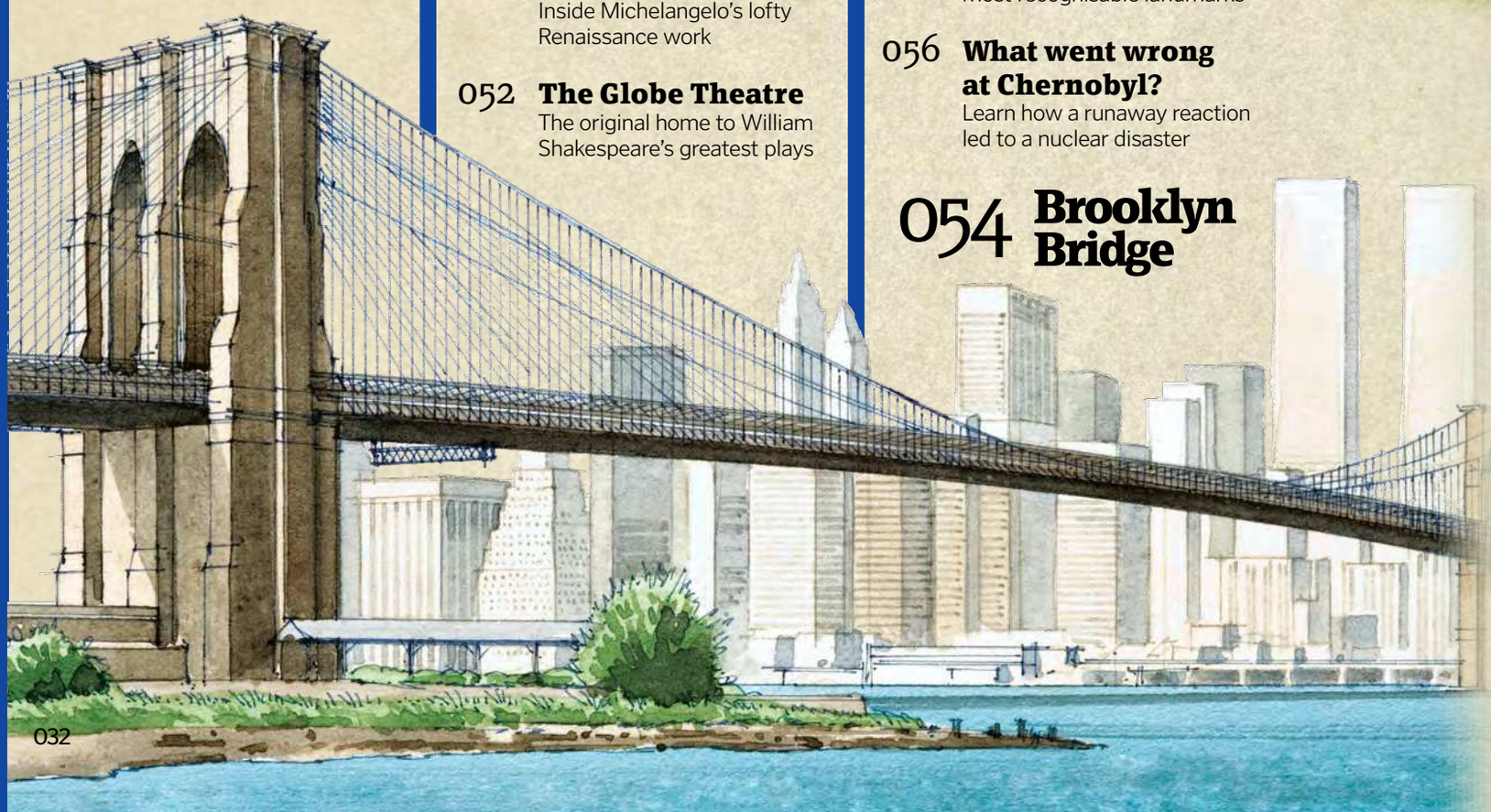
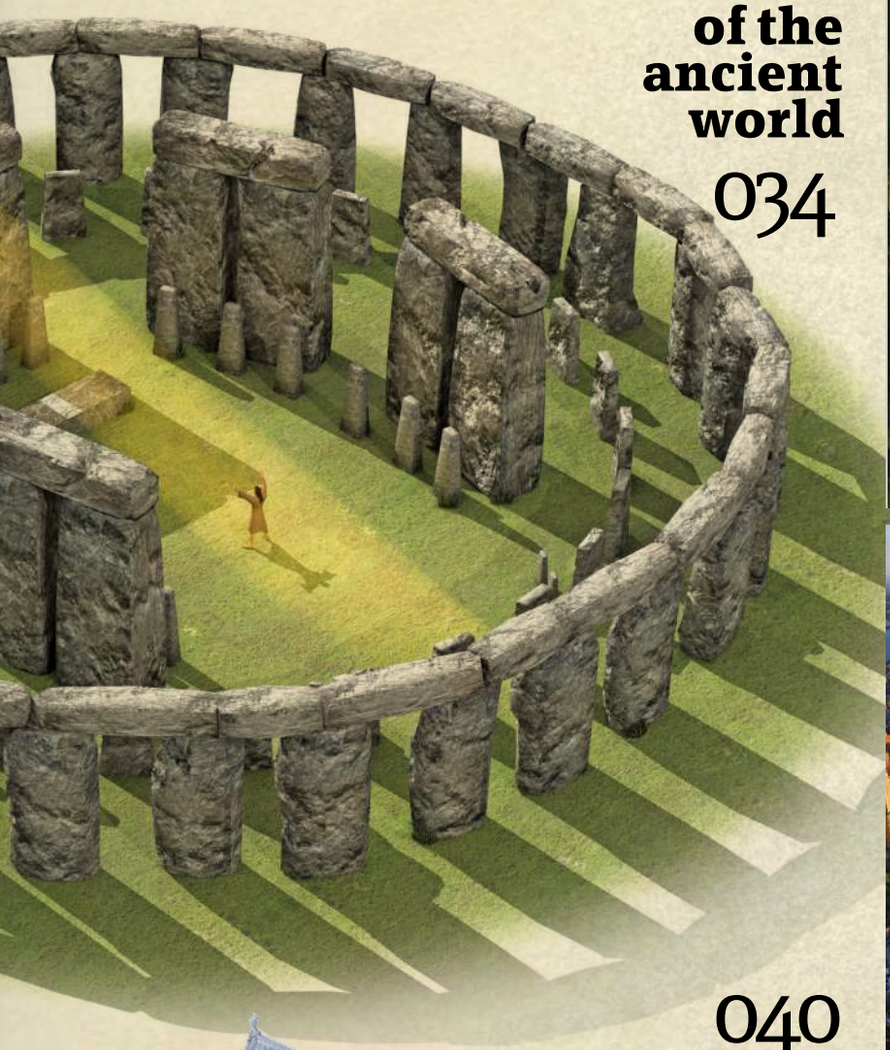
# BUILDINGS, PLACES & LANDMARKS





054 Brooklyn Bridge



## 10 wonders of the ancient world

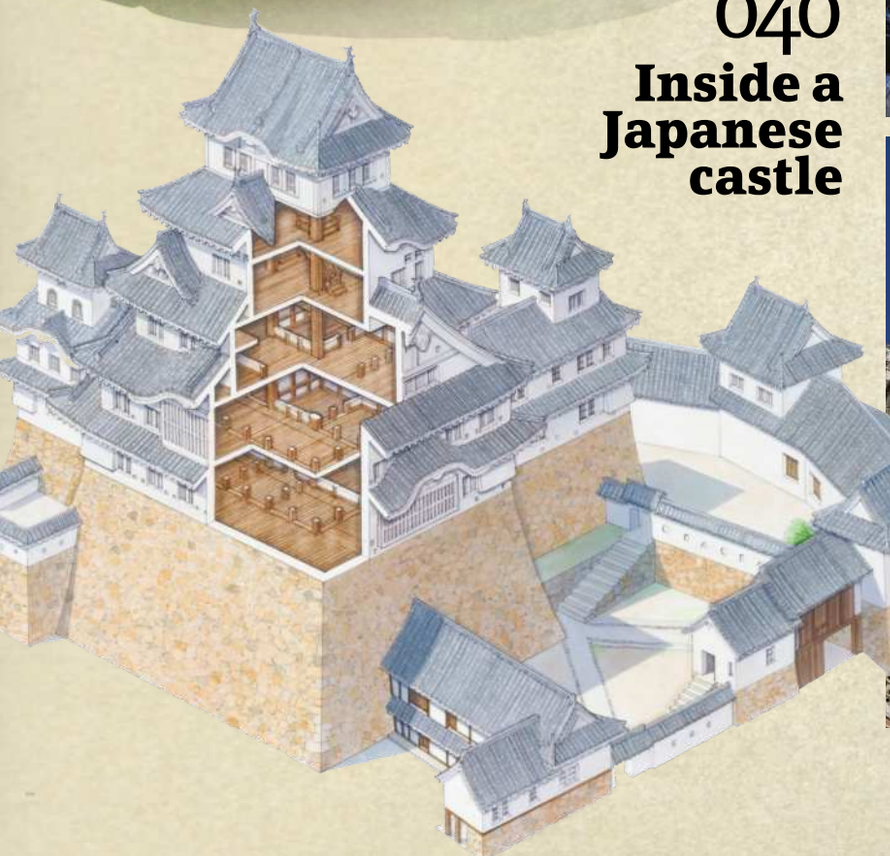
034

## Gaze at the Sistine Chapel

050

## Explore Central Park

046



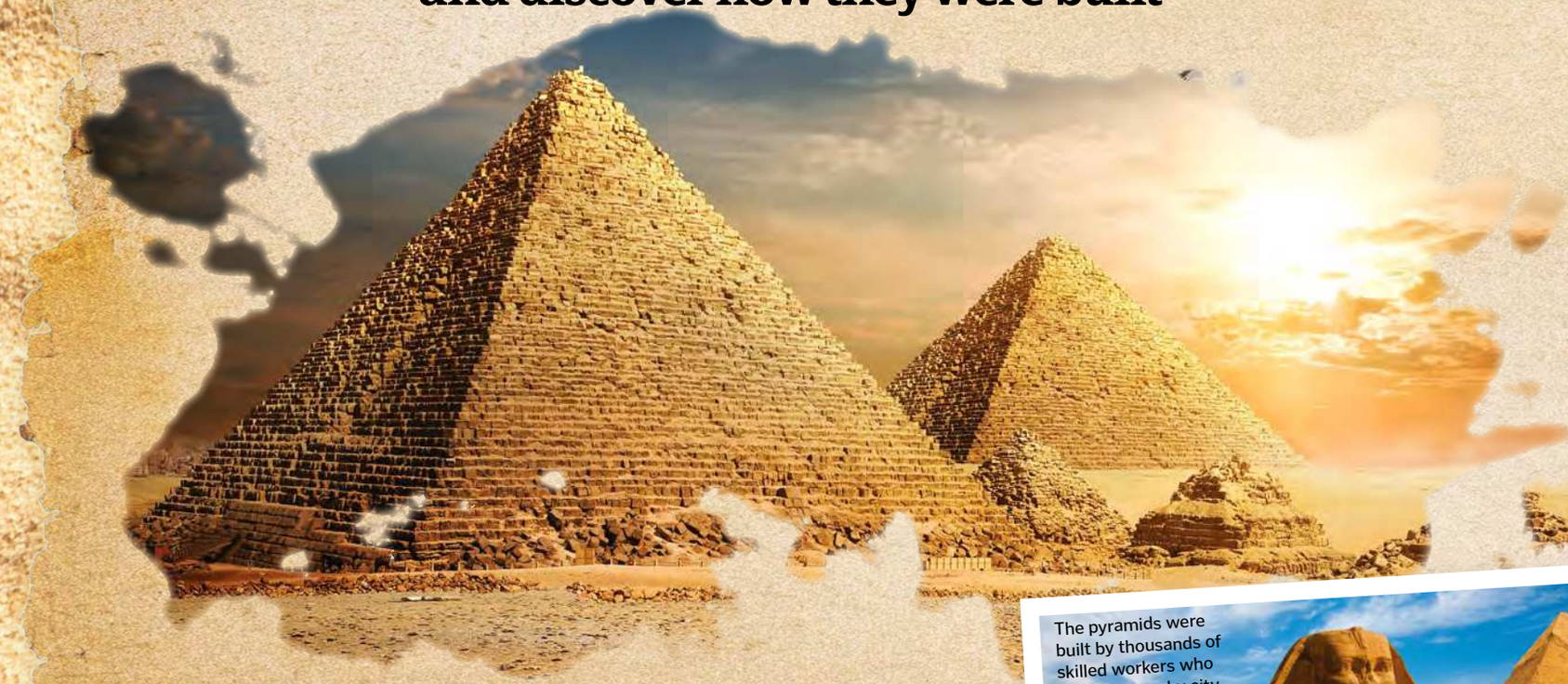
## 040 Inside a Japanese castle

## Florence Cathedral

048

# 10 WONDERS OF THE ANCIENT WORLD

**Take a tour of history's greatest human-made landmarks and discover how they were built**



## The Pyramids of Giza and the Sphinx

**The mystery of ancient Egypt's monumental feat of engineering**

Built between 2589 and 2504 BCE, the three Pyramids of Giza served as extravagant tombs for ancient Egyptian pharaohs, large enough to house everything they would require in the afterlife.

The largest, constructed for the Pharaoh Khufu, consists of 6.5 million tons of stone, some in blocks as heavy as nine tons each. However, no one quite knows how they were moved into position.

One theory is that a system of sledges, rollers and levers were used to haul the blocks up a slope that was increased in height as the pyramid grew. Meanwhile, the Sphinx, which stands close to the pyramids, was carved out of the limestone bedrock of the Giza Plateau.

The pyramids were built by thousands of skilled workers who lived in a nearby city

# The Great Wall of China

**Incredible manpower and tasty materials helped construct the world's longest wall**

Although the first sections of border walls had been built in the 8th century BCE, it wasn't until 220 BCE that Emperor Qin ordered for them to be joined up as a protective barrier. He set 300,000 soldiers plus many more peasants and prisoners to work constructing the wall from stone, soil, wood and even sticky rice, which was used to help hold the bricks together. The materials were transported to the site by hand or using wheelbarrows, ropes and animals.

