

Dr. Duncan Hull

Contents

About	5
Background	5
Full stack teaching	6
Tools	6
1 Students	7
1.1 All years: debug your CV	8
1.2 First year	8
1.3 Second year	8
1.4 Penultimate year	8
1.5 Final year	9
1.6 Masters	9
1.7 Extra-curricular	9
2 Employers	11
2.1 Recruiting students	12
2.2 Careers fairs	12
2.3 Drop-in sessions	13
2.4 Industry Club	13
2.5 Industrial mentoring	14

2.6	The Wednesday Waggle	14
2.7	Buzzing!	14
3	Research	17
3.1	SIGCSE	17
3.2	Industrial mentoring	18
3.3	Vertical tutoring	18
3.4	Code Club	18
3.5	Wikipedia	19
3.6	Informal publications	19
3.7	Formal publications	19
4	Vertical tutoring	21
4.1	Full stack mentoring	21
4.2	What is it good for?	23
4.3	How long will all this take?	23
5	Coding their future	25
5.1	Guidance for teachers	26
5.2	Guidance for students	28
6	Contact	31
6.1	Office	32
6.2	Elsewhere	32
6.3	Postal address	33
6.4	Kilburn building directions	33
6.5	Parking	33

About



Hello, my name is Duncan. I'm a lecturer in the Department of Computer Science at the University of Manchester where I lead the Industrial Experience (IE) program. This elective course has over 100 students every year working for 12 months in industry in the penultimate year of their degree.

I teach undergraduate courses, supervise tutorials, final year projects and masters projects. I serve as second year tutor, employability tutor, while also serving on the mitigating circumstances committee and the exam board. I'm interested in methods that can deliver high quality learning and student experience by using innovative techniques like vertical tutoring, industrial mentoring, live coding, Wikipedia editing and live / recorded music.

If you are an employer who would like to recruit a summer intern, placement student or graduate please get in touch. During term time, we highlight opportunities for students in the Wednesday Waggle.

Background

My background is a mixture of Natural Sciences (Plant Sciences, BSc), Computer Science (MSc & PhD) and software engineering. I've worked as a consultant and software developer for various organisations including BBC Monitoring, the Ford Motor Company and the National Health Service (NHS).

While working on Apache Taverna and myGrid I completed a PhD at the University of Manchester. This was followed by a postdoc at the Manchester Institute of Biotechnology (MIB) on the Refine project and a stint as a software engineer on Chemical Entities of Biological Interest (ChEBI) in Cambridge, UK at the European Bioinformatics Institute (ebi.ac.uk).

Full stack teaching

I have taught english, maths, science and engineering at a range of levels from primary through to postgraduate. In 2011, I completed a PGCE at the University of Bath and trained at co-educational non-selective state-funded schools in Swindon, Shaftesbury and Stockport before returning to higher education. Regardless of the age or the stage, I enjoy the challenges of teaching and have taught primary & secondary school children (K–12), undergraduates & postgraduates in the UK, India and America.

Tools

This website is written in R markdown and built using bookdown, gitbook, JabRef, JavaScript, knitr, LaTeX, Pandoc, RStudio and Visual Studio Code. Thanks to Yihui Xie for the excellent tools and documentation. The source is available on github, but you'll be better off reading the manual *Authoring Books and Technical Documents with R Markdown* first. If you're reading this on an iPhone or iPad, there is known bug with the menu bar at the top of this page which means the menu might not display properly. I could have (should have?) used blogdown and Hugo, but opted for bookdown because it is much ~~less-bloated~~ easier to use.

Chapter 1

Students

I teach, mentor, tutor, lecture on and supervise a variety of undergraduate and postgraduate courses. You can find me in the labs, my office and the lecture theatre.

`\begin{figure}`



`{`

`}`

`\caption{Question everything, or Nullius in verba as the say at the Royal Society} \end{figure}`

1.1 All years: debug your CV

- You can drop-in to my weekly one-to-one CV clinics for Computer Science students in LF25 during term-time.
- If you haven't written a CV (two pages), résumé (one page) or LinkedIn profile before, you might find the *Debug your CV* guide useful at git.io/mycv.
- Get feedback on your CV from as many people as possible, because “given enough eyeballs, all bugs are shallow” (Raymond, 1999)
- Outside of term time, it's best to book an appointment

1.2 First year

- Teaching on First year team projects: COMP101 led by Ulrike Sattler
- Mentoring one group of six first year students
- Organising first year guest lectures, which mostly run in the second semester, February to May

1.3 Second year

- Teaching on Second year software engineering: COMP23311 led by Suzanne Embury
- Organising the labs for the software engineering mentoring program
- Leading second year tutorials COMP2CARS which focus on wellbeing and working out your next steps.

