📕 #85: A Mind At Play

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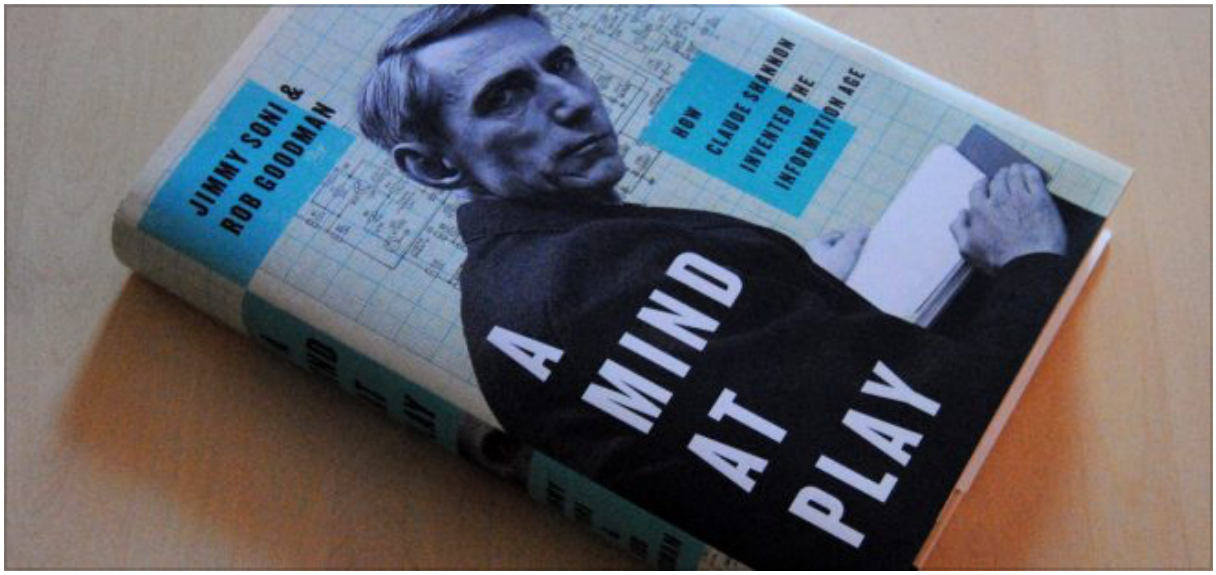


OVERVIEW

A good biography of one of the most influential thinkers of the 20th century. Claude Shannon, the creator of Information Theory (that laid the foundation for the digital age), was an intensely curious genius, whose interests spanned electronics, mathematics, gambling, juggling and chess.

His former boss at Bell Labs, Vannevar Bush, believed that, “specialization was the death of genius.” Shannon certainly lived by that, pursuing a range of interests throughout his life, especially since his initial work on Information Theory was published so early on in his career.

Perhaps the most noteworthy idea I took from the book, came from a talk Shannon gave on “Creative Thinking”. In it he introduced the concept of **constructive dissatisfaction**—“a slight irritation when things don’t look quite right”, but one that leads to solution-finding, instead of just complaining. In other words, “a genius is simply someone who is usefully irritated."

BOOK NOTES

INTRODUCTION

> "His was a life spent in the pursuit of curious, serious play; he was that rare scientific genius who was just as content rigging up a juggling robot or a flamethrowing trumpet as he was pioneering digital circuits." (pg. xv)

CHAPTER 3 - THE ROOM-SIZED BRAIN

> "For the same reason—rigor in symbolizing the world—every engineer was taught to draw. Leave pure numbers for pure mathematicians—engineers would learn math with their hands."; "A man learns to use the Calculus as he learns to use the chisel or the file." (pg. 29)

CHAPTER 4 - MIT

> "Logic, just like a machine, was a tool for democratizing force: built with enough precision and skill, it could multiply the power of the gifted and the average alike." (pg. 35)

- Interdisciplinary training was rare—little overlap between rigorous mathematic logic, and the design of electric circuits (pg. 35)

> "After Shannon, designing circuits was no longer an exercise in intuition. It was a science of equations and shortcut rules." (pg. 40)

> "Circuit design was, for the first time, a science. And turning art into science would be the hallmark of Shannon's career." (pg. 41)

CHAPTER 5 - A DECIDELY UNCONVENTIONAL TYPE OF YOUNGSTER

- Vannevar Bush's conviction: "specialization was the death of genius."

