James **Devine**

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Education

Lancaster University *Lancaster, England*
PH.D. COMPUTER SCIENCE *Jan. 2016 - May. 2020*

Undertook research on lowering the barrier to entry for innovation with microcontroller-based devices. Collaborated with a number of companies, including Microsoft, ARM, Farnell, and Samsung to produce the device runtime for the BBC micro:bit. Generalised this runtime to support a range of other products, enabling Microsoft MakeCode to reach millions of users. Applied this research in a number application contexts including Energy in Schools, where I implemented a wireless IoT infrastructure for educators and students to reduce energy consumption, and Project Brookdale, where I designed systems and hardware for designers to use in a tech-enhanced fashion show.

Lancaster University *Lancaster, England*
B.SC. COMPUTER SCIENCE, FIRST CLASS (HONS) *Oct. 2012 - June 2015*

In my 3 year undergraduate program, I started my own 3D printing design company, led a prizewinning group project, and spent two years developing the university's flagship smart phone application whilst achieving a grade within the 95th percentile of my cohort. For my dissertation project I created a per-appliance current sensing device, accompanying IoT infrastructure, and a cross-platform smart phone application for visualising data.

Experience

Researcher, Microsoft Research *Cambridge, UK*
DEMOCRATIZING HARDWARE *June. 2020 - Present*

Developing tools, systems, and experiences that make it easier to produce prototypes (one-off) and convert them to isotypes (many-off) hardware at scale. Fundamental to this research is Jacdac, a technology contributed in my PhD thesis.

- Led Project MakeAccessible, a hackathon project centred around empowering more people to build customised assistive technology. Jacdac hardware kits were given to hackers, and over 80 hackers participated across 4 continents.
- Designed and developed the micro:bit MakeCode Arcade shield.
- Designed and developed software, firmware, and hardware for Jacdac.

Intern, Microsoft Research *Redmond, USA*
PROJECT BROOKDALE *Feb. 2019 - May 2019*

Collaborated with Microsoft Research and the University of Calgary to develop intuitive wearable fashion technology, subsequently deployed and evaluated at a high profile fashion show in Brooklyn, New York. Fashion designers were able to realise their design vision for fashion-tech garments, by embedding microcontrollers and sensors and dynamically integrating them via Jacdac. This was documented in a Microsoft Research blog post.

- Worked with fashion designers and models to build and debug garments at a Brooklyn Fashion Show.
- Created a custom PCB for prototyping Jacdac devices.
- Developed a Jacdac typescript stack to enable the Web browser to act as a Jacdac debugger and device over WebUSB.
- Presented Jacdac and Project Brookdale at Microsoft Research TechFest 2019.

Intern, Microsoft Research *Redmond, USA*
JACDAC *Jun. 2018 - Sep. 2018*

Created a wired networking protocol for dynamically integrating embedded devices and peripherals. Jacdac is used as the interconnectivity solution for MakeCode Arcade devices.

- Defined and developed the Jacdac protocol stack from the physical layer, to the control layer, to the software driver models used by developers.
- Implemented the protocol on three different processor classes to prove viability.
- Presented the protocol to colleagues within Microsoft Research and the MakeCode team for input and feedback.

Research Associate, Lancaster University *Lancaster, England*
ENERGY IN SCHOOLS *Jun. 2018 - Sep. 2018*

Collaborated with Samsung Research and the Centre for Sustainable Energy to create an Internet of Things (IoT) platform for use in schools. Using the platform, students and teachers could access the real time energy consumption of their school, interact with IoT sensors and actuators, and obtain data from the Internet.

- Worked with educators to implement a platform that was valuable and reliable in the classroom
- Developed a low-infrastructure wireless mesh protocol based on constructive interference using the BBC micro:bit.
- Created a no-installation secure gateway device to join micro:bit mesh networks to IP networks.

