

BONUS PROJECTS

from
micro:bit in Wonderland

CODING & CRAFT

with the BBC micro:bit

BUFSØTE

F6

THREE
Bonus Projects
not in the book.
Try Them!

NEW
MakeCode
editor ready

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

Published by Tech Age Kids. techagekids.com | hello@techagekids.com

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Written by Dr Tracy Gardner & Elbrie de Kock.

Typeset and designed by Tech Age Kids.

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ACKNOWLEDGEMENTS

Screenshots made available by Microsoft MakeCode, makecode.microbit.org. Microsoft MakeCode is based on the open source project Microsoft Programming Experience Toolkit (PXT).

Illustrations by Sir John Tenniel from 'Alice's Adventures in Wonderland' by Lewis Carroll.

Book inspired by 'Alice's Adventures in Wonderland' by Lewis Carroll.

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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.

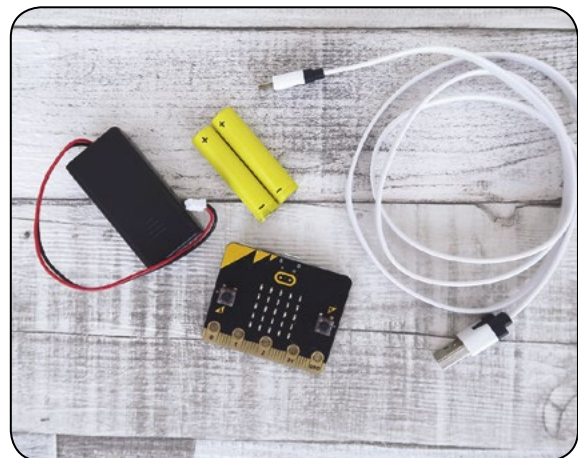
📖 **Read *Alice's Adventures in Wonderland*** by Lewis Carroll to complement the projects.

🌐 **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.

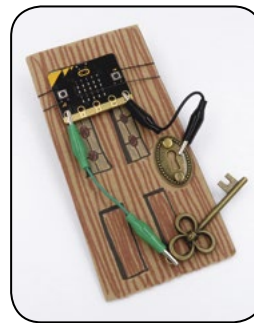
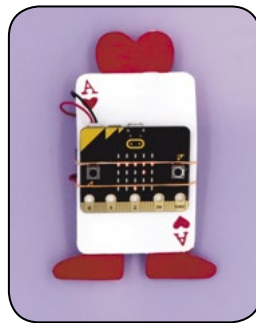
🌐 **Editor:** makecode.microbit.org

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*.



DOWNSIDE UP

BONUS CHAPTER 2

FOLLOW THE STORY

In *Alice's Adventures in Wonderland* many of the characters are playing cards.

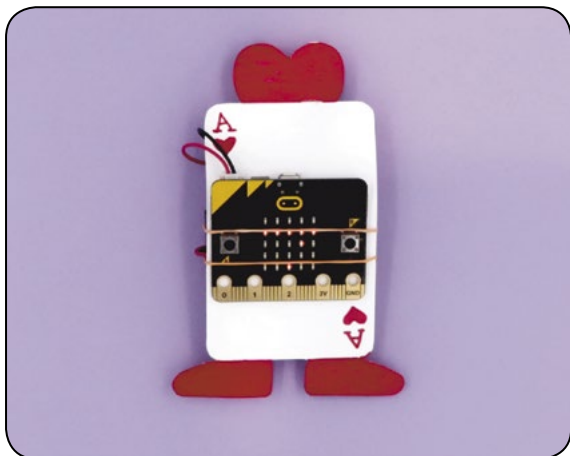
The Ace of Diamonds has rotational symmetry. It can stand on its head and look just the same.


The Ace of Hearts is jealous. It has rotational symmetry apart from the big heart in the middle.

YOU WILL MAKE

In this project you'll make an Ace of Hearts playing card that always has its heart the right way up whether it stands on its feet or its head.

