

## What will this chapter tell me?

After persuading my two friends (Mark and Mark) to learn the bass and drums, I took the rather odd decision to *stop* playing the guitar. I didn't stop, as such, but I focused on singing instead. In retrospect, I'm not sure why, because I am *not* a good singer. Mind you, I'm not a good guitarist either. The upshot was that a classmate, Malcolm, ended up as our guitarist. I really can't remember how or why we ended up in this configuration, but we called ourselves Andromeda, we learnt several Queen and Iron Maiden songs and we were truly awful. I have some recordings somewhere to prove just what a cacophony of tuneless drivel we produced, but the chances of them appearing on the companion website are slim at best. Suffice it to say, you'd be hard pushed to recognize *which* Iron Maiden and Queen songs we were trying to play. I try to comfort myself with the fact that we were only 14 or 15 at the time, but even youth does not excuse the depths of ineptitude to which we sank. Still, we garnered a reputation for being too loud in school assembly and we did a successful tour of our friends' houses (much to their parents' amusement, I'm sure). We even started to write a few songs (I wrote one called 'Escape From Inside' about the film *The Fly* that contained the wonderful rhyming couplet 'I am a fly, I want to die' – genius). The only thing that we did that resembled the activities of a 'proper' band was to split up due to 'musical differences'; these differences being that Malcolm wanted to write 15-part symphonies about a boy's journey to worship electricity pylons and discover a mythical beast called the cuteasaurus, whereas I wanted to write songs about flies and dying (preferably both). When we could not agree on a musical direction the split became inevitable. We could have tested empirically the best musical direction for the band if Malcolm and I had each written a 15-part symphony and a 3-minute song about a fly. If we'd played these songs to various people and measured their screams of agony then we could have ascertained the best musical direction to gain popularity. We have two variables that predict screams: whether Malcolm or I wrote the song (songwriter), and whether the song was a 15-part symphony or a song about a fly (song type). The one-way ANOVA that we encountered in Chapter 11 cannot deal with two predictor variables – this is a job for factorial ANOVA.

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## Theory of factorial ANOVA (independent designs)

In the previous two chapters we have looked at situations in which we've tried to test for differences between groups when there has been a single independent variable (i.e., one variable has been manipulated). However, at the beginning of Chapter 11 I said that one of the advantages of ANOVA was that we could look at the effects of more than one independent variable (and how these variables interact). This chapter extends what we already know about ANOVA to look at situations where there are two independent variables. We've already seen in the previous chapter that it's very easy to incorporate a second variable into the ANOVA framework when that variable is a continuous variable (i.e., not split into groups), but now we'll move onto to situations where there is a second independent variable that has been systematically manipulated by assigning people to different conditions.

### Factorial designs

In the previous two chapters we have explored situations in which we have looked at the effects of a single independent variable on some outcome. However, independent variables often get lonely and want to have friends. Scientists are obliging individuals and often put a second (or third) independent variable into their designs to keep the others company. When an experiment has two or more independent variables it is known as a *factorial design* (this is because, as we have seen, variables are sometimes referred to as *factors*). There are several types of factorial design:

**Independent factorial design:** In this type of experiment there are several independent variables or predictors and each has been measured using different entities (between groups). We discuss this design in this chapter.

**Repeated-measures (related) factorial design:** This is an experiment in which several independent variables or predictors have been measured, but the same entities have been used in all conditions. This design is discussed in Chapter 14.

**Mixed design:** This is a design in which several independent variables or predictors have been measured; some have been measured with different entities whereas others used the same entities. This design is discussed in Chapter 15.

As you might imagine, analysing these types of experiments can get quite complicated. Fortunately, we can extend the ANOVA model that we encountered in the previous two chapters to deal with these more complicated situations. When we use ANOVA to analyse a situation in which there are two or more independent variables it is sometimes called **factorial ANOVA**; however, the specific names attached to different ANOVAs reflect the experimental design that they are being used to analyse (see Jane Superbrain Box 13.1). This section extends the one-way ANOVA model to the factorial case (specifically when there are two independent variables). In subsequent chapters we will look at repeated-measures designs, factorial repeated-measures designs and finally mixed designs.