

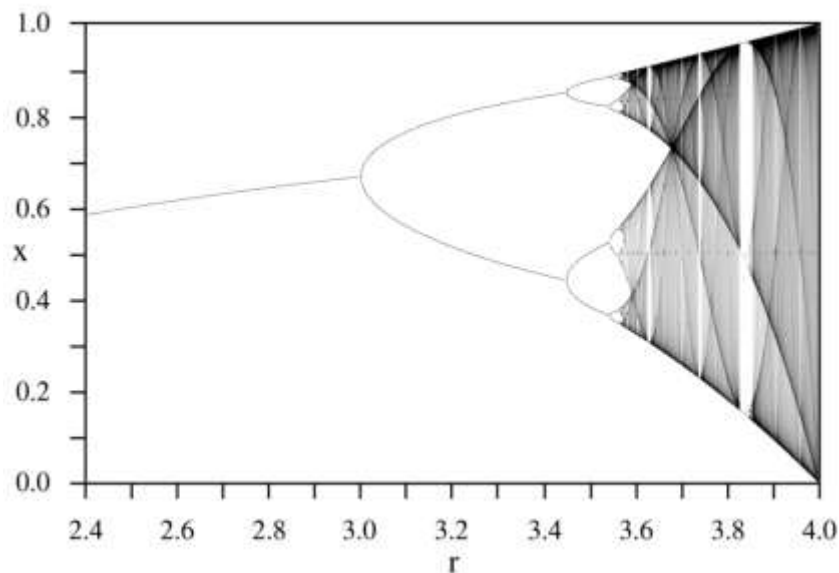
## *The Birds*

In the Hitchcock film of the same name, a small town in Bodega Bay is terrorized by birds. 'Terrorized' is the right word. Flocks of birds, of all varieties, take to attacking the citizens seemingly at random, as and when they will. There's a mass exodus of the townspeople near the end of the film, when anyone with any sense abandons the town double-quick. Some fools remain, of course, and that's what allows the film its climax. Hitchcock called this film – canny ad-man that he was – “the most terrifying motion picture I have ever made!” It's not so; others are better, *Psycho* for instance. What makes *The Birds* unique, however, is a gesture of denial, a refusal to furnish any motive for the birds' behavior. Several different explanations are considered in the film but all are rejected. In the end – after the carnage – we still don't know why the birds attacked at all, why it ever began.

I think there's something interesting about that.

In mathematics, the term *chaos* has a precise, non-intuitive definition. It refers to relations in seeming randomness and the presence of eventual patterns. Chaos can be described as a state in which the present determines the future, but the approximate present does not approximately determine the future. That is, a relation exists but it is imperfect and non-rigid. Instead, it flows. In other words, chaotic systems are highly sensitive to initial conditions.

Let's map this. So:



Starlings, also known as myna birds, are small passerine birds in the family Sturnidae. Increasingly over the last few decades, starlings are gaining a reputation as urban pests. The problem lies in their numbers: these birds are gregarious, display high sociality, and flock and roost collectively in large numbers. In so doing, they vocalize too loudly near people's homes, they affect the horticulture, they ruin paint jobs on cars by shitting on them, and so on. There have been efforts at mass poisoning, or otherwise exiling, starling flocks from some cities, but conservationists insist that starlings are a species under high stress. Their habitats are shrinking. They're at a lack of homes.

Sūrat al-Fīl in the Quran narrates an incident which, exegetes tell us, likely took place in 570 A.C. Abraha marches against Makkah with an army of elephants. But he and his army

are foiled, by birds. They are demolished, the invading army and its elephants, by a swarm of birds, a large flock of swarming birds, who pelt them with small rocks. The rainfall of falling rocks dissolves their flesh, making them -

“like an empty field of stalks and straw, of which the corn has been eaten up.”

Birds make an appearance in another Hitchcock film, this one more iconic. I am talking, of course, about *Psycho*, the essential slasher flick, the film so technically virtuoso as to stun critics both in its time and today. The film that took Freud, and Hitchcock's curious obsession with Freud, and ran with it, had a field day. The film that some would call “nihilist” because of the killing, the summary dismissal, of Marion Crane (Janet Leigh), about halfway through the film. She's gone. Kaput. Just like that – the woman we thought was the protagonist. The film continues, undisturbed, without its protagonist. The man who kills her, Norman Bates (Anthony Perkins), is repressed and shy, speaks haltingly, seems diffident. He's the owner of the Bates Motel, where Marion comes to stay, and he has a hobby: he likes stuffing birds. He's an amateur taxidermist. There's a room where all four walls are covered with stuffed, dead birds, staring out at you with glass eyes.

