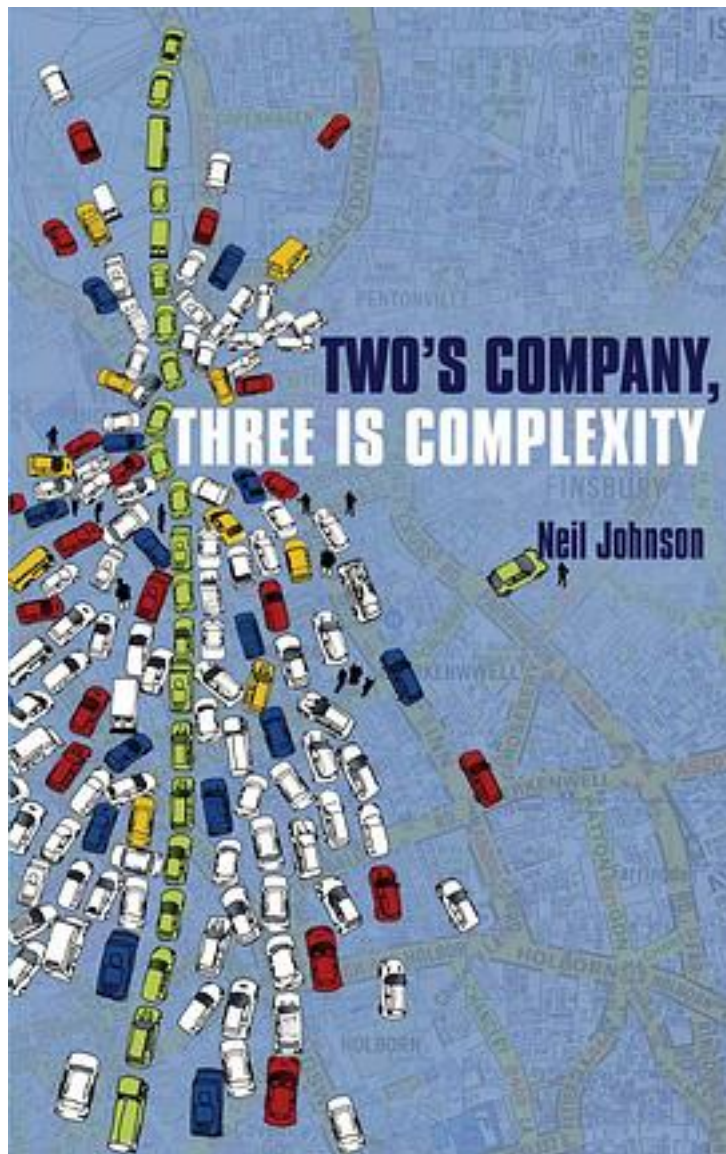


Two's Company, Three Is Complexity



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Preface

It is 2050, and you are watching Who Wants to be a Billionaire? The contestant is one question away from the jackpot. Up comes his

question: “What is the name of the theory that scientists started developing at the beginning of the twenty-first century, and

which helped the world overcome traffic congestion, financial market crashes, terrorist attacks, pandemic viruses, and cancer?” The contestant cannot believe his luck. What an easy question! But he is so nervous that his mind temporarily goes blank. He starts to consider option A: “They are all still unsolved problems” – but then quickly realizes that this is a dumb answer. Instead, he uses his last lifeline to ask the audience. The audience responds unanimously and instantaneously with option B: “The Theory of Complexity”. Without hesitation, he goes with option B. The host hands him the cheque, and the world has yet another billionaire.

Pure fantasy? Maybe not.

In this book, we will go on a journey to the heart of Complexity, an emerging science which looks set to trigger the next great wave of advances in everything from medicine and biology through to economics and sociology. Complexity Science also comes with the

prospect of solving a wide range of important problems which face us as individuals and as a Society. Consequently, it is set to permeate through every aspect of our lives.