Approximately 400,000 workers died during the Great Wall's construction

**21,196.18km**
Full length of the Great Wall

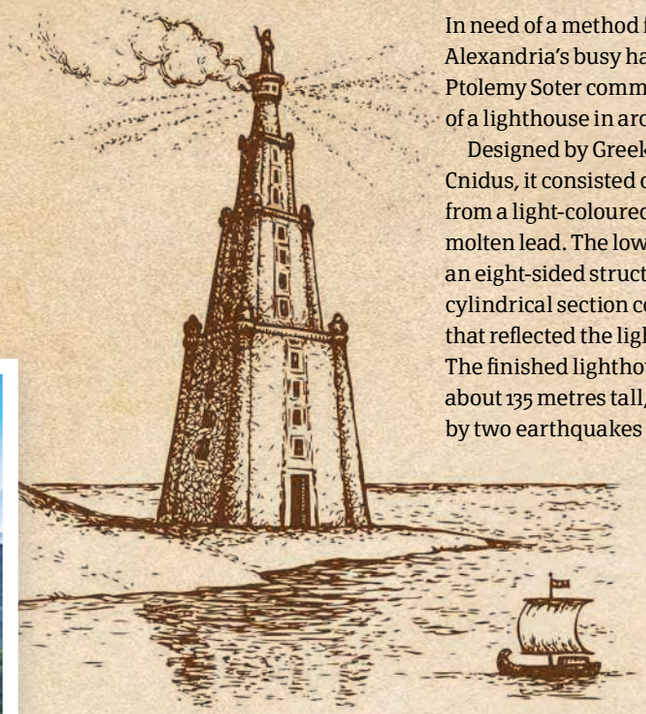
Equivalent to five times the width of the US

**100 million tons**
of brick, stone and mud were used to build it

**14 metres**
The tallest section is equivalent to the height of three buses

# Pharos of Alexandria

**The design and destruction of the world's first and most famous lighthouse**



In need of a method for guiding trade ships into Alexandria's busy harbour, the Egyptian ruler Ptolemy Soter commissioned the construction of a lighthouse in around 280 BCE.

Designed by Greek architect Sostratus of Cnidus, it consisted of three levels, each built from a light-coloured stone and reinforced with molten lead. The lower square level supported an eight-sided structure, on top of which sat a cylindrical section containing a curved mirror that reflected the light from a fire into a beam. The finished lighthouse is thought to have been about 135 metres tall, but was reduced to rubble by two earthquakes in the 14th century.

The Pharos took 12 years and a considerable amount of slave labour to construct

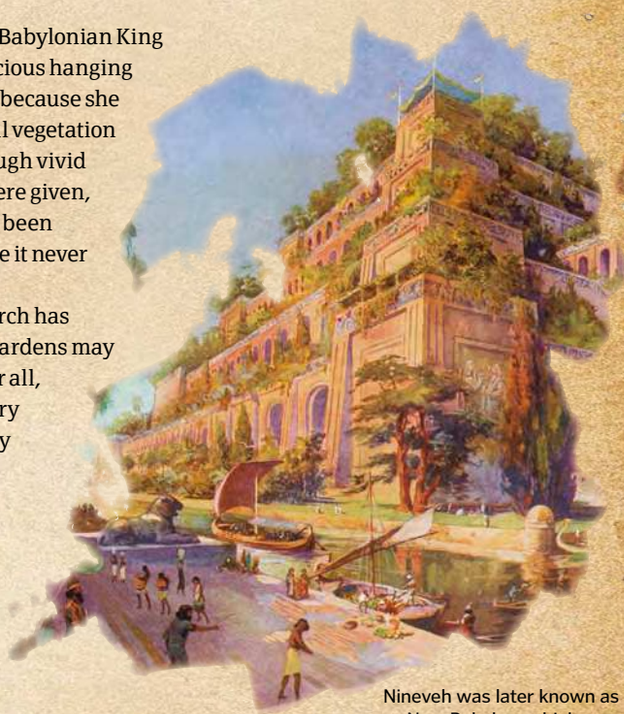
# The Hanging Gardens of Babylon

**A towering green oasis with a somewhat misleading name**

According to ancient sources, Babylonian King Nebuchadnezzar II built a luscious hanging garden for his wife in 600 BCE because she was homesick for the beautiful vegetation of her native Media. But although vivid descriptions of the gardens were given, no physical evidence has ever been found, leading many to believe it never actually existed.

However, a more recent search has discovered that the hanging gardens may not have been in Babylon after all, but were instead built a century earlier in the city of Nineveh by King Sennacherib.

It is thought they were planted on a series of terraces and an Archimedes' screw device was used to douse them with 300 tons of water every day.



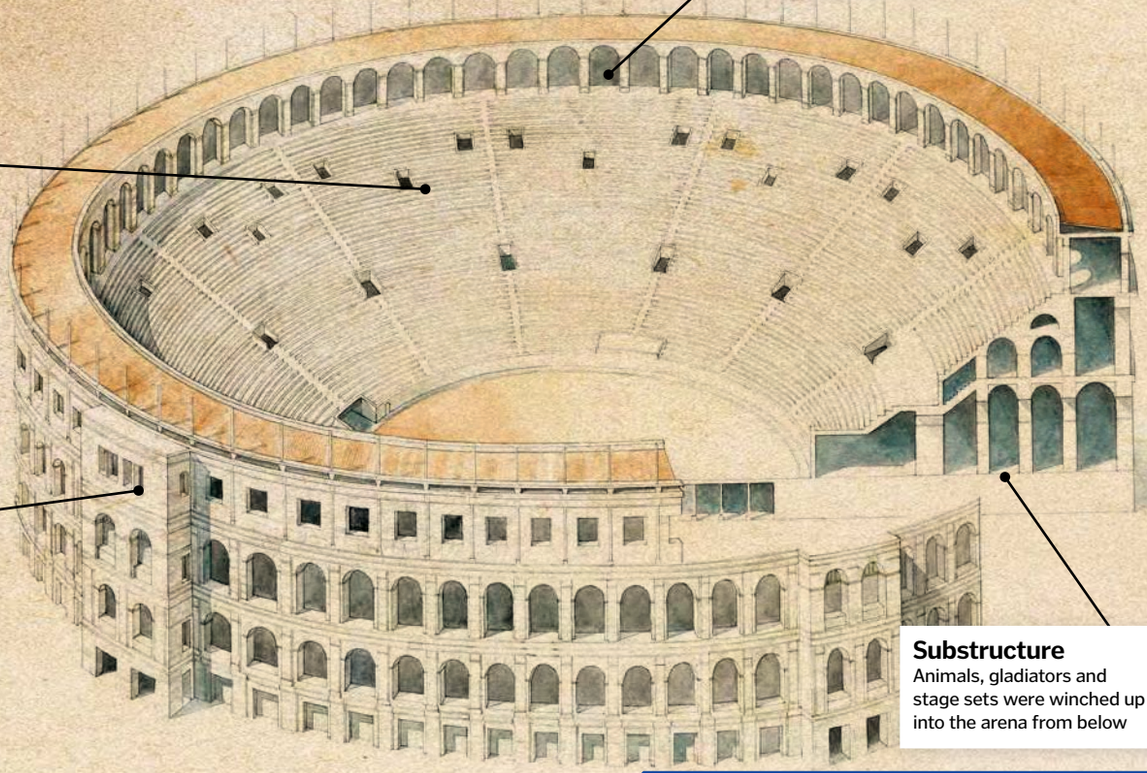
Nineveh was later known as New Babylon, which may explain the confusion over the garden's exact location

*"The hanging gardens may not have been in Babylon after all"*

# The Colosseum

**Ingenious inventions and designs made the world's largest amphitheatre possible**

In 80 BCE, after less than ten years of construction, Rome's enormous entertainment venue was completed. A pioneering feat of engineering, the Colosseum would go on to host bloody gladiator battles, re-enactments and executions for four centuries. The innovative four-tiered design of multiple vaulted arches provided the structure with plenty of support without adding excess weight and enabled more than 100,000 slaves to build it in simple, standardised parts. The recent invention of concrete also added strength to the Colosseum, helping it hold crowds of more than 50,000 people at a time.



**Awnings**
Wooden masts supported awnings that shaded the audience from the Sun

**Seating**
The tiered seating and elliptical design ensured everyone had a good view

**Crowd control**
Almost 80 separate arched entrances allowed the crowd to enter and exit with ease

**Substructure**
Animals, gladiators and stage sets were winched up into the arena from below

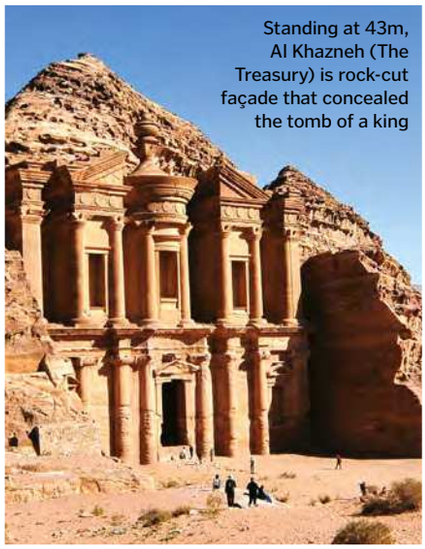
# Petra

**A unique 'Rose City' carved out of Jordan's desert rocks**

Half-built and half-carved from the pink sandstone that inspired its colourful nickname, Petra was established as the capital of the Nabataean Kingdom in 400 BCE. As a busy trading hub, the historic city was once home to around 20,000 people, but getting access to water was difficult in the middle of the desert.

The Nabataeans solved this problem by constructing an elaborate water management system featuring cisterns, reservoirs and dams that conserved seasonal rains.

They chiselled their buildings out of the cliffs by carving steps into the surrounding rock, providing them with safe ledges to work from, and ensured important monuments aligned with the sunrise on winter solstice.



Standing at 43m, Al Khazneh (The Treasury) is rock-cut façade that concealed the tomb of a king

# Banaue Rice Terraces

**A giant staircase of rice fields built by hand**

More than 2,000 years ago, the indigenous people of Ifugao in the Philippines came up with an ingenious method for farming on steep terrain.
With no tools available, they carved a series of terraces out of the mountain, bordering them with walls of mud and stone. They then harvested water from the forests on top of the mountain, flooding the individual fields so that rice could grow. This method of farming and sustaining the terraces has since been passed down through the generations and is still practised today.

The rice terraces can be found in the Cordillera Mountains

# Machu Picchu

**The amazing engineering found in the Inca's lost city**

Meaning 'old mountain' in the native Quechua language, Machu Picchu stands 2,430 metres above sea level in the Peruvian Andes.

Only recently rediscovered in 1911, the city was built by the Inca people in the 15th century and then abandoned 100 years later when their empire was conquered by the Spanish. As the Inca had no written language, there are no records indicating the purpose of the site, but many archaeologists believe it was a royal estate used by leaders.

Set on the steep mountain slopes, the 200 buildings were constructed using a dry-stone technique without mortar. Blocks of granite were precisely cut and tightly slotted together like a jigsaw, leaving cracks so small even a knife could not penetrate them.

*"Machu Picchu stands 2,430 metres above sea level in the Peruvian Andes"*

Machu Picchu features palaces, plazas, temples, homes and an irrigation system

# Easter Island statues

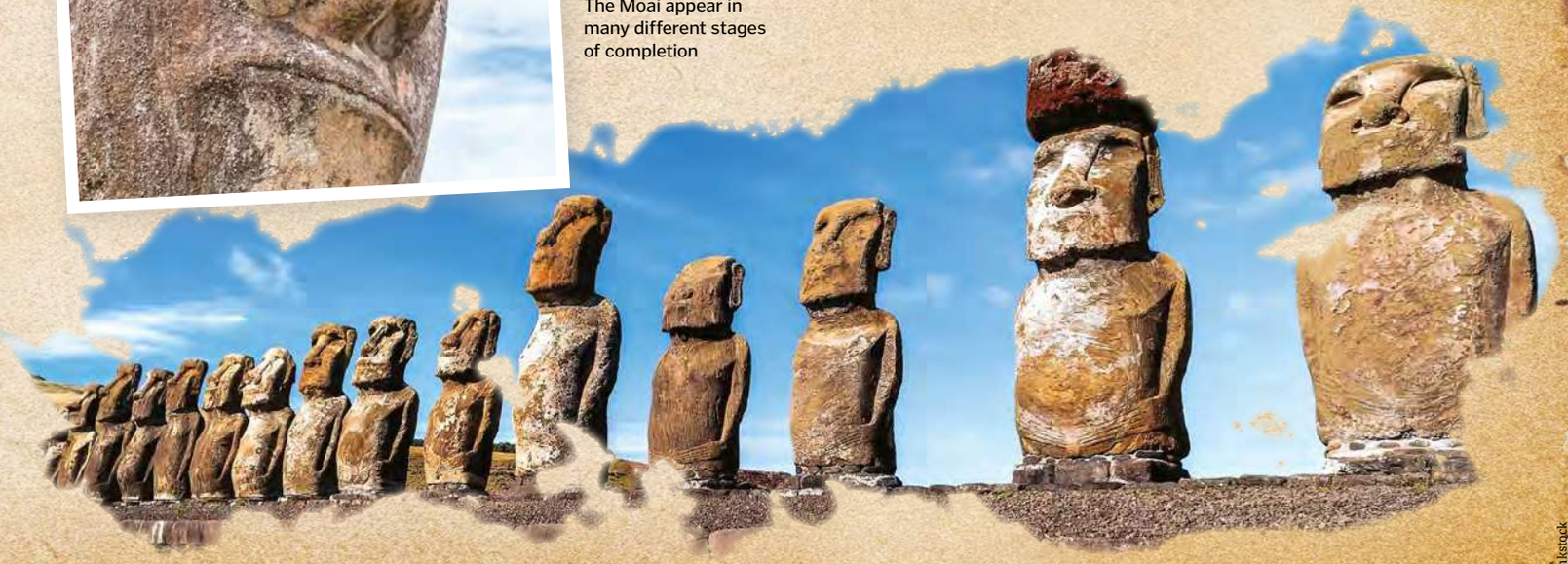
**The giant stone heads that required a lot of heavy lifting**

In the middle of the Pacific Ocean, almost 900 enormous statues called Moai can be found surrounding the remote Chilean island of Rapa Nui, the original name given to Easter Island by its Polynesian settlers.

The statues were made by the Polynesians sometime between the 12th century and the 17th century, and are thought to represent their dead ancestors.

Despite being carved out of a light, porous rock called tuff, which is formed by compacted volcanic ash, they each weigh several tons, and exactly how they were moved into position still remains a mystery.

The Moai appear in many different stages of completion



# Stonehenge

**A prehistoric monument helping us to uncover the secrets of the past**

In the Wiltshire countryside of England stands one of the most iconic and oldest human-made landmarks in the world.

Built over thousands of years, Stonehenge is the only surviving stone circle of its kind and has become a site of incredible archaeological importance. Although it has revealed a lot about certain practices of the past, the structure is still shrouded in mystery, mainly because we still can't be sure what it was built for.

The most popular theory is that it was a prehistoric temple, as the stones are precisely aligned with the movements of the Sun across the sky, which has special religious significance. What we do know is that its construction began in 3100 BCE, when a large circular ditch was dug using tools made from antlers. Around this time, the site was used for burials; in fact it's the largest late Neolithic cemetery in the UK.

In 2500 BCE, the stones were erected, having been worked into shape and smoothed using sarsen and flint hammerstones, and a few hundred years later were rearranged into their final position. Over the years many of the stones have toppled or been removed, leaving Stonehenge in its current state.

