

Dr. Duncan Hull

Yours truly, last updated on 24 May, 2024



# Contents



# Hello World



Figure 1: Hello my name is Duncan, this is what I look like now (left) and when I was a longer-haired undergraduate (right). I'm a lecturer here in the Department of Computer Science at the University of Manchester.

Hello and welcome to the Department of Computer Science at the University of Manchester. My name is Duncan and I'm a lecturer ( Assistant Professor) here with responsibility for managing our Industrial Experience (IE) program. I teach undergraduate & postgraduate students, supervise tutorials & projects while serving as industrial experience & employability tutor, departmental forum chair and a member of University senate. I'm interested in improving teaching, learning and the student experience by:

- Developing and delivering *Coding Your Future*: a course & guidebook for students at cdyf.me
- Updating students weekly on opportunities with the Wednesday Waggle newsletter at waggle.cs.manchester.ac.uk
- Improving students written communication skills by enabling them to start writing their future

- Engaging with a wide range of employers through our industry club
- Growing and building the teaching community by journal clubbing at [sigcse.cs.manchester.ac.uk](http://sigcse.cs.manchester.ac.uk) and serving on the board of [uki-sigcse.acm.org](http://uki-sigcse.acm.org)
- Supporting local schools teaching computing as a school governor and through the project coding their future
- Teaching engineers to make better software in collaboration with our industrial mentors

Our elective industrial experience program has up to 100 students every year working in paid employment for the penultimate (“sandwich”) year-in-industry of their undergraduate degrees. If you are an employer who would like to recruit a summer intern, placement student or graduate please get in touch.

## Full stack teaching

Regardless of the age or the stage, I enjoy the challenges of teaching and have taught english, maths, science and engineering to primary & secondary school children, undergraduates & postgraduates. In 2011, I completed a Postgraduate Certificate in Education (PGCE) at the University of Bath and worked as a high school science teacher in co-educational comprehensive (non-selective) state schools in Swindon, Shaftesbury and Stockport before returning to higher education. I serve as a school governor on the governing board of a school in Greater Manchester. As well as teaching in the UK I have also taught in India, Japan and America too.

## What's the story?

What's the story, Jackanory? Born in Bath, Somerset and raised using a secret West Country recipe, my story is a mixture of Natural Science (Plant Sciences, BSc), Computer Science (MSc & PhD) and software engineering. Outside of academia, I've worked as a consultant and software developer for BBC Monitoring, the Ford Motor Company and the National Health Service (NHS). As an academic, I have been part of the e-Science lab, Apache Taverna and myGrid projects and completed a postdoc at the Manchester Institute of Biotechnology (MIB) on the Pathtext project. This was followed by a

short stint as a software engineer of Chemical Entities of Biological Interest (ChEBI) at the European Bioinformatics Institute (EBI) in Cambridge, UK.

## Toolbox

This website was built using bookdown with R markdown, the R language, JavaScript, knitr, LaTeX, Pandoc, GitHub, Posit and TLC. The source code is available and the documentation in *Authoring Books and Technical Documents with R Markdown*. These pages are also available in one single pdf file and an ebook. Thanks to Yihui Xie and his collaborators for the handy tools and excellent documentation.

## Get a life!

Outside of work I sing a bassy-baritone in a local community show choir, look after bees and enjoy learning greek language and culture, preferably in a Taverna or on a beach in Greece. Α !



# **Part I**

## **DUNCANOME**



# Chapter 1

## Students

I teach, mentor, tutor, lecture on and supervise a variety of undergraduate and postgraduate courses. You can find me online during office hours, in the labs, my office hours, on youtube.com/@coding-your-future and in lecture theatres.



Figure 1.1: Posing on the BBC Breakfast red sofa with the winning team of the BBC / Barclays University Technology Challenge (UTC) in MediaCityUK, Salford

### 1.1 All years: Debug your future

If you'd like to debug your CV, application form, covering letter and job search etc, read debugging your future (?) and hacking your future (?), especially if you haven't written a CV, Résumé or LinkedIn profile before.

Once you've done this you can send me any relevant documentation and then:

- Drop-in to my weekly one-to-one CV clinics for Computer Science students online during term-time during my open office hours
- Get feedback on your CV from as many other people as possible, because “given enough eyeballs, all bugs are shallow” (?)

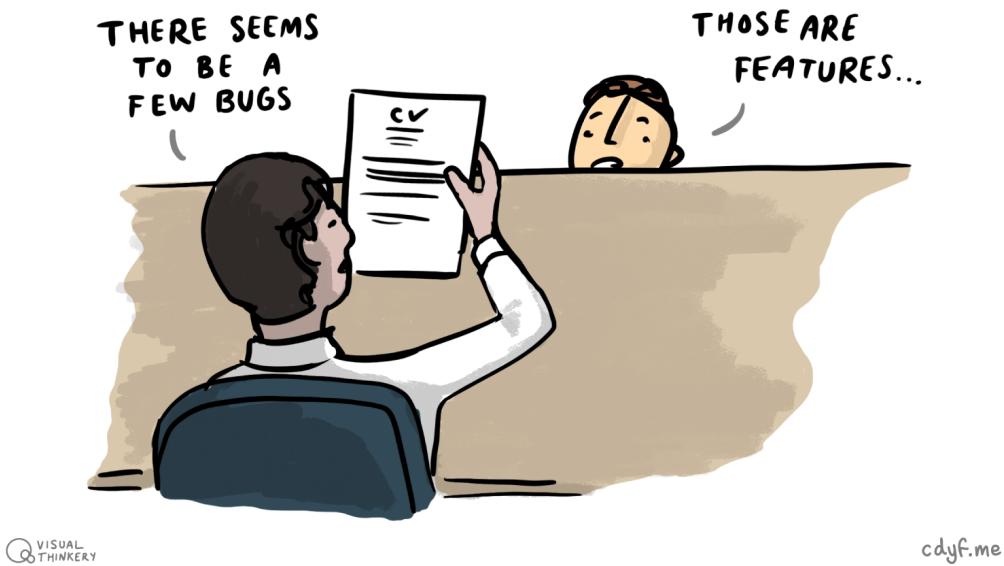


Figure 1.2: Is that a bug or a feature in your CV? It’s important to debug your CV before an employer sees it, see the Wednesday Waggle for details of my weekly live debugging sessions. Features not bugs picture by Visual Thinkery is licensed under CC-BY-ND

Outside of term time, it’s best to book a debugging appointment.

## 1.2 First year students

If you’re in your first year of study, I serve as:

- Academic staff member for First year team projects: COMP101 led by Ulrike Sattler (?), see the getting started with LaTeX lab manual

- Mentor and tutor to one group of six first year students
- Organiser of first year guest lectures, which mostly run in the second semester, February to May

## 1.3 Second year students

If you're in your second year of study, I serve as:

- Course leader for Coding your Future: COMP2CARS a course designed by me for (primarily) second year students to design, build, test and debug their futures in computing.
- Organiser of the labs for the software engineering mentoring program
- Teaching team member for second year software engineering: COMP23311, a course designed by Suzanne Embury (??)

Previously I served as second year tutor from 2016 through to 2020, and course leader for second year software engineering from 2020 to 2022.

