



Alan Turing

HIDDEN HERO OF HISTORY

Listen to the story: <https://jonincharacter.com/alan-turing/>

Alan Turing was a British mathematician and thinker who had ideas that set the stage for computers and artificial intelligence. During World War II, he played an important role in breaking secret Nazi codes.

Alan Turing was born in London, England to Julius and Ethel Turing on June 23, 1912. He was very smart and observant from a young age. While on a family holiday in Scotland, 7-year-old Alan used math to study the flight paths of the honey bees to locate their beehive. He discovered their honey, which he didn't like. But what he did like was learning about the world around him.

He wasn't like most boys he knew, which made it hard for him to make friends. He loved math, science, and books over physical and imaginative play. He had a high-pitched voice and didn't always pick up on things like sarcasm. Sarcasm is when someone says the opposite of what they mean, usually to be funny or to make a point. Many experts today think Alan Turing may have been on the autism spectrum.

At 13, Alan began his studies at a boarding school 60 miles away from his home in Southampton, England. A boarding school is where students both study and live. There was a train strike on the day Alan was supposed to leave for his new school. He found out at the last minute, so he rode his bicycle the whole way there—and he arrived on time!

Alan spent the rest of his life using his bicycle as his main source of transportation. He was very athletic. In fact, he almost made it as a member of the British team for the 1948 London Olympics, but an injury prevented him from competing.

As an adult, Alan rode his bicycle to work every day—it was a very old bike with a chain that fell off while he was riding. He'd stop to fix it and get his hands dirty with grease. But instead of getting a new bike, Alan enjoyed trying to figure out why it kept breaking. That was just the way his brain worked. He loved puzzles.

His best friend at boarding school was Christopher Morcum. Christopher loved math and science almost as much as Alan, and they'd spend time working on difficult math equations together. Christopher was the first person who Alan thought truly understood him. Sadly, Christopher died from a disease called tuberculosis at age 18.





His friend's death was very sad for Alan, but he was determined to honor his memory. Alan kept studying and doing his work in math and science.

After graduating, Alan attended the University of Cambridge in England, one of the best universities in the world. From there, he continued his studies at Princeton University, another top-notch school in the United States. This is where he earned his PhD, or doctorate, which is the highest degree you can earn in school.

While at Princeton, Alan came up with an idea he called "The Turing Machine." It's a machine that's able to decode and perform any instructions you give it. This breakthrough idea is what led to the creation of the computers that people use all over the world today.

In 1939, Alan finds himself with his biggest mathematical challenge yet at Bletchley Park in Bletchley, England.

During World War II, England, alongside many other countries, was fighting a very bad group called the Nazis in Germany. The Nazis used jumbled messages to talk to one another over machines. This was called The Enigma Code. It was Alan's job to figure out what they were saying so that he could help Britain and the Allied Forces win the war.

He and another mathematician named Gordon Welchman worked together to invent a machine called The Bombe. And it worked! They decoded the Nazis super secret messages. By 1945, the war was over, and the Allied Forces won—and that's in large part due to Alan's work.

Sadly, Alan was never publicly recognized for his brilliant work while he was alive. Alan was gay, and at that time, it was against the law to be gay in the United Kingdom. In 1952, he was arrested simply because of who he loved. As a result, he was treated unfairly and lost the job he loved so much.

Today, people around the world honor and celebrate him. In 2013, Queen Elizabeth II gave him a royal pardon, and his face now appears on the £50 banknote. In the United Kingdom, children visit Bletchley Park on field trips and learn all about the incredible impact Alan Turing had on saving the world.

Alan's story reminds us how important it is to treat everyone with fairness and respect, and that being different is often what makes someone truly extraordinary.

Glossary

Mathematician – A person who studies and solves math problems, often using numbers, shapes, and patterns to understand how things work.

World War II – A war that happened from 1939 to 1945 involving many countries around the world, including Britain, the United States, and Germany.

Code (Secret Code) – A way of writing messages so only certain people can understand them, like a secret language.

Observant – Someone who pays close attention to things and notices small details.

Sarcasm – When someone says something but means the opposite, often to be funny or to make a point.

Autism Spectrum – A way to describe how some people think, learn, and feel differently. It means their brains work in unique and wonderful ways.

Boarding School – A school where kids not only study but also live during the school year.

University – A school you attend after high school to learn more about a subject and earn special degrees.

PhD (Doctorate) – The highest degree you can earn in school.

The Turing Machine – An idea Alan came up with for a machine that could follow instructions to solve any problem. It helped lead to the invention of today's computers.

Enigma Code – A tricky code used by the Nazis in World War II to send secret messages.

Decode – To figure out the meaning of a secret or confusing message.

Allied Forces – The group of countries, like Britain and the U.S., that worked together to stop the Nazis in World War II.

The Bombe – A special machine Alan helped invent to break the Enigma Code and understand Nazi messages.

Royal Pardon – A way for the king or queen to officially forgive someone and say they were treated unfairly.

Give it Some Thought

- Alan was curious about how bees fly and where they keep their honey. What's something in nature or the world that you've been curious about?
- Alan was different from other kids and sometimes had a hard time making friends. Have you ever felt different? How did that feel?
- Alan's machine helped decode messages during a very important time in history. How do you think solving puzzles helped him get through hard situations?
- If you could invent a machine to help solve a problem in the world, what would it do?
- What's something kind, brave, or creative you'd like to be remembered for one day?

Use Your Imagination

Now it's time for you to become a codebreaker like Alan Turing!

Make a cipher wheel and write secret messages. Then, challenge friends or family members to decode them, just like Alan did to crack the Enigma Code.

Use the directions and template from the Science Museum Group to:

- Make your cipher wheel
- Create your cipher
- Write your first secret message, and
- Show it to someone to see if they can crack the code



When you're done, answer these questions:

- What was your cipher key? A = _____
- What message did you encode?
- Did someone decode your message? What did they say about it?
- What was tricky about this activity?
- What was fun about this activity?
- Why do you think codebreaking was important in Alan Turing's story?

SCIENCE MUSEUM GROUP



CIPHER WHEEL

MAKING 	Age 7-11	Topic MATHS, NUMBERS	 30 MIN
	Skills used MAKING OBSERVATIONS • PROBLEM SOLVING • CURIOSITY		

Overview for adults

A cipher is a code used to protect information that is being stored or communicated, so that only people who are allowed can access it. This activity involves making a cipher wheel and using it to encrypt and decrypt messages, with a simple cipher.

What's the maths?

Using the cipher wheel to encrypt a message (make it secret) involves transforming each letter of the message into another letter or a number by following a series of steps: an algorithm. In this case, the algorithm involves simply shifting each letter of the message by a certain number of places through the alphabet. Algorithms are commonplace in mathematics. The message's receiver is aware of the algorithm – which, in the case of cryptography, is called a cipher – and can decrypt the messages by applying the algorithm in reverse. To anyone else, the message looks nonsensical.

Explore more

During (and before) the Second World War, German military forces used sophisticated devices called Enigma cipher machines to encrypt messages.



Maths in your world

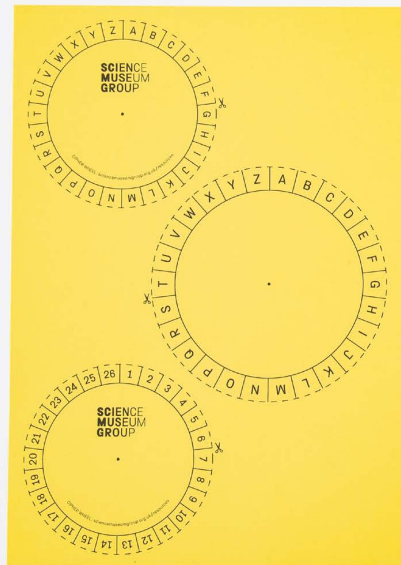
Sophisticated encryption is used to send information across the internet, ensuring that credit card details, emails and other messages cannot be read by anyone who intercepts the data. Many websites are also secured using cryptography, so that hackers cannot gain access to the computer files that make up the website or personal data stored in them. The addresses of secure websites begin with 'https' rather than 'http'.

Did you know...?

The word 'cryptography' comes from the Greek words kryptos (meaning 'hidden') and graphia (meaning 'writing').

