



SOCIETY OF ACTUARIES

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## BOOK REVIEW

# *The Perfect Swarm: The Science of Complexity in Everyday Life* By Len Fisher

Reviewed by Scott McInturff

**W**hen I was a member of the Forecasting and Futurism Section Council (2008–2010), I became very attentive when other council members began to discuss complexity science. Though I had no clue as to exactly what complexity science entailed, I found the pairing of words intriguing as it seemed to imply that scientific methodologies could be applied to complexity to better understand and cope with it.

In spite of a diversity of opinion on many topics, most actuaries would agree that the world in which we operate is indeed complex. Many of us function within complex financial institutions that operate within complex financial systems. We apply our expertise within complex networks of social and political structures built upon the complex behavior of the individuals who require and benefit from our services. And we ourselves are complex beings. Better understanding the dynamics of complex systems through study using scientific methods can help actuaries function and thrive within these systems with superior tools and approaches. A science designed to probe complexity is an obviously important area of study for actuaries and other professionals.

### *The Perfect Swarm*

As a current friend of the Forecasting and Futurism Section Council, when the opportunity arose to read and write a review of *The Perfect Swarm: The Science of Complexity in Everyday Life* by Len Fisher, I jumped at the chance. My goal was to establish a baseline of understanding as to what complexity science encompasses, hoping that I could expand my knowledge on a topic that could increase my effectiveness as an actuary. I was not disappointed by the level of information I received from reading this book; nor was I overwhelmed by the amount of information that was presented. *The Perfect Swarm* proved to be a straight-



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forward and informative introduction to several aspects of complexity science.

Fisher leads us through complexity with an intentional and logical approach. He begins by exploring swarm intelligence in nature through studying the behaviors of locusts, ants and bees. Each of these insect groups uses swarm intelligence in a different way that provides insights into the complex systems that they operate within. The discussion extends into how individuals move through crowds of other humans, following essentially the same fundamental rules as insects. Leaving bugs behind, we explore human group dynamics and the power of a diverse group to apply individual intelligence to produce results superior to those of any individual in the group. The author next takes us to networks. Understanding their structure can lead to more effective communication strategies as well as better tools to prevent the spread of contagious diseases. Next Fisher discusses techniques that allow individuals to make decisions when encountering complex problems with limited information or knowledge as to the best option. The text ends by looking at complexity itself and techniques to discover patterns in complex systems that will lead us in the right direction.

There are numerous nuggets throughout the text that I will briefly describe in the following paragraphs.

### *The Best Route*

A few bees with a clear direction can lead an entire swarm to a desired target without being clearly identified as the leaders and without even being at the front of the swarm. They simply move from the middle of the swarm in a straight line, at a pace slightly faster than other bees, to the target destination. With this approach the entire swarm ends up in the desired place, it appears, without clearly identified leaders. Social scientists have demonstrated that this same phenomenon can be observed in human experimental settings where select individuals can lead groups to certain destinations, using subtly different instructions than given the rest of the group, without even knowing that they

themselves are leading. Within our companies we can use this approach to leadership by recruiting a few like-minded individuals who are willing to lead anonymously from within our organizations.

Through pheromones, which fade over time, ants use selective reinforcement to find the most efficient route to their food. Ants tend to follow trails with the most pheromones left by predecessors. As more and more ants identify the most efficient path to a source of food, more and more pheromones accumulate and more ants follow these paths. Paths that do not attract additional traffic gradually have their pheromone trail disappear. Through this positive feedback and reinforcement, the best paths are clearly marked by the heavy traffic that uses them.

UPS collected and studied data concerning the routes followed by their drivers. They realized that the preponderance of right-hand turns was not a random event. Rather this approach was an intentional strategy developed by their drivers to optimize their delivery routes, saving time and avoiding accidents. UPS began to incorporate these optimal path rules in routing their fleets, saving 3,000,000 gallons of gasoline in 2006 alone.

Upon reflection I can see that I have personally incorporated some of the same means of dealing with complex systems in my own life. I have always followed commuting routes that avoid traffic lights and, where there are traffic lights, I have followed the routes with the most opportunities for “right turn on red.” In addition, like ants following a pheromone trail, I observe other drivers and make inquiries into the driving patterns of co-workers who have similar destinations to mine in hopes of finding even more efficient commuting routes. I am certain I am not the only driver who has developed a complex strategy for finding the most efficient route to and from work as evidenced by the small number of other cars that seem to be following the same shortcuts as the ones I have chosen. However, I think my activities are instinctual as well as logical. Perhaps in gen-

eral actuaries have stronger connections to our primordial roots of solving complex problems. I certainly gain material pleasure in outmaneuvering my fellow drivers as I find the most efficient route home, while others seem oblivious to this driving competition.

