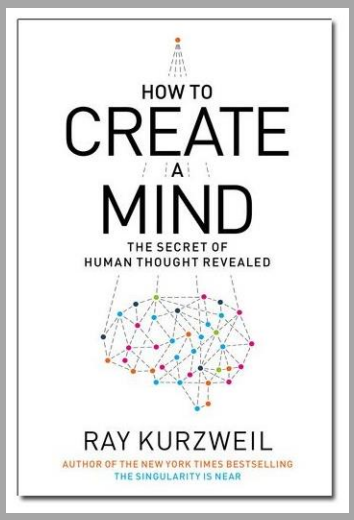
Matthew R Mottola



How to Create a Mind

Let's Connect!

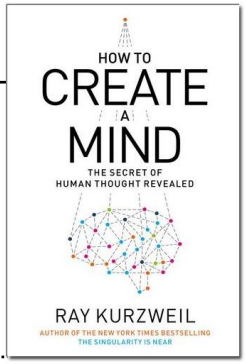
MRM

How to Create a Mind, Ray Kurzweil

My Rating (From 0-5)

Complexity (From 0-10)

9



Summary

If you want to understand artificial intelligence you must start with the brain.

Why? Because artificial intelligence is just that, mimicking through algorithms and code the human brain. On a 1-10 scale of complexity, this book is around an 8, but through this book summary we'll outline the most important principles.

My Takeaway

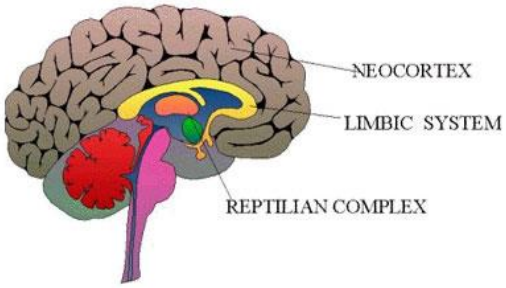
We're entering a future in which human will have a new definition. Unfortunately, this new definition won't be universal, it will apply only to those who take advantage of it. Those who don't…well they'll be left behind.

So what is the new definition? It is one of **biological and digital collaboration**.

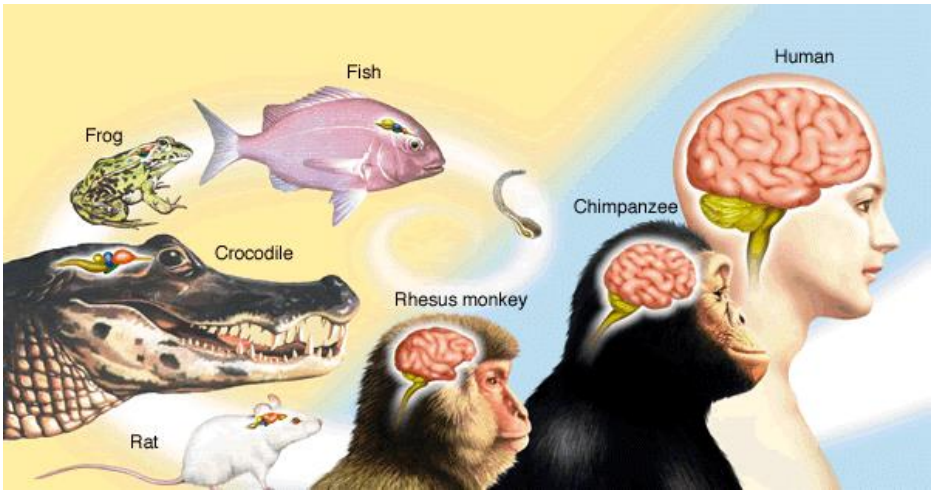
As Ray Kurzweil will show you, we're in the process of creating a digital brain, and when that happens every structure currently in society will change.

For example, intelligence will change, the job market will change, and only those that understand the principles in this book will be the one's adapting and thriving in these new conditions.

But first, let's make sure we're on the right path when talking about the brain. When we talk about the brain, we're referring to three main sections. The first can be called the "croc" brain, or **reptilian complex**. This is passed down from our first ancestors and controls our fight or flight and pleasure/pain decisions. Midway is the **limbic system**, which controls our emotions. Last is our **neocortex**, the logical "thinking" region.



The secret to our survival and domination is this neocortex. We as homo sapiens have the largest neocortex of any species.



