The NEW SCIENCE of RADICAL INNOVATION

The Six Competencies Leaders Need to Win in a Complex World

SUNNIE GILES

ADVANCED PRAISE

"If you are serious about innovation in your organization, this book is a must read. Sunnie Giles sets a new standard for understanding innovation and provides profound insights on how innovation happens and what you can do to harness that potential."
— **Jonathan Rosenberg**, Co-author of *New York Times* and *Wall Street Journal* Bestseller, *How Google Works*, Former SVP of Products at Google and Advisor to Larry Page

"Complexity is scary. So is radical innovation. But Sunnie Giles is here to tame those twin beasts. Surveying the topic from neuroscience to artificial intelligence, she extracts profound insights and an actionable set of skills she calls Quantum Leadership. Using these skills, any leader can push his/her organization to new heights of innovation and advantage."
— **Daniel Pink**, author of #1 *New York Time* Bestsellers *Drive*, *To Sell is Human,* and *When*

"This book provides a clear theoretical framework to understand the seemingly idiosyncratic business practices of successful Silicon Valley high tech companies and actual practices companies must master to win in this new world. *The New Science of Radical innovation* should be a bible for every leader aspiring for innovation."
— **Marshall Goldsmith**, World's #1 Leadership Thinker, renowned business educator and coach, author of 35 books and HBR #1 Leadership Thinker

"Paranoid about disruptive innovators? Read this book and you can learn how to become one. Well researched and practical, this book is a must-read for any leader who wants to win in today's unpredictable, complex world by producing radical innovation consistently. Whether you are a C-level executive seeking to build an innovative organization or a first line manager seeking to build an innovative team, this book will give you the insights, strategies, and behaviors to redefine the rules of the game."
— **Sean Covey**, Co-Author of *Wall Street Journal* #1 Best-Seller, *The 4 Disciplines of Execution*

The NEW SCIENCE *of* RADICAL INNOVATION

The Six Competencies Leaders Need to Win in a Complex World

SUNNIE GILES

BenBella Books, Inc.
Dallas, TX

CONTENTS

INTRODUCTION

To arrive at the truth, once in your life you have to commit yourself to undoing all the opinions that you have formerly taken for granted, and reconstruct anew all the systems of your knowledge.

—René Descartes, *Remarques sur les septièmes objections*

With brows knitted and head cocked slightly, he rubbed his forehead back and forth, furiously weighing his options, a black stone held between his fingers. Just a couple of days ago, the second-highest reigning world champion told the press he would win in a landslide victory, but now it seemed that his opponent was much stronger than he thought. At stake was not just a $1 million prize but the primacy of human intelligence. His opponent never had to take a break during the five-hour match and never got tired, hungry, or swayed by emotion.

"Oh, wow!" the crowd exclaimed in disbelief, as he grimly placed a captured white stone on the board to signal his resignation.

More than two hundred million people around the world watched this historic match, which was streamed live from South Korea in March 2016. The five-game matchup between Korean Lee Sedol, the legendary champion of the ancient Chinese board game Go (or *baduk* in Korean),

Wikimedia Commons

and AlphaGo, an artificial intelligence (AI) developed by Google's DeepMind, was over.[1] Lee lost the five-game series one to four to AlphaGo.

Go is a 2,500-year-old Chinese board game played by forty million people daily. Players take turns placing black or white stones on a board, trying to maximize territory. Go has long been viewed as the most challenging of classic games for artificial intelligence because of its enormous search space and the difficulty of evaluating board positions and moves.[2] The average number of possible moves for a given turn in Go is 250 (in chess, it's 35). The number of possible board configurations is 10^{170}, far more than the 10^{80} atoms in the universe. A typical Go game lasts 150 moves, often taking more than five hours—no wonder my mom threw out my dad's Go stones, totally exasperated! Intuition—the ability to judge the game from the overall picture of the board—is essential to win. It's a result of lifelong learning and experience in the game. For centuries, Go masters have been hailed not only for their ability to correctly analyze complex sequences of moves to maximize territory in local areas of the board but also for their far-reaching finesse in positioning stones early in the game to maximize influence before any territory has been staked. These factors make brute-force search, which is how IBM's Deep Blue won a chess match against Garry Kasparov in 1997, impractical. You might have to wait until the next big bang to see the end of the game! The cows might never come home . . . the horizontally challenged lady might never sing . . . You get the point.