You'll use the micro:bit to fix the card so that the heart is the right way up even if the card stands on its head.



 **Print** a template from the website or find one in this booklet.

 alice.techagekids.com

YOU WILL NEED

- ◆ micro:bit, USB cable and battery pack
- ◆ template for playing card or a blank playing card
- ◆ red felt tip pen
- ◆ 2 loom bands

CODING

The micro:bit has a sensor in it called an **accelerometer** that can detect movement. It can tell which way up the micro:bit is.

Try find the accelerometer on the back of the micro:bit.

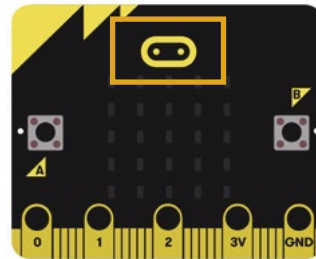
The micro:bit has a logo on the top.

It can detect when the logo is at the top (**Logo up**) and at the bottom (**Logo down**).

Let's add some code to see what happens.

Smart phones and tablets flip their displays round depending on how you hold them. Useful isn't it?

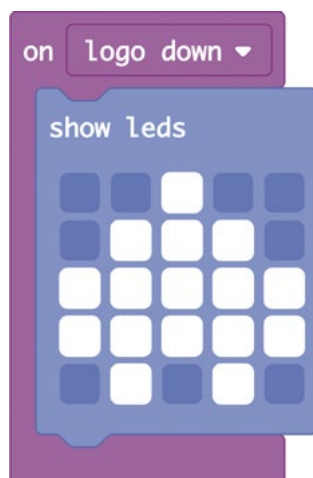
Can you think of another device that can do this?



CODE THE CENTRE HEART

In a browser go to the MakeCode editor (makecode.microbit.org). Start a new project. Add code blocks to make the centre heart for your Ace of Heart character.

Find the **on shake** block in the **Inputs** section and change it to **Logo up** using the drop-down menu.

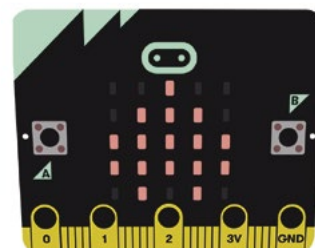



Add another **on shake** block and change it to **on Logo down**.

You want to draw an upside down heart when the micro:bit logo is down (the micro:bit is upside down).

There's no **show icon** block for an upside down heart so you'll have to use a **show leds** block to create your own.

Grab the micro:bit in the simulator and move it slightly up and down and you should see the heart flip.



 **Download** your code and transfer it to the micro:bit. Test your code by turning the micro:bit logo up and logo down.

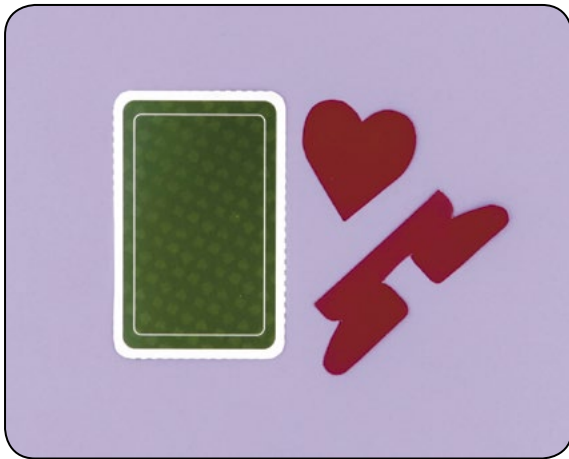
 **Tip:** You need to hold the micro:bit upright in a vertical position.

Did you should see the display change so that the heart is always the right way up, when you turned the micro:bit upside down?