The common starling has iridescent plumage. This means that the color of the bird's body changes – subtly – depending on angle of view. This property it shares in common with soap bubbles, butterfly wings and sea shells.

This is the Bates Motel, what it looked like on set:



There's nothing overtly evil about this place, but this is not surprising – evil, in its actual manifestations, is the most boring thing in the world. Completely banal. Even the observation of this is banal.

In the film, the innocuous motel becomes –



Norma Bates is a psycho, a killer. A psycho killer. He's mentally ill. He killed his mother and he pretends he's her. He kills Marion – stabs her, iconically, in the shower – and pretends it was Mother who did it. In Bates, then, we have the marriage between birds and madness, between birds and acts of horror, terrible evil. He's drawing a link in his mind, Hitchcock, and in this film – stuffed with bird references – we can just about see it, that relation. Birds ⇔ madness.

Towards evening, large flocks of starlings form moving birdclouds called *murmurations*. A murmuration can be thousands of starlings thick and it moves like one voluptuous, black cloud. It swoops and twists, loops, covers long distances, seems steered by chance and the wind. It's a felt experience; there isn't a way to render it in words. You have to *be there*, in the world. Under the birds. You look up and it's there: a magic cloud, shifting. The wonder is in how alive it is. It's a moving mass but in it are birds, birds, birds. You can hear them, sometimes, chirp. And it's like the cloud is murmuring, softly to itself. There's no force in it - it's like black velvet, just unspooling across the sky in some opulent luxury. But – it's hard

to describe – watching it, this spectacular murmuration of starlings, it feels uncanny. There's something *there*, mysterious and felt but not revealed, never fully. Something that makes you, looking up at the flowing cloud, feel your stomach lurch, the chills, a thrill of dread that catches your spine.

Walking down the main street of this abandoned town, I see shadows canting across the tops of tall buildings, many carrying warning signs, *asbestos hazard*, windows boarded. Those shadows are birds, in small flocks, floating and chuting in patterns across the sky.

They assure me that it still exists, life.

The invading army was vanquished by a flock of birds.

With the advanced tools of computer modelling and visualization, the code's been cracked. There is a clear, simple and precise mathematical explanation for why starling flocks behaves the way they do. Starling murmurations can be almost perfectly mapped to equations of critical transitions – systems, or networks, poised to tip, much like metals becoming magnetized or liquid turning to gas. In a murmuration, a starling isn't acting like itself, like a starling; it's acting like a point in a network.

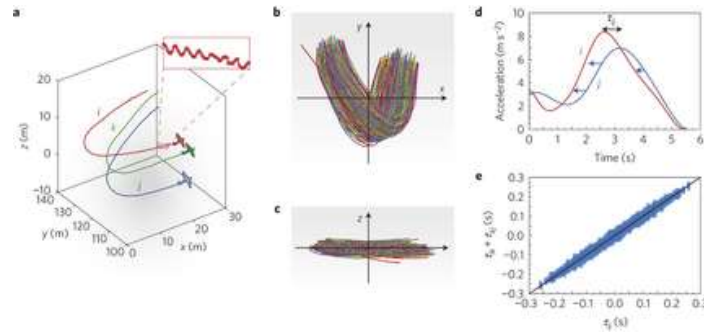
Each starling is a node. Each node is responsive to the behavior of all the other nodes, especially those that are its direct neighbors, adjacent to it in the system (the murmuration). The relation is simple: *when a neighbor moves, so do you*. Individual starlings (nodes) coordinate their movements based on observations of not just one or two, but six to seven birds (nodes) around them. And each individual starling (node) keeps a minimum distance from its neighbors, proportional to its wing span. This micro action, on the macro scale, is what animates the entire network. Whole flocks turn in unison. And when a flock turns in unison, it's a phase transition.

