Alan Turing: The Life of a Freethinker

The Golden Thread · Part 2

How does order come out of simple rules, and where do rules stop?

Alan Turing (1912–1954) asked this question all his life. He asked it in mathematics, in code breaking, in computers, in the study of intelligence and, at the end, in biology. Each time the question had a new form. This essay follows that one question through his life.

In The Golden Thread, a freethinker is someone who sees that a shared expectation is failing before others see it, and who gives a new picture of the whole. All facts were checked against at least two sources. Where sources disagree, this is said.

The pattern

Turing's work looks like five careers: logic, code breaking, computers, artificial intelligence and biology. But it follows one pattern.

1. Take a process that looks complex.
2. Find the simple rules underneath it.
3. Show how far those rules go.
4. Show where they stop.

He did this with calculation in 1936, with intuition in 1939, with learning in 1948–1950 and with the growth of living form in 1952. Each time he looked at how order, complexity and intelligence emerge from simple processes, and at the limits of explaining them by mechanical rules.

Behind all of it was an older question that began when he was a boy: how mind and matter belong together.

The start: a friend and a chemical clock (1926–1932)

Turing was born in London on 23 June 1912. In 1926 he went to Sherborne School. There he became friends with Christopher Morcom, who shared his love of mathematics, chemistry and astronomy.

In 1929 Morcom showed him the iodine clock reaction. Two clear liquids are mixed. For a while nothing happens. Then the whole liquid turns dark blue at once. A uniform state suddenly changes into a new state. Turing wrote a paper on this reaction and won a school prize for it in 1930.

Morcom died on 13 February 1930, aged eighteen. Turing chose the prize books given in Morcom's name after his death: two books by the astronomer Arthur Eddington and two by James Jeans. Two years later, while staying with Morcom's family, he wrote a short text called *Nature of Spirit*. In it he asked how a body can hold a mind, and what happens to the mind when the body dies.

So the pattern began with two things: a chemical change from uniformity to form, and a question about mind in matter.

Step 1: What can rules calculate? (1936)

At Cambridge, in 1935, Turing heard about a problem posed by the mathematician David Hilbert. Is there a fixed method that can decide, for every statement in mathematics, whether it can be proved?

Turing answered in 1936. He started with a person doing a calculation with pencil and paper. What does that person really do? He reads a sign, writes a sign, moves on and changes his "state of mind". Turing turned this into a simple model: a tape, a reading head, a few states and a table of rules. He called it an "a-machine". His teacher Alonzo Church later called it the "Turing machine".

Two results followed:

- One machine can imitate every other machine. This is the basic idea of the modern computer.
- Some questions cannot be answered by any machine. Hilbert's method does not exist.

Simple rules go very far. But not all the way.

Step 2: Where rules stop (1939)

In his doctoral thesis in Princeton (1938), Turing looked at what happens when a system of rules meets a question it cannot answer. He added an "oracle": a step that gives an answer no machine

can work out. He split mathematical thinking into two parts: ingenuity, which machines can copy, and intuition, which they cannot fully copy.

The mathematician Kurt Gödel later said that Turing had made one mistake: the human mind is not limited to a fixed number of states. Turing's own work already pointed in that direction.

Step 3: Machines that learn (1945–1950)

During the war Turing worked at Bletchley Park on breaking the German Enigma code. After the war he designed one of the first computers, the ACE, and in 1948 moved to Manchester.

He now asked a new question. If a machine is to be intelligent, it cannot just follow fixed rules. In 1948 he described "unorganised machines" that are shaped by training, and a "child machine" that learns. In 1950 he wrote that a machine that may never make mistakes cannot be intelligent. In the same paper he proposed the imitation game, now called the Turing test.

He also took the unseen seriously. In that paper he wrote that the statistical evidence for telepathy was overwhelming. He saw it as a scientific question, not as nonsense.

Step 4: Form without a builder (1951–1952)

In 1951 Turing wrote that he wanted to grow a brain, not build one. To understand how a brain grows, he first had to understand how any living form grows.

