

prob_5

4. An interaction is when the effect of one of the predictor variables on the outcome variable depends on the level of one of the other predictor variables. In this situation, the effect of the two predictor variables in question is not additive. Analysis of interaction between sex and academic rank with two-way complete ANOVA (see Table 1). This model does not show a significant relationship between rank and sex ($p = .847$). To aid the understanding of the reader is an interaction plot (Figure 2a) and a barplot (Figure 2b) of the academic ranks stacked by gender.

Figure 2a: Interaction plot for sex and rank

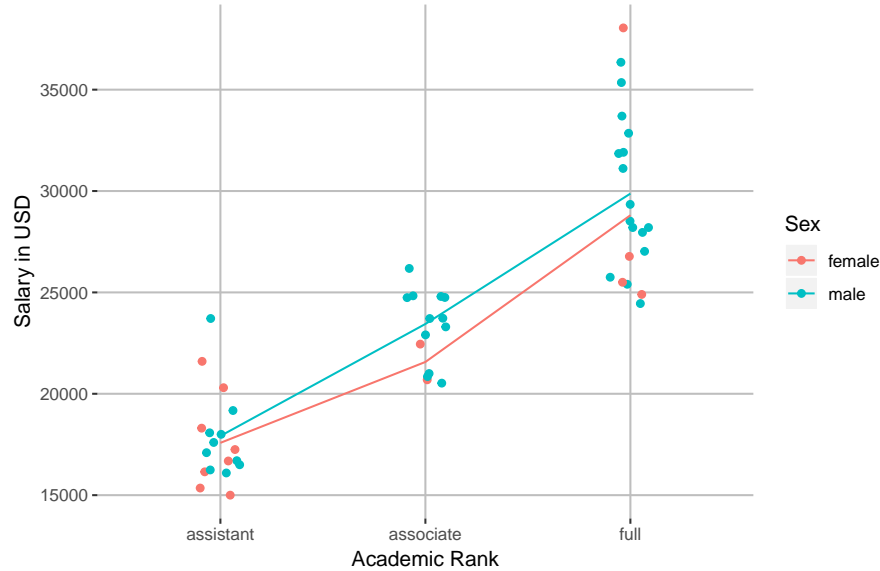


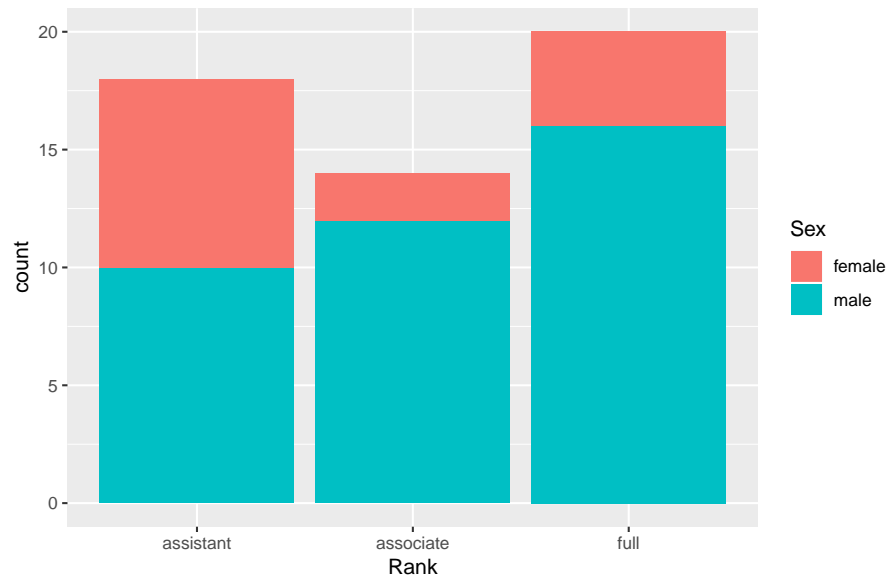
Table 1: ANOVA two-way complete model for sex and rank

	Sum Sq	Df	F value	Pr(>F)
factor(Sex)	7074743	1	0.7590047	0.3881644
factor(Rank)	1239752324	2	66.5026156	0.0000000
factor(Sex):factor(Rank)	3101661	2	0.1663789	0.8472326
Residuals	428769653	46	NA	NA

Table 2: Main effects ANOVA model of salary by three variables: rank, years in rank, and years since degree

	Sum Sq	Df	F value	Pr(>F)
Sex	187189.3	1	0.0251234	0.8747853
Rank	426746925.8	2	28.6376284	0.0000000
yr.rank.cat	1174999.0	2	0.0788504	0.9243084
yr.dg.cat	71958187.8	2	4.8288850	0.0127069
Residuals	327835540.1	44	NA	NA

Figure 2b: Proportion of males and females in each rank



5. An appropriately adjusted estimate of the difference in mean salary between male and female professors, in my mind, should adjust for rank, years in rank, and years since degree (degree itself doesn't appear to have any significant effect on salary). In order to adjust for these variables, I decided to create arbitrary categorical variables out of years in rank and years since degree, after analyzing plots of these variables (see Figures 4, 6, 8). The categories I created for years in rank are 0-4 years, 5-10 years, and over 10 years. The categories I created for years since degree are 0-9 years, 10-19 years, and 20 years and over. I found no interactions in a full/complete ANOVA model, so I have gone with a main effects ANOVA type II sums of squares model here (Table 2).