Phase transitions are more familiar in contexts of movement between inert states. Solid liquid gas. But it's also the terminology for locust criticality. Basically: a locust is just a phase. What we know as the *locust* is the swarming phase of certain species of short-horned grasshoppers. Grasshoppers are the solitary phase (harmless). Locusts, the gregarious phase (agents of plague, and, again – divine wrath).

Perhaps, though, we are all locusts, ordinary grasshoppers until a switch in time, a very particular trigger occurs, and then we undergo phase shift. There are dams that burst in people. But before a dam bursts, it endures years of slow tortuous pain. Locusts are programmed to be the way they are, with unchangeable structures in their DNA, mere phases in time. Release feels more fantastic when you don't understand it.

There are switches, like on train tracks, flipping coldly between states  $-1$  &  $0$ ,  $1$  &  $0$  – and they direct us, our energies, and we follow them blindly.

*Birds' trajectories and turning delays*



*Starling murmuration over abandoned field*



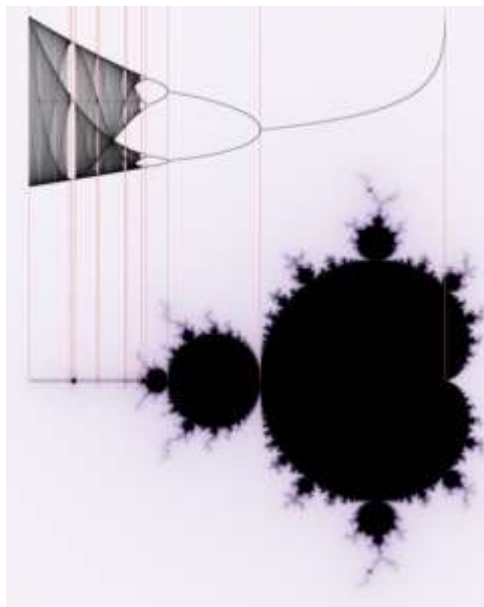
Once, in 1949 in London, so many starlings roosted on the hands of the Big Ben that they stopped the clock. Virginia Woolf's ripples of time, spreading outwards in concentric circles of tyrannical time, encircling and interpellating an entire civilization – these were halted, by the birds.



A starling murmuration is an example of those complex phenomena known as *fractals* – infinitely complex patterns that are self-similar across different scales. Mathematically speaking, fractals are an instance of the Mandelbrot set, which is when  $z_{n+1} = z_n^2 + c$  remains unbounded<sup>1</sup>.

This is the mathematical skeleton on which fractals grow.

This is consistent with chaos theory, of course.



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<sup>1</sup> That is, a complex number  $c$  is part of the Mandelbrot set if, when starting with  $z_0 = 0$  and applying the iteration repeatedly, the absolute value of  $z_n$  remains bounded however large  $n$  gets. That is:

$$z_{n+1} = z_n^2 + c$$

$$c \in M \iff \lim_{n \rightarrow \infty} |z_{n+1}| \leq 2$$

The first time we're introduced to Septimus Smith in *Mrs. Dalloway*, Woolf describes him as being "beak-nosed." Smith jumped out of a window. Woolf drowned in a river. They both heard the birds, singing in Greek.

What's madness but an imbalance of good and bad thoughts?

The sound of Norman Bates stabbing Marion Crane was simulated by plunging a knife through a melon. So it's true: things resemble other things.

So starlings in murmurations are robots, dumb and mute, responding to the tyranny of mathematical force. There's a law and they're constrained by it. There exists a mathematically precise relation – an algorithm – for the relation between each starling and its neighbors, and in its thrall the birds are not birds but points, nodes, coordinates in a map. They dumbly follow.

You just lift the skin off experience, and there's numbers underneath.

But can you watch a starling murmuration and see flying numbers? Nodes?

In *The Birds*, Hitchcock denies the neatness of coherent explanation. The film, in this sense, is faithful to experience – the ooze of it, the flow. There is something about birds which denies all explanation. They are pure force, felt experience. Like the uncanny, you simply inhale it, let it invade you. You look up at the sky and there's magic above you. The birds are black specks, flying in unison.

The birds are pure force. Uncanny, felt experience.

You have to feel it to know it.

Feel the boot that stomps endlessly over the human face.