## Superhenge

In 2015, scientists found what they thought was another stone monument, five times the size of Stonehenge, buried less than three kilometres away from the iconic landmark. Dubbed a 'superhenge', it was detected using ground-penetrating radar and believed to feature more than 100 stone monoliths.

However, when a dig was conducted, archaeologists instead found a series of deep pits that once held large wooden poles. The site was originally home to the people who built Stonehenge and the poles were erected when they left, perhaps as a memorial. However, they were later removed, and the pits were filled with chalk and covered over with a dirt bank.

The superhenge monument featured wooden poles, not large stones as previously thought

## The Henge completed

**Discover how Stonehenge might have looked in 2200 BCE**

**Bluestone**
The smaller stones travelled more than 250km via river from the Preseli Hills in southwest Wales and have a blueish tinge when wet

**Trilithons**
The tall arches were created by fitting a horizontal lintel stone on top of two vertical stones using mortice holes and protruding tenons

**Sarsen stone**
These large sandstones came from the Marlborough Downs 32 kilometres away and on average weigh 25 tons each


**Alignment**
The main axis of the stones line up with the sunrise of the summer solstice and the sunset of the winter solstice

**Alter stone**
Unique to the site, this stone is made from a type of old, red sandstone and comes from the Senni Beds in south Wales

**Lintels**
The horizontal stones on top of the outer ring were tightly slotted together using tongue and groove joints

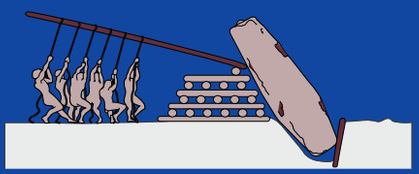
*"Stonehenge is the only surviving stone circle of its kind"*

# Assembling Stonehenge

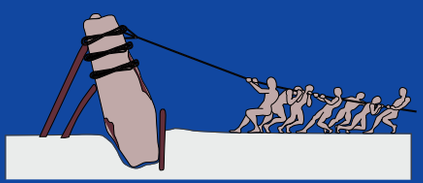
**How might the structure have been put in place with primitive tools?**

### Transportation
The stones were dragged to the site on rollers and sledges, and some even came on rafts down the River Avon.

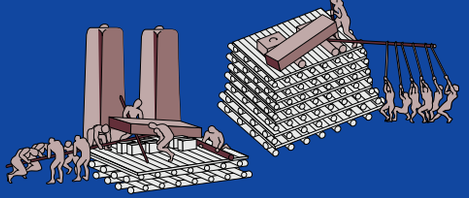
### Positioning
The stones were placed in large holes with sloping sides and lined with wooden stakes at the back.



### Raising the stones
Ropes, a wooden A-frame and sheer manpower were used to pull the stones upright, then the hole was packed with rubble.



### Placing the lintels
Timber platforms were used to lift the horizontal lintels into position before they were placed on top of the upright stones.



# Inside a Japanese castle

## We find out how Himeji Castle – a 17th-century fortification – has stood firm despite several centuries of conflict and natural disasters

Built on a hill 45 metres above sea level in southern-central Japan, Himeji Castle has survived innumerable feudal battles, sieges, earthquakes and even a WWII bombing. While today it's famed as Japan's largest castle, construction of the original site began in 1333 with the building of a small fort. The fort wasn't turned into a castle stronghold until nearly 250 years later, towards the end of the civil war era. The addition of three moats and dozens of extra buildings – including three large towers and a huge, six-storey main keep, or tenshu – saw the striking white complex become one of the greatest Japanese castles ever built.

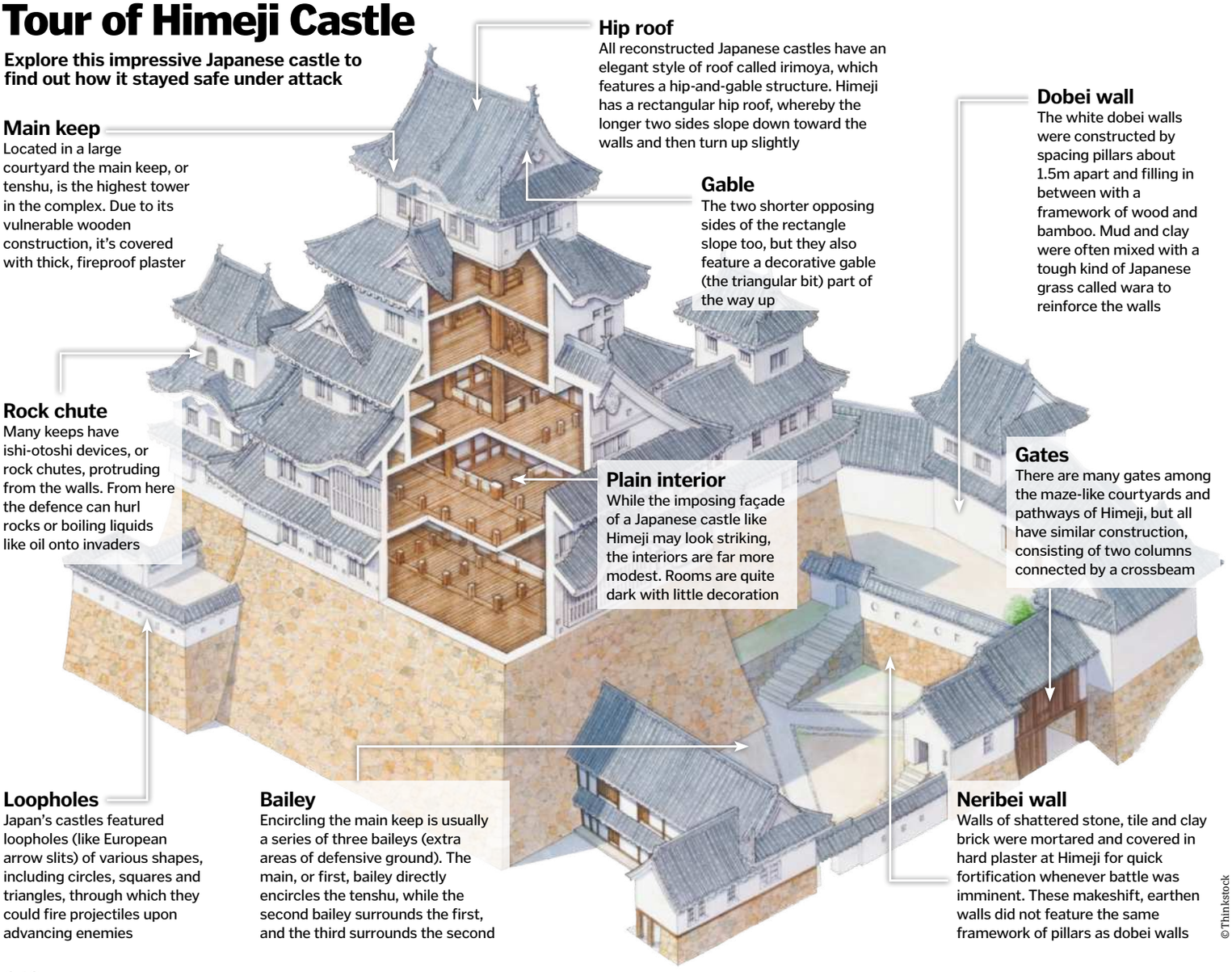
As is typical of traditional Japanese architecture, Himeji Castle is an elevated wooden structure featuring ornate tiling and embellishment. As well as gates, walls and other protective fixtures, Himeji and many other castles were equipped with a number of defensive devices to stall advancing foes.

Before they could even think about breaching the defences, the enemy would first have to navigate a frustrating maze of steep, snaking paths laid out around the castle walls. The physically demanding paths that seemed to lead directly to the main keep – but which often led instead to a dead-end – would disorientate and tire invaders. And even if they made it beyond the perimeter, the home team would then deploy an ingenious bevy of traps designed to outwit and injure the incoming aggressors, including conduits down which they would pour boiling oil or water.

Japan's best-preserved 17th-century castle, Himeji became a UNESCO World Heritage Site in 1993, which is quite remarkable considering what the region has endured, from earthquakes to attacks by US B-29 bombers. Of course, since the demolishment of the original 1333 fort, the castle has been rebuilt and remodelled by various rulers and architects, but what's interesting is that neither nature nor conflict has ever managed to get the better of Himeji.

## Tour of Himeji Castle

**Explore this impressive Japanese castle to find out how it stayed safe under attack**



### Hip roof
All reconstructed Japanese castles have an elegant style of roof called irimoya, which features a hip-and-gable structure. Himeji has a rectangular hip roof, whereby the longer two sides slope down toward the walls and then turn up slightly

### Main keep
Located in a large courtyard the main keep, or tenshu, is the highest tower in the complex. Due to its vulnerable wooden construction, it's covered with thick, fireproof plaster

### Gable
The two shorter opposing sides of the rectangle slope too, but they also feature a decorative gable (the triangular bit) part of the way up

### Dobei wall
The white dobei walls were constructed by spacing pillars about 1.5m apart and filling in between with a framework of wood and bamboo. Mud and clay were often mixed with a tough kind of Japanese grass called wara to reinforce the walls

### Rock chute
Many keeps have ishi-otoshi devices, or rock chutes, protruding from the walls. From here the defence can hurl rocks or boiling liquids like oil onto invaders

### Plain interior
While the imposing façade of a Japanese castle like Himeji may look striking, the interiors are far more modest. Rooms are quite dark with little decoration

### Gates
There are many gates among the maze-like courtyards and pathways of Himeji, but all have similar construction, consisting of two columns connected by a crossbeam

### Loopholes
Japan's castles featured loopholes (like European arrow slits) of various shapes, including circles, squares and triangles, through which they could fire projectiles upon advancing enemies

### Bailey
Encircling the main keep is usually a series of three baileys (extra areas of defensive ground). The main, or first, bailey directly encircles the tenshu, while the second bailey surrounds the first, and the third surrounds the second

### Neribei wall
Walls of shattered stone, tile and clay brick were mortared and covered in hard plaster at Himeji for quick fortification whenever battle was imminent. These makeshift, earthen walls did not feature the same framework of pillars as dobei walls

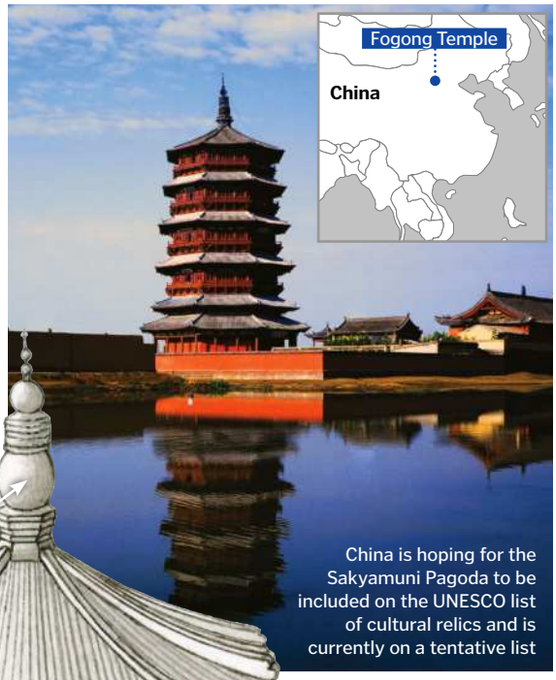
# The Fogong Temple Pagoda

## The oldest wooden pagoda in China today is an architectural marvel by anyone's standards

The pagoda, traditionally a tiered tower built of stone, brick or wood, originated in historic eastern Asia. Usually associated with Buddhism and used for the storing of relics and sacred writings, the pagoda's architectural form has since been adopted by other religions and modified for secular use throughout the world.

The Sakyamuni Pagoda of Fogong Temple forms the central element in a complex of buildings erected by the Chinese Emperor Daozong in 1056. Said to have been built on the site of his family home, the emperor was a devout Buddhist and demonstrated this through the erection of this remarkable wooden, nine-storey structure. Covered with a profusion of carved and painted decoration, the pagoda is supported by 24 exterior and eight interior pillars, and roofed with highly ornate and glazed ceramic tiles.

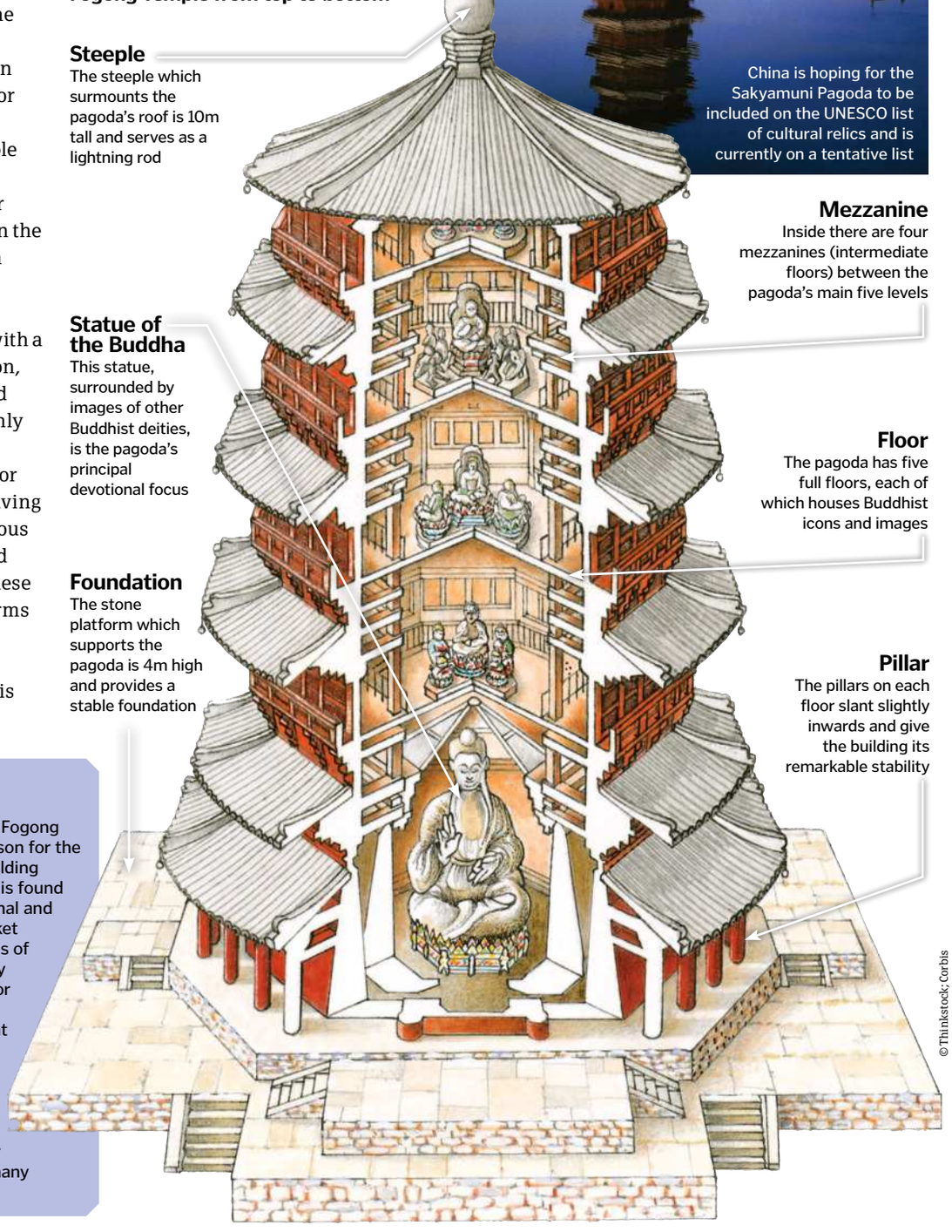
The pagoda has needed occasional minor repairs over its lifetime and, despite surviving numerous natural disasters, the only serious threat it has faced came during the Second Sino-Japanese War (1937-1945) when Japanese soldiers raked the structure with small-arms fire. Today, the Fogong Temple Pagoda is a popular tourist attraction rather than a religious site, but its cultural significance is recognised in both China and beyond.