## 1.4 Penultimate year students

If you're on placement during your penultimate year (your last-but-one), I serve as:

- Course leader for “with industrial experience” (IE), an elective and intercalated year in industry.
- Year tutor for students on placement, either face to face or via telecon

## 1.5 Final year students

If you're in your final year of study, you'll find me:

- Supervising final year educational projects based in secondary schools in Greater Manchester, see coding their future. (?)

## 1.6 Masters students

If you're doing a Masters degree, you'll find me:

- Leading the course on Principles of Digital Biology which covers Bioinformatics, Computational Biology and a bit of medical informatics
- Supervising Master of Science projects in Computer Science and Data Science. (?) This typically involves various combinations of Wikipedia, Wikidata, SPARQL (?) and chatbots. (?)

## 1.7 PhD students

If you've got any interesting PhD research ideas you like to pitch to me, particularly if they involve computer science education or professional issues, I'm all ears!

## 1.8 Extracurricular and flexible learning

Outside all of the above, I'm in flexible and extracurricular learning including:

- Organising, facilitating and promoting extra-curricular activities such as hackathons (??) and edit-a-thons. (???) These usually occur off-timetable, for example Wednesday afternoons, evenings and weekends.
- Judging competitions such as studenthack.com and greatunihack.com since 2014. These two hackathons are organised by UniCS, a student-led tech society formed by the merger of HackSoc (computer geekery) and CSSoc (socialising). Many other hackathons exist, they are usually aimed at beginners looking to learn new skills, rather than experts looking to compete. (??)
- Piloting the introduction of Microsoft Fundamental Certifications across the University in collaboration with the Flexible Learning Program see [cdyf.me/achieving#microsoft](http://cdyf.me/achieving#microsoft) and below. (?)

## 1.9 Teaching awards

Thanks to all the students at the University of Manchester Students' Union who nominated me for an academic advising champion award in 2024, see [manchesterstudentsunion.com/awards](http://manchesterstudentsunion.com/awards) and figure ???. These annual awards recognise the achievements of staff and students who have gone above and beyond to represent student interests. (?)

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## Google Chrome was not found. Try setting the `CHROMOTE_CHROME` environment variable
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Figure 1.3: Thanks to all the students at the UMSU who nominated me for academic advising award and thanks Sambbhav for recording it. UMSU is the largest students' union in the UK representing over 40,000 students. You can also watch the full 30 second video embedded in this figure at [youtu.be/pem8\\_lKUz0](https://youtu.be/pem8_lKUz0) (?)



# Chapter 2

## Employers

We work with a wide range of employers from the smallest bedroom startup to the worlds largest multi-national corporations, and are always looking for more organisations that can offer our students a stimulating working environment. According to [highfliers.co.uk](http://highfliers.co.uk), the University of Manchester is the most targeted University in the UK by the Times Top 100 Graduate Employers. (????) We can still do better, for example by engaging with a more diverse group of employers, especially those in Manchester and the Northern Powerhouse, see [git.io/manc](http://git.io/manc). (?????)

### 2.1 Recruiting students

If you are recruiting computer scientists and software engineers as a summer interns, placement students or as graduates please get in touch with me or Mabel Yau (careers and placements officer). We typically have around 250 undergraduate students graduating annually, alongside a smaller number of Masters and PhD students. The entry tariff of our students (A\* A\* A\* including mathematics) is comparable to other leading Computer Science (CS) departments in Russell Group universities as shown in the table below.

Institute	UCAS entry tariff
University of Manchester	A* A* A*
University of Cambridge	A* A* A

Institute	UCAS entry tariff
University College London	A* A* A
Imperial College London	A* A* A
University of Oxford	A* A A

If you are looking to recruit science and engineering students from other disciplines like Physics, Maths, Chemistry, Mechanical, Aerospace & Civil Engineering (MACE), Materials Science and Electrical & Electronic Engineering (EEE) you should talk to:

- academic staff in those departments and/or
- the central careers service of the University via [employers.manchester.ac.uk](http://employers.manchester.ac.uk)

## 2.2 Careers fairs

Our annual Computer Science careers fair is held in the Kilburn building in autumn, we typically have around 30 employers exhibiting over two days. As space is limited, we are always over-subscribed and are not able to accommodate every employer that our students will be interested in. We give priority to employers that offer internships, placements and graduate roles and have contributed to our community through the activities described on this page. The central careers service also organises:

- the big careers fair every autumn, see the events
- a smaller careers fair in May
- hundreds of other employer events on campus during term time (?)

## 2.3 Drop-in sessions

If you aren't willing or able to exhibit at careers fairs, we also run ad-hoc drop-in sessions where employers can come in and set up a stand in the foyer to talk to computer science students informally on their way to and from lectures. These usually happen during lunch in term time. If you're



Figure 2.1: Any employer recruiting our students is welcome to join our industry club, see details below

interested in exhibiting at either of these events, please contact the careers and placements officer Mabel Yau.

## 2.4 Industry Club



All employers are welcome to join our industry club mailing list by sending an email to [listserv@listserv.manchester.ac.uk](mailto:listserv@listserv.manchester.ac.uk) with the text **subscribe cs-industryclub yourfirstname yoursecondname** in the body of the email

message. The industry club is part of our wider business engagement activities.

The mailing list is low-traffic, typically two to three updates per year and an invitation to our annual industry club meeting. We promise not to spam you or sell your email details on to third parties.

## 2.5 Industrial mentoring

The Industrial mentoring scheme for software engineers allows employers meet students during code review sessions.

## 2.6 Co-supervised projects

If you would like to co-supervise a project student in collaboration with an academic member of staff, there are several options. The best option depends on the domain, level and duration of the project:

- **Bachelors projects:** these are completed in the final year of a Bachelors degree and last for six months, starting in September and finishing in March. Projects are proposed (and offered to students) in March and start in September of the same year.
- **Masters projects:** again these are six months in duration but start in March and finish in September. Projects are proposed (and offered to students) in the preceding November.
- **PhD projects:** For industrially sponsored or co-supervised projects, speak to the research office at [cs.manchester.ac.uk/research](http://cs.manchester.ac.uk/research).
- **Knowledge Transfer Partnerships:** We have a range of KTPs, speak to the research office for details
- **Impact Acceleration Accounts:** We have a range of IAAs, speak to the research office for details

For Bachelors and Masters projects, you can contact academic members of staff directly, or speak to Terence Morley (final year project lead) or Thomas Thomson, who leads our postgraduate taught (Masters) courses.

## 2.7 The Wednesday Waggle

During term time, we highlight events and vacancies for Computer Science students from a wide range of sources in a weekly newsletter called the *Wednesday Waggle* ([waggle.cs.manchester.ac.uk](http://waggle.cs.manchester.ac.uk)) . This goes out to around ~1500 Bachelors and Masters Computer Science students in Manchester each week. If you have vacancies or events you would like our students to know about, you can advertise them at [careerconnect.manchester.ac.uk](http://careerconnect.manchester.ac.uk), and let me know when they are live in the system, then I can highlight them to the weekly newsletter. Alternatively, point us to where they are advertised online, see advertising vacancies to students. It can help students find your needle in the jobs haystack.