1.4 Penultimate year

- Leading the course for “with industrial experience” (IE), an elective and intercalated year in industry.
- Visiting students on placement

1.5 Final year

- Supervising final year educational projects based in secondary schools in Greater Manchester, see coding their future. (Hull, 2019a)

1.6 Masters

- Supervising Master of Science projects in Computer Science and Data Science. (Wickham and Grolemund, 2017) This usually involves some combination of Wikipedia, Wikidata, SPARQL (DuCharme, 2013) and chatbots. (Sharwood, 2019)

1.7 Extra-curricular

- Organising, facilitating and promoting extra-curricular activities, usually off-timetable (for example Wednesday afternoons, evenings and weekends). I'm proud to have served as a judge of the fantastic studenthack.com and greatunihack.com since 2014. These hackathons (Fogarty, 2015) are organised by UniCS, a student-led tech society formerly known as HackSoc and CSSoc.

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 (Birchall, 2019b) (Birchall, 2019a) (Birchall, 2019c), 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. (Hull, 2019b)



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* AA including A* in mathematics) is comparable to other leading universities in the Russell Group as shown in the table below.

University	Entry tariff	Students per year
Cambridge	A* A* A	~100
Oxford	A* A A	~50
Imperial	A* A A	~200
Manchester	A* A A	~250

If you are looking to recruit science and engineering students from other disciplines like Physics, Maths, Chemistry, MACE, Materials and EEE you should talk to the Careers Service centrally at careers.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. The central careers service also organises:

- the big careers fair in Manchester Central every autumn, see the Big Careers Fair
- a smaller careers fair in Fallowfield Armitage centre in May
- hundreds of other employer events on campus during term time (Birchall, 2019b)

2.3 Drop-in sessions

If you aren't 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 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 with the 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 The Wednesday Waggle

During term time, we highlight events and vacancies for Computer Science students from a wide range of sources in the Wednesday Waggle. If you have vacancies or events you would like our students to know about, get in touch with us or contact the careers service.

2.7 Buzzing!

At peak times, we can get **very busy** with many concurrent employer events on campus. (Birchall, 2019b) 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 5.8 Universities Targeted by the Largest Number of Top Employers in 2018-2019

	Ranking in 'Good University Guide' *		Ranking in 'Good University Guide' *
1. Manchester	20	14. Exeter	12
2. Bristol	19	15. Edinburgh	28
3. Birmingham	14	16. York	22
4. Warwick	10	17. London School of Economics	9
5. London University College	8	18. Newcastle	21
6. Cambridge	1	19. Southampton	18
7. Nottingham	16	20. London King's College	35
8. Durham	7	21. Loughborough	5
9. Leeds	11	22. Glasgow	17
10. Oxford	2	23. Cardiff	32
11. London Imperial College	4	24. Liverpool	31
12. Sheffield	25	25. Leicester	38
13. Bath	13		

Source - The Graduate Market in 2019

* The Times & Sunday Times Good University Guide 2019

Figure 2.1: According to [highfliers.co.uk](https://www.highfliers.co.uk), the University of Manchester is the most targeted University in the UK by the [Times Top 100 Graduate Employers](https://www.top100graduateemployers.com) [@highfliers2019]

Chapter 3

Research

My research interests are in Computer Science Education (CSE) and pedagogy. (Biggs and Tang, 2011) I'm interested in methods that can deliver high quality learning and student experience using innovative techniques like vertical tutoring, industrial mentoring, live music, live coding, Wikipedia editing and more.

`\begin{figure}`



`}`

`\caption{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 Creative Commons Attribution-NonCommercial 2.5 License}` `\end{figure}`

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 both the practical and theoretical aspects of the subject. To that end:

- I'm an active member of the Association for Computing Machinery (ACM) Special Interest Group (SIG) in Computer Science Education (SIGCSE.org).
- As part of that I founded and chair a journal club for educators in Manchester, if you'd like to join us, subscribe to the mailing list by emailing `listserv@listserv.manchester.ac.uk` with the text **subscribe sigcse-journal-club yourfirstname yoursecondname** in the body of your message
- I'm serving on the program committee for Computing Education & Practice (CEP) conference at Durham University in 2020.

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.

3.3 Vertical tutoring

We are currently piloting a vertical tutoring (VT) scheme, see vertical tutoring for details.