China is hoping for the Sakyamuni Pagoda to be included on the UNESCO list of cultural relics and is currently on a tentative list

## Anatomy of a pagoda

**Examine the Sakyamuni Pagoda of Fogong Temple from top to bottom**



**Steeple**
The steeple which surmounts the pagoda's roof is 10m tall and serves as a lightning rod

**Mezzanine**
Inside there are four mezzanines (intermediate floors) between the pagoda's main five levels

**Statue of the Buddha**
This statue, surrounded by images of other Buddhist deities, is the pagoda's principal devotional focus

**Floor**
The pagoda has five full floors, each of which houses Buddhist icons and images

**Foundation**
The stone platform which supports the pagoda is 4m high and provides a stable foundation

**Pillar**
The pillars on each floor slant slightly inwards and give the building its remarkable stability

## Built to last

During the first 50 years of its existence, the Fogong Pagoda survived seven earthquakes. The reason for the building's resilience is both its design and building material. The key to its wooden construction is found in its slanting pillars, which act as both external and internal buttresses, and the 54 kinds of bracket arms used to create it. These interlocking sets of brackets, called 'dougong' in Chinese (literally 'cap and block'), provide increased support for the weight of the horizontal beams that span the pagoda's pillars by transferring the weight over a larger area.

In this way a building consisting of many storeys may be constructed. Most importantly the use of multiple bracket arms allows structures to be elastic, which is how the Sakyamuni Pagoda has repeatedly withstood earthquakes that have flattened many of its neighbours.

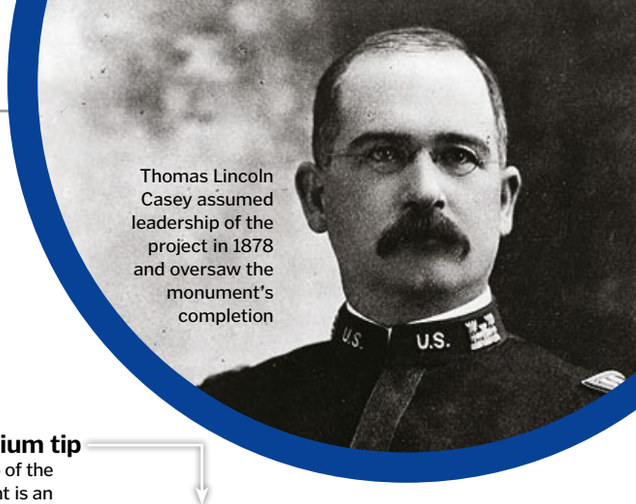
# The Washington Monument

## Inside the US capital's iconic marble obelisk that commemorates the achievements of the nation's first president

Standing tall above the US' capital city, the Washington Monument is a constant reminder of the legacy of founding father George Washington. As the first president of the United States, he is one of the most important figures in the nation's history.

The 169-metre-high monument was designed by Robert Mills in the shape of an Ancient Egyptian obelisk. It started out as a private project that was financed by the Washington National Monument Society, with Mills contributing the chosen design. A crowd of around 20,000 Americans gathered to watch as the first cornerstone was laid on 4 July 1848.

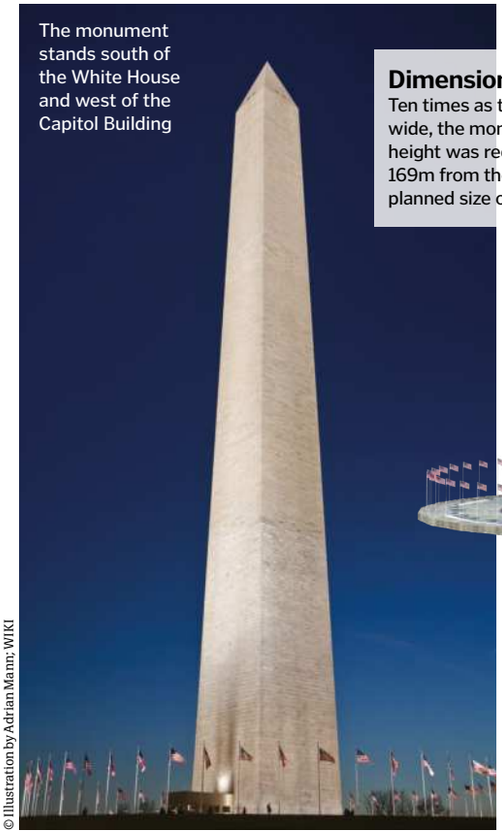
However, the project soon ran into issues. In 1854, the society was declared bankrupt, and a year later Mills died. Construction was halted throughout the US Civil War and was only restarted in 1876. The US Congress took control over construction and things ran much more smoothly. The monument was finally completed in 1884 and eventually opened to the public four years later.



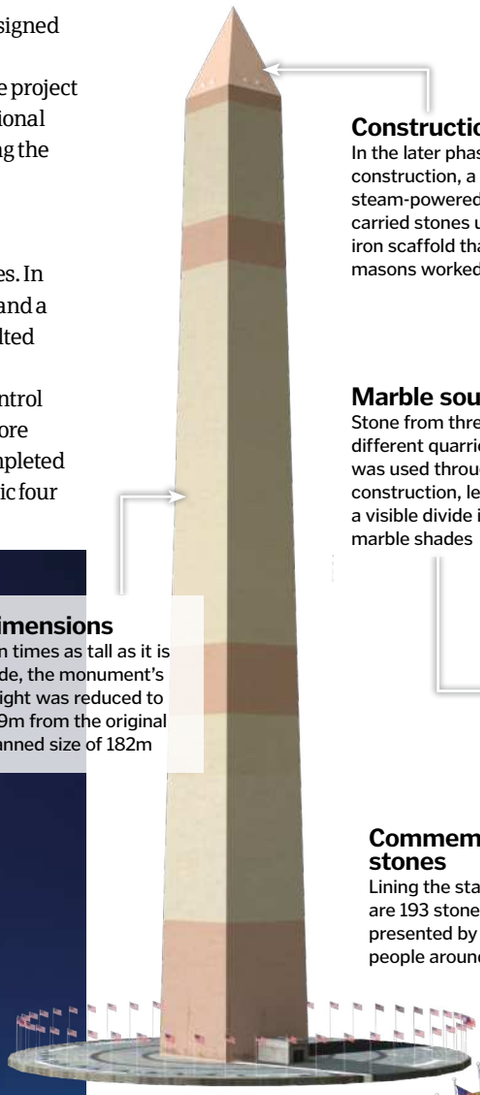
Thomas Lincoln Casey assumed leadership of the project in 1878 and oversaw the monument's completion

## Inside the Washington Monument

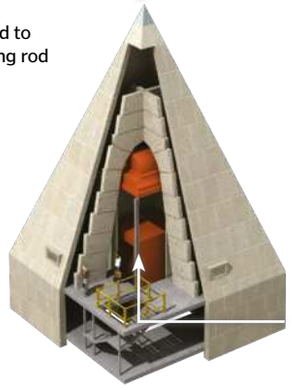
**Take a tour of one of the US capital's most iconic structures**



The monument stands south of the White House and west of the Capitol Building

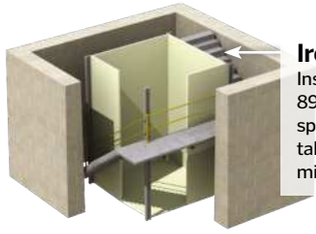


**Aluminium tip**
At the top of the monument is an aluminium cap, originally intended to serve as a lightning rod



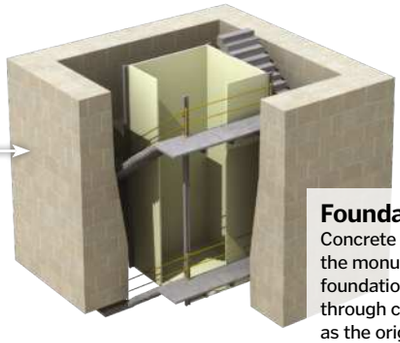
**Steam-powered lift**
In 1888, a steam-powered lift was installed that could take visitors to the observation deck in 12 minutes. The first electric lift was added in 1901, and has been updated several times since

**Construction**
In the later phases of construction, a steam-powered lift carried stones up the iron scaffold that the masons worked from



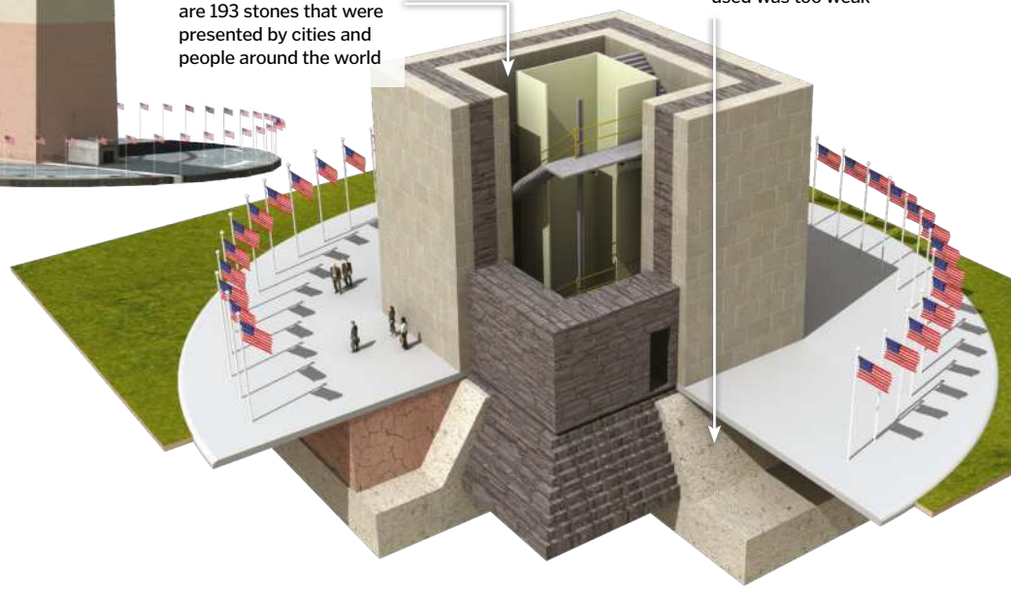
**Iron staircase**
Inside the tower is an 897-step, 50-flight spiral staircase that takes about 20 minutes to ascend

**Marble sources**
Stone from three different quarries was used throughout construction, leaving a visible divide in the marble shades



**Foundations**
Concrete was added to the monument's foundations part way through construction, as the original material used was too weak

**Commemorative stones**
Lining the stairwell, there are 193 stones that were presented by cities and people around the world



**Dimensions**
Ten times as tall as it is wide, the monument's height was reduced to 169m from the original planned size of 182m

# Windmills

## Find out how these towers have helped harness wind power throughout history

It is thought that the windmill was invented around 1,500 years ago. Historians are still unsure exactly where the first one was constructed, but it is believed that it was either in ancient China or ancient Persia.

The first windmill mechanisms used millstones powered by sails that rotated a drive shaft to pump water or mill cereal. They became an integral part of ancient agriculture and were also used in sawmills and to help with irrigation and drainage.

The first windmills turned on a vertical axis. Later versions revolved horizontally, which was found to be a more efficient process. Tail fans were also added to later models to automatically move the sails in the direction the wind was blowing.

To remedy variable wind speeds, modern windmills utilise overspeed controls to turn the mechanism away from the wind if the gusts are too powerful for the sails to handle. Before the invention of windmills, grinding corn, pumping water and cutting lumber was done by hand. Windmills sped up and increased the efficiency of the process significantly, having a dramatic impact on the world's agriculture and economy.

