16. *Writing about Interactions*

SOLUTIONS

1. For each of these figures from *Writing about Multivariate Analysis, 2nd Edition*, (i) name the independent and dependent variables involved in the interaction, and state (ii) whether the interaction is in terms of direction or magnitude of association, and (iii) whether it is ordinal or disordinal.

   a. Figure 17.4 from Pottick et al.
      i. The independent variables involved in the interaction are time since admission (*x* axis) and type of health insurance (legend), and the dependent variable is discharge from the hospital (*y* axis).
      ii. The interaction between type of insurance and time since admission is in terms of direction of association. The slopes of the two hazard curves are in opposite directions, but of approximately equal steepness.
      iii. The interaction is disordinal because the hazard curves for the two types of insurance cross one another in the observed range of values of the independent variables.

   b. Figure 16.1
      i. The independent variables involved in the interaction are educational attainment (*x* axis) and race/ethnicity (legend), and the dependent variable is birth weight (*y* axis).
      ii. The interaction between race/ethnicity and educational attainment is in terms of magnitude, because birth weight increases with rising educational attainment for all three racial/ethnic groups (same direction of association) but with a decreasing racial gap (magnitude).
      iii. The interaction is ordinal because the rank order of birth weight by educational attainment is the same for all three racial/ethnic groups.

   c. Figure 16.2 from Miller and Rodgers (2008)
      i. The independent variables involved in the interaction are marital status (*x* axis) and gender (legend), and the dependent variable is monthly earnings (*y* axis).
      ii. The interaction is in terms of both direction and magnitude. Not only does the earnings difference by marital status work in opposite directions for men than for women, the size of

the earnings gap is larger for men than for women: NT$3,176 *more* per month for married compared to unmarried men, but NT$1,595 *less* per month for married compared to unmarried women.

iii. The interaction is disordinal because the rank order of earnings by marital status for women is the reverse of that for men. For women, married earnings $<$ unmarried earnings; for men, married earnings > unmarried earnings.

d. Figure 18.1 from Krivo et al.

i. The independent variables involved in the interaction are neighborhood-level racial/ethnic composition (panels) and city-level segregation (legend), and the dependent variable is neighborhood crime rate (*y* axis). Neighborhood disadvantage is also plotted (on the *x* axis) to show how different the levels and ranges of that variable are for neighborhoods with different racial/ethnic compositions.

ii. The cross-level interaction between neighborhood racial/ethnic composition and segregation shows up primarily as a difference in the intercept—the level of the crime rate. The curves relating neighborhood disadvantage, city-level segregation, and neighborhood crime rate are upward sloping for all of the racial/ethnic groups.

iii. The interaction is ordinal because the curves relating disadvantage, segregation, and crime remain approximately parallel within each of the neighborhood racial/ethnic composition groups.

e. Figure 18.2 from Phillips et al. (2004)

i. The independent variables involved in the interaction are NJ KidCare Plan level (*x* axis), family race/ethnicity (legend), and county physician racial composition (legend), and the dependent variable is disenrollment in NJ KidCare (*y* axis).

ii. The interaction is in terms of magnitude, which appears as a wider gap in disenrollment rates for families in NJ KidCare Plan D than in Plans B and C.

iii. The interaction is ordinal because the rank order of disenrollment by family race/ethnicity and county physician racial composition is the same in both Plans B/C and Plan D.

3. Using the results for the total sample

a. **TABLE 16D.** Predicted self-esteem by gender and widowhood status, CLOC sample, 1987–1994

	Male	Female
Widow	1.62	1.72
Nonwidow	2.13	1.53

a. Explanation: Each of the cells includes the intercept. The “female/nonwidow” cell adds in the coefficient on the “female” dummy; the "male/widow" cell adds in the coefficient on the "widow" dummy; the "female/widow" cell adds in both of those coefficients along with the "female _ widow" interaction term. (Note: Results differ from those shown in Carr [2004] because they do not include values of other variables in her model that are excluded from table 16A.)