> "It is unfortunate when a brilliant and creative mind insists upon living in a modern monastic cell." (pg. 49)

CHAPTER 7 - THE LABS

> "The goal of Bell Labs wasn't simply clearer or faster phone calls. The Labs were tasked with dreaming up a future in which every form of communication would be a machine-aided endeavor." (pg. 66)

PART 2

CHAPTER 14 - THE UTTER DARK

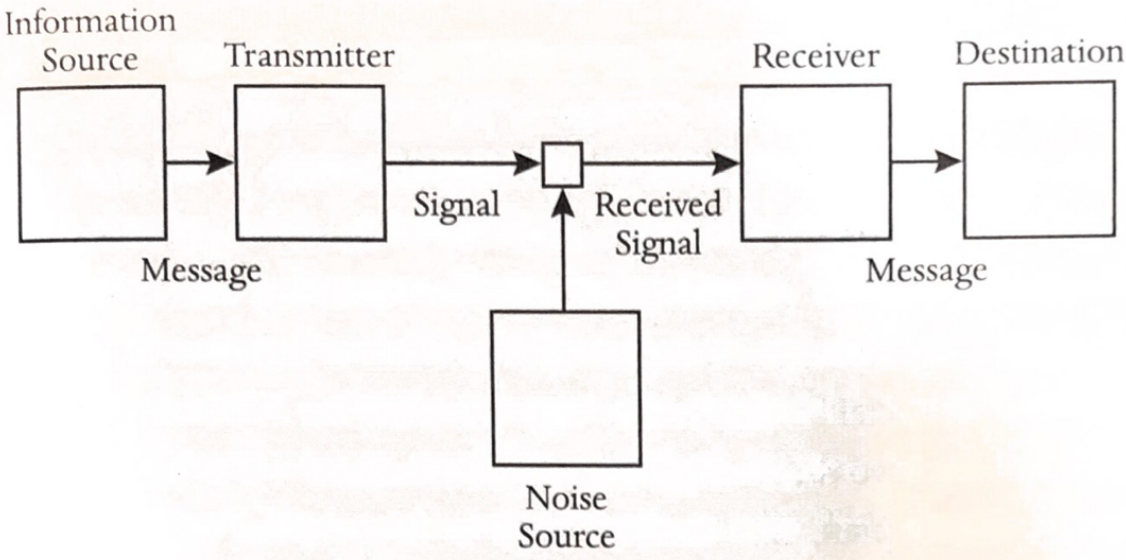
- Three enduring lessons from the Transatlantic cable fiasco (pg. 123)
  1. Communication is a war against noise
  2. There are limits to brute force
  3. The hope of doing better, “lay in investigating the boundaries between the hard world of physics and the invisible world of messages.”

CHAPTER 15 - FROM INTELLIGENCE TO INFORMATION

- “Elementary Areas” ➜ “picture elements” ➜ “pixels” (pg. 135)

CHAPTER 16 - THE BOMB

- "A Mathematical Theory of Communication" (link to paper)



- The *information source* produces a message.
- The *transmitter* encodes the message into a form capable of being sent as a signal.
- The *channel* is the medium through which the signal passes.
- The *noise source* represents the distortions and corruptions that afflict the signal on its way to the receiver.
- The *receiver* decodes the message, reversing the action of the transmitter.
- The *destination* is the recipient of the message.