3.4 Code Club

I lead an after school CodeClub as part of a global network of free coding clubs for 9–13 year olds. (Smith et al., 2014) The aim is to have fun using scratch, (Resnick et al., 2009) 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.

3.5 Wikipedia

Wikipedia and wikidata.org (Vrandečić and Krötzsch, 2014) (Turki et al., 2019) are powerful tools for improving digital skills and communication skills, regardless of your age or level of computer literacy. (Proffitt, 2018) (Reagle Jr., 2010) As an experienced and long serving editor of Wikipedia since 2004, I organise and participate in edit-a-thons which recruit and train new Wikipedia editors.(Hull, 2017) (Hull, 2015) More information at:

- wiki-loves-scientists.org.uk
- en.wikipedia.org/wiki/User:Duncan.Hull

3.6 Informal publications

Informal publications can be found on my sporadically updated blog

- duncan.hull.name/lablog

3.7 Formal publications

Formal peer-reviewed publications can be found on DBLP, ORCID and Google Scholar...

- dblp.org/pid/h/DuncanHull
- orcid.org/0000-0003-2387-503X
- scholar.google.com/citations?user=iDJ-t7IAAAAJ

...and even wikidata:

- wikidata.org/wiki/Q47012855

Chapter 4

Vertical tutoring

We are currently piloting a vertical tutoring (VT) system for undergraduate students. VT is already widespread in secondary education, (Barnard, 2010) (Drury, 2013) but as far as we know has not been widely used in higher education.

Extending the idea of Peer Assisted Study Sessions (PASS) pass.manchester.ac.uk, vertical tutoring creates tutorial groups with a representative from *one of each* year of undergraduate study combined with alumni.

4.1 Full stack mentoring

A vertical tutor group will typically contain five members as shown in Figure~??. The group meets physically where possible, or virtually via a slack channel which consists of:

1. One first year student
2. One second year student
3. One penultimate year student (out on industrial placement)
4. One final year student (returned from placement or summer internship)
5. One member of our alumni, recent graduate or via network.manchester.ac.uk

Vertical tutor groups meet twice per semester. It is very unlikely that a free timetable slot for all years and alumni can be found during normal office

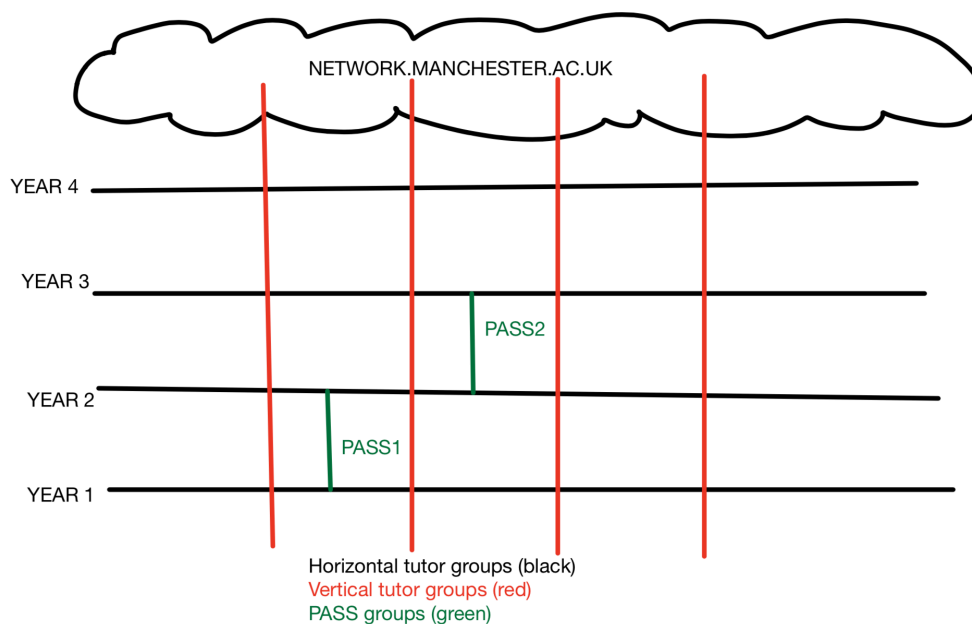


Figure 4.1: Conventional horizontal tutor groups (shown in black) bring together a group of students in the same year. For example, year 1 students meet as a small group once per week during term time with their tutor. Vertical tutor groups (shown in red) are made of of one student from each year and an alumni. Vertical tutor groups extend the idea of PASS, to full stack mentoring, crossing all levels

hours, because of the complexities of timetabling. So evenings will be likely to work best. Where possible, tutor groups will meet face to face, with remote members (e.g. placement students and alumni) typically joining virtually by slack or similar.