As I watched the match unfold, I became intensely curious about how AlphaGo beat Lee Sedol. How did AI achieve this seemingly impossible feat ten years faster than industry sages anticipated? I ended up discovering several principles behind AlphaGo's victory and was fascinated to find that these are the exact same principles that Google and many other Silicon Valley tech companies use for managing people to spawn radical innovation and redefine the rules of the game. These principles have not

just helped these companies tweak things here and there to make *incremental* improvements but have catapulted their organizations far ahead of their competition and radically changed how the game is played in their industry. These principles work because they're based on laws of nature that govern all living organisms, including people and organizations. These same principles govern how complexity is created in the business environment. Complexity, as used in this book, is the holistic, unpredictable result of many self-organizing, interdependent agents learning by profuse trial-and-error experiments, following simple rules. To better understand how complexity is created and how it works, let's first take a closer look at the examples of AlphaGo and Google.

Complexity is the unpredictable result of many self-organizing, interdependent agents learning by profuse trial-and-error experiments, following simple rules.

PRINCIPLES OF COMPANIES (AND AI) THAT WIN

Self-organizing agents

AlphaGo and Google both use self-organizing agents. In AI, agents are nodes where computation happens, similar to individual neurons in our brains. They take input from sensors and direct their activities toward certain goals. In AlphaGo, the agents learn on their own, instead of relying on preprogrammed instructions from Go grandmasters to decide the next move.

Google's stance on this principle is seen in how it manages people: "Hire the best people and get out of their way."[3] Google allows people to self-organize. At Google, managers are encouraged to delegate as much as possible, to the point where they start feeling slightly uncomfortable.[4] Self-organization is also evident in Google's 20 percent–time policy, where employees spend 20 percent of their time working on what *they* think will most benefit Google. This freedom empowers them to be more innovative.

Some wildly successful projects have come from this policy, such as the multibillion-dollar AdSense business.[5]

Using simple rules

To provide some cohesive direction and coordination among the many self-organizing agents pursuing different things, both AlphaGo and Google use simple rules. AlphaGo uses two sets of simple rules to consider each move. One group of rules, called policy networks, evaluates board positions and reduces the *breadth* of the search, and another set of rules, called value networks, predicts the probability of winning in a given position and reduces the *depth* of the search. It has to simplify the search space because a brute-force evaluation of every possible move is not practical.

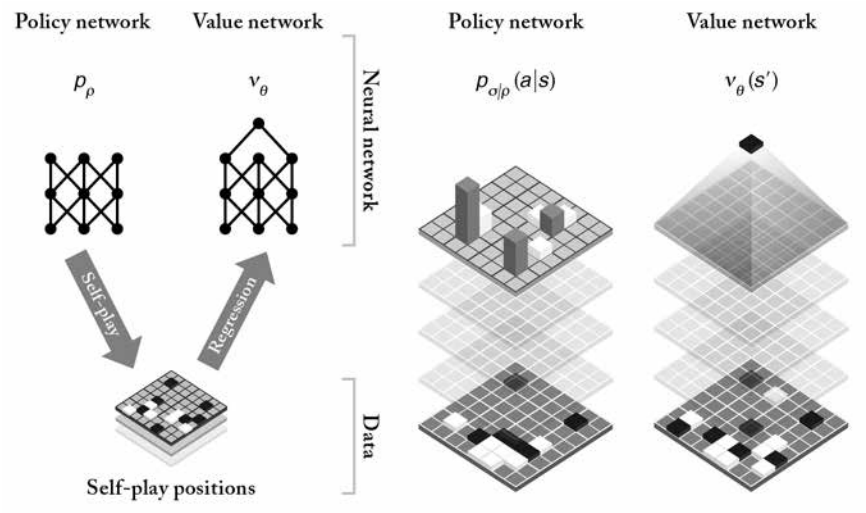


Figure 0.1 *Neural network training pipeline and architecture in AlphaGo by Google DeepMind, published in* Nature[6]

Using these rules increases the speed of computation by reducing the input AlphaGo needs to process. Human brains do the same thing; we use mental models to process the same input more quickly next time.

Google, too, uses simple rules as loose guidelines for a diverse population of self-organizing employees. Without these simple rules, thousands of employees doing different things would result in chaos, with no

consistency in direction. Google's simple rule to decide priorities? Focus on the user and all else will follow. When to add a layer under a manager? Have a minimum of seven employees.[7] What about office space? Keep it open to maximize interaction. Ethics? "Don't be evil." How to allocate corporate funds? Spend 70 percent on existing products, 20 percent on emerging products, and 10 percent on moon-shot projects.

These simple rules not only provide cohesive parameters by which employees can self-organize but also speed up decision-making, another essential criterion for innovation. In today's complex business environment, where things are changing constantly, speed of execution is a lot more important than perfect execution.