## 2.8 Join the community

There is a thriving community of engineers and entrepreneurs in Manchester and across the North of England. One of the best ways to recruit engineers and scientists is to join and *contribute* to the community. Get involved in events, sponsor a hackathon, deliver a guest lecture, host your own event or become a software engineering mentor. Employers who engage **early and often** are much more likely to get something back. As an employer, you may also be interested in events run by:

- The Institute of Student Employers (ISE)
- The Association of Graduate Careers Advisory Services (AGCAS)
- The Work Based and Placement Learning Association (ASET)

If you're a startup new to employment, you may find the guide at [gov.uk/employ-someone](http://gov.uk/employ-someone) useful.

## 2.9 Buzzing!

At peak times, we can get **very busy** with many concurrent employer events on campus, see figure ???. Please be patient and persistent if we do not reply immediately. Unfortunately, we are not always able to respond to everyone because our students, staff and space are all finite resources. We give priority to employers that have already given their time and expertise to our community.

**Table 4.6 Universities Targeted by Largest Number of Top Employers in 2023-2024**

	<i>Ranking in 'Good University Guide' *</i>		<i>Ranking in 'Good University Guide' *</i>
<b>1. Birmingham</b>	<b>22</b>	<b>11. Bath</b>	<b>8</b>
<b>2. Manchester</b>	<b>23</b>	<b>12. Sheffield</b>	<b>18</b>
<b>3. Nottingham</b>	<b>32</b>	<b>13. Cambridge</b>	<b>3</b>
<b>4. Leeds</b>	<b>24</b>	<b>14. London King's College</b>	<b>xx</b>
<b>5. Bristol</b>	<b>16</b>	<b>15. Oxford</b>	<b>2</b>
<b>6. Warwick</b>	<b>9</b>	<b>16. Edinburgh</b>	<b>13</b>
<b>7. London University College</b>	<b>6</b>	<b>17. Glasgow</b>	<b>12</b>
<b>8. Southampton</b>	<b>17</b>	<b>18. London Imperial College</b>	<b>5</b>
<b>9. Durham</b>	<b>7</b>	<b>19. London Queen Mary</b>	<b>46</b>
<b>10. Exeter</b>	<b>11</b>	<b>20. Liverpool</b>	<b>29</b>

Source - The Graduate Market in 2024

\* *The Times & Sunday Times Good University Guide 2024*

Figure 2.2: According to highfliers.co.uk, the University of Manchester is the second most targeted University in the UK by the Times Top 100 Graduate Employers (?)

## 2.10 Employability

We are working hard to improve the employability of students because while having a Computer Science is necessary for some jobs, it is not sufficient. (????) Over the last decade we have been successful in *more than doubling* the number of our students going on year long placements in industry to around 100 per year, see figure ???. This is a win-win-win situation for:

1. **Students:** benefit from a broader education, and develop social and non-cognitive skills that can be challenging to teach and learn in a purely academic environment. This is known as the winning personality (?).
2. **Employers:** placements are a cost-effective way for employers to recruit (and retain) graduate talent
3. **Universities:** produce better graduates (?) with broader and deeper skills, who earn more and get better jobs (?). Well paid placements can also facilitate social mobility. (?)

Previously our students have secured year long placements at a wide range of

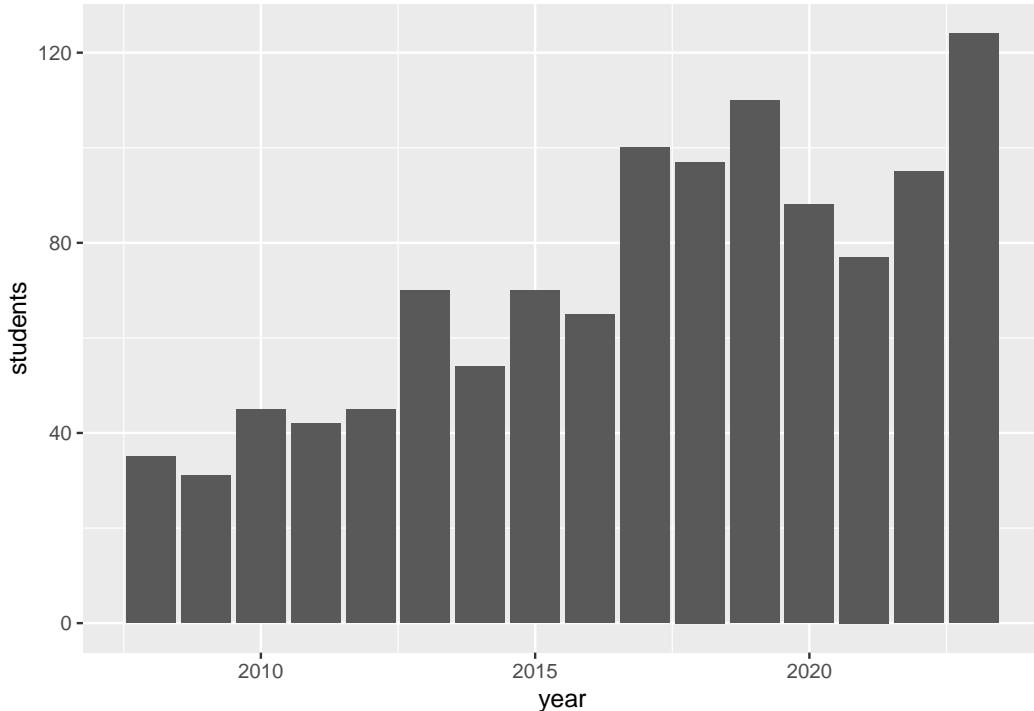


Figure 2.3: Number of undergraduate Computer Science students completing a year in industry as part of their degree at the University of Manchester. Since 2008 over 900 students have completed the program. I have been leading the program since 2012 and managed to ~double the number of students doing placements per year. As you can see in the histogram, the COVID-19 pandemic started having an effect on students starting placements in 2020.

employers including Accenture, Agilent Technologies, Amazon, AND Digital, Apadmi, Arggo, ARM, Autodesk, AVL Powertrain, BAML, the BBC, Biorelate, BJSS, Bloomberg, BMW Mini, Bsquare Controls, BT, Cantarus, Celtra, CERN, Codethink, d3t, Elysian Systems, Feral Interactive, Fidelity, FiveAI, HMRC, IBM, Imagination Technologies, Intel, ISA Software, JP Morgan, Keysight Technologies, KPMG, Matillion, McAfee, Mentor Graphics, Monoprix, Morgan Stanley, NCC Group, Nokia, Nomura, Novacoast, Ocado, PA Consulting, PwC, Schlumberger, ServiceNow, Siemens, Soda Software, SteamaCo, The Hut Group, The Start Up Factory, Uber, Visa and Vodafone.

There's still more we can do to improve the employability of our graduates. If you'd like to help our graduates become more employable, get in touch.

# Chapter 3

## Research

My research interests are in Computer Science Education and pedagogy. (???) I'm interested in methods that can improve learning and student experience using techniques like coding your future, journal clubbing, industrial mentoring, live music, working with schools, editing Wikipedia and more. Previously I've worked in bioinformatics, knowledge representation and reasoning and symbolic AI.



