The dream of a lifetime
Shaping how our children learn computing

Simon Peyton Jones, Microsoft Research
What is education for?
“Education should prepare young people for jobs that do not yet exist, using technologies that have not yet been invented, to solve problems of which we are not yet aware.”

Richard Riley
Disciplines

Skills
Disciplines

Ideas, knowledge, principles, techniques, methods

Maths, science, history, English

Skills

Artefacts, devices, programs, products, organisations, business

Presentation skills, metalwork, textiles, food technology, teamwork
What has happened in practice?
ICT
Information and Communication Technology

Spreadsheets, databases, Powerpoint, web, internet, audio, video, e-safety
Too much focus on technology
Not enough on ideas
Mission

Establish computer science as a foundational subject, that every child should learn, from primary school onwards.
Articulate the vision
What is Computer Science?
What is Computer Science?

Algorithms + data structures = programs

Computation + information = computer science
Computational thinking is the process of *recognising* aspects of computation in the world that surrounds us, and *applying* tools and techniques from computing to understand and reason about both natural and artificial systems and processes.

- Computational thinking is something **people** do, not something **computers** do
- Computational thinking is **ubiquitous**; it is useful in every profession, and in daily life

Don't forget "informational thinking" too
Look!
No computers

Video

http://csunplugged.org/sorting-networks
Follow the arrows to generate a sentence.

A tiny clown and an old dog laughed and danced. The pirate sang.
Programming ≠ Computer science (discipline)

Programming (craft, skill)
Programming

Programming incarnates computer science
Why Computer Science for every child?
Why?

• Understand the digital world

• Understand the natural world

• Skills for almost any job
Summary so far

1. Computer science is **educationally foundational**

2. Computer science equips students to meet the **huge un-met demand** from employers.

3. Computer science is **tremendous fun**: creativity, intellectual beauty, programming, robots, making things do stuff.

What more do you want?
Which leaves the problem
Engage the Policy makers
Computer Science: A curriculum for schools

Computing at School Working Group

http://www.computingatschool.org.uk

endorsed by BCS, Microsoft, Google and Intellect

March 2012
2011/2: High profile reports

• Feb 2011: The Livingstone/Hope report
  • Bring computer science into the National Curriculum as an essential discipline

• 2011: Ofsted report on ICT

• Jan 2012: Royal Society Computing in Schools Report
  • The current delivery of Computing education in many UK schools is highly unsatisfactory
  • Computer Science is a rigorous academic discipline and needs to be recognised as such in schools
  • Every child should have the opportunity to learn Computing at school
2011: Into political discourse

"I was flabbergasted to learn that today computer science isn't even taught as standard in UK schools," he said, "Your IT curriculum focuses on teaching how to use software, but gives no insight into how it's made."

Eric Schmidt, CEO Google, August 2011
<table>
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<th>Awarding bodies</th>
<th>Number of GCSEs in Computer Science</th>
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New dirt-cheap hardware platforms
culminating in...
Computing
Programmes of study for Key Stages 1-4

Aims

The National Curriculum for computing aims to ensure that all pupils:

- can understand and apply the fundamental principles of computer science, including logic, algorithms, data representation, and communication
- can analyse problems in computational terms, and have repeated practical experience of writing computer programs in order to solve such problems
- can evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems
- are responsible, competent, confident and creative users of information and communication technology.
Making it Happen
New, foundational subject
Training teachers
Pedagogy
Materials
Assessment
Qualifications
Who will do all this?
Not the
Department for Education
We will!
A once-in-a-generation opportunity...
...for all of us:
companies
computer scientists
educational folk
software professionals
all of us...
...to shape what the subject we know best means in practice...
...for the children we love...
...and the rest of the world

England is first out of the gate
Everyone else is watching
• Simply a group of individuals, concerned about the state of computing education at school in the UK

• Varied backgrounds, common concerns
  • Teachers
  • Industry (eg Google, Microsoft)
  • University academics (incl CPHC, UKCRC)
  • Members of exam board (eg AQA)
  • Members of professional societies (eg BCS)
  • Parents
  • Local educational advisers
  • Teacher trainers

• Virtually no staff, no money, no office. All volunteers
20,000 members
Growing at 500/month

- About 3/4 teachers
- Both primary and secondary
- A community
- A gift economy
163 Hubs
CPD and the Network of Excellence

• Massive challenge
  250,000 primary teachers
  20,000 secondary teachers

• Computing at School (CAS) and the British Computer Society (BCS) have launched a national **Network of Excellence for Teaching Computer Science**

• 800+ schools signed up

• Single goal: support and equip our teachers to teach Computing

• Modest DfE funding
Resources
Our friends... we love you

Cambridge Hacklab
Apps for Good
Greenfoot
cs4fn
Code Club
Technocamps
Codio
Raspberry Pi
Hack to the future
YouSrc
Computing at School
Make Things Do Stuff
Sonic Pi
Young Rewired State
CoderDojo
NextGen skills campaign
PPIG!
Your country needs you!
Two challenges

Scale

Evidence-driven reflection
Programming

What language? For what purpose?

Scratch, Kodu, TouchDevelop, Greenfoot, Minecraft, Python, HTML, CSS, Javascript...

Programming as a vehicle for learning computational/information thinking, rather than as an end in itself

Debugging, explaining, predicting, not just writing code
Pedagogy and assessment

Testing what we want students to learn, not just what is easy to measure

Plugged vs unplugged?

Which concepts in which order for which age groups?

Discovery, or worked-out examples?
Practical steps

Join CAS
Go to a CAS Hub
Partner with a teacher
Be a cs4fn speaker
Run a Code Club
Write a research proposal
This is our moment
It won't come again
Engaged, curious
Creative, playful
Empowered, informed
Employed