In today's complex business environment, where things are changing constantly, speed of execution is a lot more important than perfect execution.

Lots of trial and error

In the process of implementing self-organization and at the same time deciding which simple rules work best, both AlphaGo and Google employees learn from repeated experiments of trial and error. AlphaGo played against *itself* 30 million times, using reinforced learning. These trial-and-error results are used either to amplify or attenuate the input, which slowly improves the algorithm. AlphaGo *had* to lose many times to slowly improve its win rate because failures are a necessary input to improvement.

In an interview with me, Jonathan Rosenberg, SVP of Products at Google and one of the coauthors of *How Google Works*, expounded on how this aspect of AlphaGo is analogous to Google's own culture:

> *One of the things I observed in listening to the expert commentary on AlphaGo was that AlphaGo's algorithm threw out moves that violated the basic principles that most Go masters held to be self-evident for many, many years and tried them. One of the things that we embrace at Google culturally is people often flip things on their head and throw out very crazy suggestions and then run with them and see where they go.*

Success comes from learning, and learning requires failures, which means success *requires* failures for both AI and organizations. Tolerating failures and learning from each iteration of trial and error is essential in today's complex business environment.

Diversity of input

To maximize the potential of many self-organizing agents and produce right answers, both AlphaGo and Google ensure diversity of input. Diversity of input improves AlphaGo's performance. Developers trained AlphaGo with 160,000 games played by decent amateurs, which is how it learned to predict what the next move would be. Research has shown that the collective wisdom of many ordinary people is more accurate than one expert's opinion.[8]

Rosenberg and former executive chairman of Google Eric Schmidt agree:

> *Homogeneity in an organization breeds failure. A multiplicity of viewpoints, aka diversity, is your best defense against myopia. People from different backgrounds see the world differently. These differences of perspective generate insights that can't be taught. When you bring these together in a work environment, they integrate to create a broader perspective that is priceless.*[9]

From this vantage point, *diversity is not a compliance issue—it is a strategic issue*.

General intelligence versus narrow intelligence

To increase the diversity of input and minimize chances of errors, both AlphaGo and Google use general intelligence, as opposed to narrow intelligence. Unlike a narrow AI, which is used for very specific purposes, AlphaGo is an artificial general intelligence (AGI)—a single system that can operate on a wide range of tasks. The problem with narrow AI, such as those used in smart homes, is that it breaks when faced with unexpected situations outside of handcrafted, preprogrammed solutions. Imagine asking your smart home system, "I forgot to brush my teeth this morning—what is the impact on my future?" As Johnny 5 would say, "Malfunction! Need

more input!" General-purpose algorithms like AlphaGo's are much more resilient and adaptive.

Rosenberg and Schmidt explain how they see the quandary of the generalist versus the specialist:

> *Favoring specialization over intelligence is wrong, especially in high tech. The world is changing so fast across every industry and endeavor. Hiring a specialist in such a dynamic environment can backfire. A specialist brings an inherent bias to solving problems that spawns from the very expertise that is his punitive advantage and may be threatened by a new type of solution that requires a new expertise. A generalist doesn't have a bias and is free to survey a wide range of solutions and gravitate to the best one.*[10]

Specialists' inherent bias results in mental frames through which they view the world, limiting their ability to respond to new, never-seen-before challenges. A generalist doesn't have this bias and hence can respond better to new challenges.

During my interview with him, Rosenberg explained the importance of using the generalist approach:

> *The generalist approach builds a new platform on which incremental innovation can build, much like Google's AdWords, the transistor, the steam engine, and electricity. These things were developed for initial point solutions but evolved into much bigger things, like a framework for lots of other innovations to build on.*

A generalist approach is not a perfect solution for all things but produces enough solutions to most problems that it gets adopted as a standard framework. Partly because of its culture of using the generalist approach over specialists, Google has been ranked among Boston Consulting Group's top three most innovative companies ten years in a row.[11]

These principles, which helped AlphaGo beat Lee Sedol, are the same principles that help Google create a culture that can serve as a primordial soup to spawn radical innovation. Google and other companies that follow these principles—which I call Quantum Companies—are creating and harnessing complexity. When an organization achieves a higher level of complexity, it

increases the organization's options and ability to respond to external challenges and produce radical innovation. It can also dramatically improve the capacity for innovation *all* companies need to successfully compete.

