CAUSAL MODELS STAT 209 4/19

1. Path Analysis

A

```
> # Maruyama (1988) Basics of structural equation modeling ex p.57
> selfesteempredR = matrix(c(1, .39, -.33, .39, 1, -.33, -.33, -.33,1), nr=3)
> selfesteempredR
      [,1]  [,2]  [,3]
[1,]  1.00  0.39 -0.33
[2,]  0.39  1.00 -0.33
[3,] -0.33 -0.33  1.00
> selfesteemR = c(.19, .14, -.14)
> pathcoeff = selfesteemR%*%solve(selfesteempredR)
> pathcoeff     #coeffs for ability social class famsize respectively
          [,1]       [,2]        [,3]
[1,] 0.1423315 0.06036429 -0.07311039
> selfesteemR%*%t(pathcoeff)  #Rsq for eq
          [,1]
[1,] 0.04572944
```

X transformed to (0,1) standardized metric

$r_{xx} = (x'x)$ $(p \times p)$ $n \times p$

r_{yx}

$r_{xx}\, b = r_{yx}$

```
class   1.00 . . . .
famsize -.33 1.00  . . .
ability  .39 -.33 1.00 . .
esteem   .14 -.14  .19 1.00 .
achieve  .43 -.28  .67  .22 1.00
```

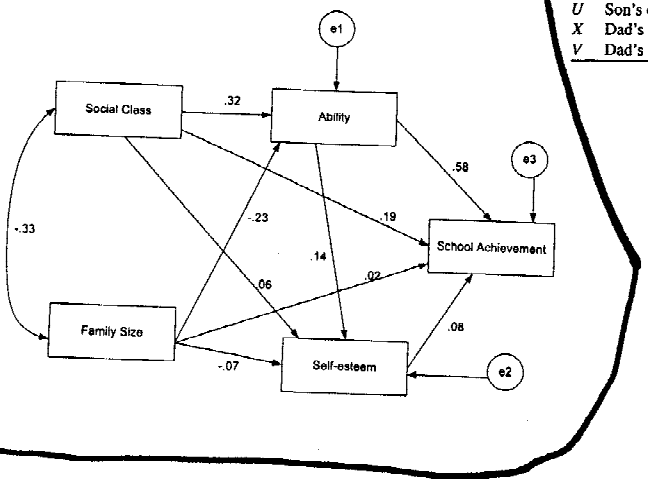
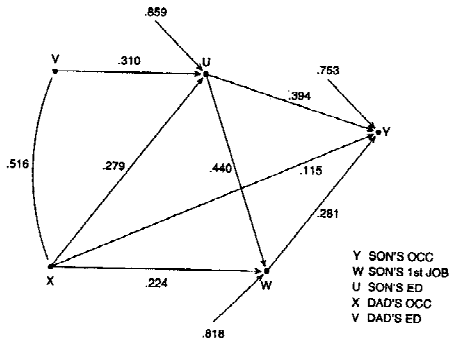


Table 1. Correlation matrix for variables in Blau and Duncan's path model.

		Y Son's occ	W Son's 1st job	U Son's ed	X Dad's occ	V Dad's ed
Y	Son's occ	1.000	.541	.596	.405	.322
W	Son's 1st job	.541	1.000	.538	.417	.332
U	Son's ed	.596	.538	1.000	.438	.453
X	Dad's occ	.405	.417	.438	1.000	.516
V	Dad's ed	.322	.332	.453	.516	1.000

Figure 1. Path model. Stratification, US, 1962.



B

```
> #Blau-Duncan, stratification US (DAF p.76)
> #Do the Y-eq (son occupation)
> bdpredR = matrix(c(1,.538,.417,.538,1,.438,.417,.438,1), nr = 3, byrow=T)
> bdpredR
      [,1]  [,2]  [,3]
[1,] 1.000 0.538 0.417
[2,] 0.538 1.000 0.438
[3,] 0.417 0.438 1.000
> bdYR = c(.541,.596,.405)
> bdYcoef = bdYR%*%solve(bdpredR)

> bdYcoef  #coefss for W U X respectively (cf DAF p.76)
          [,1]      [,2]      [,3]
[1,] 0.2807282 0.3945428 0.1151266

> bdYR%*%t(bdYcoef)  #Rsq for eq
          [,1]
[1,] 0.4336477
> sqrt( 1 - bdYR%*%t(bdYcoef))  #see p.76 Y eq disturbance term
          [,1]
[1,] 0.7525638
```

st errors for HW

Decomposing correlations (normal eq's)

Path Analysis 4/19 con'd

C.

Roth, D. L., Wiebe, D. J., Fillingim, R. B., & Shay, K. A. (1989). Life events, fitness, hardiness, and health: A simultaneous analysis of proposed stress-resistance effects. *Journal of Personality and Social Psychology, 57,* 136–142.

Kline p. 117

TABLE 5.1. Analysis of a Recursive Path Model of Factor of Illness with Multiple Regression

Correlations, means, and standard deviations (Roth et al., 1989; $N = 373$ university students)

Variable	1	2	3	4	5
1. Exercise	—				
2. Hardiness	−.03	—			
3. Fitness	.39	.07	—		
4. Stress	−.05	−.23	−.13	—	
5. Illness	−.08	−.16	−.29	.34	—
M	40.90	0.00	67.10	4.80	716.70
SD	66.50	3.80	18.40	6.70	624.80

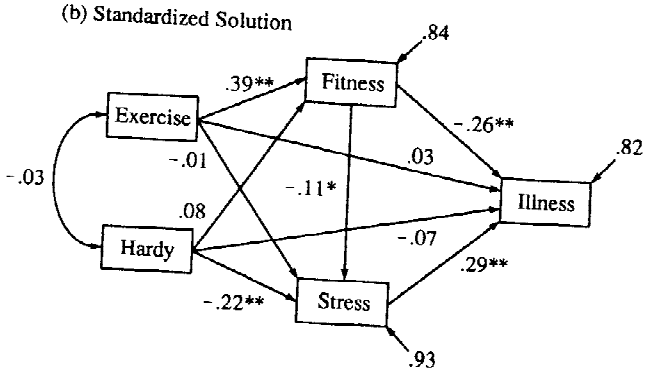


TABLE 5.2. Decomposition of Standardized Effects for a Model of Illness

Causal variable	Endogenous variable: Fitness	Stress	Illness
Exercise			
Direct effect	.39**	−.01	.03
Indirect via Fitness	—	−.04*	−.10**
Indirect via Stress	—	—	.00
Indirect via Fitness and Stress	—	—	−.01[nt]
Total effect	.39**	−.05	−.08
Hardiness			
Direct effect	.08	−.22**	−.07
Indirect via Fitness	—	−.01	−.02
Indirect via Stress	—	—	−.06*
Indirect via Fitness and Stress	—	—	.00[nt]
Total effect	.08	−.23**	−.15**
Fitness			
Direct effect	—	−.11*	−.26**
Indirect via Stress	—	—	−.03
Total effect	—	−.11*	−.29**
Stress			
Direct effect	—	—	.29**

Trace rule
Kline p. 121