


# Contents

## 06 SPARK

- 06 **Top Projects**  
Show us what you've been making!
- 16 **Objet 3d'art**  
Summer special 3D prints
- 18 **Meet the Maker: Rachel Wong**  
Cutesy wearables for all you Japanophiles
- 22 **Columns**  
Why a trade war is bad for makers
- 24 **Letters**  
Streamlining, safety, and classical music
- 25 **Kickstarting**  
Stumble in darkness no longer
- 26 **Hackspace Ipswich Makerspace**  
Making for fun in the far east

## Cover Feature



# 30

## ESSENTIAL TOOLS

Upgrade your life with a fresh set of tools. Now, what to choose...?  
Decisions, decisions!

# 32

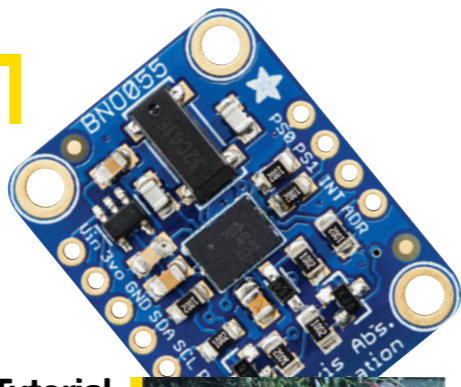
## 88



## 31 LENS

- 32 **50 Essential Tools**  
Build more and better with some shiny new tools
- 46 **How I Made: Cubert**  
Inside the building of a programmable LED cube
- 50 **Remap**  
How volunteer makers are sharing their skills
- 54 **Interview Tim Richardson**  
The robot ringmaster of Pi Wars!
- 62 **Improviser's Toolbox** Nail clippers  
From manicure to man at war

## 118



## Tutorial

School of making:  
Google AIY Vision robot sentry



82 Defend the garden with an intelligent water pistol

## Kickstarting

### Automatic night light



25 One light to bring them all, and in the darkness, find them

## 69 FORGE

- 70 **SoM Arduino**  
Pointers and linked lists in Arduino programming
- 76 **SoM Electronics**  
From electron shells to resistance
- 82 **SoM Google AIY Vision sentry**  
Train a water pistol to shoot pesky humans
- 88 **Tutorial MIDI controller**  
Build a USB joystick MIDI controller
- 94 **Tutorial Food sculpture**  
Make your own moulds for tasty treats
- 96 **Tutorial Oscillating multi-tool**  
For when you want to cut with surgical precision
- 98 **Tutorial Follower counter**  
Build a device to count your online friends
- 106 **Tutorial Teensy drum machine**  
Make artificial beats on a breadboard
- 110 **Tutorial Knife handle**  
Create a unique tool you'll keep forever

Some of the tools and techniques shown in HackSpace Magazine are dangerous unless used with skill, experience and appropriate personal protection equipment. While we attempt to guide the reader, ultimately you are responsible for your own safety and understanding the limits of yourself and your equipment. HackSpace Magazine is intended for an adult audience and some projects may be dangerous for children. Raspberry Pi (Trading) Ltd does not accept responsibility for any injuries, damage to equipment, or costs incurred from projects, tutorials or suggestions in HackSpace Magazine. Laws and regulations covering many of the topics in HackSpace Magazine are different between countries, and are always subject to change. You are responsible for understanding the requirements in your jurisdiction and ensuring that you comply with them. Some manufacturers place limits on the use of their hardware which some projects or suggestions in HackSpace Magazine may go beyond. It is your responsibility to understand the manufacturer's limits.



46

## Interview

Tim Richardson

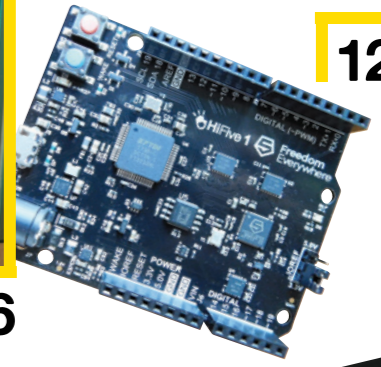


54 Making Pi Wars: a tale of making, robots, and magic blue smoke

## 115 FIELD TEST

- 116 **Direct from Shenzhen Hydroponics**  
Grow salad and herbs on your windowsill the techie way
- 118 **Best of Breed**  
Four of the best inertial measurement modules
- 122 **Can I Hack It?**  
Pull an MP3 player to bits
- 124 **Review TinyLily Mini**  
An Arduino-compatible microcontroller smaller than a 1p piece
- 126 **Review SiFive HiFive**  
The open hardware of RISC-V comes to microcontrollers
- 128 **Review SketchUp**  
Web-based design software with an online sharing community
- 129 **Book Review Junkyard Jam Band**  
Make musical instruments out of bits and bobs (and brains)

126



06