4.2 What is it good for?

Vertical tutoring is an attractive idea but does it actually work? If so, how? What is it useful for? We would like to find out:

1. If there is any appetite for vertical tutoring amongst students and alumni
2. How it could work e.g. with slack.com or discord etc?
3. How many times can/should vertical tutor groups meet? Twice per semester? More frequently? Less frequently?
4. What are suitable topics for discussion in a vertical tutorial? Careers, wellbeing, networking etc
5. What kind of specialist groups could be useful e.g. all female groups, research focussed tutorial groups (with MSc & PhD students), ordinary “vanilla” groups etc

As this is an experiment, students have been selected on a voluntary basis. If you’re a student or former student and would like to get involved, let me know.

4.3 How long will all this take?

We ask that tutees commit to:

- two one hour sessions per semester
- some setup and administration, slack channels, scheduling suitable times and dates with your group
- Two hours of time for feedback and review after each semester, by email survey

Chapter 5

Coding their future

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

The aim is to improve and support Computer Science education at key stages 3, 4 and 5. (Furber, 2017) (Furber, 2012) (Swan et al., 2013)



The University provides schools with a final year student who can teach Computer Science in your school or college as a teaching assistant. In return, the school provides our undergraduate students with a safe and supportive environment in which to teach which extends and augments your curriculum. This can either be an after school, extension / lunchtime club or during scheduled lesson time, typically between year 7 and 13. Since these projects were started in 2012, our students have worked with a range of schools in the private and public sector, both selective and non-selective, co-educational and single-sex including:

- Fairfield High School for Girls, Droylsden
- University Technical College (UTC) @MediaCityUK, Salford
- Manchester Communication Academy, Harpurhey
- The Barlow RC High School, Didsbury
- Cheadle Hulme High School, Stockport
- Altrincham Grammar School for Girls, Trafford
- Altrincham Grammar School for Boys, Trafford
- Manchester Grammar School, Fallowfield

The projects were setup by Duncan Hull and David Rydeheard (retired 2019), and are now run and supervised by Duncan. We hope to transfer ideas between private and public sector, to find out more, see guidance for teachers and guidance for students below.

5.1 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.

5.1.1 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 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

5.1.2 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.

5.1.3 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.

5.1.4 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

5.1.5 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!

5.2 Guidance for 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. (Furber, 2017)

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. (Furber, 2012)

Undergraduate students can make a significant difference here, by supporting teachers in the classroom to create and deliver new classroom resources in Computer Science. (Hull, 2019a) 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

5.2.1 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 supervised by Dr. Duncan Hull 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.

5.2.2 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 the schools current provision for computer science in the school

In order to achieve this, you will need to attend a series of education and outreach events, as part of the programme and sign up and complete the Science, Technology, Engineering & Mathematics (STEMnet) ambassador training (which includes DBS checks) supplied by the Museum of Science and Industry (MOSI) in Manchester.

During the project you will be spending a significant amount of time in the classroom, visiting your school at least once every two weeks 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 etc. In addition, guidance on classroom use, such as a lesson or series of lessons to support the tool.

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.

5.2.3 When do the projects start and finish?

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

Chapter 6

Contact

You can contact us using the the details below

`\begin{figure}`



`}`

`\caption{Paying homage to Alan Turing at a mural on the Princess
Parkway by tankpetrol.com} \end{figure}`

6.1 Office

Our offices are in the Kilburn building, close to the Byte cafe, past the Student Support Office (SSO), through the double doors, down the ramp.

Dr. Duncan Hull, Lecturer

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

Mabel Yau, Careers and placements officer

- Room LF26, Kilburn Building
- email: mabel.yau@manchester.ac.uk
- telephone: +44 161 275 6140
- [linkedin.com/in/mabel-yau](https://www.linkedin.com/in/mabel-yau)

Student Support Office

- Room LF21, Kilburn Building
- email: compsci-sso@manchester.ac.uk
- telephone: +44 161 306 8155

6.2 Elsewhere

You can get in touch via t'internet at:

- Slack: search for “Duncan Hull” or my work email
- Skype: search for “duncanhull”
- Blog: duncan.hull.name
- Github: github.com/dullhunk
- Twitter: twitter.com/dullhunk

6.3 Postal address

Send post to :