Adjusting for rank: Figure 3 (for why it might be reasonable to adjust for rank, see Figure 4).

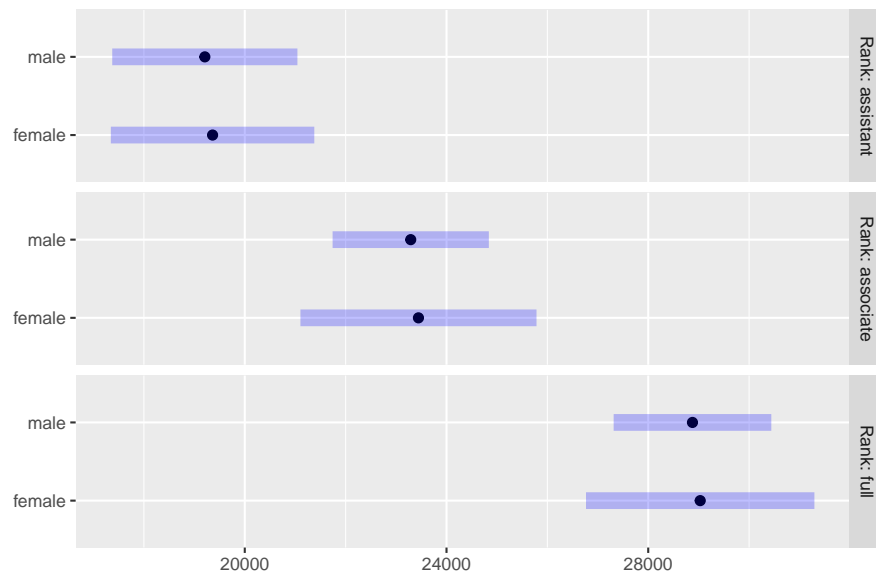
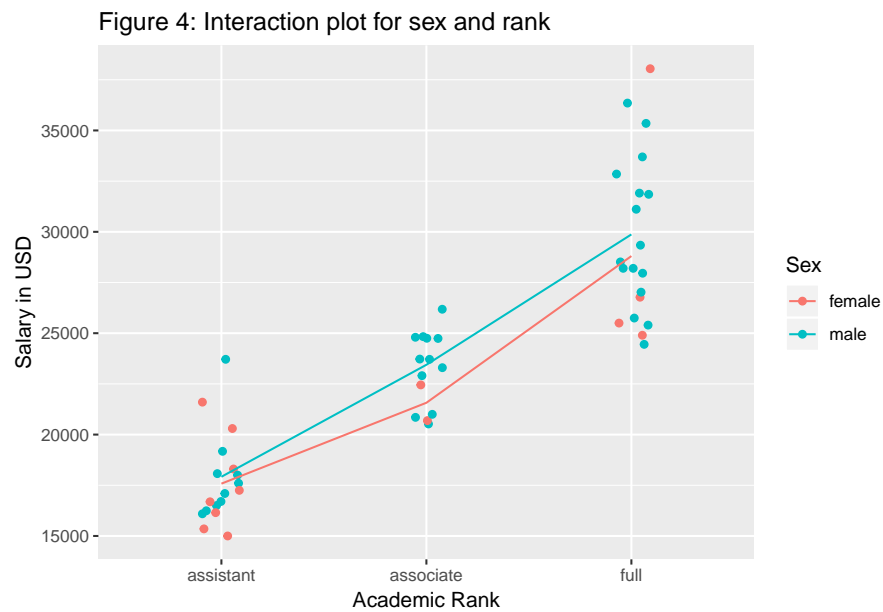


Figure 3: Means and 95% CIs for salary by sex, adjusted for rank



Adjusting for years in rank: Figure 5 (for why it might seem reasonable to adjust for years in rank, see Figure 6).

