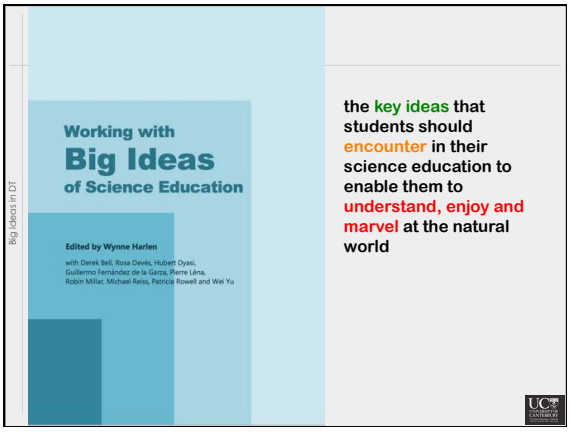
Tim Bell

Polls

- Thoughts about new curriculum
- Level of confidence
- Level of teaching

Big Ideas in DT



the key ideas that students should encounter in their science education to enable them to understand, enjoy and marvel at the natural world

- to respond to students' perceptions of science as a fragmented collection of facts and theories of little relevance to them,
- help students to explain things they find important
- basis for selection from the enormous range of possible curriculum content
- inform the development of curriculum frameworks built on progression towards big ideas

Big Ideas in DT

Big ideas in science

1. All matter in the Universe is made of very small particles
2. Objects can affect other objects at a distance

3. Changing the movement of an object requires a net force to be acting on it
4. The total amount of energy in the universe is always the same but can be transferred from one energy store to another during an event

5. The composition of the earth and its atmosphere, and the processes occurring within them, shape the earth's surface and its climate
6. Our solar system is a very small part of one of billions of galaxies in the universe

7. Organisms are organised on a cellular basis and have a finite life span
8. Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms

9. Genetic information is passed down from one generation of organisms to another
10. The diversity of organisms, living and extinct, is the result of evolution

Big Ideas in DT

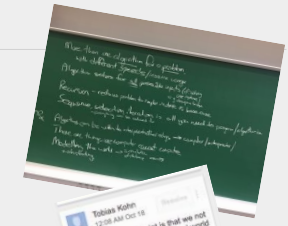
λ?

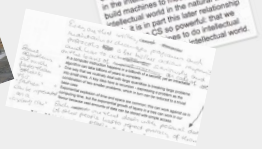
the key ideas that students should encounter in their computing education to enable them to understand, enjoy and marvel at the digital world

Big Ideas in DT

Tim Bell

- CMSC 2017
- Poznan workshop
- Expert forum (HDKF)
- WiPSCE 2017

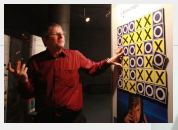


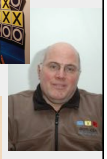


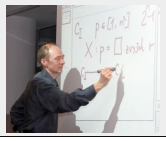
Big Ideas in DT

Curriculum designers

- Jens Gallenbacher
- Paul Tymann
- Amiram Yehudai
- Ira Diethelm
- Juraj Hromkovič







Big Ideas in DT

The big ideas in CS/CT

1. Data is represented in digital form on a computer.
2. Algorithms interact with data to solve computational problems.
3. The performance of algorithms can be modelled and evaluated.
4. Some computational problems cannot be solved by algorithms.
5. Programs express algorithms and data in a form that can be implemented on a computer.
6. Computing systems are designed by humans to serve human needs.
7. Computing systems create virtual representations of natural and artificial phenomena.
8. Protecting data and system resources is critical in computing systems.
9. Time dependent operations in computing systems must be coordinated.
10. Protocols facilitate communication between computing systems.

Big Ideas in DT

Data is represented in digital form

on a computer

0 1

Big Ideas in DT

Poll: Where are you at with binary representation?

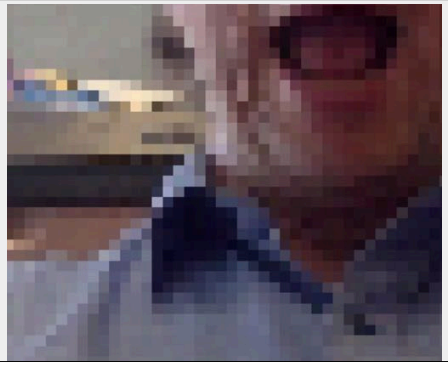
- Confident with how it works
- Kind of get it
- Have dabbled
- Don't understand it
- Never heard of it

Big Ideas in DT

Digital technologies?

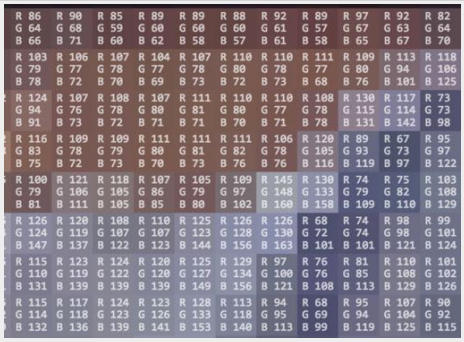
Big Ideas in DT

Digital technologies?