## Inside a thatched smock mill

**How a windmill uses wind power to mill grain**

**1 Revolving cap**
The cap of the mill rotates to face whichever way the wind is blowing, increasing rotation speed

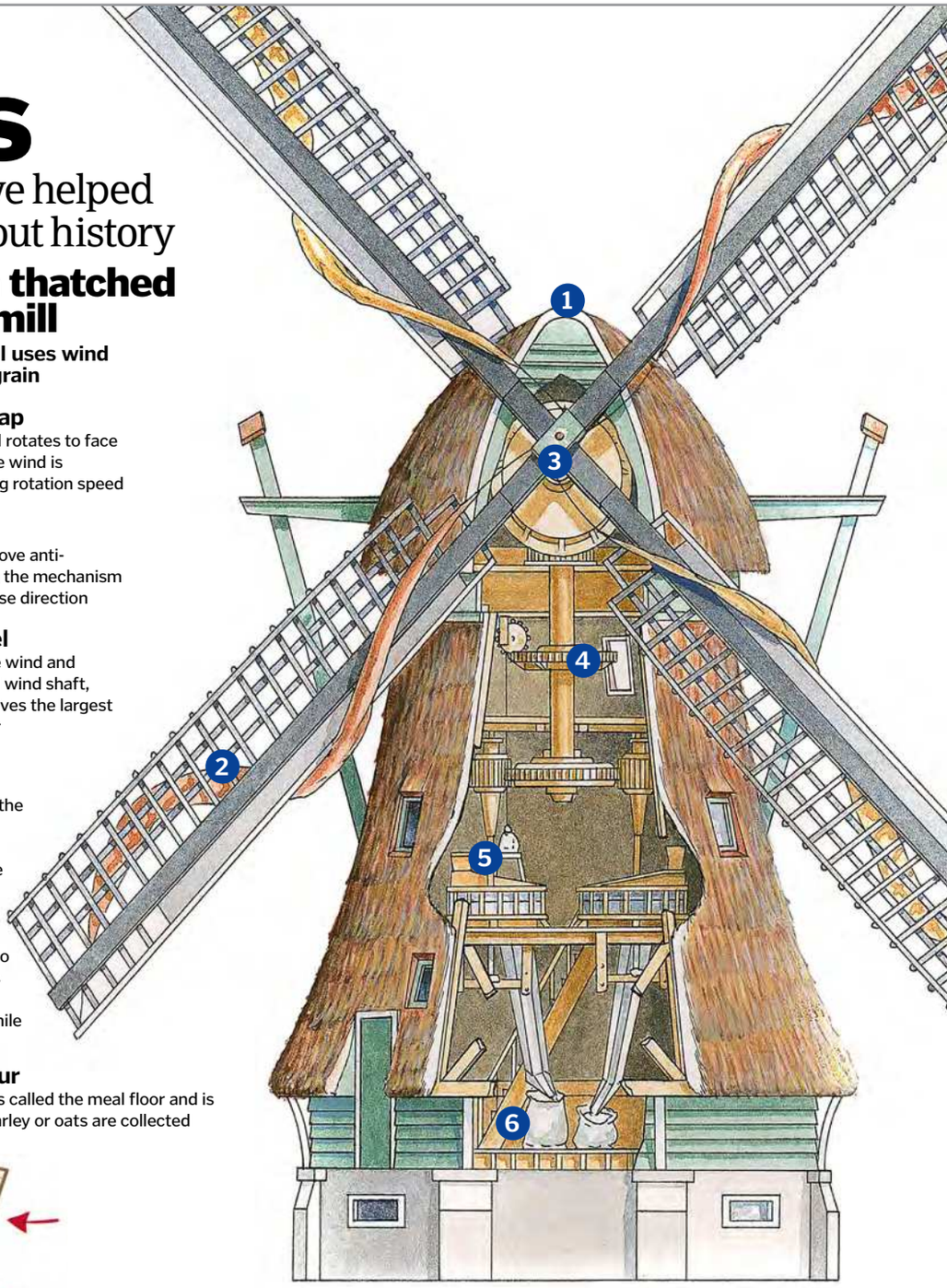
**2 Sails**
The lattice sails move anti-clockwise, turning the mechanism inside in a clockwise direction

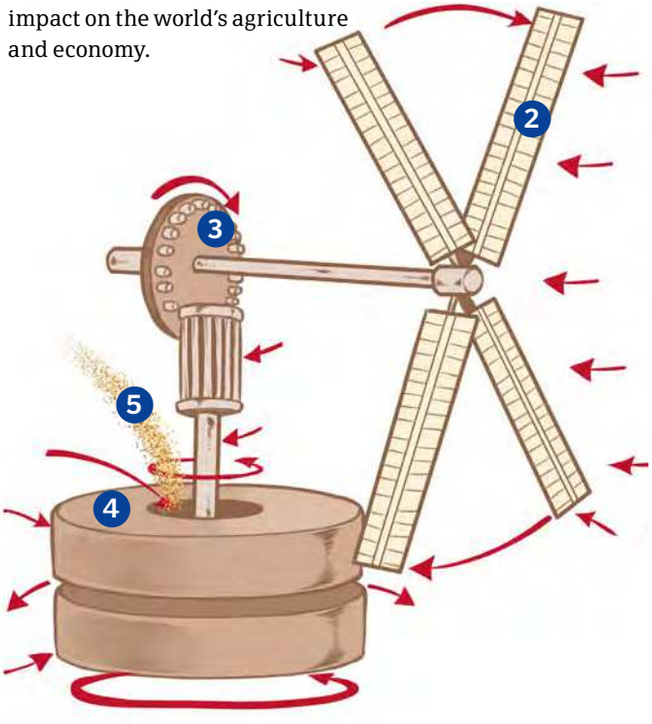
**3 Brake wheel**
The sails catch the wind and turn the horizontal wind shaft, which in turn revolves the largest cog, the drive gear

**4 Dual millstones**
The movement of the drive gear turns a vertical shaft that powers a millstone

**5 Feeding the grain**
The grain is fed into the two millstones by a hopper. One millstone is still while the other rotates

**6 Grain to flour**
The bottom floor is called the meal floor and is where the flour, barley or oats are collected




## Why did windmills fall out of use?

The use of windmills has declined in the modern world. This is primarily down to the introduction of steam power in the Industrial Revolution. This reduction only became even greater than before when electricity came into common use. Today, windmills are mainly listed as heritage sites or have fallen into disrepair. Rather than grinding grain, today's windmills take the form of wind turbines and are one of the world's leading renewable energy sources. Moreover, simple wind pumps have been around since ancient times and are still commonly used both for draining wetlands and obtaining groundwater in areas short on drinking water.

# Edinburgh Castle's story

## The scene of numerous sieges, Edinburgh Castle still stands proudly today as a symbol of military might

Sitting proudly atop of Castle Rock (a 700-million-year-old extinct volcano), Edinburgh Castle is one of the most iconic battlements on Earth and Scotland's second most visited tourist attraction.

Once the site of a fortification known as the 'Castle of the Maidens', the edifice that now stands on Castle Rock was constructed in the 12th century by David I, Prince of the Cumbrians and later King of the Scots from 1124–1153.

At over 131 metres above sea level and featuring looming sheer walls, the castle could not be stormed from any direction save the east. Yet despite posing a formidable obstacle to anyone wishing to take it, opponents knew that control of the castle meant control of the city.

Witness to numerous bloody encounters, the first major battle fought at Edinburgh Castle unfolded in 1296 following King Edward I of England's invasion of Scotland in March of that year, an incursion that sparked the First War of Scottish Independence. Following a three-day bombardment, the garrison inside the castle surrendered, but England's hold upon this strategically vital position would be anything but consistent in the centuries to follow.

Following the Scottish Wars for Independence, King David II, son of the fearsome warrior Robert the Bruce, had to contend with the damage inflicted upon Edinburgh Castle during the conflict. Eager to repair the broken fortress, King David oversaw a period of restoration that included the initial work to construct David's Tower, which was later replaced by the Half Moon Battery.

In the succeeding years Edinburgh Castle would witness further attempts by both the English and the Scots to wrest control of the castle and suffer the damage that such brutal clashes often caused.

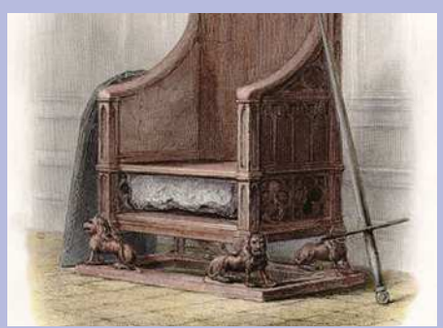
Predominantly used to house prisoners of war captured during England's many foreign campaigns in the 18th and 19th centuries, the castle became a national monument in 1814. With over 1 million visitors a year, today Edinburgh Castle is a crucial part of the city's £1.6 billion tourist industry.

## The Stone of Scone

Also known as the Stone of Destiny, this 66-centimetre-long block of red sandstone weighs in at around 152 kilograms and has seated numerous monarchs over the centuries.

Thought to have originated in Ireland, the stone was transported from Scotland to England in 1296 to be placed within the throne of King Edward I. It would reside in England for approximately 654 years until its illegal removal by four Scottish students in 1950.

Attempting to return it to Scotland, the students accidentally broke the stone in two. It was found in 1951 and finally returned to its homeland. Residing today in the Crown Room of Edinburgh Castle, it will only leave Scotland when there is another royal coronation.



The Stone of Scone set into the Coronation Chair in Westminster, London, in 1855

## Beyond the walls

**From cannons to crown jewels, Edinburgh Castle is home to much of Scotland's history**

A key leader in the Scottish Wars of Independence, a statue of William Wallace stands before the castle gates

**Great Hall**
Constructed during the reign of King James IV, the Great Hall is thought to have been used by the Scottish Parliament

**National War Memorial**
Built to commemorate Scotland's fallen during WWI, the War Memorial was first opened in 1927. Entrance is free to the public

**Royal Palace**
Once used as royal apartments by the Stewart monarchy, the Royal Palace now houses the Stone of Scone

**Half Moon Battery**
Built above the remains of David's Tower, this battery was finished in 1588. It was enormous by the standards of its time

*"Control of the castle meant control of the city"*

### Saint Margaret's Chapel
The oldest building in Edinburgh, the chapel dates from the 1100s and was constructed by King David I in honour of his mother

### Mons Meg
Built in Belgium in 1449, this six-ton canon was last fired in 1681 when saluting the arrival of the future King James VII and II

### One o'clock gun
Once an 18-pound cannon, today this 25-pound Howitzer is fired at exactly 1pm every day except Sunday, Good Friday and Christmas Day

### The Lang Stairs
70 steps long, the Lang Stairs were the original link between the middle and upper sections of the castle

### Dog cemetery
This small plot of land has been used since the Victorian era for the burial of army dogs and mascots

### Argyle Tower
Overhanging the portcullis gates, this tower was constructed between 1886–1887 and named after the 9th Earl of Argyll

Despite its royal heritage, Saint Margaret's Chapel was used to store gunpowder in the 16th century

# Thomas Randolph, captor of the castle

Born in 1278, Thomas Randolph, 1st Earl of Moray was the nephew of Robert the Bruce and a key figure in the Wars for Independence.

Supportive of his uncle's rebellion in 1306, Randolph was imprisoned by the English following the Battle of Methven in that same year and fought for King Edward I until he was recaptured by the Scots in 1308.

Installed as Earl of Moray in 1312, Randolph would repay his uncle's kindness in 1314 when he led a band of 20 men on a daring raid to retake Edinburgh Castle. Scaling the seemingly impassable walls, Randolph's audacious plan worked as the English were completely taken by surprise. With the castle back in Scottish hands, Randolph went on to fight courageously in the crushing victory over the English at Bannockburn three months later.


An inscription commemorating Randolph's raid. The date is incorrect due to calendar changes

# The history of Central Park

## How did such a huge area of New York City become a green space?

If you look at the huge, sprawling space in New York that is occupied by Central Park, you probably won't realise quite how much it has changed since it was first created. The land, acquired by the City of New York in 1853, was over 700 acres of mostly barren swampland.

The story of Central Park began in the 1840s, when wealthy merchants and landowners urged the state to consider a public ground that would compare to parks in London and Paris. After many debates over the size and location of the park, a huge area in central Manhattan was chosen. In all, 9,792 standard 25 x 100-foot (7.6 x 30.5-metre) building plots were acquired for a grand total of over $5 million. At the time, this area was distant from the built-up area of the city, which was mainly in south Manhattan. The land chosen was uneven terrain, with rocky outcrops and swamps dotted around, making it undesirable for building. However, that didn't mean that there was nobody living there; in fact, around 1,600 poor residents were displaced by the project, including a stable African-American settlement in Seneca Village.

Converting this space into the beautiful park you see today was an enormous task. In 1858, a landscape design competition was held to choose the style and layout of the park, and work began soon after. It's estimated that 20,000 workers were involved in reshaping the land, and 260 tons of gunpowder was used to blast through the rock on site. Over 270,000 trees and shrubs were planted in the park, and a new reservoir was constructed. In the winter of 1859 the first part of the park opened to the public.

Construction continued for many years, and the cost of building the park rose to almost $4 million. In 1871, the now famous Zoo was given permanent quarters, and quickly became the park's most popular feature.

## Planning Central Park

**Building this vast public space was a huge job**


**1 Walk past an Egyptian**
This genuine ancient Egyptian obelisk is one of a pair (the other is in London) and is the oldest outdoor monument in New York City



**4 Panoramic view**
Built in 1869, Belvedere Castle provides excellent views of the park, and also houses a weather station. It is a mix of Gothic and Romanesque style



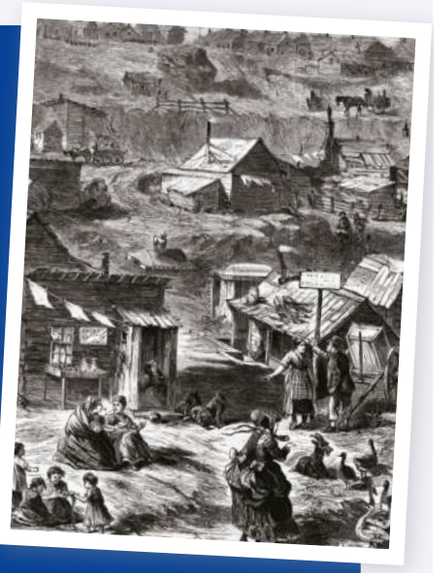
**3 Bethesda Terrace**
This terrace was one of the first structures built in Central Park. The lower terrace features the beautiful Bethesda Fountain

The park stretches from 59th Street all the way to 110th Street

## The history of Seneca Village

Seneca Village is an area within Central Park that looks like any other, but there is a lot of history hidden in the land. Nearly 200 years ago, in 1825, Andrew Williams and Epiphany Davis became the first African-Americans to purchase land in Seneca Village. Within four years, nine substantial houses had been built in the area, which was near the Hudson River (for fishing) and a natural spring.