Figure 3.1: Too many educational practices are not backed up by good evidence that they actually work. More evidence is needed to support many of the claims made about effective pedagogy. *Wikipedian Protester* cartoon by Randall Munroe at [xkcd.com/285](http://xkcd.com/285) published under a Creative Commons Attribution-NonCommercial 2.5 License

### 3.1 SIGCSE

Computer Science has only been taught to undergraduates in the UK for 50 short years (??), so there's lots of open questions about how to teach the practical, theoretical and professional aspects of the subject. To that end:

- I'm an active member of the Association for Computing Machinery (ACM) and its Special Interest Group (SIG) in Computer Science Ed-

ucation ([sigcse.org](http://sigcse.org)). In 2020 I founded the ACM SIGCSE journal club and chair the monthly Manchester meetup. Anyone is welcome to join, see [sigcse.cs.manchester.ac.uk/join-us](http://sigcse.cs.manchester.ac.uk/join-us)

- I serve on the program committee of the United Kingdom and Ireland Computing Education Research (UIKICER) conference, on the board of UK ACM SIGCSE and have served on the program committee for Computing Education & Practice (CEP) conference at Durham University

## 3.2 Industrial mentoring

Since we started the industrial mentoring scheme for software engineers in 2015, more than 1000 students have been through the mentoring scheme with 250 students taking the course every year. We are very grateful for continued support from our industrial partners in making this happen.

Mentors meet with a group of six second year students for two one hour meetings and do some gentle code review of their gitlab repository, as they start to fix bugs and add features to a large open source software project. You don't *need* to be an expert in the tools students are using (Java, Eclipse, Jenkins, Git, JUnit and Ant) it is more about the general process (and politics) of building and testing high quality software in large and distributed teams, than the specifics of the [stendhalgame.org](http://stendhalgame.org) codebase we happen to be using. Mentors are typically software engineers, both junior and senior.

## 3.3 Coderdojo & Code Club

I'm a volunteer at [coderdojo.com](http://coderdojo.com) (?). Coder dojos are local community engineering clubs for young people; with several other volunteers I help out at CoderDojo North West. We meet once a month to help young people broaden their digital and computational horizons.

Previously I lead an after school CodeClub as part of a global network of free coding clubs for 9–13 year olds. (?) As with coderdojo, the aim is to have fun using Scratch, (?) python and other interesting technology we can get our hands on including Raspberry Pi, (?) Micro:bits, (?) LEGO® MINDSTORMS®, (??) Oculus Rift, Sonic Pi (?) and CodeBug etc.

## 3.4 Wikipedia

Wikipedia and wikidata.org (??) are powerful tools for improving both digital skills and communication skills, regardless of your age or level of computer literacy, (???) particularly in the following areas:

- Literacy generally, the ability to read and write in any natural language. The literacy skills of some engineers and scientists leaves plenty of room for improvement, but literacy has many overlapping dimensions including:
  - Data literacy the ability to read and write (data)
  - Digital literacy the ability to read and write (digitally)
  - Computer literacy the ability to read and write (using a computer)
  - Information literacy the ability to read and write (information)
  - Scientific literacy the ability to read and write (science). How many people do you know who *unashamedly* proclaim their scientific or mathematical illiteracy? (???)

As an experienced and long serving editor of Wikipedia since 2004, I organise and participate in Wikipedia training events which recruit new Wikipedia editors. Some recent examples include:

1. 2020-06-24 Wikipedia: Women, War and Peace run in collaboration with the Imperial War Museums' War and Conflict Subject Specialist Network, with support from the Arts Council England and Art Fund.
2. 2020-02-26 Wikimedia in Education UK Summit, Coventry University #wikiedu20
3. 2019-11-22 Training of Trainers (ToT) workshop, University of Glasgow
4. 2019-10-19 Learn to edit Wikipedia with Ada Lovelace, Sackville Street Building, University of Manchester (?)
5. 2019-10-12 Wikipedia Edit-a-Thon with Zebra Hub HQ, Pankhurst Centre, Manchester
6. 2017-10-13 Physiology Friday, Hodgkin Huxley House, Farringdon, London (?)
7. 2015-09-02 First Wikipedia Science Conference #wikisci, Wellcome Collection, London, NW1 (??)

More information on past and future events like this can be found at:

- [wiki-loves-scientists.org.uk](http://wiki-loves-scientists.org.uk)

- [en.wikipedia.org/wiki/User:Duncan.Hull](http://en.wikipedia.org/wiki/User:Duncan.Hull)

### 3.5 Tuning complete

Tuning complete started as a boy band in Manchester, Lancashire , named after the famous Computer Scientist Alan Tuning. We use his eponymous Tuning machine to make music which is quality assured using the Tuning test.



Figure 3.2: The founder members of Tuning Complete were Jez Lloyd, Steve Furber, Justin Timberfake and yours truly. With apologies to Richard Avedon and his psychedelic portraits of John, Paul, Ringo and George. Artwork by Jez Lloyd.

Our founding members, shown in figure ?? include:

- Jez Lloyd: Bachelor of Music, DJ and backing vocals
- Steve Furber: bass guitar.

- “All we’ve got is Steve’s guitar, three chords and the truth.” (??)
- Justin Timberfakie: lead vocals, lead dancer (?)
- Duncan Hull: MC,
  - synth (MicroKORG)
  - drum machine (Sonic Pi)
  - embarrassing dad dancing (?)

Theoretically, we are a Turing Complete band. (??) Artistically, this means that what we lack in youth, good looks, fame, fortune, fashion sense, fanbase and back catalogue we compensate for with:

- Musical geekery (??)
- Mathematical geekery (?)
- Computer geekery (?)

We played our debut gigs to packed theatres of over 200 second year & first year undergraduate computer science students in the autumn of 2019 and are currently planning future live events while writing a (hopefully) lucrative hit single, working title: #LivingTheDream. If you would like to book our services for your next event, hackathon, wedding, bar mitzvah etc, please contact our agent Mrs. Kilburn shown in Figure ??.

### 3.5.1 From boy band to musical collective

After several years of rehearsing, touring and time in the studio, we decided to invite women to join our boy band, because we soon realised they could do all the things we weren’t so good at such as:

- Singing
- Dancing
- Performing
- Looking good
- Reading and writing music
- Playing musical instruments

So, as of 2024, Tuning Complete are a musical collective with a fluid membership model, we’re always looking for new members to contribute. Newer members have included:

- Billie Fakish: guest vocalist (?)
- Olivia Fakerigo: guest vocalist (?)



Figure 3.3: Mrs. Kilburn is our manager, booking agent and promoter. She is the power behind our boy band throne, so all bookings must be approved and scheduled by her office. Please do not approach band members directly with gig requests or offers of marriage, we are all answered for!

- Faky Perry: guest vocalist (?)
- Faker Swift: guest vocalist (?)

If you can sing, dance or play a musical instrument and would like to join us, please get in touch.

