Chapter 7

7.1

We will look in this chapter at the ways in which predictor variables may ‘work together’ to affect an outcome variable. The first way is that they can work together as a moderator effect. A variable is said to moderate the effect of a second variable if the effect of the second variable depends upon the level of the first variable. (In ANOVA this is called the interaction effect). The second way that two variables may work together is as a mediated relationship. A mediated relationship is said to occur if a predictor variable has its effect on the outcome variable via a second predictor variable.

7.2

The different terms of moderator effect and interaction effect are fairly interchangeable. Moderator effects are usually used to refer to cases where at least one of the independent variables is continuous. Interaction effects in ANOVA are a special case of a moderator with categorical variables. A third variable (Z) is said to moderate the relationship between two other variables (X and Y) if the degree of relationship between X and Y is affected by the level of Z.

It is also possible to find that a continuous variable moderates the relationship between two other continuous variables. In every case of regression where we wish to test for a moderated relationship, we need to create a new variable to represent the moderator effect. We will first look at a regression analysis with two categorical predictor variables plus a moderator term. Next, we will examine the case of a regression analysis with one continuous predictor variable moderated by one categorical predictor variable. Finally, we will examine a case with two continuous variables interacting.

Two categorical variables

One of the most common designs in experimental psychology is the 2 x 2 factorial ANOVA. There are two independent variables, and one dependent variable. The experimenter assesses the effect of each predictor variable on the dependent variable, and then assesses the interaction effect of the two-predictor variables on the dependent variable (the total analysis is on page 169-172).

We can have a balanced or an unbalanced design. The balanced design has the advantage that all of the predictor variables are uncorrelated, and so there are no adjustments to be made due to the predictor variables sharing variance. It is much harder to analyse an unbalanced design by hand, because the calculations are more complex.

It is also possible to have a design that is larger than a 2 x 2 factorial design. For example, for a 2 x 2 x 2 design where we have factors A, B, and C, we must create three indicator-coded variables along with three two-way interaction terms, and one three-way interaction term.

If we have a 3 x 2 design, we need to represent the first predictor using two indicator variable (A1 and A2) and the second using one indicator (b). We then need to create the interaction by using B x A1 and B x A2.

Categorical and continuous variables

The procedure of two categorical variables, is easy to use in a situation where we have one categorical independent variable and one continuous independent variable. (Procedure on pages 176-178). The procedure on those pages generalises readily to more complex situations, including the case where:

- The categorical variable may have three or more possible values.
- There may be other predictor variables that could be entered into the equation (for control purposes).
- There may be two or more categorical variables as well as a continuous predictor variable.

Two continuous predictors

In this case the relationship between a continuous predictor variable and a continuous outcome variable is moderated by a continuous variable. This means that the effect of the first continuous variable depends upon the level of the second continuous variable (analysis on page 182-186). Interactions with continuous variables can take on more complex forms and can include non-linear terms and higher order interaction terms.

7.3

As well as acting as a moderator of the relationship between two variables, a variable may act as mediator of the relationship between a predictor and an outcome variable. A variable is said to mediate the relationship between a predictor and outcome variable if the predictor variable first has an effect on the mediator variable, and this in turn influences the outcome variable. For example when hormones mediate the relationship between sex and height to such an extent that genes had no influence on height other than the influence through hormones, the effect of hormones is referred to as complete mediator. Sometimes a variable may be a ‘partial mediator’ of the relationship between a predictor variable and an outcome. The predictor variable exerts some of its influence via a mediation variable, and it exerts some of its influence direct and not via the mediator. Baron and Kenny (1986) described the detection of mediator relationships. They described four steps: (three variables, X, the predictor variable, Y, the outcome variable and M, the mediator variable)

- Show that X is a significant predictor of Y, using regression.
- Show that X is a significant predictor of M, using regression.
- Show that M is a significant predictor of Y, when we control for X. To do this we carry out a multiple regression using X and M as predictors, and Y as the outcome.
- If M is a complete mediator of the relationship between X and Y, the effect of X, when controlling for M, should be zero. If it is only a partial mediator the effect will be merely reduced, not eliminated.

An example of these four steps is on page 189.

7.4

It is possible for moderation and mediation to combine in ways that are more complex. This can happen in two ways, referred to as moderated mediation or mediated moderation. It is also possible for multiple independent variables to be mediated in their effect by one or more variables. Finally, mediator effects may also be non-linear.