Intern, Microsoft Research

Redmond, USA

EMBEDDED LEARNING LIBRARY (ELL)

Jun. 2017 - Sep. 2017

Undertook an internship with the <u>ELL</u> team in Microsoft Research Redmond to create a wake-word recognition solution (like "Hey Cortana!") for resource-constrained microcontrollers.

- Investigated the theory of recurrent neural networks and their role in machine learning
- Developed an efficient C implementation of mel-frequency cepstrum cepstral coeffient calculations
- Created implementations of various neural networks in LLVM and C++: LSTM, GRU, RNN

Research Associate, Lancaster University

Lancaster, England

THE BBC MICRO:BIT, MAKECODE, AND CODAL

Jun. 2015 - 2020

I co-wrote the micro:bit runtime, a memory efficient lightweight operating system designed to support higher level languages like JavaScript. I later generalised the micro:bit runtime into CODAL, which now supports upwards of 50 devices in the MakeCode programming editor. <u>The BBC micro:bit</u> is a small embedded physical computing device that was given to 750,000 11–12 year old students in the UK in 2015. Designed to provide an engaging, low barrier way to learn computer science concepts, there are now over 6 million micro:bits in use worldwide.

- Helped design and develop the micro:bit runtime, a lightweight operating system that runs in less than 2 kB of RAM.
- Worked as part of a large project team that involved a number of partners, including ARM, Farnell, Samsung, the BBC, and Microsoft.
- I continue to be involved in design discussions and future directions for the <u>micro:bit foundation</u>, and Microsoft MakeCode. I also add new devices to the MakeCode ecosystem using CODAL

Various - Part Time

England

APPLE, LANCASTER UNIVERSITY, WAITROSE, CTO DOWNLOADABLE CREATIONS

Sep. 2014 - Oct. 2019

Alongside my degrees, I worked various part time jobs to support my learning and career development.

- Developed the university's Flagship application iLancaster, working with stakeholders across the university to develop applets for their needs.
- Assisted teaching on critical undergraduate computer science modules.
- Worked as a sales assistant in the Trafford Centre Apple Store
- Served on the delicatessen at Waitrose during holiday periods.
- Co-founded a 3D printing startup and built out the technological infrastructure to support the sale of 3D printing designs.

Publications

A Survey and Taxonomy of Electronics Toolkits for Interactive and Ubiquitous Device Prototyping
 Mannu Lambrichts, Raf Ramakers, Steve Hodges, Sven Coppers, James Devine
 Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies, Volume 5, Issue 2 (2021). 2021

Web-based Programming for Low-cost Gaming Handhelds
 Michal Moskal, Thomas Ball, Abhijith Chatra, James Devine, Peli Halleux, Steve Hodges, Shannon Kao, Richard Knoll, Galen Nickel, Jacqueline Russell
 The 16th International Conference on the Foundations of Digital Games (FDG) 2021, 2021

Multisensory Physical Computing for the Blind and Visually Impaired
 Venkatesh Potluri, Jennifer Mankoff, James Devine, Steve Hodges
 Rethinking the Senses Workshop, CHI (2021). 2021

Rethinking the Runway: Using Avant-Garde Fashion To Design a System for Wearables
 Teddy Seyed, James Devine, Joe Finney, Michal Moskal, Peli Halleux, Steve Hodges, Thomas Ball, Asta Roseway
 Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems, 2021

The BBC micro: bit–from the UK to the World
 Jonny Austin, Howard Baker, Thomas Ball, James Devine, Joe Finney, Peli Halleux, Steve Hodges, Michał Moskal, Gareth Stockdale
 Communications of the ACM (2020). ACM, 2020

Enabling intuitive and efficient physical computing
 James Devine
 Thesis (2020). Lancaster University, 2020

MakeCode and CODAL: intuitive and efficient embedded systems programming for education
 James Devine, Joe Finney, Peli Halleux, Michał Moskal, Thomas Ball, Steve Hodges
 Journal of Systems Architecture (2019). Elsevier, 2019