## 3.6 Publications

Informal publications can be my lab log:

- [duncan.hull.name/lablog](http://duncan.hull.name/lablog)

Formal peer-reviewed publications can be found on DBLP, ORCID, Google Scholar, the ACM Digital Library, Wikidata etc:

- [dblp.org/pid/h/DuncanHull](http://dblp.org/pid/h/DuncanHull)
- [wikidata.org/wiki/Q47012855](http://wikidata.org/wiki/Q47012855)
- [dl.acm.org/profile/81350580198](http://dl.acm.org/profile/81350580198)
- [orcid.org/0000-0003-2387-503X](http://orcid.org/0000-0003-2387-503X)
- [europepmc.org/authors/0000-0003-2387-503X](http://europepmc.org/authors/0000-0003-2387-503X)

- [profiles.impactstory.org/u/0000-0003-2387-503X](http://profiles.impactstory.org/u/0000-0003-2387-503X)
- [scholar.google.com/citations?user=iDJ-t7IAAAJ](http://scholar.google.com/citations?user=iDJ-t7IAAAJ)
- [research.manchester.ac.uk/en/persons/duncan.hull](http://research.manchester.ac.uk/en/persons/duncan.hull)

According to Google scholar, my most cited papers are on:

1. Apache Taverna, published in *Nucleic Acids Research* (?)
2. Another Taverna paper, published in *Concurrency and Computation* (?)
3. A paper on modelling human metabolism, published in *Nature Biotechnology* (?)
4. A review of tools for managing large bibliographies, published in *PLOS Computational Biology* (?)

The first paper for which I was formally acknowledged was on simulated environmental change in the subarctic published in *New Phytologist* (?). I was a humble field assistant, not a co-author, one of the *absolut* best summer jobs I've ever had!



# Chapter 4

## Coding your future

Your future is bright, your future needs coding. So let's start coding your future.

*Coding your Future* is a guidebook written to help students design, build, test and code their futures in computing, see figure ???. Written by yours truly, (?) the full text of the book is freely available online at [www.cdyf.me](http://www.cdyf.me). If you'd prefer to read it in ebook format, you can also download it in a single file, see section ??.

### 4.1 Reading your future

Coding your future is a guidebook and course is aimed at ALL students in higher education. While the guide supports undergraduate teaching at the University of Manchester, it doesn't actually matter:

- *where* in the world you are studying
- what *stage* of your degree you are at, from first year through to final year
- what *level* you are studying at, foundation, undergraduate or postgraduate
- what *institution* you are studying at, this book is University and institution agnostic
- what *subject* you are studying, as long as you are **computationally curious**

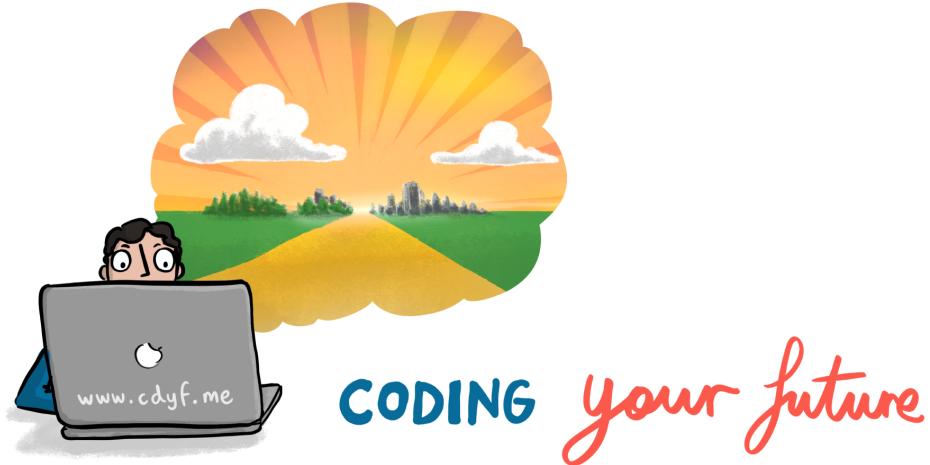


Figure 4.1: Coding your Future is a guidebook to help students design, build, test and code their futures in computing, see [www.cdyf.me](http://www.cdyf.me). *Coding your Future* illustration by Visual Thinkery is licensed under CC-BY-ND

*Coding your Future* has something for any student of computing, both those inside and outside of Computer Science departments.

## 4.2 Downloading your future

The full text of the guidebook is freely available at [www.cdyf.me](http://www.cdyf.me), this means the web version (that's all the `*.html`) is searchable, browsable and linkable in any web browser on your phone, tablet or desktop computer. If you'd prefer to read the guidebook in a single ebook file, you can download a copy at:

- [cdyf.pdf](http://cdyf.pdf)
- [cdyf.epub](http://cdyf.epub)

Since the guidebook is published open access and open source, I welcome constructive feedback from students, employers, academics and any other contributors, see [cdyf.me/#contributing](http://cdyf.me/#contributing)

# Chapter 5

## Coding their future

Their future is bright, their future needs coding. So let's start coding their future...

Coding their future is a collaboration & partnership between secondary schools and the Department of Computer Science at the University of Manchester.

For:

- Coding **YOUR** future: a guidebook for students, see [cdyf.me](http://cdyf.me)
- Coding **THEIR** future: a collaboration between secondary schools in Greater Manchester and the University of Manchester, read on...

Our aims are to:

- improve and support computing education before, during and after GCSE Computer Science, particularly at key stages 3, 4 and 5. (????)
- widen participation in higher education, especially in under-represented groups. (????)
- enable our undergraduate students to develop their leadership and communication skills by working with young people in the classroom

The University provides schools with a final year student who can teach Computer Science in your school or college as a teaching assistant (TA). In return, the school provides our undergraduate students with a safe and supportive environment in which to teach which extends and augments your

the art of teaching and  
learning the discipline of  
computer science

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Computer  
science education

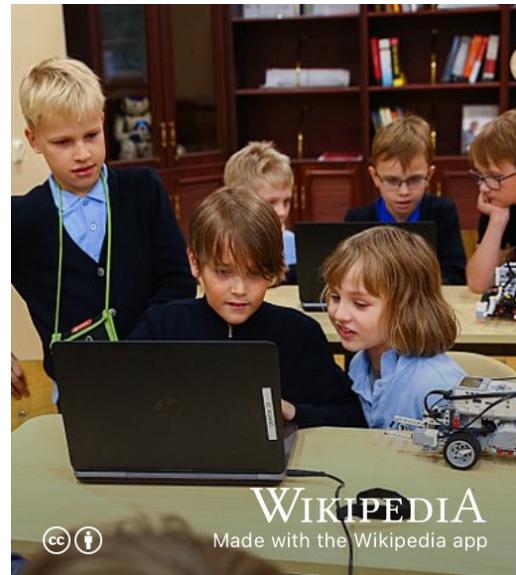


Figure 5.1: Is it art or is it science? It's both: Undergraduate students regularly practice the art of computer science education in secondary schools as part of our wider social responsibility activities (??) and schools, colleges and public activities Picture of children coding adapted from an original by Arno Mikkor on Wikimedia Commons w.wiki/65A2 using the Wikipedia app

current curriculum. This can either be an after school, extension / lunchtime club or during scheduled lesson time, typically between year 7 and 13. This is similar to the Undergraduate Ambassador Scheme (UAS), (??) and school placements (?) except students work is assessed using our final year project framework. (??)