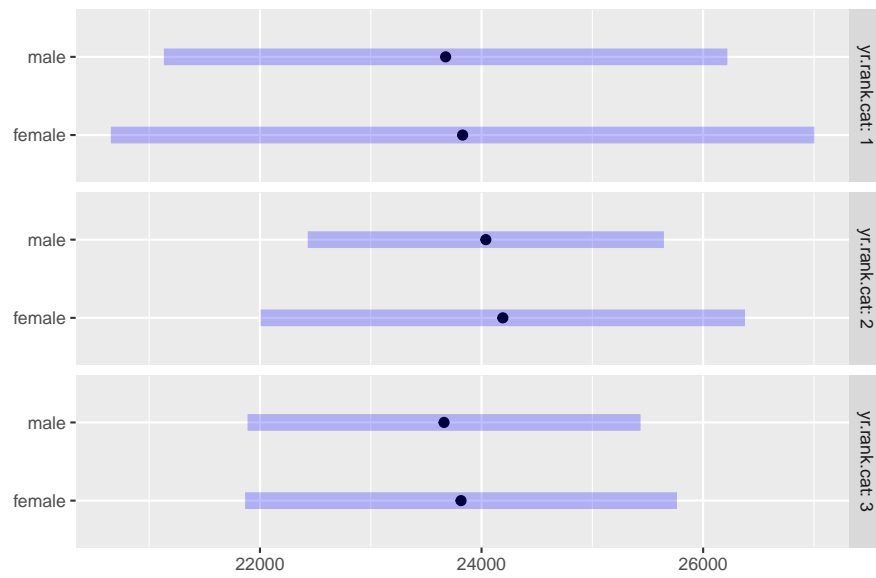
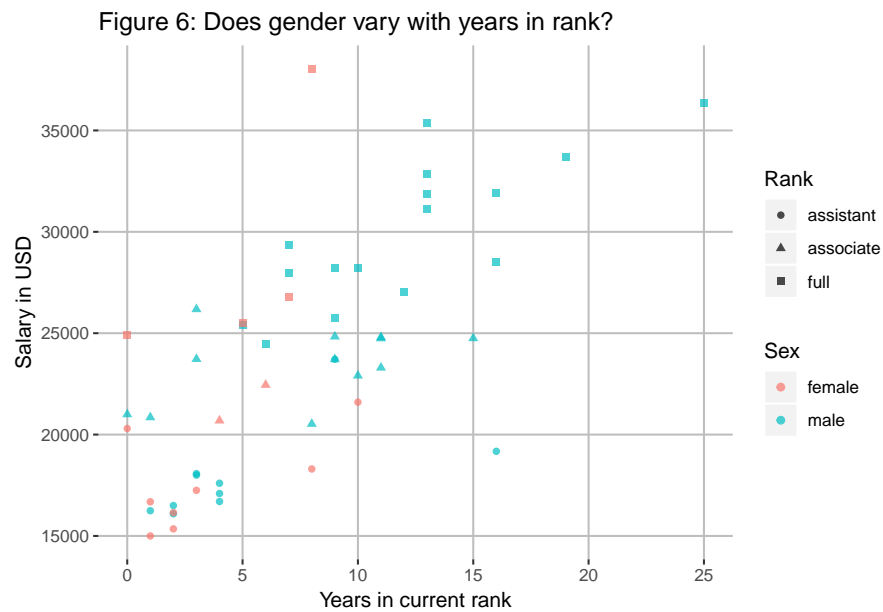


Figure 5: Means and 95% CIs for salary by sex, adjusted for years in rank



And adjusting for years since degree: Figure 7 (for why it might be reasonable to adjust for years since degree, see Figure 8).

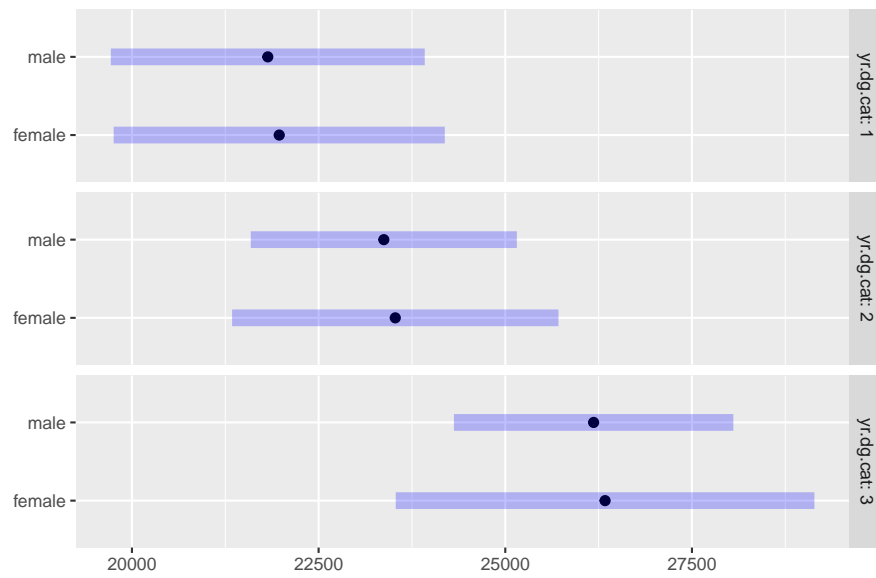


Figure 7: Means and 95% CIs for salary by sex, adjusted for years since degree

Figure 8: Do rank and gender vary with years since degree?