Energy in Schools: Promoting Global Change through Social Technical Deployments
 Kathy New, James Devine, Taylor Woodcock, Sophie Beck, Joe Finney, Mike Hazas, Nick Banks, Karen Smith, Tim Bailey
 In Living in the Internet of Things: Harnessing Economic Value (2019). IET, 2019

MakerArcade: Using Gaming and Physical Computing for Playful Making, Learning, and Creativity
 Teddy Seyed, Peli Halleux, Michal Moskal, James Devine, Joe Finney, Steve Hodges, Thomas Ball
 Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems, 2019

MakeCode and CODAL: Intuitive and Efficient Embedded Systems Programming for Education
 James Devine, Joe Finney, Peli Halleux, Michał Moskal, Thomas Ball, Steve Hodges
 Proceedings of the 19th ACM SIGPLAN/SIGBED International Conference on Languages, Compilers, and Tools for Embedded Systems, 2018

Awards

2021	**Gaming Accessibility challenge winner**, Microsoft	*Cambridge, England*
2020	**Hack for Good, Ability Hack, Software + Hardware = Inclusion challenge winner**, Microsoft	*Cambridge, England*
2018	**Associate Fellow of the Higher Education Academy**, Higher Education Academy	*Lancaster, England*
2017	**Staff impact award**, Lancaster University	*Lancaster, England*
2016	**PhD scholarship**, Microsoft Research	*Cambridge, England*

Talks & Presentations

Using the micro:bit and Jacdac for accessibility

MICRO:BIT LIVE 2021

Cambridge, England (Virtual)

December. 2021

- Delivered a talk on how the micro:bit can be used to build low-cost assistive technology.

Enabling more people to build low-cost assistive technologies

TECHABILITY 2021

Cambridge, England (Virtual)

October. 2021

- Delivered a talk on building low-cost assistive technology with the micro:bit and Jacdac.

Jacdac

MICROSOFT RESEARCH REDMOND LEARNING SERIES

Cambridge, England (Virtual)

Dec. 2020

- Delivered part of the Jacdac presentation to Microsoft Research leadership.

Citizen engineering: enabling community innovation

LANCASTER UNIVERSITY FACULTY CONFERENCE

Lancaster, England

Dec. 2019

- Invited talk at Lancaster University's Faculty of Science and Technology conference.

Turning Blocks into Code with MakeCode and CODAL

MICRO:BIT LIVE

Manchester, England

Oct. 2019

- Delivered an introductory deep-dive on programming the BBC micro:bit in C/C++.

Presenting Project Alava

MICROSOFT RESEARCH FACULTY SUMMIT

Redmond, USA

Jul. 2019

- Co-presented Project Alava, a project that enables novices to more easily connect, compose, and program microcontrollers.

Presenting Project Brookdale

MICROSOFT RESEARCH TECHFEST

Redmond, USA

Feb. 2019

- Co-presented Project Brookdale, a toolkit that allows fashion designers to more easily embed microcontrollers and sensors into garments.

Teaching & Mentoring

Intern Mentor

MICROSOFT RESEARCH

Cambridge, England (Remote)

Summer 2021

- Co-mentored two interns, Richard Lin and Jorge Garza over the summer period.

Module Technical Lead

LANCASTER UNIVERSITY

Lancaster, England

Oct. 2019

- Designed teaching materials for the undergraduate embedded systems module SCC369.

Dissertation Project Advisor

LANCASTER UNIVERSITY

Lancaster, England

Jan. 2016 - Sep. 2019

- Advised and assisted students undertaking their final year dissertation projects at Bachelors and Masters level.

Teaching Associate

LANCASTER UNIVERSITY

Lancaster, England

Jan. 2016 - Jan. 2018

- Taught on a range of modules, including: Advanced Programming, Embedded Systems, Operating Systems, and Networking.

Hobbies & Interests

Maker · Tinkerer · Hacker · Musician · Motorcyclist