## 5.1 Schools participating in Coding Their Future

Since these projects were started in 2012, our undergraduate students have worked in twenty different schools in Greater Manchester. Participating organisations are mostly non-selective state schools, to align with the University of Manchester's values of social responsibility and civic engagement. Current and previous participating schools are shown in table ??, ranked by the percentage of their students entitled to free school meals (FSM).

Table 5.1: Schools our undergraduate students have worked with in teaching computing in since 2013, ordered by the percentage of students entitled to free school meals (FSM). As of 2023, the UK average for students entitled to FSM according to gov.uk is **23.8%**. (?) This number has been increasing over the last decade as the UK falls behind on tackling child poverty (??) Note that all private schools have an FSM percentage of zero because their students do not qualify for benefits, which makes it difficult to compare intakes of state and private schools. It seems likely that children in private schools probably don't need free school meals anyway.

School	Location % FSM via gov.uk
theeastmanchesteracademy.co.uk	Beswick 65.9%
manchestercommunicationacademy.com	Harpurhey 54.9%
wrhs1118.co.uk	Whalley 41.6%
	Range
stpetershigh.com	Longsight 41.4%
allhallowssalford.com	Salford 37.4%

School	Location % FSM via gov.uk
thebarlowrchigh.co.uk	Didsbury 37.2%
didsburyhighschool.org.uk	Didsbury 35.6%
stannes.academy	Stockport 34%
pwhs.co.uk	Didsbury 31.3%
utcmediacityuk.org.uk	Salford 31.3%
trinityhigh.com	Hulme 31.1%
whgs-academy.org	Whalley 30.9%
	Range
<b>“Bog Standard Comprehensive”</b>	<b>Anywhere 23.8%</b>
fairfieldhigh.tameside.sch.uk	Droylsden 23.1%
laurusheadlehulme.org.uk	Cheadle 16.6%
	Hulme
knutsfordacademy.org.uk	Knutsford 12.4%
chhs.org.uk	Cheadle 11.1%
	Hulme
blue-coat.org	Oldham 10.3%
stretfordgrammar.com	Stretford 9.9%
agsb.co.uk	Altrincham 8%
aggs.bright-futures.co.uk	Altrincham 6%
mgs.org	Rusholme 0%

The project was setup by Duncan Hull and David Rydeheard and is now run by Duncan. There are lots of open questions about how Computer Science should be taught. (????) To find out more, see the guidance for teachers and guidance for students below.

There's a well documented shortage of Computer Science teachers in the UK.(???) Students working in schools can address this issue by learning from and supporting current teachers of Comptuer Science.

## 5.2 Guidance for teachers

Our aim is to support the teaching and learning of Computer Science in your school and to help engage schoolchildren in the subject. This page describes what we can provide you with and what we expect to get in return.



Figure 5.2: An abundance of free software and relatively cheap new hardware like the Raspberry Pi (?), Microbit, (?) Makey Makey [?; ?;] Crumble Controller and Arduino (?) has opened up lots of new possibilities for teaching Computer Science. Picture via Alex Bate. (?)

### 5.2.1 What the University is offering your school

The University of Manchester will provide your school or college with at least one student ambassador with some relevant training who has completed two years of study in Computer Science and has:

- A good knowledge of, and enthusiasm for Computer Science
- Completed Disclosure and Barring Service (DBS) clearance
- An interest in teaching and working with young people
- Achieved a minimum of a 2:1 or 1st class degree in their second year

### 5.2.2 What the University expects from your school

In return, we expect that the school provides the undergraduate student with:

- Opportunities to engage with a classroom or after school club of children as a Teaching Assistant (TA). This is typically for around one or two hours during term time. Initially, this could be through classroom observation and teacher assistance, culminating in the student delivering at least one lesson (and potentially a series of lessons) with your support and guidance
- Advice, suggestions, feedback, assessment and encouragement from you to suggest the kinds of resources that would be useful, appropriate or engaging for the Computer Science curriculum you are teaching

- Classroom and behaviour management: the students are not trained teachers and will be relying on your expertise in classroom and behaviour management.

### 5.2.3 Resources developed by students

Undergraduates typically develop a range of resources. The project will involve development of a computer-based system together with supporting activities, lessons and resources. The resource could be a variety of things including, a game, robotics, animations, hardware (Raspberry Pi, Arduino etc) or software, intended to enthuse school students at one of the Key stages 3 or 4 about fundamental concepts in computing preferably linked to one of the new Computer Science curricula.

### 5.2.4 Project timing

The projects run for 6 months from September to March, divided into three phases.

1. **September to October** Observation in the classroom teaching by the student around once per week. Development of ideas for an educational tool that the student will make, with the advice of the classroom teacher
2. **November to January** From November to January, our students develop and tests prototype tool (or tools) with the supporting material, this can happen sooner for students who make a quick start to the project.
3. **February to April** From February to April, our students are expected to liaise closely with teachers to develop an educational tool that will be of use in the classroom using teachers' suggestions as to what is appropriate to build. Students will spend some time in a classroom working closely with teachers and students developing and delivering a new resource for teaching. More details on final year projects can be found in COMP300, the undergraduates already know what is required from their project

### 5.2.5 Assessment and monitoring

Formal supervision and mentoring is undertaken by the university (Duncan and David), but we will ask you to fill in a one page form on your assessment of their progress during their time at your school, we very much value your input and hope that these projects can be beneficial for both your school and the University. We don't want to burden you with unnecessary bureaucracy that all teachers battle with!

## 5.3 Guidance for students



Figure 5.3: Lecture theatre 1.1 (LT 1.1) in Kilburn full of first year students

So why would you, an undergraduate student, want to work on an education project in secondary school? The UK government would like Computer Science should be taught in all secondary schools in the UK. (?) However, in many UK schools there is a shortage of teachers who are trained in Computer Science, consequently, many teachers find themselves being asked to teach a subject they may know little about. (?)

Undergraduate students can make a significant difference here, by supporting teachers in the classroom to create and deliver new classroom resources in Computer Science. (?) In addition, undergraduate students will have the chance to:

- develop leadership skills in the classroom
- gain valuable experience of working on “real world” problems in a stimulating environment

- improve your communication skills, especially spoken communication work as part of a team (in the school) and join a small group of like-minded undergraduate students (in the University) working on related projects
- test your knowledge & technical ability in a challenging and dynamic environment working with young people
- last, but not least, there is a good chance you will have lots of fun and have a rewarding experience of teaching make yourself more employable by doing all of the above

### 5.3.1 Who is involved?

Initially, the number of undergraduate students involved in these projects will be less than ten. We also require that you will have a minimum of a 2:1 or 1st in your second year exams. Projects are co-supervised by Duncan with additional supervision from an experienced member of teaching staff at a participating school.

We have carefully selected schools in Manchester that are relatively easy for you to get to, are already teaching Computer Science and have supportive staff and teachers in place to help you. You will be expected to work directly with school children with the support of the teaching staff in your school. Schools we have worked with are all the Manchester area.