Make a cipher wheel, and use it to send secret messages to your friends and family.

You will need...



Pencil for making
notes and writing
messages



Split pin



Cipher Wheel
templates

Scissors



Think and talk about...



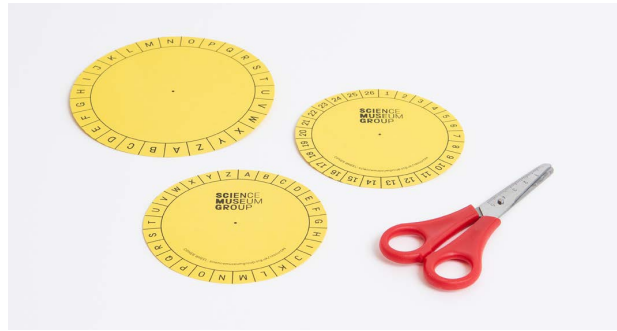
- Could you work out the encrypted message without the cipher wheel?
- What kinds of things might people want to keep secret?

Investigate...

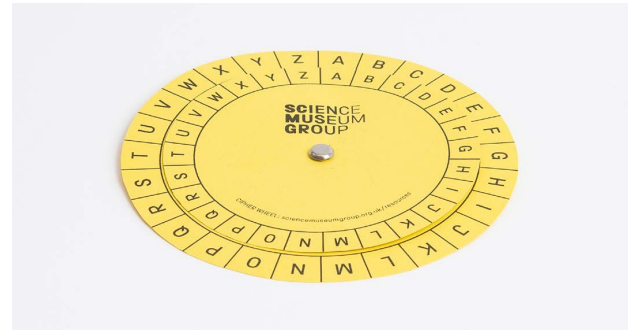


- How quickly can you encrypt and decrypt a message?
- Can you use a different cipher (for example $A = 1 \times 2 + 1$, $B = 2 \times 2 + 1$ and $C = 3 \times 2 + 1$) which is more difficult to solve? Try encrypting your message and see if someone else can decrypt it with your equation.
- Try encrypting a new message where you rotate the number wheel after each letter you use. How would you write this cipher so that someone can decrypt your message?

Follow these steps...



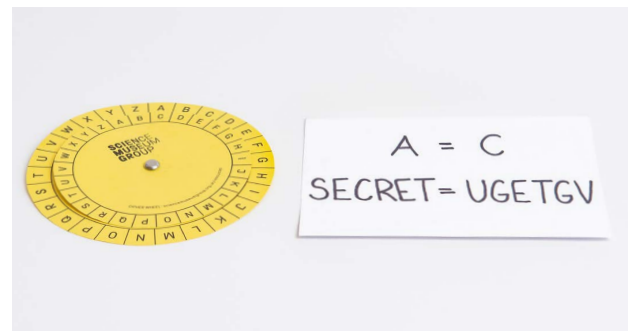
1 Cut out the templates.



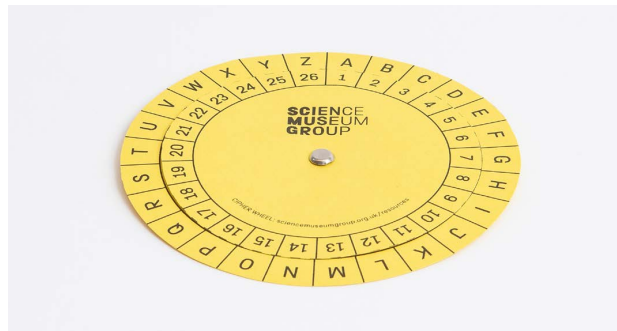
2 Take the small circle with the letters on it and put it on the large circle. Secure with a split pin in the centre.



3 Turn the smaller wheel so that each letter on it lines up with a different letter on the larger wheel.



4 Now encrypt your message (make it secret). For each letter, write down the letter on the smaller wheel that appears directly beneath it.



5 Replace the smaller letter circle with the number circle. Now you can encrypt messages with numbers instead of letters.



6 Encrypt messages to a friend in letters or numbers, and ask them to send you encrypted messages too.

Maths in your world

Encryption is used to send emails and information across the internet. Instead of a cipher wheel, a computer uses really complicated mathematics to encrypt the information.



