Book Review / Recension d'ouvrage

Bell, K.N.I. (2008). *Analysing Cycles in Biology and Medicine.* St. John's, NL: Razorbill Press. 184 pages.

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As a high school mathematics teacher, I approached *Analysing Cycles in Biology and Medicine* not from the perspective of a biology specialist, but instead from the perspective of someone with a background in mathematics who wanted to learn more about this particular branch of statistics through the lens of biology.

Cycles are all around us, and are particularly important in biology and medicine. It is, therefore, important to know how to analyze and understand them. However, Bell argues in his book that researchers keep cycles out of data too often by restricting sampling to the same time in a particular cycle, such as at the same time of day. He also argues that this is not necessarily the best approach because one has to wait for these special times for data collection, which may be costly to a researcher. As a result, the opportunity to describe key cycles may be lost, so findings can lose meaning because they only reflect what happens during specific times, and cannot necessarily be generalized. Bell indicates that much more information can be gained if sampling occurs more randomly within a cycle. To that end, it is important to learn how to effectively deal with circular variables.

In his introduction, Bell indicates that:

As biologists, we typically acknowledge cycles verbally but not quantitatively – in short, we pay them lip service. This little book seeks to correct that.

Many of the conventional statistical methods that apply to linear variables do not apply when studying circular variables. This can be clearly shown by the following simple example in Chapter 2 of his book:

One hundred and three ants are released from a central point, and the direction is taken from their positions after 30 seconds. What is their mean direction?

It can be very easily seen that the traditional method of calculating the mean does not apply here, as the ants are not all moving in the same direction. As a result, the analysis must be

completed by using different statistical methods that use circular variables, taking both direction and distance into account.

In his book, Bell explains how circular statistical techniques allow us to easily answer this and other questions, such as determining a periodic regression, and comparing two or more independent populations that follow a periodic pattern. While many of examples given in the book are taken from biology, it is clearly evident how these techniques could be used in other disciplines as well.

A major focus of Bell's book deals with the quantification of circular variables, such as dates and times, in order to make these variables statistically relevant. This is important because, as with circular variables, zero is arbitrary. Circular statistics allow us to deal with this concept, and to get meaningful results from the corresponding statistical analysis.

To that end, the verbal and mathematical explanations given in the book are clear and written in plain language. Bell gives an excellent overview of the trigonometric basics and introductory statistics that are required in order to work with circular statistics. As a result, one need not be a specialist in mathematics in order to work with the statistics that are described in this book.

A number of appendices supplement the main text of the book to help demonstrate how circular statistical methods work. These appendices include a number of examples that are completely worked through, as well as spreadsheet formulas and macros that can help support these methods and an introductory statistics refresher.

This book serves as an excellent reference for anyone needing to perform statistical analyses on data that is periodic in nature. The writing style is clear and the examples provided are very good. The mathematics presented are also clear and are easy to follow. The methods are not intimidating for anyone with a good background in trigonometry, introductory statistics and working with a spreadsheet, such as Excel. I would recommend this book as a reference for researchers who work with periodic data.