### 5.3.2 What will the educational projects be expected to deliver?

You will be expected to work closely with the teacher to develop resources that

- engage students with one or more aspects of the new Computer Science curriculum at an appropriate key stage. This is usually key stage 3, key stage 4 or key stage 5 ages 11-18.
- complement **and extend** the schools current provision for computer science in the school
- a substantial piece of software or hardware, this is a requirement for all projects in Computer Science

During the project you will be spending a significant amount of time in the

classroom, visiting your school every week during school term time throughout the duration of your project to develop resources. These must include a computer-based teaching tool which may use, for example, Raspberry Pi's, visual aids, demonstrations, videos, online questionnaires, formative feedback, games, drones, robotics, music, (?) algorithms (?) or even just the command line (?) etc.<sup>1</sup> In addition, guidance on classroom use, such as a lesson or series of lessons to support the tool. Remember that you don't actually need a computer, see Computer Science Unplugged: Computer Science without a Computer. (?)

All deliverables for standard final year projects will be expected of these projects including:

- first semester presentation
- demonstration of the resource being used in the classroom
- final written report

Assessments for these projects will be as for standard projects, (??) but part of the evaluation of the project will be a classroom demonstration, a description and evaluation of which should be included in your final report.

### 5.3.3 Blended learning

COVID 19 has changed teaching, from primary and secondary school right through to higher education. You need to get clued up on blended learning. Start with Moving to Blended Learning, Part 1: Terminology and Concepts, then take a look the video below with Steve Pettifer explaining techniques for slides that work for blended learning videos:

When you teach, think about how you can support students before and after your time in the classroom.

### 5.3.4 When do the projects start and finish?

Projects start annually in September and are handed at Easter time, see final year project guidelines. For more information contact Duncan Hull.

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<sup>1</sup>Conquer the command line is part of the The MagPi essentials series, there are lots of others like it you may find useful on using the camera module, gaming in python, simple electronics and more at <https://store.rpipress.cc>

Figure 5.4: If you're making presentations for students to watch before or after your lessons, its worth spending some time thinking about how to make your slides video friendly. You can also watch the full 7 minute video embedded in this figure at [youtu.be/Y50mTVIzAYk](https://youtu.be/Y50mTVIzAYk) (?)

## 5.4 Getting a head start

So you've selected *Coding their future* as your third year project and now you are ready to get started. There are plenty of resources to help you prepare and improve your effectiveness in the classroom.

- **Work with young people**
  - Any experience of working with young people will be beneficial, if you have the time and opportunity over the summer you can get some experience of working with young people for example through codeclub.org and coderdojo.com. If you're in Manchester over the summer, see mrcoderdojo.org.uk which meets every month at the Manchester Technology Centre on Oxford Road, they are always looking for new volunteers.
  - It doesn't have to be coding either, you could get involved with any activities such as sporting events or others, see find-volunteering.manchester.ac.uk
- **Read around** There are lots of really good articles and books to help you, I recommend you start with:
  - *Teaching Computing* (?) by Carl Simmons & Claire Hawkins, is aimed at teachers of computing, particularly trainee computer science teachers. e-book available here, University of Manchester login required
  - *Computer Science Education* (?) edited by Sue Sentance, Erik Barendsen and Carsten Schulte. Only available in print form, useful for reference
  - *The Cambridge Handbook of Computing Education Research* edited by Sally Fincher and Antony V. Robins (?), electronic copies available at doi.org/gb5d (UoM login required) this is a comprehensive overview of the field, useful for reference
  - *Hello World* magazine, see helloworld.raspberrypi.org is packed full of ideas for teaching computing (and its free too)
  - *Quick Reads* give short two page introductions to teaching computing, see blog.teachcomputing.org/tag/quickread
- **Do some courses** there are lots of free Open University courses to get prepared for teaching:
  - Impact of Technology: How To Lead Classroom Discussions. Learn how to keep 14-16 year-old students engaged in discuss-

- sions while teaching computer science. Supported by Google [futurelearn.com/courses/impact-of-technology](https://futurelearn.com/courses/impact-of-technology)
- Teaching Physical Computing with Raspberry Pi and Python [futurelearn.com/courses/physical-computing-raspberry-pi-python](https://futurelearn.com/courses/physical-computing-raspberry-pi-python)
  - Since some of your teaching is likely to be asynchronous, you would also benefit from having a look at taking your teaching online from OpenLearn
  - Many more Teaching Computing Courses at [futurelearn.com/subjects/teaching-courses/teaching-computing](https://futurelearn.com/subjects/teaching-courses/teaching-computing)
- **Join the community** The UK Special Interest Group (SIG) on Computer Science Education (CSE) has monthly events listed online at [uki-sigcse.acm.org/events](https://uk-sigcse.acm.org/events), these cover computing events from primary through to secondary and higher education

# Chapter 6

## Will you be my referee?

As industrial experience and employability tutor, I get asked to write *lots* of references for students applying for jobs and further study, see figure ???. I'm happy to do this if:

- You have been my personal tutee in first, second, placement or final year
- We have worked together outside of ordinary teaching

However, it's impossible for me to say YES to every request for a reference. It is difficult for academics to write references for students they don't know much about, as all they can do is confirm facts (attendance, academic marks, degree program) without opinions which doesn't make for a very compelling reference.

For progressing students, you can obtain an unofficial copy of your transcript by emailing [soe.hub@manchester.ac.uk](mailto:soe.hub@manchester.ac.uk). For graduating students, transcripts of marks can be obtained at [man.ac.uk/fQ9otX](http://man.ac.uk/fQ9otX)

Whoever agrees to be your referee, make sure you read and understand the following:

### 6.1 Who can provide a reference for me?

The best person to provide a reference for you is somebody who knows you, such as your personal tutor. See the careers service guide what are references

Referees may be assisted by umpires, linesmen, timekeepers, or touch judges

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Referee

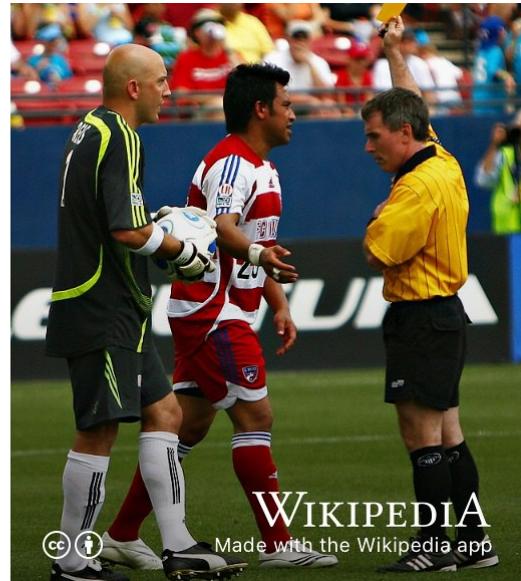


Figure 6.1: Come on ref! I'm not *that* kind of referee, but I *can* provide facts and opinions about you to employers subject to conditions outlined on this page. Whoever your referee is, make sure you ask their permission beforehand, otherwise you may receive an unexpected (virtual) penalty card from your referee. CC BY image of a referee by Jason Gulleedge on Wikimedia Commons w.wiki/3dqE adapted using the Wikipedia app

and how should I choose a referee? and guidance to staff providing references for students from the University of Manchester, which gives extra context.