- Origin of "Bit"
  - "New sciences demand new units of measurement…The new unit of Shannon's science was to represent this basic situation of choice. Because it was a choice of 0 or 1, it was a 'binary digit'." (pg. 141)
  - "One bit of information is the amount of information that results from a choice between two equally likely options. So 'a device with two stable positions…can store one bit of information'." (pg. 141)
- "Information is stochastic. It is neither fully unpredictable nor fully determined." (pg. 145)
- Shannon defined, *Channel capacity*, as "the number of bits per section that a channel can accurately handle". (pg. 157)

- "As long as we respect the speed limit of the channel, there is no limit to our accuracy, no limit to the amount of noise through which we can make ourselves heard." (pg. 160)
- "Bits are the universal interface." - Dave Forney (pg. 161)
- "Organisms organize" - James Gleick in *The Information*

> "We sort the mail, build sandcastles, solve jigsaw puzzles, separate wheat from chaff, rearrange chess pieces, collect stamps, alphabetize books, create symmetry, compose sonnets and sonatas, and put our rooms in order…We propagate structure (not just we humans but we who are alive). We disturb the tendency toward equilibrium. It would be absurd to attempt a thermodynamic accounting for such processes. But it is not absurd to say that we are reducing entropy, piece by piece. Bit by bit." (pg. 163)

CHAPTER 18 - MATHEMATICAL INTENTIONS, HONORABLE OR OTHERWISE

- On John Nash's Nobel winning ideas on Game Theory...

> "Seemed initially too simple to be truly interesting, too narrow to be widely applicable, and, later on, so obvious that its discovery by someone was deemed all but inevitable." (pg. 170)

CHAPTER 23 - THE MAN-MACHINES

- Shannon "had earned the right to be non-productive." (pg. 199)

> "When not besting his colleagues in board games, he could be found piloting a unicycle through Bell Labs' narrow passageways, occasionally while juggling."

- "I think the history of science has shown that valuable consequences often proliferate from simple curiosity." (pg. 202)

> "Curiosity in extremis runs the risk of becoming dilettantism, a tendency to sample everything and finish nothing. But Shannon's curiosity was different. His kind meant asking a question and then constructing—usually, with his hands—a plausible answer." (pg. 202)

CHAPTER 24 - THE GAME OF KINGS

- Shannon built what was by some accounts, the first chess playing computer; "another illustration of Shannon's eagerness to build with his hands what he had dreamed up on paper." (pg. 215)

CHAPTER 25 - CONSTRUCTIVE DISSATISFACTION

- *Creative Thinking* talk - http://www1.ece.neu.edu/~naderi/Claude%20Shannon.html
- Constructive dissatisfaction - "a slight irritation when things don't look quite right" (pg. 218)
- "A genius is simply someone who is usefully irritated."
- Problem solving strategies (pg. 219)
    1. Simplifying - "Almost every problem that you come across is befuddled with all kinds of extraneous data of one sort or another; and if you can bring this problem down into the main issues, you can se more clearly what you're trying to do."
    2. "Encircle your problem with existing answers to similar questions, and then deduce what it is that the answers have in common
        - Ingenious incrementalism - "it seems to be much easier to make two small jumps than the one big jump in any kind of mental thinking."
    3. Restate the question; "Change the words. Change the viewpoint…Break loose from certain mental blocks which are holding you in certain ways of looking at a problem." (pg. 219)
    4. Structural analysis of a problem - "breaking an overwhelming problem into small pieces."
    5. "Problems that can't be analyzed might still be inverted"

PART 3

> "I think the history of science has shown that valuable consequences often proliferate from simple curiosity." (pg. 266)

> "Shannon's body of work is a useful corrective to our era of unprecedented specialization." (pg. 275)

> "His courage was joined to an ego so self-contained and self-sufficient that it looked, from certain angels, like the absence of ego." (pg. 278)