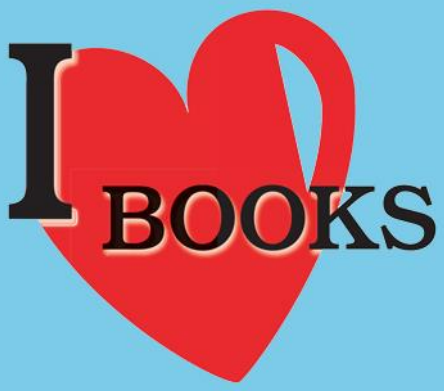


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THE ANATOMY OF A BICYCLE

When it was perfected at the end of the nineteenth century, the humble bicycle transformed transport – and helped launch the very first women's movement.

Two-wheeled travel began in 1817 when German forestry official Baron Karl von Drais set out to replace the horse. He gave his wooden running machine, or "Laufmachine", two wheels, and handlebars for steering, but it lacked pedals – riders had to kick themselves along.

Bicycles developed in strange and dangerous ways. By 1870 an "ordinary" bicycle had a huge wheel at the front and a tiny one behind. The saddle was as high as a man's shoulder, and a fall from one of these machines could be dangerous. In Britain they were nicknamed "penny-farthings" after the smallest coin, the farthing, and the much bigger penny, which was worth four times as much.

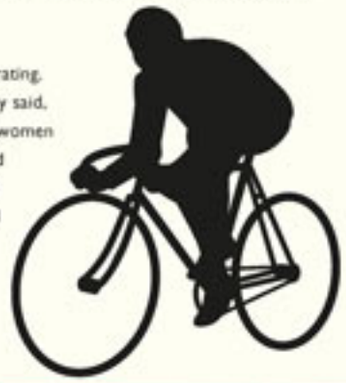
SAFE, MODERN BICYCLES

Then in 1885, English inventor John Starley produced a bicycle with a radically better design. His "Rover" cycle had a diamond-shaped frame, similar-sized wheels, a chain drive with pedals, and handlebars connected directly to the front forks. In most ways it resembled the modern bicycle shown opposite.

These "safety" bicycles were not cheap, costing nine weeks' wages for a factory worker, but they could be found for less second-hand, and were not nearly as expensive as horses, which required a stable and feed. On a bicycle, people too poor to own a horse could travel further, and more quickly, in a day than they could walk.

FREEWHEELING WORLD

For women the bicycle was – literally – liberating. In 1896, American feminist Susan B. Anthony said, "bicycling ... has done more to emancipate women than anything else in the world... I stand and rejoice every time I see a woman ride by on a wheel ... the picture of free, untrammeled womanhood." The bicycle gave women the freedom to travel, and relieved them of corsets and ankle-length dresses. Instead they wore "rational dress" – baggy trousers called knickerbockers. These "New Women" wanted more than just the right to cycle. Before long they demanded, and won, something much more important: the right to vote.



RACY RACERS

Laufmachine riders also appeared on stage: scantily clad acrobats rode them to entertain audiences at music-halls.

UNDERCOVER CYCLISTS

American women caused a sensation when they first cycled in "bifurcated nether garments" (trousers). Newspapers reported in 1804 that more than 200 women were cycling in New York – but only at night, when nobody could see them.

SHEEP SHEARING

Bicycle technology made sheep-shearing easier: around 1900, several companies introduced bike-powered fleece-clippers. Propped up on a stand, and pedalled by a boy, a bicycle could power clippers for two shearers.



1	REAR MUDGUARD	11	BRAKE LEVER	21	CRANK
2	REAR BRAKE	12	HANDLEBAR STEM	22	CHAIN
3	SEAT STAY	13	HEADSET	23	PEDAL
4	SEAT POST	14	SEAT TUBE	24	REAR HUB
5	SADDLE	15	TOP TUBE	25	CHAIN STAY
6	HANDLEBAR	16	DOWN TUBE	26	RIM
7	EXPANDER BOLT	17	TUBE HEAD	27	TYRE VALVE
8	HANDLEBAR GRIP	18	FRONT BRAKES	28	FRONT HUB
9	BRAKE CABLE	19	FRONT FORK	29	SPOKE
10	FRONT MUDGUARD	20	CHAINRING	30	TYRE

THE STRUCTURE & ATMOSPHERE of PLANET EARTH

Human beings may be the dominant species on Earth, but our success is confined to the planet's surface. We have hardly explored beneath our world's crust, and gravity and thin air make it difficult to soar very far above it.

Until about 400 years ago, the suggestion that the earth was solid seemed absurd. The existence of caves suggested a hollow world – perhaps a Hell – underground. It was an idea that proved hard to shake off. As late as 1818 American explorer John Symmes suggested that the earth was "hollow, habitable within, and widely open about the poles".

Geologists have since learned a lot more about Earth's structure, though most of their evidence remains indirect. The world's deepest mine drills just four kilometres into the earth's crust, so how do we know what's lower down?

The best clue that the earth is not hollow is gravity. Gravity gives everything its weight, and it's proportional to the planet's mass. If the earth were hollow, we would weigh less. Magma spewing from volcanoes shows there's liquid rock down there, but Earth's magnetic field tells us that it's not all liquid. There must be a solid iron core, like a giant magnet. Earthquakes tell us more: by timing their shockwaves, geologists learned that the core floats in a liquid outer core, enclosed by a stickier mantle.









FLIGHT ADVANTAGES

A few birds fly into the stratosphere: bar-headed geese can fly over Everest, the world's highest peak at 8,900 metres. Aircraft also fly into the stratosphere to avoid the turbulence caused by storms and clouds. This high up there is too little oxygen to support human life, so the air in the fuselage is compressed to the same density as the atmosphere 2,000 metres above sea level.

The summit of the earth's highest mountain, Everest, reaches the top of the breathable atmosphere.

ABOVE OUR HEADS

The earth's atmosphere is easier to observe, if no simpler to explore. Human beings live in the bottom 5,500 metres, where there is enough oxygen to survive. This habitable layer is about half of the troposphere, where almost all water vapour is located. The warmer stratosphere is heated by the sun's rays, preventing clouds from rising above it.

The cooler layers immediately beyond the stratosphere are collectively called the ionosphere, because their gases are partly ionised. Energy from the sun knocks electrons off them, leaving them with a positive electrical charge. This charge makes the ionosphere reflect radio waves, and this is how broadcasts bend round the earth's surface instead of beaming straight out into space.

Above the ionosphere, Earth's atmosphere turns to plasma, a mix of electrons and positively-charged particles. This layer protects us from the solar wind – charged particles from the sun, heated to one million degrees Celsius. Without it, the solar wind would strip our atmosphere of oxygen.