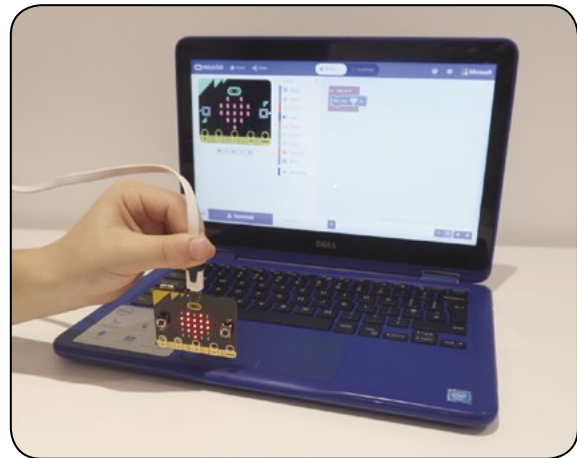
CRAFT

Make an Ace of Hearts card character to attach the centre heart you coded.

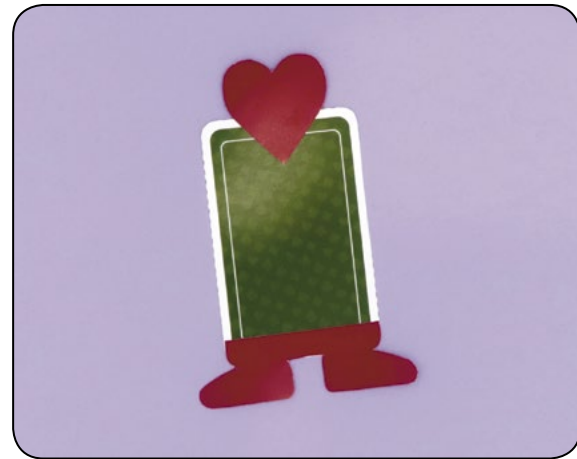
1. Cut out the card shape, heart and feet from the template.



2. Write the letter A and a heart in the top left corner with a red felt tip. Rotate the card 180 degrees and draw another A and a heart in the top left corner. You should now have As and hearts in diagonally opposite corners of your playing card.



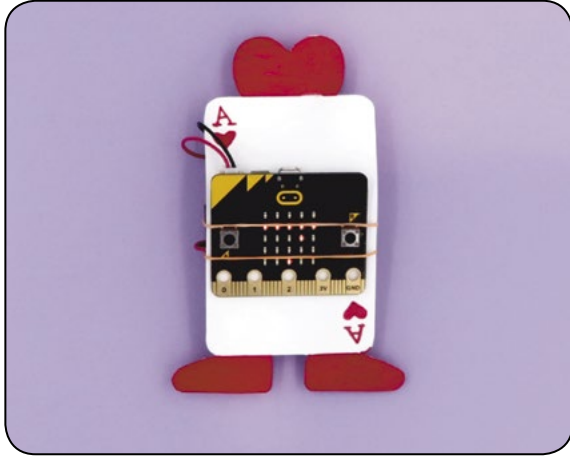
3. Use sticky tape to attach the heart at the top of the card as your character's head and the feet at the bottom.



4. Colour the other side of the heart and feet in red to complete your character. You can decorate the character in your own style.



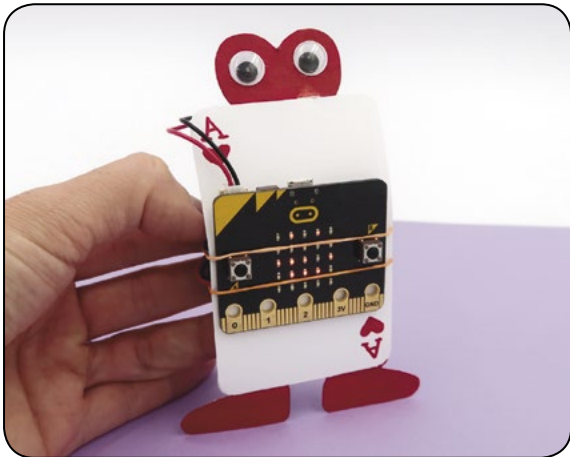
5. Use two loom bands to attach the micro:bit to your playing card so that the display becomes the heart in the middle. (Keep the USB cable attached.)