### Cognitive Diversity

When discussing the wisdom of crowds, a concept skillfully explained by James Surowiecki in *The Wisdom of Crowds* (reviewed in the July 2010 *Forecasting & Futurism Newsletter*), Fisher provides an excellent synopsis of the type of diversity that is essential to using groups to solve problems. Diversity must be of a specific type to lead to superior group results. The diversity that is required is cognitive diversity, which includes diversity of knowledge, perspectives, interpretations, approaches and models. Without cognitive diversity in combination with individual opinions developed and collected independently of others in the group, group decision making has all the flaws of individual decision making. Unless there is diversity and independence, group decision making is as likely to produce the wrong answer as it is likely to produce the right one. Thus, a non-diverse group without independent decision making would be best advised not to waste the time of the entire group to make a decision when a simple coin toss would have equal probability of choosing the best direction.

### Swarm Intelligence

Swarm intelligence can be used as a foundation for a business that operates in a complex environment. The key to swarm intelligence is that each member of the group must participate in the group as a stakeholder rather than merely as a shareholder. Cooperatives are examples of the best applications of combining group intelligence and swarm intelligence. Swarm businesses gain their power by giving it away. These businesses share with and support the swarm by putting the welfare of members of the swarm ahead of an unyielding objective of making money.

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As a nonprofit organization, Wikipedia demonstrates the power of allowing stakeholders open access to build a database of information to be used by others. By limiting editorial control and trusting the stakeholders to control the content, Wikipedia has grown to become one of the most widely used single sources of information in the world, though with an accuracy that is somewhat lower than that of carefully controlled and researched encyclopedias *[citation needed ... as usual with Wikipedia]*.

### Heuristics

One interesting and practical chapter is concerning decision rules called heuristics. We are often asked to make decisions based on little data. It turns out that sometimes having less information can lead to a better decision than having more information. The author lists five heuristics that he suggests are simple approaches to complex problems:

1. Recognition: When given two alternatives and only one is the right answer, choose the one that is most familiar.
2. Fluency: When asked to choose the correct answer given multiple alternatives and you recognize more than one, choose the one that is most recognizable.
3. Tallying: When given a choice between which of several options is correct, consider positive and negative cues that point to the veracity of each option and choose the one with a greater number of positives over negatives without weighting them.
4. Take-The-Best: When facing a choice between two options, order cues by ranking them based on your expectation of which cue has the highest utility. Choose the option based on the first cue that allows you to favor one choice over the other.
5. Satisficing: When given several alternatives, choose the first one that exceeds your aspiration level.

Fisher discusses each of these heuristic rules in some detail, and, using examples, he significantly increases the logic behind each rule beyond what can be surmised by a simple listing of each rule above.

Fisher continues in this chapter to discuss rules used by Internet companies such as eBay, Yahoo and Amazon and technology companies such as Dell, Cisco and Intel who are operating “on the edge of chaos” where there is short-term order with rapidly fluctuating patterns and unpredictable long-term trends. These companies rely on simple rules that allow them to respond rapidly and flexibly to emerging opportunities that may be short-lived. The operating rules must be clearly established in advance and address the following: 1. actions to take when a certain situation arises; 2. boundaries for the businesses in which to operate; 3. priorities for resources; 4. parameters for the timing of efforts; and 5. circumstances for exiting initiatives.

### Begin at the End

In his introduction, the author comments that some readers of his prior works have started at the Notes section at the end of the book. The Notes section contains thoughts and references that the author excludes from the flow of the text. He includes these at the end for those seeking to go deeper into the topics he discusses in the main body of the text. While some might find this a reasonable starting point, I personally would have no inclination to start at this particular point. However, I would have found it useful to read the final chapter, Chapter 10, titled “Simple Rules for Complex Situations” before reading the preceding nine chapters. In his final chapter, which is only six pages long, Fisher lists 10 tips for dealing with complex situations and then summarizes multiple sets of rules regarding complexity that emerge from various disciplines and that were discussed in the preceding chapters. Now I am not suggesting that one should read only Chapter 10 and skip the rest of the text. Much would be lost in doing so as the author ably builds to the final chapter over the course of the book. My suggestion is simply that while it is an appropriate and natural approach to follow the careful path set out by the author starting at Chapter 1, one might find it useful to take a peek at the final chapter to see where the book is heading, just as many prefer to look at a map to get an overview of the route to the final destination before blindly following the twists and turns of a GPS system. By perusing Chapter 10 first, you’ll

have a better understanding while you travel as to how you will get to your final destination. Whatever your approach, be sure to enjoy the scenery along the way.

### Conclusion

*The Perfect Swarm* is an easy read. The author has an understated sense of humor that shines through from time to time, making the reading enjoyable. The book scratches the surface of complexity science, leaving the reader hungry for more, the same way the perfect appetizer satisfies and still leaves one with plenty of room for the main course. Hopefully the hunger from reading this book will lead the reader to have increased involvement with the Forecasting and Futurism Section to explore complexity science further. ▼

BY PERUSING CHAPTER 10 FIRST, YOU'LL HAVE A BETTER UNDERSTANDING WHILE YOU TRAVEL AS TO HOW YOU WILL GET TO YOUR FINAL DESTINATION. WHATEVER YOUR APPROACH, BE SURE TO ENJOY THE SCENERY ALONG THE WAY.

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