That is what this book is about: demystifying radical innovation—what it is, how it comes about, and what companies, and leaders within them, need to do to consistently produce it. That is a challenge because of the unpredictable nature of business environments, but this book will teach you how to harness complexity and jump-start radical innovation. It will reveal how to use complexity to your advantage instead of becoming paralyzed by or irrelevant because of it. It will teach you the concepts and tools necessary to adopt and exploit positive complexity, stimulating radical innovation with your products and services. It will reveal the secret DNA that many Quantum Companies have in common—what makes them so successful.

It will also teach you how to transform traditional companies into Quantum Companies by implementing the tools and concepts in this book. Every company and every leader can benefit from applying the leadership principles in this book. Even if you are a line manager and the rest of the company has not bought the concepts in this book, you can start experimenting with these tools and concepts within your own sphere of control. Before you know it, you will be making radical changes and the rest of the company will be curious to learn about what you're doing. Then you can increase your circle of influence by sharing with them how to use the tools in this book.

This book is not about how to make *incremental* improvements. There are myriads of books out there to help you achieve that goal. This book is about *radical* innovation, the kind that causes everyone to play by the rules that *you* define, changes the fundamental dynamics of an industry, catapults your company a generation ahead of the competition, and sets a new framework—a new platform for others to build on, with 10x improvements, as Peter Thiel calls it.[12]

These are the principles that I wish I had known when I was managing my teams. In many aspects, I failed as a leader because I didn't know the role of a leader and, even worse, how to become a good one. If I had known these tools and concepts, I would have been a much more effective leader. It is my sincere hope that this book will help leaders in all walks of life to transform their organizations and lives and make the world a better place for all of us.

ABOUT THE AUTHOR

Dr. Sunnie Giles is president of Quantum Leadership Group. She catalyzes leaders to produce radical innovation and redefine the rules of the game as individuals and organizations. She is a TEDx speaker on radical innovation.

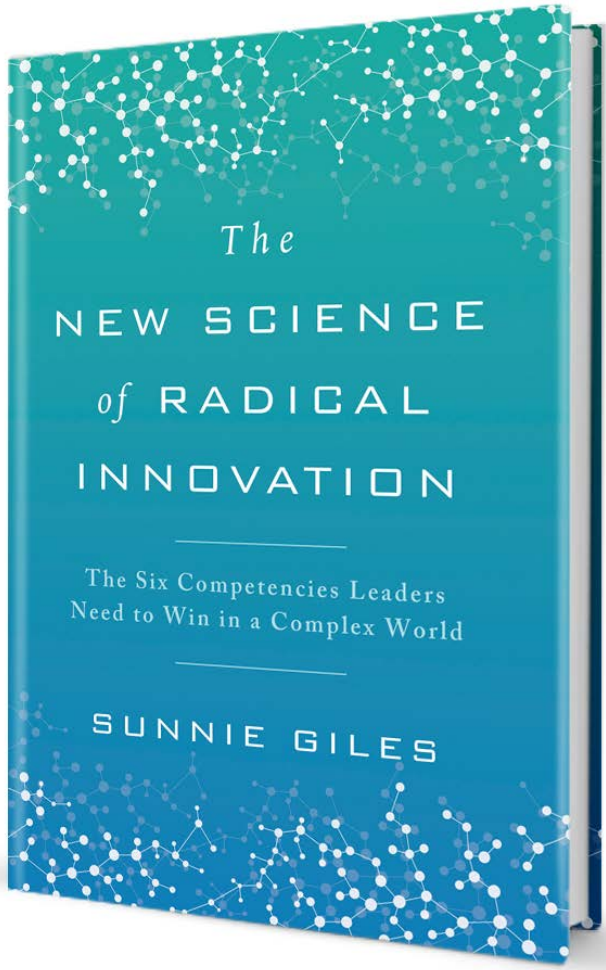
She is an adviser at Stanford Business School's Institute for Innovation in Developing Economies. Her research on global leadership for innovation has been published by the *Harvard Business Review*. Her thoughts have been published in *Forbes*, *Inc.*, *World Financial Review*, the *Korea Times*, the *Korea Economic Daily*, and Management Matters Network.

Sunnie received her MBA from the University of Chicago Booth School of Business and her PhD in systemic psychology (Marriage and Family Therapy) from Brigham Young University.

Readers can connect with her the following ways:

- Homepage: www.sunniegiles.com
- Twitter: https://twitter.com/sunnie_giles
- LinkedIn: www.linkedin.com/in/sunniegiles
- Facebook: www.facebook.com/CoachSunnie

ORDER YOUR COPY TODAY!



SHARE | BUY BN 800 ceo read Hudson Booksellers