Big Ideas in DT

Digital technologies?



http://csfieldguide.org.nz/en/chapters/data-representation.html

Big Ideas in DT

Binary cards

1 dot is visible

http://csfieldguide.org.nz/en/interactives/binary-cards/index.html?digits=5&start=BBBBB

Big Ideas in DT

Binary cards

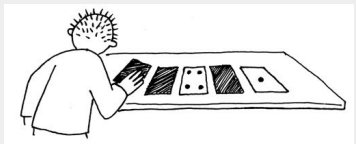
Chat: do you want the 16 card?

1 dot is visible

http://csfieldguide.org.nz/en/interactives/binary-cards/index.html?digits=5&start=BBBBB

Big Ideas in DT

Binary cards



http://csunplugged.org/binary-numbers/

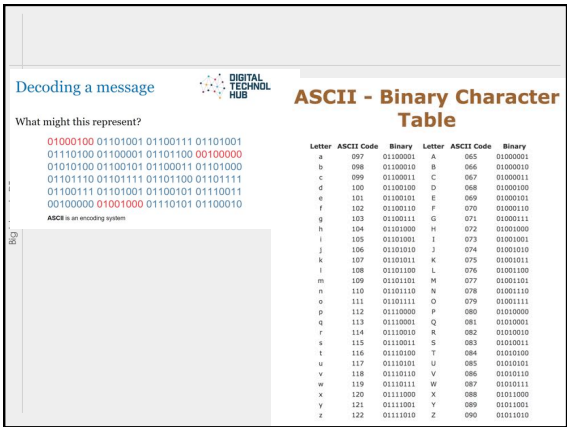
Big Ideas in DT

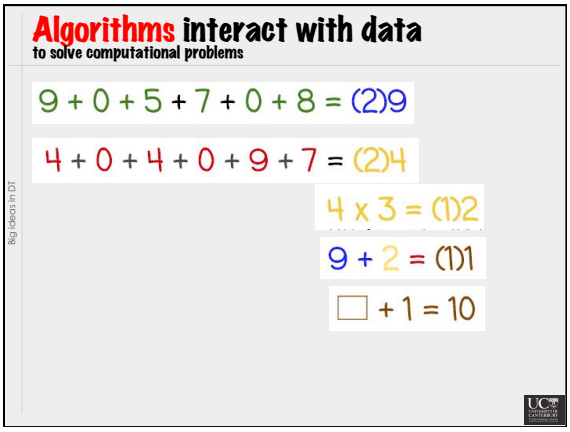
Letters using digits

0 - 00000 -	9 - 01001 - I	18 - 10010 - R
1 - 00001 - A	10 - 01010 - J	19 - 10011 - S
2 - 00010 - B	11 - 01011 - K	20 - 10100 - T
3 - 00011 - C	12 - 01100 - L	21 - 10101 - U
4 - 00100 - D	13 - 01101 - M	22 - 10110 - V
5 - 00101 - E	14 - 01110 - N	23 - 10111 - W
6 - 00110 - F	15 - 01111 - O	24 - 11000 - X
7 - 00111 - G	16 - 10000 - P	25 - 11001 - Y
8 - 01000 - H	17 - 10001 - Q	26 - 11010 - Z