This **neocortex region is where the future of artificial intelligence lies**. The below principles attempt to show us how Ray Kurzweil believes we can create a mind and thus create what he calls a "digital neocortex".

I'll be honest, about 70% of this book went way over my head (why it's a 9 for complication), and probably would for those without a neuroscience PhD.

So let's begin!!

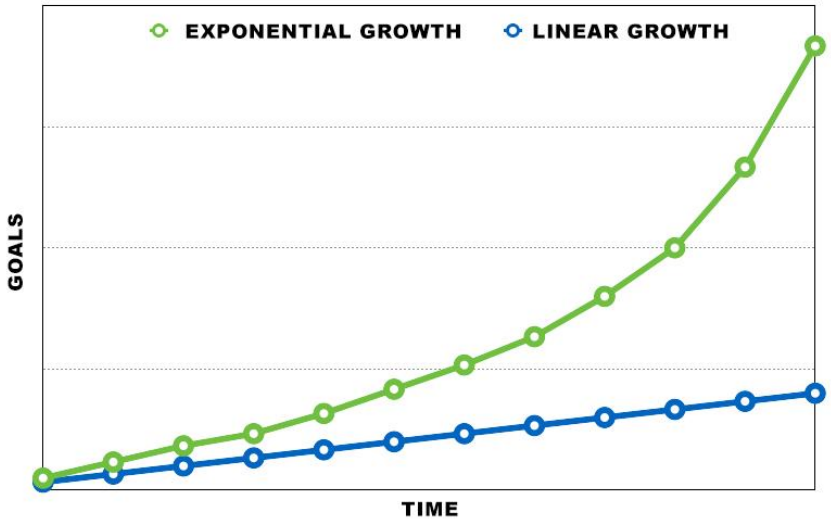
Top Takeaways

1: The advent of digital allows us unlimited capacity for a digital brain. This will create the follow conditions:

1: A harmony between our biological brain and a digital brain.

3: Human value will transfer to those in the arts, also called right brainers, also those who excel in creativity. Left brainers, the math and logic, will be outsourced to the digital neocortex.

3: Since we're moving into an information technology age, our brain will become exponential. This is in accordance with his **LOAR – law of accelerating returns**, and our brain grow in accordance with "Moore's Law", instead of the traditional linear growth.



2: A digital brain means a forever backup, avoiding any slack in knowledge from one generation to the next. Homo Sapiens evolutionary advantage lie in evolving knowledge. We did this through our invention of story. At first story was oral, then written. With a digital neocortex, our evolution of knowledge will be backed up in the cloud, leaving zero slack.

3: No one can explain "consciousness". Is this our human inherent advantage?

4: The ultra-intelligent machine might be the last machine we ever need.

Introduction

Lesson 1: Hierarchal Thinking

The structure of thinking within our neocortex is hierarchal thinking. This means:

> "understanding a structure composed of diverse elements arranged in a pattern, representing that arrangement with a symbol, and then using that symbol as an element in a yet more elaborate configuration".

Lesson 2: Passing of Knowledge

Homo Sapiens is the only species that leads knowledge through evolution.

> "Only Homo Sapiens have a knowledge base that itself evolves, grows exponentially, and is passed down from one generation to another"

Lesson 3: Our First Invention

How do we evolve knowledge? Through our first invention, story.

> "Our first invention was the story: spoken language that enabled us to represent ideas with distinct utterances"

Lesson 4: LOAR – Law of Accelerating Returns

His theory that the evolutionary process inherently accelerates and it's products grow exponentially in complexity and capability.

Lesson 5: Recreating the Brain

The purpose of this book and the purpose of artificial intelligence is as follows:

> "The goal of the project is to understand precisely how the human brain works, and then to use these revealed methods to better understand ourselves, to fix the brain when needed, and – most relevant to the subject of this book – to create even more intelligent machines."

Lesson 6: Bernoulli's Principle

Bernoulli's Principle is the theory underlying aviation. It states that there is slightly less air pressure over a moving curved surface than over a moving flat one. This produces the wing lift that allows us to go from Boston to Shanghai in 12 hours.

The importance within this principle and this book is that the mathematics behind this isn't fully settled, yet we still capitalize on the results it produces. The deeper meaning with everything, is that we may not understand the root cause, but we can still take advantage of the effect.