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

6.4 Kilburn building directions

From the train stations, it takes about 20 minutes to walk from Manchester Piccadilly (MAN) and ten minutes from Manchester Oxford Road (MCO). Our official postcode (M13 9PL) takes you to University Place next door, so you're better off using the what3words locations (Leatherdale, 2019) below which are more accurate:

- Google map of the Kilburn building [bit.ly/directions-to-kilburn-building](https://www.google.com/maps/dir/53.468555,-2.234555/53.468555,-2.234555)
- There are two ground floor entrances to the Kilburn building, North and South
 - North entrance: what3words.com/port.museum.rips
 - South entrance: what3words.com/common.wiping.email
- There is no formal reception so the best place to meet is [bit.ly/ByteCafe](https://www.bit.ly/ByteCafe) on the first floor
- See also [cs.manchester.ac.uk/about/maps-and-travel/](https://www.cs.manchester.ac.uk/about/maps-and-travel/)

6.5 Parking

If you are driving, the nearest car parks are:

- **University Car Park B** Manchester Aquatics Centre Car Park, NCP M13 9SS

- **University Car Park D** Booth Street West Car Park, M15 6AR, access via Higher Cambridge Street
- See estates.manchester.ac.uk/services/operationalservices/carparking .

Bibliography

- Barnard, P. (2010). *Vertical Tutoring: Notes on school management, learning relationships and school improvement*. Grosvenor House Publishing Limited.
- Biggs, J. and Tang, C. (2011). *Teaching for Quality Learning at University*. McGraw-Hill Education Ltd.
- Birchall, M. (2019a). Civil service named the UK's number one graduate employer. *The Times Top 100 Graduate employers*.
- Birchall, M. (2019b). *The Graduate Market in 2019: Annual review of graduate vacancies & starting salaries at the UK's leading employers*. High Fliers Research Limited.
- Birchall, M. (2019c). *The Times Top 100 Graduate Employers 2019-2020*. High Fliers Publications Ltd.
- Drury, E. (2013). A guide to vertical teaching: Advice from experts and teachers who use vertical teaching in their schools. *The Guardian*.
- DuCharme, B. (2013). *Learning SPARQL*. O'Reilly UK Ltd.
- Fogarty, T. (2015). Hackathons are for beginners. *medium.com*.
- Furber, S. (2012). *Shutdown or restart? The way forward for computing in UK schools*. Royal Society.
- Furber, S. (2017). *After the reboot: computing education in UK schools*. Royal Society.
- Hull, D. (2015). Improving the troubled relationship between scientists and wikipedia.

- Hull, D. (2017). Wikipedia at the royal society: The good, the bad and the ugly.
- Hull, D. (2019a). Getting started with computing education projects.
- Hull, D. (2019b). The northern software house: tech employers in the north west #NotJustLondon. *github*.
- Leatherdale, D. (2019). What3words: The app that can save your life. *BBC News*.
- Proffitt, M., editor (2018). *Leveraging Wikipedia: Connecting Communities of Knowledge*. American Library Association.
- Raymond, E. S. (1999). *The Cathedral & the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary*. O'Reilly Media.
- Reagle Jr., J. M. (2010). *Good Faith Collaboration: The Culture of Wikipedia*. The MIT Press.
- Resnick, M., Silverman, B., Kafai, Y., Maloney, J., Monroy-Hernández, A., Rusk, N., Eastmond, E., Brennan, K., Millner, A., Rosenbaum, E., and Silver, J. (2009). Scratch: Programming for all. *Communications of the ACM*, 52(11):60.
- Sharwood, S. (2019). Ibm asks remaining staff to take career advice from HR-bot. *The Register*.
- Smith, N., Sutcliffe, C., and Sandvik, L. (2014). Code club: bringing programming to UK primary schools through scratch. In *Proceedings of the 45th ACM technical symposium on Computer science education - SIGCSE '14*. ACM Press.
- Swan, C., Beale, C., Avroutine, I., Hodgson, J., Waller, D., Smith-Nunes, G., Kershaw, J., Saeed, S., Dixon, L., Surrall, A., and Pitt, J. (2013). Cambridge GCSE computing MOOC. Technical report.
- Turki, H., Shafee, T., Taieb, M. A. H., Aouicha, M. B., Vrandečić, D., Das, D., and Hamdi, H. (2019). Wikidata: A large-scale collaborative ontological medical database. *Journal of Biomedical Informatics*, 99.

Vrandečić, D. and Krötzsch, M. (2014). Wikidata: a free collaborative knowledgebase. *Communications of the ACM*, 57(10):78–85.

Wickham, H. and Grolemund, G. (2017). *R for Data Science*. O'Reilly UK Ltd.