It is good to have references from different sources, so if you are providing several referees try to pick people from inside and outside the University. Within the University, this is most likely to be your tutor:

- Your personal tutor from year one
- Your personal tutor from year two (if different to first year)
- Your Industrial Experience (IE) tutor (sometimes that's me)
- Your third year project supervisor
- Your Masters project supervisor
- Anyone else who knows you personally

If you ask somebody who does not know you very well to write a reference for you, all that they are able to do in a reference is confirm rather dull facts such as your grades, your attendance, start date and graduation date. As I've already said, this does not make for a very useful reference.

## 6.2 Should I ask permission from my referee?

You should always ask the person providing your reference, see figure ??.

## 6.3 What is a reference for?

References have two main purposes:

1. Providing and confirming *facts*
  - i. to give a factual account, e.g. of academic record, attendance, etc
  - ii. to confirm the accuracy of statements made in an application
2. Providing *opinions*
  - i. to give the referee's opinion as to the candidate's suitability for the post/course in question, and his/her potential for the future

## 6.4 How can I help my referee?

It can make it much easier for your referee if you provide them with information you would like them to mention in your reference. This might include:

- an updated CV
- comments on your character
- any relevant experience you have
- any relevant projects you have completed
- specific aspects of your academic performance
- what the reference is for e.g. a job, Masters or PhD application

All of this information will help your referee to write a better reference for you.

## **6.5 Can I have a copy of my reference?**

It is unusual for a referee to provide a reference directly to its subject (that's you).

Typically, a referee is asked to provide a reference for a student (or former student) directly by the organisation concerned. For example, if you're applying for postgraduate study, the reference request will be sent by the University directly to your referees email address, who will usually respond by clicking on a link to upload the reference document.

You can, once you're employed, make a request to see your reference under data protection law.

# Chapter 7

## Contact

You can get in touch using the details below, which include directions and parking information.

### 7.1 Kilburn office

My office is LF25 in the Kilburn building shown in figure ???. From the Byte cafe on the lower first floor, go through the double doors on the South side of the building and down the ramp. LF25 is at the bottom of the ramp on the right, see [bit.ly/Kilburn-lower-first-floor](http://bit.ly/Kilburn-lower-first-floor).

- Room LF25, Kilburn Building
- email: `duncan.hull ATE manchester.ac.uk` where ATE=@
- telephone: +44 161 275 6186
- [linkedin.com/in/duncanhull](https://www.linkedin.com/in/duncanhull)

Details of my office hours can be found in the Wednesday Waggle.

### 7.2 Student support

I might not be the best person to talk to, depending on what you want. If you're a student, you might be better off contacting student support in person by the neon signs in the engineering building, see figure ??.



Figure 7.1: Paying homage to Alan Turing at a mural on the Princess Parkway by tankpetrol.com. According to Jonathan Swinton, Turing is the “patron saint of Manchester” (?). As a Manchester icon, he is commemorated locally by the Alan Turing building, the Alan Turing Memorial, some blue plaques and the Alan Turing Way (?)



Figure 7.2: A panoramic picture of the Kilburn building taken from the Oxford Road. The building stands next to University Place, shown in the right of the picture here, which looks a bit like a giant tin of baked beans.



Figure 7.3: The Student Support office on the first floor of the engineering building are here to help you, they should be your first port of call. If you have something more specific about a personal, academic or employment issue I can help.

You can also contact student support online at [www.studentsupport.manchester.ac.uk](http://www.studentsupport.manchester.ac.uk) or via one of the emails below.

Query	contact
General UG & PGT Queries	<a href="mailto:soe.programmes@manchester.ac.uk">soe.programmes@manchester.ac.uk</a>
Appeals and Conduct	<a href="mailto:soe.appealsandconduct@manchester.ac.uk">soe.appealsandconduct@manchester.ac.uk</a>
Assessment and Progression	<a href="mailto:soe.assessment@manchester.ac.uk">soe.assessment@manchester.ac.uk</a>
Attendance Queries and Issues	<a href="mailto:soe.attendance@manchester.ac.uk">soe.attendance@manchester.ac.uk</a>
Programme Changes	<a href="mailto:soe.programmes@manchester.ac.uk">soe.programmes@manchester.ac.uk</a>
Course Unit Changes	<a href="mailto:soe.courseunits@manchester.ac.uk">soe.courseunits@manchester.ac.uk</a>
Mitigating Circumstances, support and Welfare	<a href="mailto:soe.wellbeing@manchester.ac.uk">soe.wellbeing@manchester.ac.uk</a>
Placements	<a href="mailto:soe.placements@manchester.ac.uk">soe.placements@manchester.ac.uk</a>
Timetabling	<a href="mailto:soe.timetabling@manchester.ac.uk">soe.timetabling@manchester.ac.uk</a>
Student Data	<a href="mailto:soe.studentdata@manchester.ac.uk">soe.studentdata@manchester.ac.uk</a>
Student Support Hub	<a href="mailto:soe.hub@manchester.ac.uk">soe.hub@manchester.ac.uk</a>
Student Experience <sup>1</sup>	<a href="mailto:soe.studentexperience@manchester.ac.uk">soe.studentexperience@manchester.ac.uk</a>
Visas	<a href="mailto:visas@manchester.ac.uk">visas@manchester.ac.uk</a>
Any Other Business (AOB)	<a href="mailto:soe.programmes@manchester.ac.uk">soe.programmes@manchester.ac.uk</a>

If you provide the following information in your email, they will be able to

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<sup>1</sup>for FSE careers bulletin

respond to your query more efficiently:

- Name of Department (e.g. Computer Science)
- Student ID Number
- Programme of Study
- Brief description of how we can assist you

### 7.3 Postal address

Send post by carrier pigeon or snail mail to:

Dr. Duncan Hull  
Lecturer  
Department of Computer Science  
Kilburn Building  
The University of Manchester  
Oxford Road  
Manchester  
M13 9PL  
Lancashire



Figure 7.4: A panoramic picture of the South entrance of the Kilburn building with the Oxford Road on the left hand side of the picture.

## 7.4 Kilburn building directions

The Kilburn building shown in figure ?? is about 20 minutes walk from either Manchester Piccadilly (MAN) or ten minutes from Manchester Oxford Road (MCO). Our official postcode (M13 9PL) takes you to University Place (which looks like a giant tin of baked beans) next door, so you're better off using the what3words locations (?) below which are more accurate:

- Google map of the Kilburn building [bit.ly/directions-to-kilburn-building](http://bit.ly/directions-to-kilburn-building)
- There are two ground floor entrances to the Kilburn building, North and South
  - North entrance: [what3words.com/port.museum.rips](http://what3words.com/port.museum.rips), see figure ??
  - South entrance: [what3words.com/common.wiping.email](http://what3words.com/common.wiping.email), see figure ??
- There is no formal reception so the best place to meet is [bit.ly/ByteCafe](http://bit.ly/ByteCafe) on the first floor
- See also [cs.manchester.ac.uk/about/maps-and-travel](http://cs.manchester.ac.uk/about/maps-and-travel)



Figure 7.5: A panoramic picture of the North entrance of the Kilburn building with the Oxford Road on the right hand side of the picture.

## 7.5 Parking

If you are driving, the nearest car parks are: