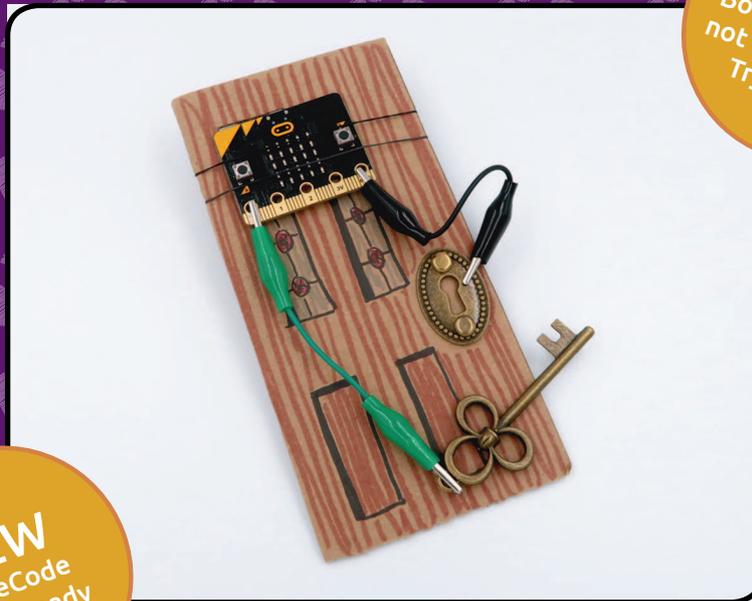# BONUS PROJECTS

from
micro:bit in Wonderland

CODING & CRAFT
with the BBC micro:bit

Chapter 3: Lock & Key

THREE
Bonus Projects not in the book. Try Them!

NEW
MakeCode editor ready

written by Dr Tracy Gardner & Elbrie de Kock
Tech Age Kids

TRADEMARKS

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INTERNET ADDRESSES

All the internet addresses (URLs) and information given in this book were valid at the date of print. Please contact Tech Age Kids if you find any missing or incorrect information.

GUIDE TO THIS BOOKLET

This booklet contains three bonus projects that introduce you to the Tech Age Kids book *micro:bit in Wonderland*.

The projects are designed for beginners to coding and the BBC micro:bit. Each chapter recreates objects and scenes from Alice's adventures providing, an imaginative backdrop for developing modern skills.

Children, teens and adults will learn to code the micro:bit and make fun and useful things.

We've found that children are more engaged with coding and electronics when there's a purpose behind what they make.

The book, *micro:bit in Wonderland*, contains 12 further coding and craft projects inspired by the story of *Alice's Adventures in Wonderland* by Lewis Carroll.

THE BBC MICRO:BIT

The BBC micro:bit is a small, programmable computer that has built-in inputs and outputs, with the capability to connect more. You can use it to make a wearable device, cool gadgets, useful science equipment and creative craft and coding projects.

The micro:bit can be powered from a battery pack with 2 AAA batteries. You also need a, preferably long, USB cable for programming.

SAFETY

The projects in this booklet use electronics equipment and craft tools. The projects are intended to be completed with adult supervision or support. The projects are undertaken at your own risk.

📖 **Read** *Alice's Adventures in Wonderland* by Lewis Carroll to complement the projects.

🌐 **Website** accompanying this booklet: alice.techagekids.com

PROJECTS IN THIS BOOKLET

The projects in this booklet will introduce you to simple block-based coding, craft and electronics. They include:

- ♣ Chapter 1: **10/6 The Mad Hatter's Hat** (Learn how to download your program to the micro:bit.)
- ♣ Chapter 2: **Downside Up** (Discover code blocks and make things happen on the micro:bit.)
- ♣ Chapter 3: **Lock and Key** (Learn how to attach external inputs to the micro:bit.)
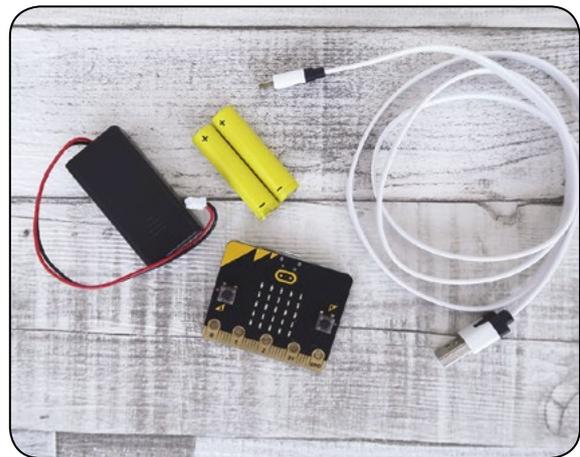
Please read the safety advice online at microbit.org/guide/safety-advice before using the micro:bit.

ADDITIONAL TIPS TO USE YOUR MICRO:BIT SAFELY

The tips below are not a substitute for reading the safety advice, however, we want to highlight some key points:

- Projects combine craft and tech activities. It's important that you have a tidy workspace. Make sure that materials don't unintentionally touch the micro:bit.

- Keep kitchen foil well away from the micro:bit unless you are using it as conductive material as instructed in a project. Don't use kitchen foil as decorative material.

- When you are not using the micro:bit, unplug the device and put it away.

- Try to only hold the micro:bit by its edges when it's in use.

- The micro:bit is designed to run cold. If yours is hot, stop using it and check the safety advice.

- None of the projects require you to connect crocodile clips to the micro:bit pin marked 3V (power supply pin).

- Do not attach the battery pack and the USB cable at the same time.

CODING

You'll use the Microsoft MakeCode editor, with drag and drop code blocks, to programme the micro:bit.

The editor is free and runs in a web browser. It also runs on Chromebooks, Raspberry Pi computers and Android or iOS devices.
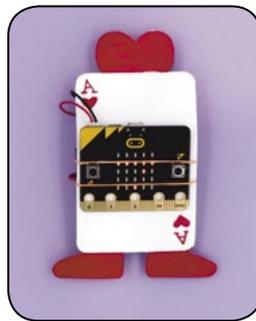
🌐 **Editor:** makecode.microbit.org

CRAFT

We think it's important to continue to do craft activities to learn modern skills.

Each chapter includes some craft activity and tells you what materials you will need to complete the project.

🌐 **Find** additional templates and more information at alice.techagekids.com. Templates are included in this booklet.

MAKE IT YOURS

You will learn the skills needed to eventually imagine, design and make your own projects . Try the Challenges and Make It Yours sections in each chapter.

We'd love to see what you've created, so share images and videos of your projects with us on social media.

Remember when sharing to keep your personal information private. Take note of the age restrictions on social media platforms, children should ask a responsible adult to share their creations online.

🌐 **Find** us on Facebook, Twitter and Instagram and share using the hashtag *#techalice*.

Share your make #techalice

LOCK AND KEY

BONUS CHAPTER 3

FOLLOW THE STORY

📑 **Read** Chapter 2 *The Pool of Tears* where Alice discovers a little door.

In *Alice's Adventures in Wonderland*, Alice finds a key and then looks for a door that it might open.

💬 *"Suddenly she came upon a little table, all made of solid glass. There was nothing on it but a tiny golden key, and Alice's first idea was that this might belong to one of the doors of the hall; but, alas! either the locks were too large, or the key was too small, but, at any rate, it would not open any of them. However, on the second time 'round, she came upon a low curtain she had not noticed before, and behind it was a little door about fifteen inches high. She tried the little golden key in the lock, and to her great delight, it fitted!"*

YOU WILL MAKE

In this project you'll make the micro:bit react to a door being unlocked with a key.

You'll learn how to create a simple electric circuit using the micro:bit and conductive material.

YOU WILL NEED

- ♣ micro:bit, USB cable and battery pack
- ♣ 2 crocodile/alligator clip leads
- ♣ metal key or any conductive key
- ♣ kitchen foil, to make a lock escutcheon
- ♣ packaging cardboard
- ♣ felt tip pens/colouring pencils
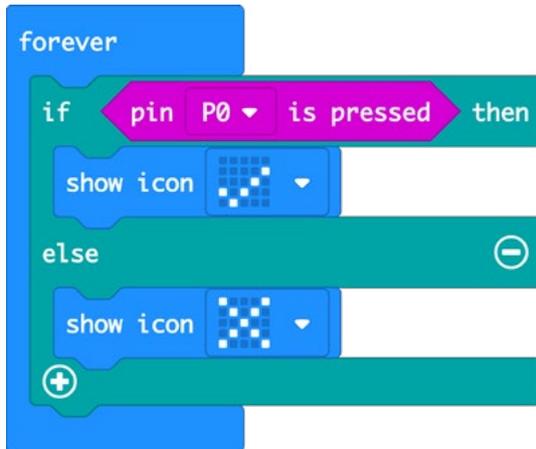- ♣ loom bands, split pins, glue

CODING

The micro:bit can detect an electrical connection between its GND (ground) pin and its numbered pins.

You're going to use Pin 0 (P0) and the ground pin (GND) in the program.

In a browser go to the MakeCode editor (makecode.microbit.org). Start a new project. Add these code blocks.


⬇ **Download** your code and transfer it to the micro:bit.

CRAFT

CONDUCTIVE KEY AND LOCK

You're going to make a door with a conductive key and lock.

1. Use a strip of kitchen foil and scrunch it up to make a long sausage shape. Bend and shape the foil to form a small keyhole. This is your lock. You can also use a metal lock escutcheon.

2. Cut a rectangle 8cm x 12cm from packaging cardboard and decorate it if you like. This will be your door.

3. Attach your lock using glue or split pins.

4. Connect a crocodile clip lead to the **GND** pin on the micro:bit and the other end to your foil **lock**.

5. Attach the second crocodile clip lead to **Pin P0** and the other end to the **key**.

Pin 0   Ground Pin
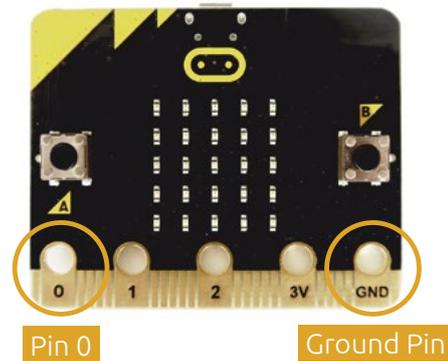
This code will keep checking whether pin 0 is pressed. In other words, does Pin 0 have a connection to GND?

If it does the micro:bit will display a tick/check mark (✓) to show that the door is unlocked. Otherwise the micro:bit will show a cross (✗).

Conductive escutcheon

Pin 0   Ground Pin

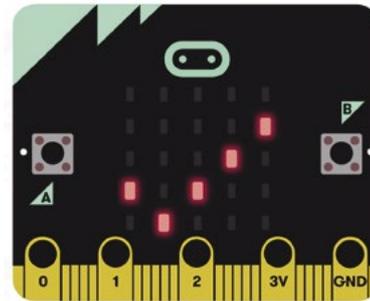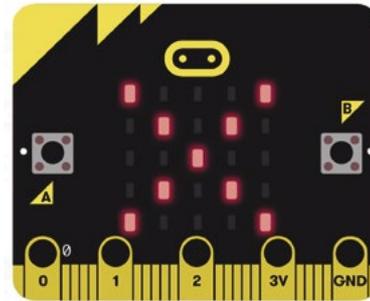Lock

Key
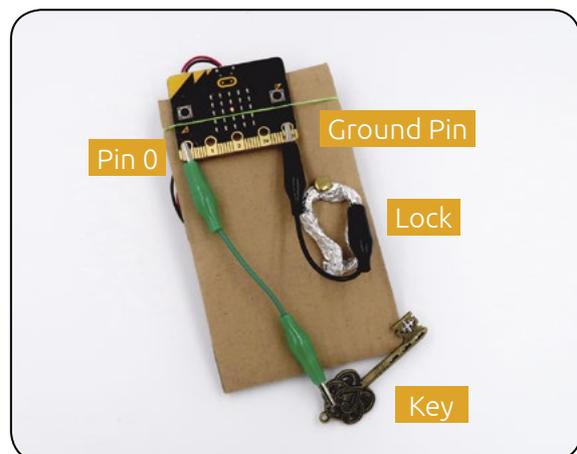
TEST YOUR PROGRAM

Test your code by touching the lock with the key.

A tick will show on the micro:bit when the lock is touching the key and a cross when it is not.

This project works because the micro:bit can detect when an electrical current flows through its pins. The crocodile clip leads (the wire part inside), the foil lock and the key are all conductive.

When you connect P0 to GND, by touching the key to the lock, electrical current can flow and the `pin 0 is pressed` block returns true.

⋰ **Think** about the code and make sure you understand how it works.

EXTENSION ACTIVITY

Find a few friends and make a human chain with the external input you made.

Ask one person to hold the key. Then ask another person to touch the lock. Add more people between these two people.

What happens on the micro:bit display when everyone holds hands?

⋰ **Think** what this means about your body's conductivity.

MAKE IT YOURS

Customise your project in your own style:

💬 *"Alice opened the door and found that it led into a small passage, not much larger than a rat-hole; she knelt down and looked along the passage into the loveliest garden you ever saw."*

♣ Change what the micro:bit shows on it's display. You could design a flower on the micro:bit. What would you like to find behind the door?

♣ Try different show icon blocks or experiment with the show leds block.

♣ Show a short animation when the door is open or closed?

ABOUT

MICRO:BIT IN WONDERLAND

micro:bit in Wonderland is a project book for the BBC micro:bit that guides beginners aged 9 and over through 12 projects inspired by *Alice's Adventures in Wonderland*. The projects develop modern skills in creative and computational thinking, computer programming, making and electronics.

The projects use simple, inexpensive electronics and everyday household and craft material and provide a playful introduction to coding, electronics and the BBC micro:bit.

Gradually build modern skills as you learn about wearables, electronic games, e-textiles, electronics circuits, digital music, animation and much more.

The book is published by Tech Age Kids and available in print or digital copy. It's updated to the latest MakeCode editor.

⊕ **Web:** alice.techagekids.com to purchase the book, micro:bit and accompanying electronics kit.

THE AUTHORS

Dr Tracy Gardner has a **Computer Science** PhD. She worked as a software engineer and software architect, including 10 years at IBM. Tracy has two children and focuses on introducing technology to the next generation. She develops educational content for the Raspberry Pi Foundation. Between 2014 to 2017, Tracy taught Computing to Key Stage 2 children (aged 7-11). Tracy is a director of Tech Age Kids.

Elbrie de Kock has an Interior **Design** degree and worked in design, marketing and business development. Elbrie has three children. Her eldest son's passion for computer programming inspired her to find opportunities for kids to learn to code. She develops projects that combine craft, coding and electronics. Elbrie is a director of Tech Age Kids.
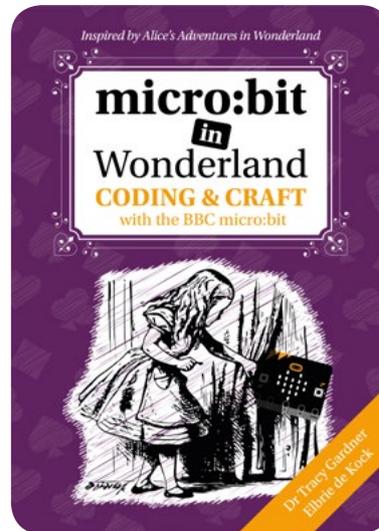
TECH AGE KIDS

Tech Age Kids is an online company that helps parents and educators find **constructive** and **creative** uses of technology for children and teens.

The company creates educational material and online content for techagekids.com, including approachable project ideas, news and reviews of the latest educational and creative technology products, as well as advice on digital parenting issues.

Tech Age Kids believes that modern children should develop skills in **coding**, **electronics** and **design** so that they can understand the present and shape the future.

The company supports the **STEAM** (Science, Technology, Engineering, Art and Mathematics), **Maker** and Digital Making movements.

♣ Follow on social media at Facebook, Twitter, Instagram and occasionally Youtube.

♣ Email at hello@techagekids.com.

Template for top hat and card character.

Print on card and cut along the **dashed** lines.

Top Hat Brim

Top Hat Top Part

Card Character Feet

Card Character Head

Card Character Body