Lesson 7: PRTM – Pattern Recognition Theory of Mind

Think of PRTM as the basic algorithm of the neocortex. Understanding this is understanding and mastering intelligence.

> "The implication of the PRTM combined with the LOAR is that we will be able to engineer these principles to vastly extend the powers of our own intelligence".

Chapter 1: Thought Experiments on the World

Lesson 1: The Power of Thought

Through Albert Einstein, the author shows us how the field of physics came from "thought experiments".

Chapter 2: Thought Experiments on Thinking

Lesson 1: Memory Storage

Our memories are sequential in order and can be recalled only in the order they are sequenced. For example, try saying the ABC's backwards instead of forwards.

Lesson 2: Patterns

Similar to files on your computer, everything stored in our brain is in pattern form.

> "There are no images, videos, or sound recordings stored in the brain. Our memories are stored as sequences of patterns. Memories that are not accessed dim over time."

These patterns also don't need to be in complete form. For example, we fill in the gaps when given pictures partly covered or sentences with words partly left out.

Lesson 3: Prediction

Our brain is responsible for always predicting the future and telling us our best play.

Chapter 3: A Model of the Neocortex

Lesson 1: Patterns over Logic

Our neocortex has a very weak capability for logic, but a very strong ability to recognize patterns. This ability comes down to what Ray calls "**pattern processing**". Pattern processing is done by pattern processors, and the complexity and depth of pattern processing one can endure is in relation to the amount of pattern processors they have.

The **promise in AI is of unlimited pattern processors**.

> "Ultimately our brains, combined with the technologies they have fostered, will permit us to create a synthetic neocortex that will contain beyond a mere 300 million pattern processors. Why not a billion? Or a trillion?"

Lesson 2: Prediction Machine

As seen in the last chapter, our brain is a prediction machine. Each prediction is contingent on the data available to make that prediction, and with AI this data becomes infinitely larger (big data). This means far superior predictions.

Lesson 3: Two Types of Thoughts – Directed & Undirected

Undirected thought is the allowing of our thoughts without trying to move them in any particular direction (transcendental meditation). Directed thought is instead is a more orderly process of recalling memories/thought.

Lesson 4: Chunking & Recursion

Our neocortex establishes it's hierarchy of lists/patterns through recursion – "the ability to put together small parts into a larger chunk, and then use that chunk as a part in yet another structure, and to continue this process iteratively".

Sounds like the Japanese principle of Kaizen.

Lesson 5: The Story Teller

The neocortex is constantly telling itself stories to make sense of the world around it.

The author uses the example of financial markets, in which every time something happens, plenty of commentators give their take on why it happened. In actuality, they have no clue, but instead of saying that they come up with elaborate stories to make sense of it.

Chapter 5: The Old Brain

Lesson 1: Old Brain Sets the Stage

The old brain decides the problem, then our neocortex sets out to solve that problem.

Lesson 2: Sparse Coding

The problem with above, and with our brain in general, is that we don't see the world in full, we instead see in hints, 12 pictures to be specific. In the AI field they call this **sparse coding**, and in application this means throwing away most of the input information to retain only the most salient details.

Chapter 6: Transcendent Abilities

Lesson 1: Future of Creativity

The future of creativity is in the partnership and harmony of our human intelligence with the "non-biological" equivalent.

> "A nonbiological neocortex will ultimately be faster and could rapidly search for the kinds of metaphors that inspired Darwin and Einstein. It could systematically explore all of the overlapping boundaries between our exponentially expanding frontiers of knowledge".

Lesson 2: The Cloud

This intelligence will also be stored in the cloud, allowing the advancement of one system to spread to every system within seconds. Imagine if every lesson learned by one human was in seconds transferred to every human?

Chapter 7: The Biologically Inspired Digital Neocortex

Lesson 1: Speeding Up of Learning Process

> "We are now in a position to speed up the learning process by a factor of thousands or millions once again by migrating from biological to non-biological intelligence. Once a digital neocortex learns a skill, it can transfer that know-how in minutes or even seconds".

Lesson 2: Back-Up

Since intelligence now lies in the cloud, it will always be backed up. The current method for this is written language – books, encyclopedia's – social media now.

This also means no longer diminishing memory. Anyone remember the book "The Giver"?