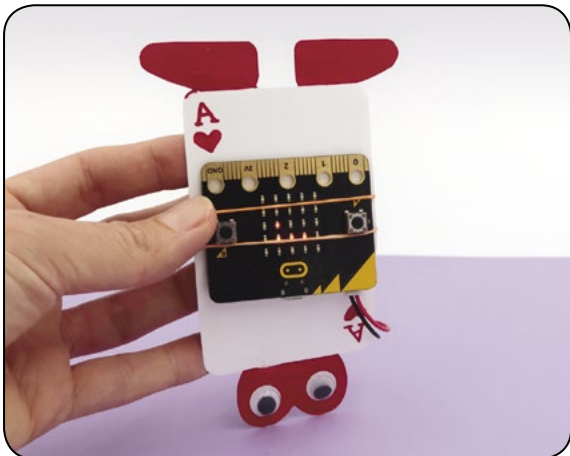
You can optionally disconnect the USB cable and attach a battery pack.



6. Hold the card character upright and then turn it upside down. Does the Ace of Hearts have rotational symmetry?



Give your character some personality by adding eyes and other features.



MAKE IT YOURS

Customise your project in your own style:

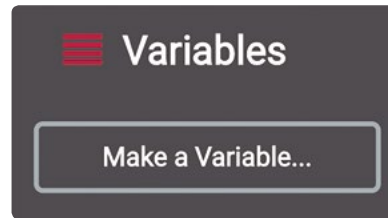
- ♣ You could make a head and feet for your playing card (like the characters in *Alice's Adventures in Wonderland*) using 3D printing or air drying clay.
- ♣ Use the [show leds](#) block to design your own picture and an upside down version.
- ♣ Try the extension activity to make the heart beat in the upright and upside down position.

Share your make #techalice

EXTENSION: BEATING HEART

Let's make the heart even better by making it beat.

In the **Variables** section make a new variable called **up**. The **up** variable will remember which way up the micro:bit is.



```
on logo up
  set up to true
  while up
    do
      show icon [Normal Heart]
      show icon [Small Heart]
```

Set **up** to **true** at the beginning of **on logo up**. (You'll set **up** to **false** when the logo is down).
While the logo is up you want to make the heart beat by creating an animation between a normal heart and a small one.

```
on logo down
  set up to false
  show leds [Upside Down Heart]
```

You need to set **up** to **false** when the micro:bit is turned upside down so that the right-way-up heart stops flashing.

CHALLENGE:

Can you make the upside down heart beat too?

Add a **while** loop that runs while the micro:bit is **not up** (it's upside down).
Can you add code to make the heart flash when it's upside down too?
Tip: You need another **show led** block.

```
on logo down
  set up to false
  while not up
    do
      show leds [Upside Down Heart]
```

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.

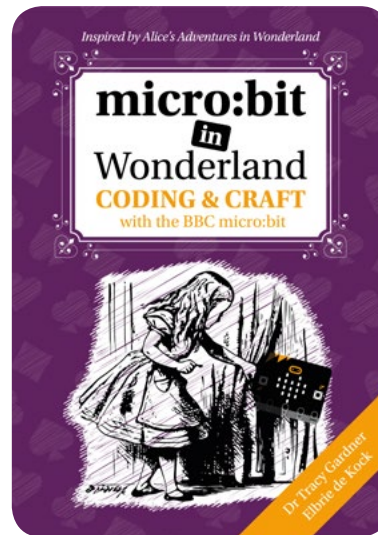
The book is published by Tech Age Kids and available in print or digital copy. It's updated to the latest MakeCode editor.

🌐 **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](https://www.facebook.com/techagekids), [Twitter](https://twitter.com/techagekids), [Instagram](https://www.instagram.com/techagekids) and occasionally [Youtube](https://www.youtube.com/techagekids).
- ♣ Email at hello@techagekids.com.

PROJECT TEMPLATES

(BLACK & WHITE)

Template for top hat and card character.

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