An early embryo is almost the same everywhere. Yet it becomes a body with a front and a back, with limbs, spots or stripes. Where does that form come from?

Turing's answer, published in 1952, used two chemicals. They react with each other and spread through the tissue at different speeds. In a perfectly even tissue nothing happens. But the even state is unstable. The smallest change grows, and the system settles into a pattern: spots, stripes or rings. No plan is needed. No builder is needed. The form comes from the system itself.

This is the iodine clock of 1929, now as a theory of life. That link is not documented. It is a shared form.

In his last years he applied the idea to the way leaves are placed on a stem, where the Fibonacci numbers appear. He did not finish this work.

Step 5: The unseen world (1952–1954)

On 31 March 1952 Turing was convicted for a relationship with a man, which was a crime in Britain at the time. He chose a year of hormone treatment instead of prison. From 1952 he was in analysis with Franz Greenbaum, a Jungian psychoanalyst, and wrote down his dreams.

In March 1954 he sent four postcards to his friend Robin Gandy with the title *Messages from the Unseen World*. They are about Eddington, the light cone and creation. One line says: "Science is a Differential Equation. Religion is a Boundary Condition."

He died on 7 June 1954, aged 41, of cyanide poisoning. The inquest said suicide. His mother believed it was an accident. The question is still open. In 2013 he received a royal pardon.

The question behind the pattern

The five steps share one theme: how ordered complexity comes out of simple processes, and where explanation by rules alone stops.

Year	Field	Simple process	Where rules stop
1929–1932	Chemistry, *Nature of Spirit*	A chemical clock changes all at once	How does a body hold a mind?
1936	Mathematics	Reading and writing signs by rules	Some questions cannot be decided
1939	Logic	Formal proof	Intuition cannot be fully copied
1948–1950	Intelligence	A machine that is trained	Learning needs room for mistakes
1952	Biology	Two chemicals reacting and spreading	Form needs no plan from outside

Year	Field	Simple process	Where rules stop
1954	Cosmology, religion	Eddington's physics	"Messages from the Unseen World"

The thread to Spinoza and Rosen

Not every link is a direct influence. The series uses two kinds:

- A **trace** is a documented link: a teacher, a letter, a book that was read.
- An **echo** is a shared idea without proof that one person learned it from the other.

Person	Link to Turing	Kind
Christopher Morcom	Friend; showed him the iodine clock	Trace
Arthur Eddington	Read at school; used in *Nature of Spirit*; in the 1954 postcards	Trace
Alonzo Church	Teacher in Princeton; named the Turing machine	Trace
Kurt Gödel	Showed the limits of formal systems; criticised Turing's view of the mind	Trace
Erwin Schrödinger	*What is Life?* (1944); Turing knew it and looked for his own answer	Trace
D'Arcy Thompson	*On Growth and Form*; Turing placed his work in Thompson's line	Trace

Person	Link to Turing	Kind
Goethe	Study of form, reaching Turing only through Thompson	Echo
Robert Rosen	Wrote in 1968 on Turing's chemical model; later argued that living systems cannot be fully simulated by machines	Trace
Spinoza	Mind and body as two sides of one reality	Echo

One book connects the three stories: Schrödinger's *What is Life?*. It quotes Spinoza twice: "the body cannot make the mind think, and the mind cannot make the body move" (*Ethics* III, 2). Turing knew the book. Rosen opened his last book with an essay on "The Schrödinger Question".

Spinoza asked how mind and matter belong together. Turing asked how far simple rules can explain mind and form. Rosen asked why living things are more than machines. It is one question, asked three times.

The expectations that failed

1. **That every mathematical question can be decided by a method.** Turing showed in 1936 that this is not so.
2. **That living form needs a plan or a builder.** Turing showed in 1952 that form can arise by itself.
3. **That only humans can think.** Turing raised this question in 1950. It is still open.

The golden thread in Turing's life is the search for the principles through which complexity, intelligence and living form emerge, and for the limits of explaining them by mechanical rules alone. He looked for the simple rules behind complex things, and he always showed where those rules end. That is what makes him a freethinker.

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