> "When we augment our own neocortex with a synthetic version, we won't have to worry about how much additional neocortex can physically fit into our bodies and brains, as most of it will be in the cloud, like most of the computing we use today. I estimated earlier that we have on the order of 300 million pattern recognizers in our biological neocortex. That's as much as could be squeezed into our skulls even with the evolutionary innovation of a large forehead and with the neocortex taking about 80 percent of the available space. As soon as we start thinking in the cloud, there will be no natural limits – we will be able to use billions or trillions of pattern recognizers, basically whatever we need, and whatever the law of accelerating returns can provide at each point in time".

Lesson 3: Evolutionary/Genetic Algorithms (GA's)

These algorithms are exactly what they sound like – they leverage the natural selection of evolution to create the best algorithms. The author tells us they can do in minutes what biological organisms take decades and generations.

Chapter 9: Thought Experiments on the Mind

Lesson 1: Consciousness, No One Understands

Put simply, the author goes through many different theories to show us that science can't rightfully claim to understand consciousness.

Lesson 2: Machines Will Become Consciousness

The author claims that by 2029, we will be able to empathize and relate to robots as if they're humans due to the fact that robots will have "convincing" human qualities.

> "My objective prediction is that machines in the future will appear to be conscious and that they will be convincing to biological people when they speak of their qualia."

Based off this, I ask the question, "Is consciousness simply something one can relate and empathize with?"

Lesson 3: Alien Intelligence

Assuming lesson 2 is correct, what happens when robots bring "alien" intelligence to the table? That is intelligence that may be correct, but is of a quality we can relate and/or understand.

> "But what about more alien forms of intelligence that are not humanlike".

Lesson 4: West and East

The western and eastern worlds have seemingly opposite views of consciousness.

> ***East:*** Consciousness is fundamental reality, physical world comes in through thoughts of conscious beings.
>
> ***West:*** Starts with physical world, evolution creates consciousness.

Lesson 4: Establishing Identity - Development of Neocortex

All structures that define personality, skills and knowledge in the neocortex are result of own thoughts and experience.

> "The people I choose to interact with and the ideas and projects I choose to engage in are all primary determinants of who I become".

With AI, this forces us to understand our identity first, then structure AI around that identity.

Chapter 10: The Law of Accelerating Returns

Lesson 1: Exponential Learning

Since our world is evolving into an information technology world, everything within our neocortex must evolve to the conditions information technology puts in place.

With learning, this means we must transition from linear learning, to exponential learning. What does this mean? Our learning must accelerate in accordance with Moore's law instead of linear progression. For example, the author points to companies, and the difference between traditional growth and growth with information technology companies. We can write a book summary just on this, but with IT companies, growth is either exponential or bust.

How do we do this?

Through the collaboration of our "digital neocortex" and biological neocortex.

Epilogue

By far the most important section!!!!

Lesson 1: Exponential World

The world is evolving into an information technology world. Data trumps knowledge, logic trumps facts, and growth is exponential versus linear.

Lesson 2: The Limits of Nature

Our biological brain has a fixed architecture, as learned with available capacity of pattern processors. The digital brain will augment with this to release our capacity constraint.

Lesson 3: Power of the Arts

Who's best positioned for an AI future? The arts.

According to the author, our ability to digitize the quantitative logic of the neocortex, will release our neocortex to focus on the qualitative, or the arts.

> "From quantitative improvement comes qualitative advance. The most important evolutionary advance in homo sapiens was quantitative: the development of a larger forehead to accommodate more neocortex. Greater neocortical capacity enabled this new species to create and contemplate thoughts at higher conceptual levels, resulting in the establishment of all the varied fields of art and science. As we add more neocortex, in a nonbiological form, we can expect even higher qualitative levels of abstraction."

Lesson 4: This Might Be It

According to the author, the first ultra-intelligent machine might be the last machine we ever need.

> "The last invention that biological evolution needed to make – the neocortex – is inevitably leading to the last invention that humanity needs to make – truly intelligent machines - and the design of one is inspiring the other. Biological evolution is continuing but technological evolution is moving a million times faster than the former. According to the law of accelerating returns, by the end of this century we will be able to create computation at the limits of what is possible, based on the laws of physics as applied to computation. We call matter and energy organized in this way "computronium," which is vastly more powerful pound per pound than the human brain. It will not just be raw computation but will be knowledge. Over time we will convert much of the mass and energy in our tiny corner of the galaxy that is suitable for this purpose to computronium. Then, to keep the law of accelerating returns going, we will need to spread out the rest of the galaxy and the universe".

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