 (1300)
Rhode Island Reds						Plymouth Rocks			

Experiment is on imprinting of chicks to wooden decoy, Row factor (<u>C</u>ue) is whether the decoy "clucks" (audio-visual) or not (visual). Column factor (<u>P</u>eriod) is hours of age (6, 12, 24, or 72) at time of first exposure to cue. Panel factor is <u>B</u>reed of chick (Rhode Island Red versus Plymouth Rock). Data are minutes out of 180 spent following the decoy. Ten chicks are assigned a random to each CPB combination. The table gives the cell means with cell totals in parentheses.

I. Computing the ANOVA

A. If needed, get pooled means and totals for various 2-way and 1-way matrices. Notice that these matrices show the means we need to graph various effects.

Grand

75.625 (12100)

Period

6	12	24	72
20 (800)	87.5 (3500)	110 (4400)	85 (3400)

Cue

V	A-V
51.25 (4100)	100 (8000)

Breed

RIR	PR
78.75 (6300)	72.5 (5800)

Period by Cue

	6	12	24	72
V	10 (200)	70 (1400)	70 (1400)	55 (1100)
A-V	30 (600)	105 (2100)	150 (3000)	115 (2300)

Period by Breed

	6	12	24	72
RIR	25 (500)	115 (2300)	100 (2000)	75 (1500)
PR	15 (300)	60 (1200)	120 (2400)	95 (1900)

RIR PR

Cue by Breed

V	55 (2200)	47.5 (1900)
A-V	102.50 (4100)	97.5 (3900)

B. Compute the basic ratios

$$[T] = \frac{12100^2}{160} = 915062.5$$

$$[C] = \frac{4100^2 + 8000^2}{80} = 1010125$$

$$[B] = \frac{6300^2 + 5800^2}{80} = 916625$$

$$[P] = \frac{800^2 + 3500^2 + 4400^2 + 3400^2}{40} = 1095250$$

$$[CB] = \frac{2200^2 + 1900^2 + 4100^2 + 3900^2}{40} = 1011750$$

$$[CP] = \frac{200^2 + 1400^2 \ldots + 3000^2 + 2300^2}{20} = 1211500$$

$$[BP] = \frac{500^2 + 2300^2 \ldots + 2400^2 + 1900^2}{20} = 1134500$$

$$[CBP] = \frac{100^2 + 900^2 \ldots + 1700^2 + 1300^2}{10} = 1259000$$

[Y] = (given) 1334000

C. Compute the various SS

Systematic Sources

$SS_M = 915062.5$

$SS_C = 1010125 - 915062.5 = 95062.5$

$SS_B = 916625 - 915062.5 = 1562.5$

$SS_P = 1095250 - 915062.5 = 180187.5$

$SS_{CB} = 1011750 - 1010125 - 916625 + 915062.5 = 62.5$

$SS_{PB} = 1134500 - 10952.50 - 916625 + 915062.5 = 37687.5$

SS_{PC} = 1211500 – 1095250 – 1010125 + 915062.5 = 21187.5

SS_{CPB} = 1259000 – 1011750 – 1211500 – 1134500 + 1010125 + 916625 + 1095250 – 915062.5 = 8187.5

(Note: The sum of the various SS for systematic sources equals 1259000. This is equal to [CPB] or the sum of the squared cell totals.]

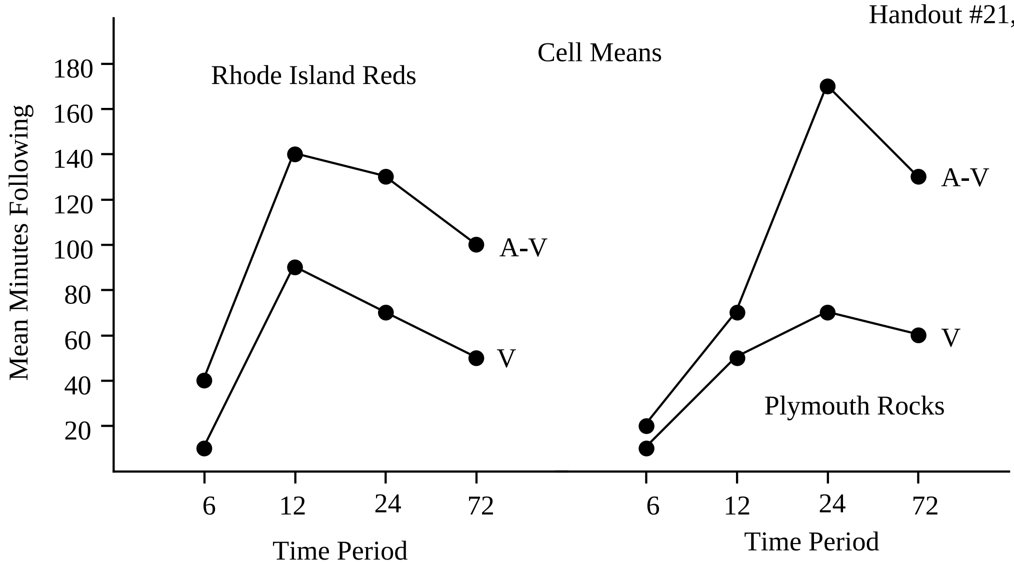
Error Source $SS_{S/CPB}$ = 1334000 – 1259000 = 75000