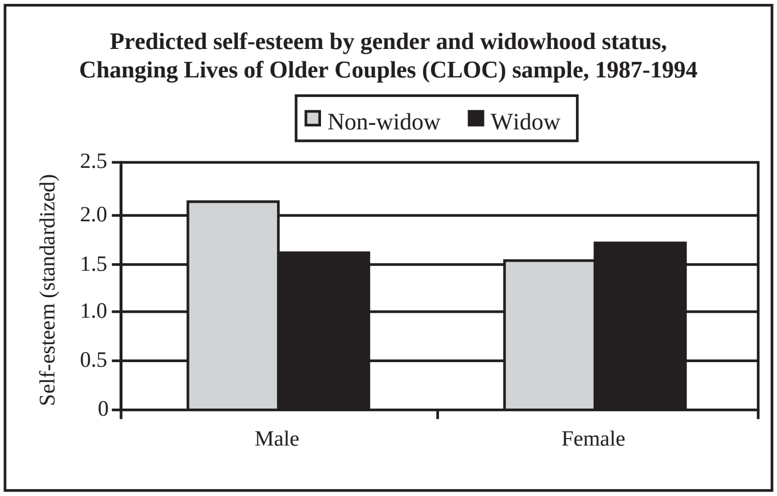

Figure 16A.

b. Figure 16A presents predicted self-esteem for each of the four possible combinations of gender and widowhood status (Carr 2004).
c. "As shown in table 16D the association between widowhood and self-esteem differs by gender. Among males, self-esteem averages nearly half a standard deviation unit lower among widows than among those whose spouses are still alive at wave 2 (1.62 versus 2.13 points, respectively). Among females, however, widows have higher self-esteem than nonwidows (1.72 and 1.53, respectively)."

5. Perform the following tasks using the information in tables 16B and 16C and the techniques explained in chapter 16 of *Writing about Multivariate Analysis, 2nd Edition* and the associated references.

a. The difference in earnings for married men compared to unmarried women (the reference category) = $\beta_{\text{Married}} + \beta_{\text{Man}} + \beta_{\text{Man\_married}}$ = –1,595 + 3,205 + 4,771 = 6,381.
b. The formula for the standard error of the compound coefficient for married males = square root [(variance (β_{Married}) + (2 × covariance (β_{Married}, $\beta_{\text{Man\_married}}$) + variance ($\beta_{\text{Man\_married}}$)]. Substituting the values from table 16D gives square root [45,497.59 + (2 × (–36,700.40)) + 61,826.53] = 184.18
c. Calculate the 95% confidence interval around the point estimate of the difference in earnings for each marital status/gender combination compared to the reference category (unmarried women).

   95% confidence interval for married women = β_{Married} ± (1.96 × std error (β_{Married})) = –1,595 ± (1.96 × 213) = –1,595 ± 418

$= -2{,}103$ to $-1{,}177$. Coefficient and standard error are from table 16B; or you can use the square root of the variance from table 16C to calculate the standard error.

95% confidence interval for unmarried men $= \beta_{Man} \pm (1.96 \times$ std error $(\beta_{Man})) = 3{,}205 \pm (1.96 \times 201) = 3{,}205 \pm 395 = 2{,}810$ to 3,600. Coefficient and standard error are from table 16B.

95% confidence interval for married men $= (\beta_{Man} + \beta_{Married} + \beta_{Man\_married}) \pm (1.96 \times$ std error $(\beta_{Man\ \&\ Married})) = 6{,}381 \pm (1.96 \times 184.2) = 6{,}381 \pm 395 = 6{,}021$ to 6,743. Standard error for the compound coefficient was calculated in part b.

d. Conduct and write up results of statistical tests for differences in predicted earnings between the following pairs of groups:
   i. "Married women are predicted to earn NT$1,595 less than their unmarried counterparts (95% CI: NT$–2,103 to NT$–1,177)."

      Notes: The statistical test for a difference in earnings for married versus unmarried women is based solely on the coefficient and standard error for the dummy variable "Married" since the reference category is unmarried women.
   ii. Married versus unmarried men. "Married men are predicted to earn NT$3,177 more than their unmarried counterparts ($p < 0.05$)."

Notes: Subtract the differences for married men and unmarried men (when each is compared to unmarried women) to obtain NT$3,177. Because the 95% confidence intervals around the differences in earnings for married men (6,021 to 6,743) and unmarried men (2,810 to 3,600) do not overlap, their values are statistically significantly different from one another.