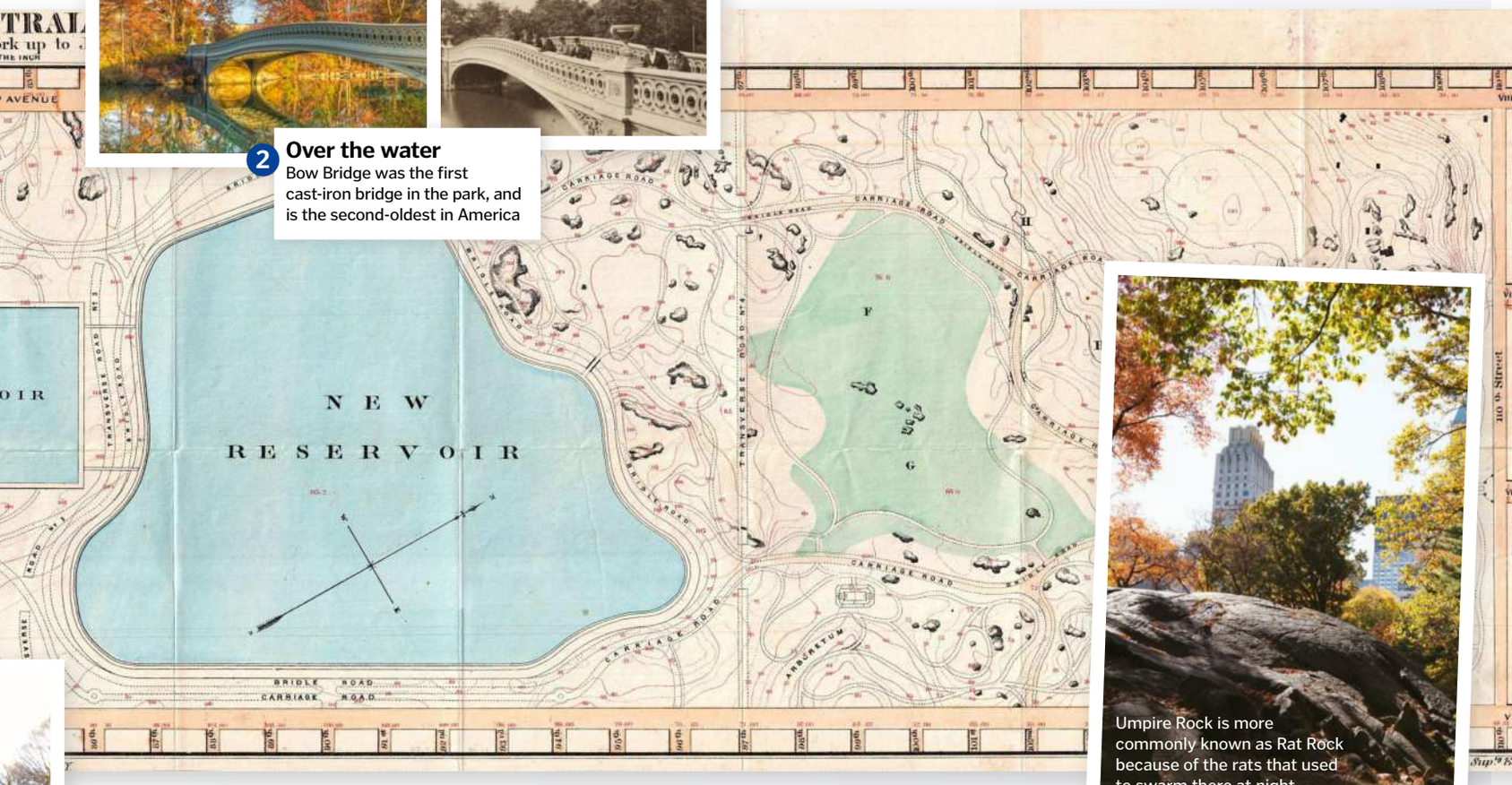
By 1855 a census indicated that Seneca Village was home to around 250 people in 70 houses. However, when the plans for Central Park were made, the New York State legislature used a rule called 'eminent domain' to take this private land for public use, and compensate the owners in return. The community was forced to leave and the houses were demolished to build the park. Modern excavations in the area are now uncovering artefacts and stone foundations that tell us more about how the community lived.



Seneca Village was home to African-Americans and European immigrants

*"Creating the beautiful park you see today was an enormous task"*

**2 Over the water**
Bow Bridge was the first cast-iron bridge in the park, and is the second-oldest in America






Umpire Rock is more commonly known as Rat Rock because of the rats that used to swarm there at night

## Five Central Park facts

### Real history
Umpire Rock is one of several points where the bedrock of New York City is exposed. The rock was formed hundreds of millions of years ago during the Paleozoic era.

### Sheep Meadow
The iconic Sheep Meadow really did use to be home to sheep. They were kept at the Tavern on the Green, and were let out to graze twice daily.

### No racing!
The curved roads within the park were designed to stop people racing their carts and injuring people. Now people race their bikes along the paths instead!

### No picnics!
Strict rules in the first decade of the park's existence meant that group picnics were prohibited within the park, which discouraged a number of less wealthy families from visiting.

### No ball games!
When the park was first completed, schoolboys were only allowed to play ball games on the lawns if they had a note signed by their principal.


## The statistics...



### Florence Cathedral

**Height:** 114.5m (375ft)
**Length:** 153m (502ft)
**Width:** 38m (125ft)
**Cost:** At least £500m ($802m)
**Date of construction:** 1296-1436
**Architect:** At least 11 different architects

# Florence Cathedral

## Crowned with the largest masonry dome in the world, Florence Duomo is a Renaissance masterpiece

Popularly called the Duomo, Florence Cathedral's name is derived from the Latin 'domus dei' – the House of God – and is dedicated to the Virgin Mary Santa Maria del Fiore (St Mary of the Flower). The present building was started in 1296 and is the third cathedral to stand on the site. Taking 140 years to build, the original plan was only changed once during construction when the eastern half of the cathedral was massively expanded to allow for the now iconic dome. Work on this extraordinary structure began in 1420 and was completed in just 16 years. Higher and wider than any previously built, the octagonal dome was constructed without using a temporary wooden supporting frame. Consisting of a double shell made of sandstone, marble and brick, the base of the dome is about 52 metres (171 feet) above the ground and has a staggering 44-metre (144-foot) diameter.

The cathedral's exterior walls are faced in alternate vertical and horizontal bands of coloured marble – white from Carrara, green from Prato and red from Siena. Despite the many architects to work on it the building retains a remarkable architectural and aesthetic cohesion. The interior is sparsely decorated, but contains a number of major Renaissance artworks and 44 stained-glass windows – in fact, the largest expanse of glass installed during 14th and 15th century Italy.

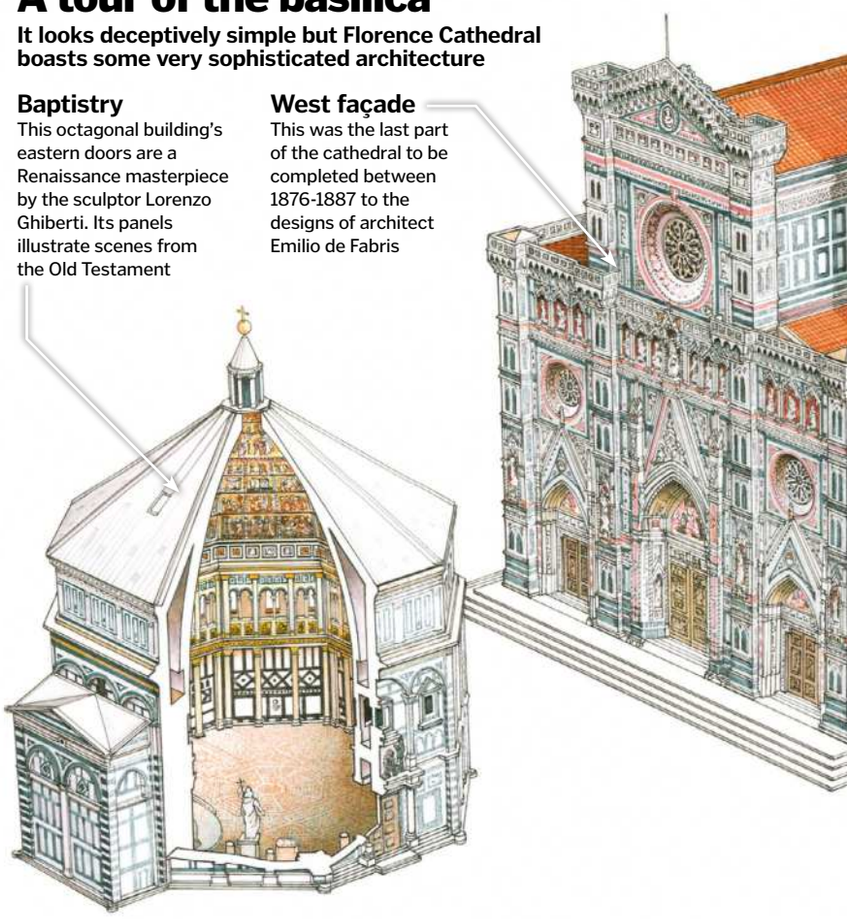
Above the main door is the basilica's one-handed liturgical clock, which shows all 24 hours. Erected in 1443, it is still working today. The largest cathedral in Europe when it was built, it has become symbolic of Florence and its dome is instantly recognised around the globe. Such is the Duomo's cultural importance that the cathedral complex was designated a UNESCO World Heritage site in 1982.

## A tour of the basilica

**It looks deceptively simple but Florence Cathedral boasts some very sophisticated architecture**

**Baptistry**
This octagonal building's eastern doors are a Renaissance masterpiece by the sculptor Lorenzo Ghiberti. Its panels illustrate scenes from the Old Testament

**West façade**
This was the last part of the cathedral to be completed between 1876-1887 to the designs of architect Emilio de Fabris



**Lantern**
A stone lantern crowns the dome and is surmounted by a gilt-copper cross and ball containing holy relics

**Dome interior**
The interior surface of the dome is covered in an enormous fresco depicting The Last Judgement, painted by Giorgio Vasari

**Campanile**
Considered by many to be Italy's most beautiful bell tower, the top of the campanile can be reached by climbing 414 steps

**Dome**
The double-skinned dome comprises more than 4 million bricks and over 37,000 tons of material

**Nave**
Consisting of four vast bays, the nave is designed for processions and to accommodate large congregations of worshippers

**Crypt**
Located beneath the body of the basilica, the crypt houses the tombs of the bishops of Florence and other notable people

**Transept**
The cathedral's small transepts (the 'cross arms') house a number of chapels, tombs and major sculptural works

**Chancel**
The silver shrine of St Zenobius, the first bishop of Florence, is located in the chancel's eastern chapel

## The Baptistry of St John

This octagonal building stands slightly to the west of the cathedral. Built to house the font in which all Christians in Florence were baptised, it was constructed between 1059 and 1128. The baptistry is famous for three sets of artistically important bronze doors. The eastern pair, facing the cathedral, so impressed Michelangelo that he called them the 'Gates of Paradise'. Made of sandstone and faced with marble incorporating many reused fragments of Roman buildings, the exterior features many sculptural groups and two massive porphyry columns.

The interior of the baptistry is clad in marble, while the inside of the dome which roofs the structure is inlaid with magnificent gold mosaics. The floor is covered in marble featuring a design based on the zodiac. Unusually, the baptistry also houses a number of tombs, including that of the antipope John XXIII which is considered a significant early-Renaissance sculptural work.

## Giotto's campanile

The campanile, or bell tower, was designed by the celebrated painter Giotto di Bondone and it houses seven bells. Standing next to the cathedral, it is built from the same coloured marbles and so blends in well with its neighbour. The tower is square in plan with sides measuring 15 metres (47 feet) and it soars 87 metres (278 feet) high. Embraced by polygonal buttresses at its corners, it's divided into five separate levels – the upper three of which contain windows. Each of the three top levels is larger than the one below it in every dimension. These differences in size counter the effect of perspective so when viewed from below, the three top levels of the tower look equal in size. Although Giotto originally intended the campanile to be surmounted by a tall spire, after his death it was decided to build a large projecting terrace instead, which lends the tower a dramatic 'broken off' look.

# How was the Sistine Chapel's ceiling painted?

## Explore the tools and techniques behind Michelangelo's lofty Renaissance masterpiece

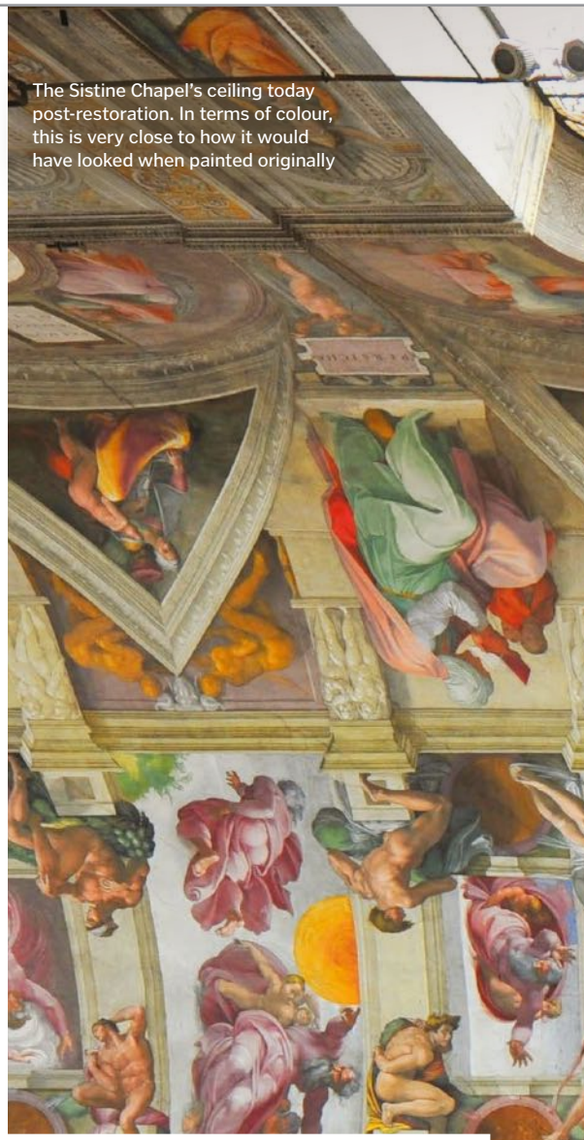
In painting the Sistine Chapel's ceiling in the early part of the 16th century, Michelangelo had to overcome a number of daunting hurdles. The first comes directly from the physical properties of the ceiling, as it is a barrel vault, which is a curved surface. To make it more difficult still, that barrel vault is intersected with smaller vaults positioned over the windows. As such there are no flat surfaces anywhere except around the windows, where the artist also painted a series of half-moon-shaped lunettes. As a result, even prior to picking up a paintbrush Michelangelo had to first work out how to create realistic portrayals of human figures in proper proportion and in motion on these wildly uneven surfaces. His ability to pull this off is testament to his immense artistic skill.

Another major challenge in painting the Sistine Chapel's ceiling was actually getting up there, as it is 20 metres above the floor. Fortunately, a conservation campaign that started in the Eighties revealed the method Michelangelo employed to reach such heights: he constructed a complex scaffold. The scaffold consisted of a truss bridge that spanned across the vault and ran on rails that were at a 90-degree angle to the walls. This permitted Michelangelo to access all areas of the ceiling as the scaffolding could be moved along the rails – it was only ever covering a quarter of the vault at any one time, as he needed ambient light from the windows to paint. Interestingly, the holes that were made to support this structure can still be seen in the walls to this day.