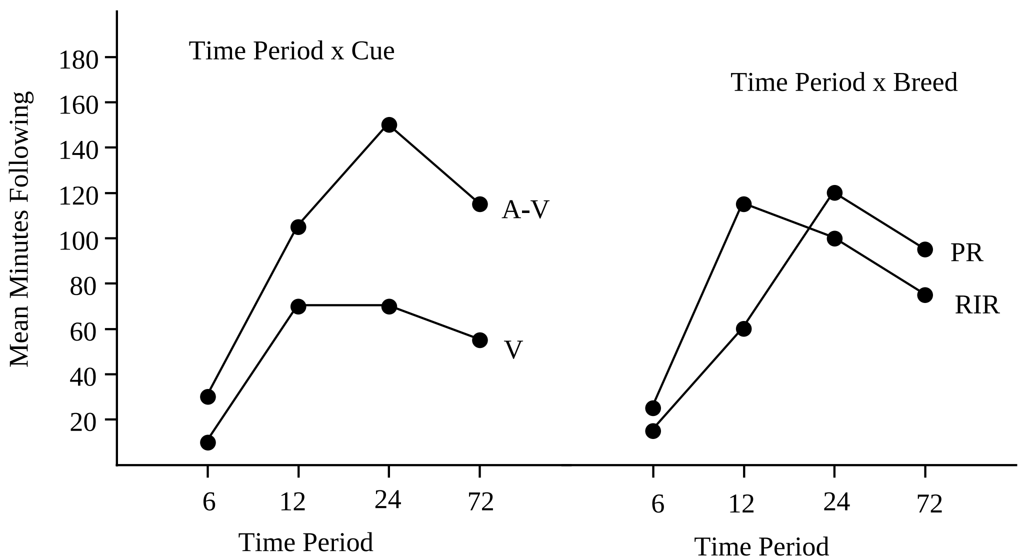
D. Compute MS values and enter in table

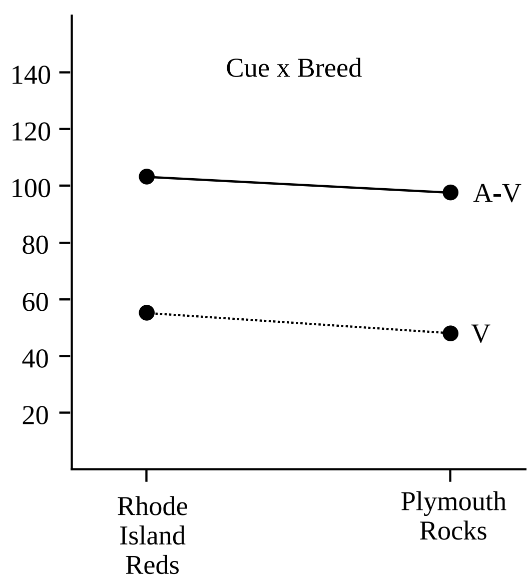
Source	df	SS	MS	F	p
Mean	1	915062.50	915062.5	1756.93	< .01
Cue	1	95062.50	95062.5	182.52	< .01
Period	3	180187.50	60062.5	115.32	< .01
Breed	1	1562.50	1562.5	3.00	ns
C x P	3	21187.50	7062.5	13.56	< .01
C x B	1	62.50	62.5	.12	ns
P x B	3	37687.50	12562.5	24.12	< .01
C x P x B	3	8187.50	2729.17	5.24	< .01
S/CPB	144	75000.00	520.83		
	160	1334000.00			

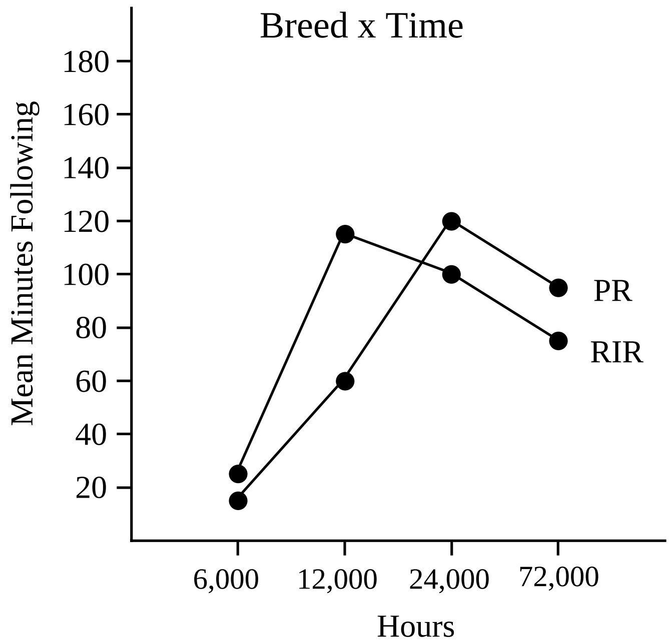
Checks: ∑df = # of observations = 10 S/cell x 16 cells
∑SS = [Y] = 1334000.00

$F^*(1, 120) = 3.92$ (no value available for $df_{error} = 144$)
$F^*(3, 120) = 2.68$ (no value available for $df_{error} = 144$)


Cell Means
Rhode Island Reds
Plymouth Rocks
Mean Minutes Following
180
160
140
120
100
80
60
40
20
6
12
24
72
Time Period
A-V
V


Time Period x Cue
Time Period x Breed
Mean Minutes Following
180
160
140
120
100
80
60
40
20
6
12
24
72
Time Period
A-V
V
PR
RIR


Cue x Breed
140
120
100
80
60
40
20
A-V
V
Rhode Island Reds
Plymouth Rocks


Breed x Time
Mean Minutes Following
180
160
140
120
100
80
60
40
20
6,000
12,000
24,000
72,000
Hours
PR
RIR