There is, however, one problem. We don’t yet have a fullyfledged “theory” of Complexity. Instead, I will use this book to assemble all the likely ingredients of such a theory within a common framework, and then analyze a wide range of real-world applications within this same common framework. It will then require someone from the future – perhaps one of the younger readers of this book – to finally put all these pieces into place.

Complexity Science is a double-edged sword in the best possible sense. It is truly “big science” in that it embodies some of the hardest, most fundamental and most challenging open problems in academia. Yet it also manages to encapsulate the major practical issues which face us every day from our personal lives and health, through to global security. Making a pizza is complicated, but not complex. The same holds for filling out your tax return, or mending a bicycle puncture. Just follow the instructions step by step, and you will eventually be able to go from start to finish without too much trouble. But imagine trying to do all three at the same time. Worse still, suppose that the sequence of steps that you follow in one task actually depends on how things are progressing with the other two. Difficult? Well, you now have an indication of what Complexity is all about. With that in mind, now substitute those three interconnected tasks for a situation in which three interconnected people each try to follow their own instincts and strategies while reacting to the actions of the others. This then gives an idea of just how Complexity

might arise all around us in our daily lives.

While I was writing this book, I had the following “wish-list” in my head concerning its goals:

1. To provide a book which a wide cross-section of people would want to read and would enjoy reading – regardless of age, background or level of scientific knowledge.
2. To introduce readers to the exciting range of real-world scenarios in which Complexity Science can prove its worth.
3. To provide the book on Complexity that “I never had but always needed”. In other words, to provide an easily readable yet thorough guide to this important scientific revolution.
4. To provide a book that my kids could read – or rather, a book that they would actually choose to read all by themselves. This is a very important goal, since Complexity will likely become the science of interest for future generations.
5. To provide a book which is just as readable on a plane or bus as in a library. As such, it should also make sense when read in short chunks.
6. To provide a book which provides professional scientists, economists, and policy-makers with a new perspective on open problems in their field, and to help stimulate new Complexity-based interdisciplinary research projects.

However, as I finish the book and offer it up to potential readers, I realize that the above wish-list can essentially be reduced to just

one item: I would wish that you enjoy reading this book, and that it might provide you with fresh thoughts and insights for dealing

with the complex world in which we live, and which our children will inherit.

There are some practicalities concerning the book’s content and layout which I would like to explain. The language, examples and

analogies are kept simple since the focus of the book is to explain what Complexity Science is all about, and why it is so important for

us all. I therefore avoid delving into too much detail in the main text. Instead, the Appendix describes how to access the technical

research papers upon which the discussions in the book are based, and gives a list of Internet websites containing additional information about Complexity research around the world. Having said this, I won’t pull any punches in the sense that I tackle all the topics

which I believe to be relevant. Part 1 of the book takes us through the theoretical underpinnings of Complexity, while Part 2

dives into its real-world applications. Some of the territory is only just beginning to be

explored, with very few answers available

for the questions being posed. From the perspective of other scientific revolutions throughout history this might seem to be par

for the course. However we are not talking about history here –instead, we are looking at work which is emerging at the forefront

of a new discipline. For this reason we will be highlighting where such research is heading, rather than where it has been.

But why should you believe what I write about Complexity? This is a crucially important question given that Complexity Science is still being developed and its potential applications explored. Unfortunately many accounts of Complexity in the popular press are second-hand, i.e. they are typically written by people who have done little, if any, research on Complexity themselves and are instead reporting on their interpretation of

other people’ s work. Given the relatively immature nature of the field, I believe that such indirect interpretations are potentially

dangerous. For this reason, I will base the book’ s content around my own research group’ s experience in Complexity. This has

various advantages: (i) it reflects my own understanding of the Complexity field; (ii) it represents what I believe to be the most

relevant and important topics; (iii) it will hopefully give the reader a sense of what it is like to be at the “pit-face” in such a

challenging area of research; and (iv) it ensures that any reader can challenge me directly on any claims that I make, and can

demand an informed answer. To facilitate this process of public scrutiny, a complete list of the relevant scientific research reports

is presented in the latter part of the Appendix. I also encourage any readers who wish to email me with questions, to do so at

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作者介绍:

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