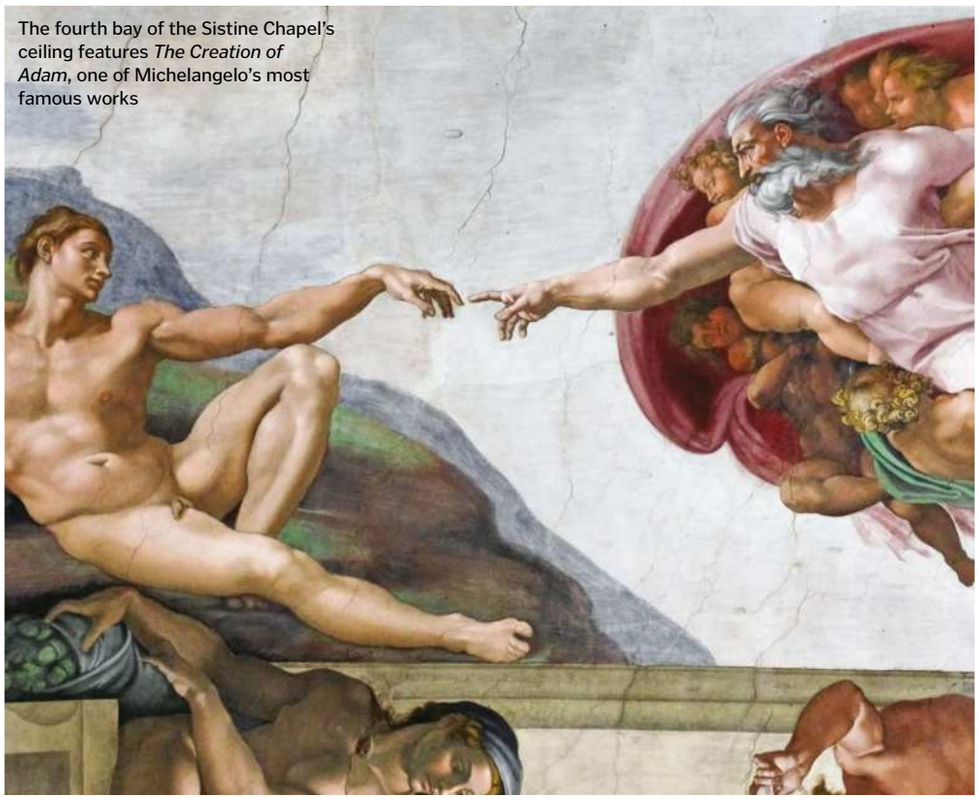
The third problem Michelangelo had to tackle was how to lay out the sketch lines for the entire ceiling. He did this by dividing the vault into various units by stretching chalked strings from one end of the chapel to the other (with help from assistants), before snapping them against the prepared plaster. In doing this, he laid out the linear structure of all the architecture, which is consistent throughout.

The last major obstacle that Michelangelo faced was the sheer scale of the project, which incredibly only took four years to complete. Painting the ceiling was a massive logistical undertaking and so he invited some of his friends from Florence to Rome to aid him.

As well as painting some of the recurring elements, such as columns and statues, these assistants helped him to build the scaffolding and mix/prepare the plaster, as well as lending a hand with the manufacture of paints, the trimming of paintbrushes and the sketching of full-sized drawings on paper for transferral onto the vault. This latter process involved the paper sketch being pressed against the ceiling, pricked with small holes around the outlines and then covered with black chalk dust to produce a dotted outline on the plaster.



The Sistine Chapel's ceiling today post-restoration. In terms of colour, this is very close to how it would have looked when painted originally



The fourth bay of the Sistine Chapel's ceiling features *The Creation of Adam*, one of Michelangelo's most famous works

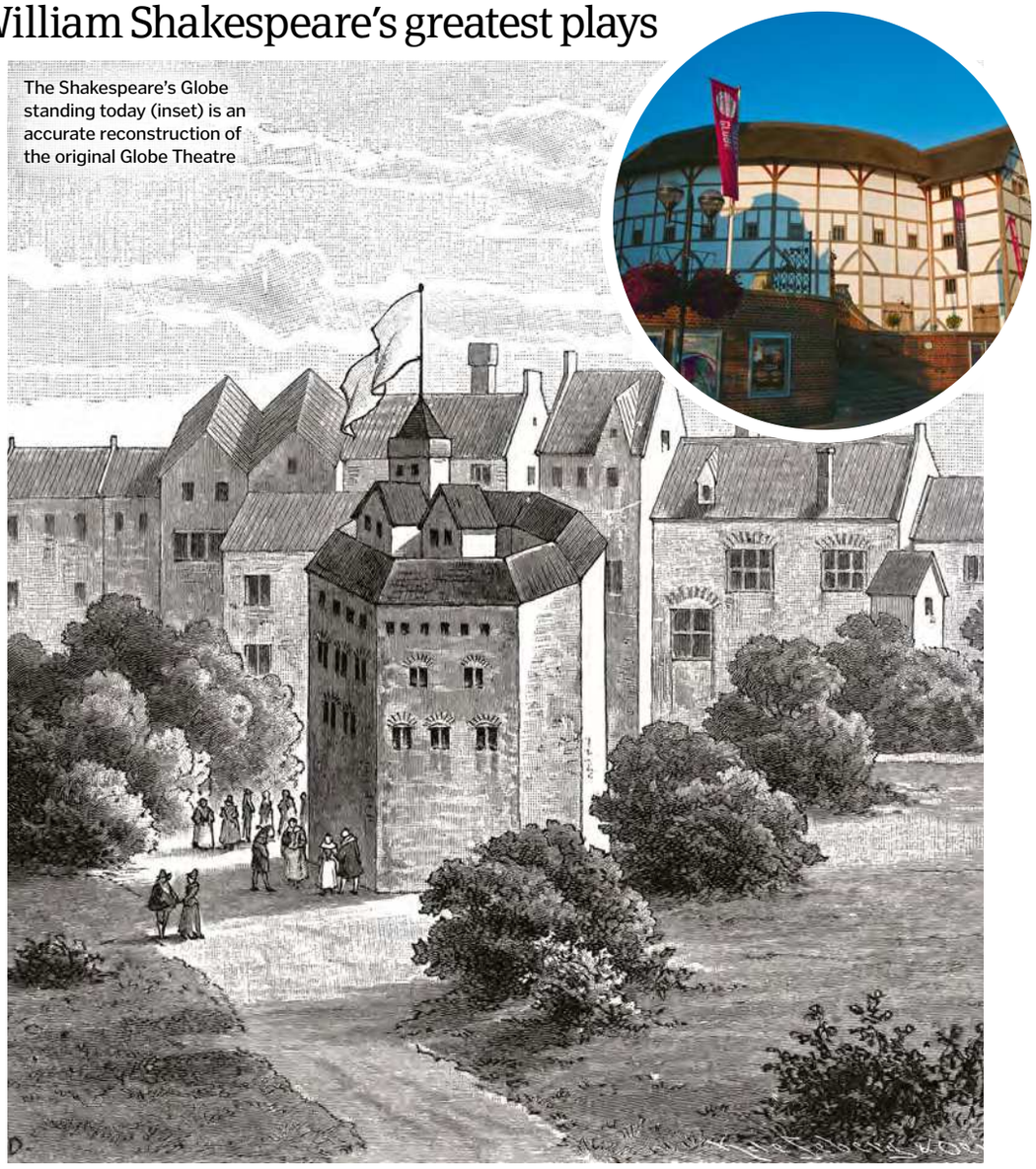
***DID YOU KNOW?*** *Michelangelo is one of many masters to paint in the Sistine Chapel; others include Botticelli and Pinturicchio*

# The Globe Theatre's story

## The most famous and historic theatre in Britain – if not the world – the Globe was the original home to William Shakespeare's greatest plays

The Globe Theatre was an Elizabethan-era playhouse part-owned and made famous by the great playwright William Shakespeare. Built from the remains of an existing theatre in Shoreditch, London, made by English actor and theatre owner Richard Burbage and his brother Cuthbert, the Globe was constructed out of timber over just a few months in 1599. It was a very attractive and imposing theatre at its time. The playhouse became the home of the Lord Chamberlain's Men, a troupe of which Shakespeare and the Burbages were members. The group went on to perform many of the Bard's most famous plays there. Reportedly, the first performance was *Julius Caesar*, with subsequent famous plays such as *Richard II, Romeo And Juliet* and *A Winter's Tale* also shown there.

The Globe proved a great success, with its 3,000 capacity frequently tested to the limit, both in the cheap standing-only pit area as well as in the more prestigious tiered seating located around the inner walls. Unfortunately, however, on 29 June 1613 during a performance of *Henry VIII*, a theatrical cannon misfired and ignited the wooden beam and thatch roof, leading to the entire building burning down. Luckily, the success of the Globe's owners and its performances resulted in the theatre being rebuilt again in 1614, with the new playhouse continuing to host many acting troupes well after Shakespeare's death in 1616. In fact, it was not until 1642 that the theatre was closed down – a casualty of the English Civil War. Its legacy, however, is just as eternal as the plays written by the Bard himself.



The Shakespeare's Globe standing today (inset) is an accurate reconstruction of the original Globe Theatre

## The Globe over time

**Check out some of the main events in the theatre's history now**

**1599: Grand opening**
The Globe Theatre is opened on Bankside, London.

**1601: *Richard II* runs**
Shakespeare's acting troupe, the Lord Chamberlain's Men, are commissioned to stage *Richard II*.

**1608: Blackfriars bought**
The Globe's co-owner, Richard Burbage, acquires the lease for the Blackfriars Theatre, which is then used for winter performances.

**1614: Globe rebuilt**
Following a disastrous fire that burned down the Globe, it is rebuilt a year later on the original foundations.

**1642: Plays suppressed**
In the English Civil War, Parliament issues an ordinance that forbids all stage plays. The Globe is shut down.

**1644: Globe destroyed**
The theatre is razed to the ground again – this time by order of the Puritans. Landowner Sir Matthew Brend builds tenement houses on the site in its place.

**1997: Resurrection**
An accurate reconstruction of the Globe is built near to the site of the original building. It stages Shakespeare's works and is a popular tourist attraction to this day.

**1616: Mortal coil**
William Shakespeare dies aged 52 in Stratford-upon-Avon, where he is buried in the Holy Trinity Church.

## A modern-day Globe

Theatre fans today can visit the modern reconstruction of the Globe. It was nevertheless made to be historically accurate, consulting the plans, construction methods and materials of the 1599 original, albeit with modern safety standards in mind. Shakespeare's Globe is built from 100 per cent English oak, with components linked with mortise and tenon joints – both features shared by the original – and also has the only thatched roof permitted in all London since the Great Fire of 1666. The attention to historical detail even extends to the pit area, which remains standing only, albeit with a concrete surface rather than the earthen/straw mix of the 16th/17th century. A second Shakespearean play venue, the Blackfriars Theatre, has been reconstructed and opened as the Sam Wanamaker Playhouse in January 2014.

# Trip around the Globe

**This famous theatre is unique – but how was it structured?**

### Roof
In 1599, the Globe had a thatched roof, but it was replaced with tiles after catching fire in 1613. The performance space was open air

### Balcony
The Globe's balcony was used for performing as well as a place to position the company's musicians. The balcony was flanked by large wooden columns that supported an overhanging roof

### Stage platform
The stage platform extended the stage into the centre of the theatre's pit. At 13.1m wide and 8.2m deep, the stage was raised approximately 1.5m off the floor. It had a trapdoor at the centre for quick entrances and exits

### Tiring house
The stage's back wall had three doors on the ground floor and a couple on the first floor as well as a balcony. These doors led to the theatre's backstage area, known as the 'tiring house', where props and costumes were stored and actors prepared to perform

### Pit
Surrounding the platform lay the pit, a standing-only area where the poorer visitors could watch. Food and drink were sold here and any rubbish was dropped onto the mud and straw on the ground

### Storeys
The Globe had a three-storey seating arrangement used by the middle and upper classes. Basically the higher the seat, the more expensive it was

### Foundations
Despite appearing circular in design, with a diameter of just over 30m, the Globe's foundations were actually a 20-sided polygon (icosagon). At the centre of the theatre lay the rectangular stage platform

### Entrance (not shown)
There was one main entrance to the theatre, which was directly opposite the stage and led into the pit. Two sets of stairs near the entrance led into the upper seating tiers

## The statistics...

### *Globe Theatre*

**Opened:** 1599
**Capacity:** 3,000
**Stage width:** 13.1m
**Stage depth:** 8.2m
**Theatre diameter:** 30m
**Closed:** 1642

# Brooklyn Bridge

## One of New York's most recognisable landmarks, the Brooklyn Bridge was the first-ever steel-wire suspension bridge

Built between 1870 and 1883, the Brooklyn Bridge links Brooklyn and Manhattan by spanning the East River in New York City. Designed by a German immigrant, John Augustus Roebling, it was his son, Washington Roebling, and daughter-in-law, Emily, who actually oversaw most of the construction after John's unexpected death just months before building commenced.

The bridge consists of two main elements. First, there are the two anchorages that are positioned either side of the river and between them are two towers (also known as piers) which stand at approximately 84 metres high. Consisting of limestone, granite and cement, the towers – designed in a neo-Gothic architectural style – stand on concrete foundations that run 13.4 metres and 23.8 metres deep on the Brooklyn and Manhattan sides, respectively.

Second, the bridge itself is constructed from iron and steel-wire cables, with a layer of tarmac on the main deck. At 26 metres wide and 1,825 metres long, the Brooklyn Bridge was the longest suspension bridge in the world when it was first built, a record that it held for over 20 years. Roebling's design includes many redundancies, such as a diagonal stay system between cables and stiffening trusses, which make the bridge very safe; indeed, even if one of the main support systems were to fail altogether the bridge would sag, rather than completely collapse.

More unusually, the bridge also has its own nuclear fallout shelter built into one anchorage. Having fallen out of use and been forgotten, the shelter was rediscovered in 2006, along with provisions from the Cold War era. Designated a National Historic Landmark in 1964, since the Eighties the bridge has been floodlit at night to highlight its distinct architectural features. Initially intended to carry motor vehicles, trains, street cars, bicycles and pedestrians, since the Fifties, the bridge has only taken cars, cyclists and foot traffic. Over 120,000 vehicles, 4,000 pedestrians and 3,100 cyclists cross it every day.

*"More unusually, the bridge also has its own nuclear fallout shelter built into one anchorage"*

# The origins of suspension bridges

In a suspension bridge the deck – the load-bearing portion – is hung below suspension cables on vertical suspenders, which bear the weight. Although bridges of this design first seem to have been invented in 15th-century Tibet, it was really the 19th century which saw their application on a massive scale.

The materials used in the construction of the Brooklyn Bridge were sourced in the US. The granite blocks were quarried in Maine and delivered to New York by boat. The wire rope and steel cable were produced in local factories, while the pigment used in the red paint with which the bridge was originally covered came from the mines at Rawlins, Wyoming.

The design and construction techniques employed in the Brooklyn Bridge have changed little in their essentials over the last century or so. Although at least 81 suspension bridges today are longer than the Brooklyn Bridge, they are all fundamentally the same – except that now the materials tend to be drawn from all over the globe rather than sourced locally.

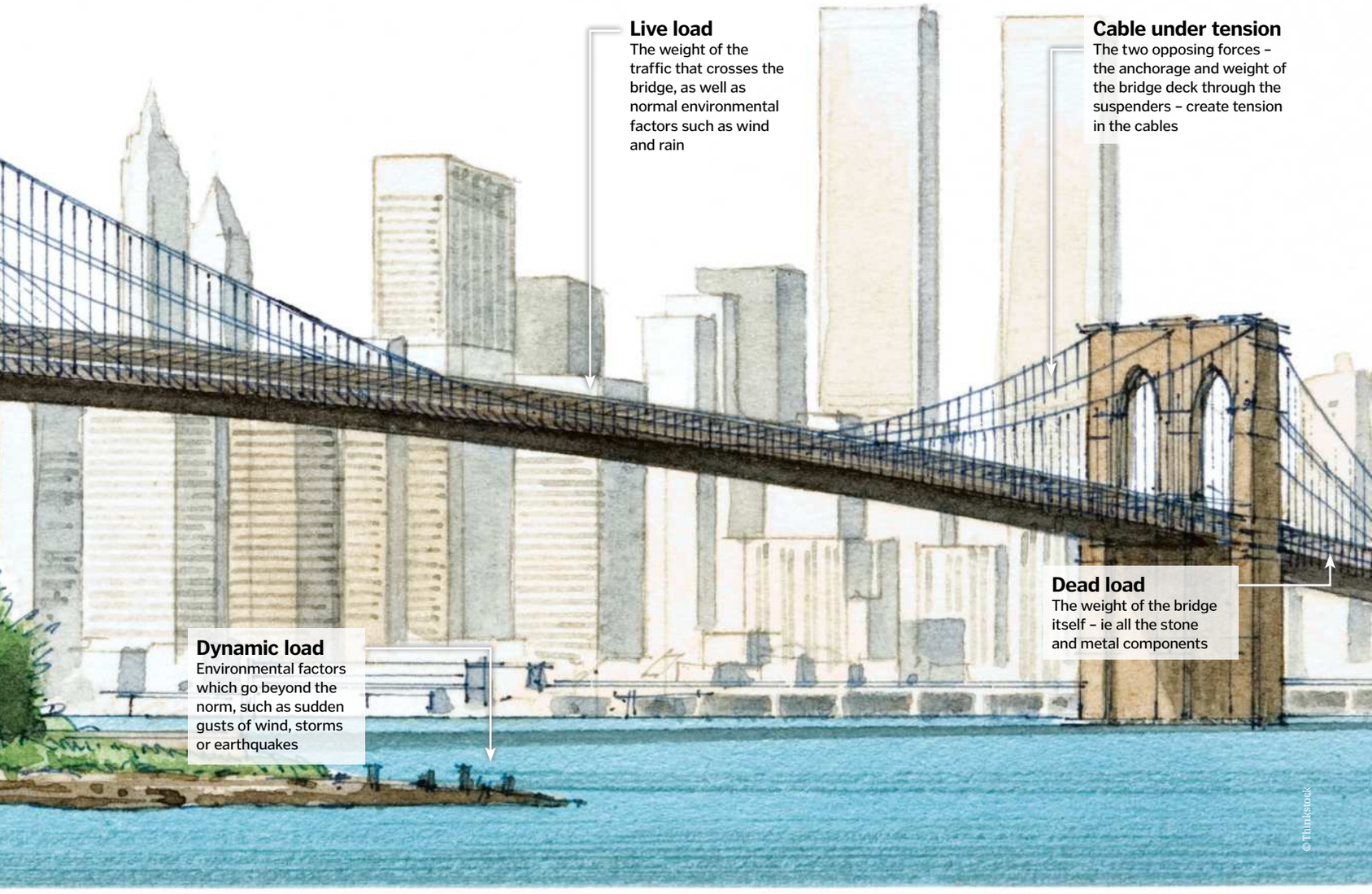
The Brooklyn Bridge during construction in the late-19th century

# Cultural impact

Since its completion, the Brooklyn Bridge has inspired many an artist and poet. The modernist American poet Hart Crane, for example, famously published the ode *To Brooklyn Bridge* in 1930. Regarded as a wonder of its age, people flocked to see the structure's opening with a spectacular fireworks display and regatta in 1883 – a celebration which was repeated on its 100th anniversary.

Many people have jumped off the bridge as publicity stunts or suicide attempts, while others have got married on it. In 1919 the Caproni heavy bomber, which was then the world's largest aeroplane, was flown under the deck, while in 2003 it was the intended target of an Al-Qaeda terrorist plot.

The Brooklyn Bridge has also frequently appeared in Hollywood movies, such as *I Am Legend*, *The Dark Knight Rises*, *Godzilla*, and more recently *The Amazing Spider-Man 2*.



# What went wrong at Chernobyl?

## Learn how a runaway reaction led to a nuclear disaster...

On 25 April 1986, engineers at the nuclear plant at Chernobyl began a test that would lead to the worst nuclear disaster in history. The power plant, located around 130 kilometres north of Kiev, Ukraine, was completed in 1983. Three years later, engineers ran an experiment to see how long the turbines could continue producing energy in the event of a power cut.

The first fatal error made by the technicians that day was to turn off the crucial safety systems in the facility. They would have affected the experiment, which involved running the plant at low power, but this action prevented workers realising the dire situation they were soon to put themselves in.

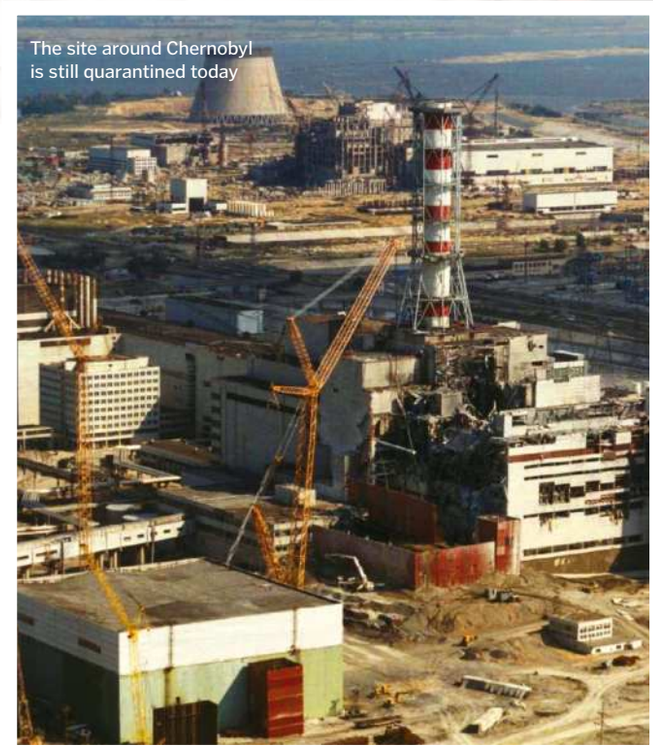
The process of creating nuclear fission is regulated by control rods, which, when inserted into the reactor core, absorb neutrons and slow production. The idea was to lower lots of these rods to reduce the power output and see what happened. Unfortunately, too many were lowered and the output dropped at too high a rate. Rods were then raised again to increase output, returning to about 12 per cent.

However, due to the rods being raised too far and too quickly, a dangerous power surge occurred and the reactor overheated; the water cooling system, unable to cope with the sudden demand, turned to steam.

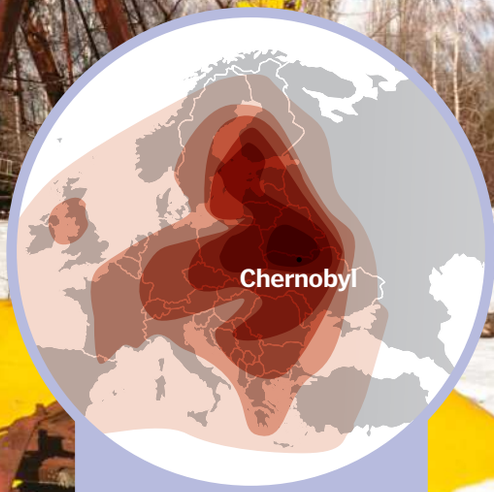
The emergency button was pressed and the rods began to lower but this led to even more rapid reactions in the core.

In the early hours of 26 April, the reactor's roof was blown off and radioactive material began to escape into the atmosphere.

The fire took nine days to extinguish and the radioactive material had far-reaching health and political consequences.



The site around Chernobyl is still quarantined today




## Nuclear fallout

The explosion and meltdown was shocking enough, but worse was still to come in the form of radiation spread and health issues for much of Europe.

31 people died immediately after the event with 28 of those deaths a direct result of radiation poisoning inside and around the power plant site.

The worst of the fallout centred around Chernobyl, but increased levels of radiation were detected in areas as far away as the UK, Portugal and Sweden.

Thyroid cancer, caused by the inhalation of contaminated air, has increased tenfold in adolescents in Belarus since 1986 with cases in adults also rising. Cases in children up to the age of 14 also increased, but that number has since reduced due to many of that age group being born after the event.

The impact of the contaminated air has also affected animals, crops and water supplies and the effects are still widely felt to this day. Radiation levels around Chernobyl will remain far higher than average for many millennia.

# Countdown to disaster

**Find out how history's worst nuclear accident played out**

**1 Safety switches**
The safety switches were intentionally turned off to allow the experiment to run without intervention

**2 Rods dropped**
Control rods were lowered to reduce power output, but the power reduced too much too quickly

**3 Rods raised**
In order to get the plant working again, the rods were raised causing a rapid increase in production

**4 Water heating**
The all-important cooling water began to overheat, turning to steam and failing to cool the reactor

**5 Emergency**
Pressing the emergency button lowered the rods again, but they displaced the remaining water

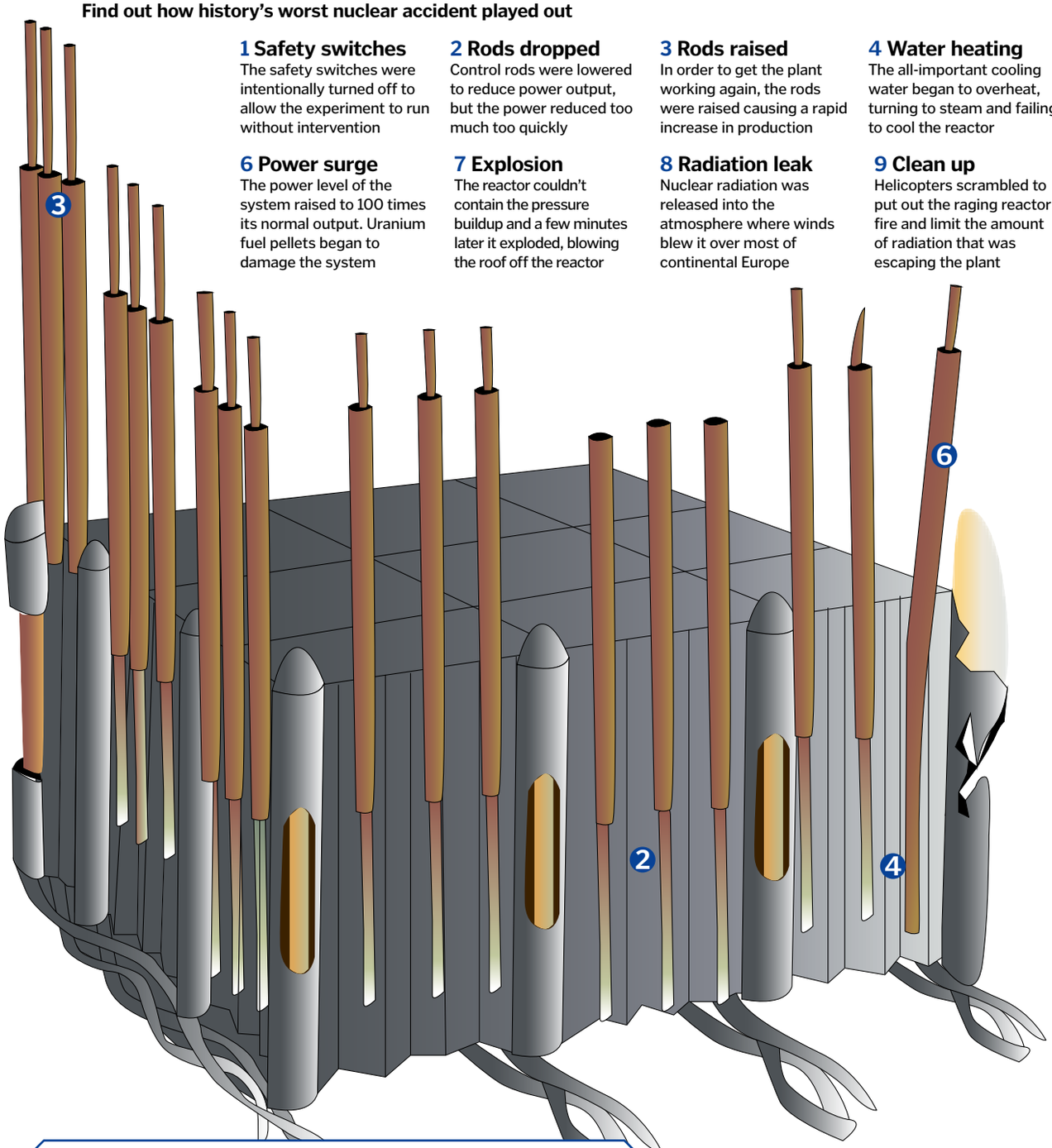
**6 Power surge**
The power level of the system raised to 100 times its normal output. Uranium fuel pellets began to damage the system

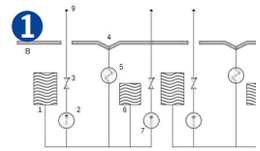
**7 Explosion**
The reactor couldn't contain the pressure buildup and a few minutes later it exploded, blowing the roof off the reactor

**8 Radiation leak**
Nuclear radiation was released into the atmosphere where winds blew it over most of continental Europe

**9 Clean up**
Helicopters scrambled to put out the raging reactor fire and limit the amount of radiation that was escaping the plant

**10 Sarcophagus**
A concrete shell was hastily constructed and placed over the nuclear plant to limit the release of radiation from Chernobyl









## How it toppled the USSR

The leader of the Soviet Union at the time of the Chernobyl disaster, Mikhail Gorbachev, has claimed that the incident was a key factor in the demise of the USSR.

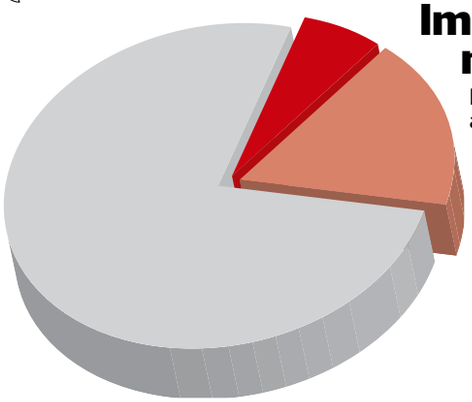
The government's response to the disaster was to try and cover it up as much as possible, with barely any official announcement of it and no warning to residents in the surrounding area as to the dangers of radioactive poisoning. It took a radioactive cloud that passed over Sweden to bring the event to the world's attention.

Furious at the lack of information and protection they had received, especially as Gorbachev had promised a new era of political clarity and honesty, citizens railed against the political system.

The general public lost faith in the government and the government in turn lost control of the general public. Five years later, the Soviet Union was dissolved, with Gorbachev quoted as saying, "The nuclear meltdown at Chernobyl [...] was perhaps the real cause of the collapse of the Soviet Union."

## Impact of the meltdown

**How many were directly affected by the disaster?**



**55,000**
6.4% died from radiation

**150,000**
17.4% were left disabled

**655,000**
76.2% underwent medical supervision