Big Ideas in DT

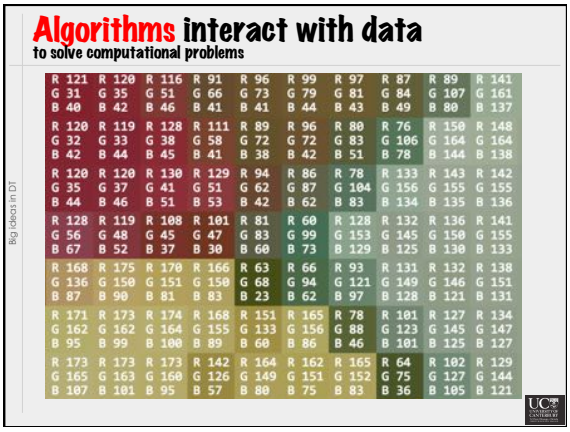
Tim Bell


Decoding a message
DIGITAL TECHNOL HUB
What might this represent?
01000100 01101001 01100111 01101001
01110100 01100001 01101100 00100000
01010100 01100101 01100011 01101000
01101110 01101111 01101100 01101111
01100111 01101001 01100101 01110011
00100000 01001000 01110101 01100010
ASCII is an encoding system
ASCII - Binary Character Table
Letter ASCII Code Binary Letter ASCII Code Binary
a 097 01100001 A 065 01000001
b 098 01100010 B 066 01000010
c 099 01100011 C 067 01000011
d 100 01100100 D 068 01000100
e 101 01100101 E 069 01000101
f 102 01100110 F 070 01000110
g 103 01100111 G 071 01000111
h 104 01101000 H 072 01001000
i 105 01101001 I 073 01001001
j 106 01101010 J 074 01001010
k 107 01101011 K 075 01001011
l 108 01101100 L 076 01001100
m 109 01101101 M 077 01001101
n 110 01101110 N 078 01001110
o 111 01101111 O 079 01001111
p 112 01110000 P 080 01010000
q 113 01110001 Q 081 01010001
r 114 01110010 R 082 01010010
s 115 01110011 S 083 01010011
t 116 01110100 T 084 01010100
u 117 01110101 U 085 01010101
v 118 01110110 V 086 01010110
w 119 01110111 W 087 01010111
x 120 01111000 X 088 01011000
y 121 01111001 Y 089 01011001
z 122 01111010 Z 090 01011010


Algorithms interact with data
to solve computational problems
9 + 0 + 5 + 7 + 0 + 8 = (2)9
4 + 0 + 4 + 0 + 9 + 7 = (2)4
4 x 3 = (1)2
9 + 2 = (1)1
□ + 1 = 10
Big Ideas in DT

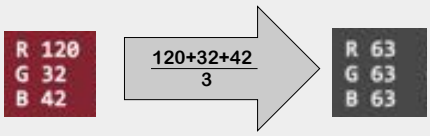

Algorithms interact with data
to solve computational problems
Big Ideas in DT


Algorithms interact with data
to solve computational problems
Big Ideas in DT


Algorithms interact with data
to solve computational problems
Big Ideas in DT

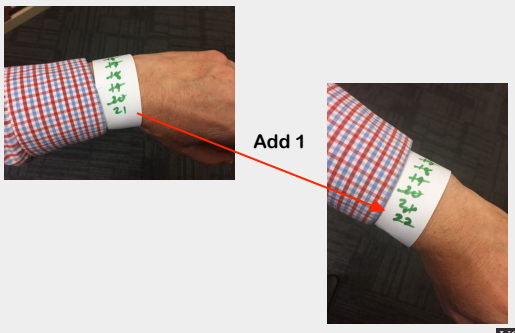

Algorithms interact with data
to solve computational problems
Big Ideas in DT

Algorithms interact with data
to solve computational problems



Big Ideas in DT

Algorithms interact with data
to solve computational problems



Big Ideas in DT

The performance of algorithms
can be modelled and evaluated

https://www.youtube.com/watch?v=iDVH3oCTc2c

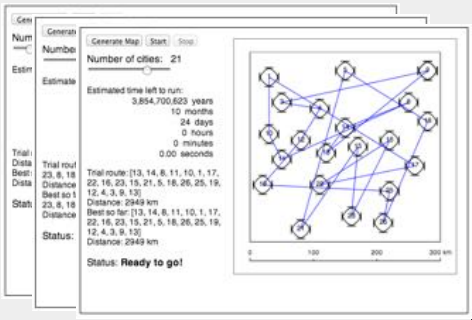
Big Ideas in DT

The performance of algorithms
can be modelled and evaluated

http://csunplugged.org/sorting-algorithms/

Big Ideas in DT

Some computational problems
cannot be solved by algorithms



Big Ideas in DT

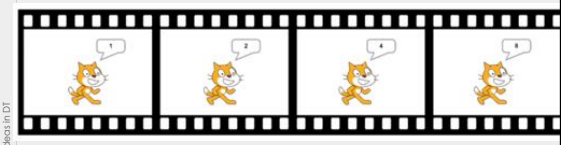
Some computational problems
cannot be solved by algorithms

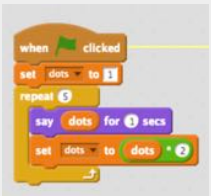
Proof That Computers Can't Do Everything
(The Halting Problem)

https://www.youtube.com/watch?v=92WHN-pAFCs

Big Ideas in DT

Programs express algorithms and data
in a form that can be implemented on a computer.



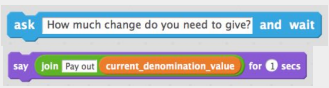


Big Ideas in DT

Programs express algorithms and data
in a form that can be implemented on a computer.

Storage

Input/output



Sequence, selection, iteration

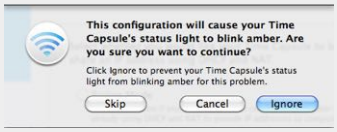
Big Ideas in DT

Alan Turing

http://www.turingarchive.org/viewer/?id=521&title=4, Public Domain, https://commons.wikimedia.org/w/index.php?curid=22828488

Big Ideas in DT

Computing systems are designed by
humans to serve human needs



Big Ideas in DT

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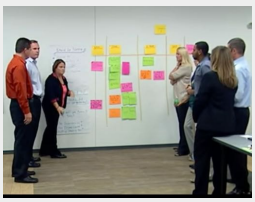


https://www.youtube.com/watch?v=q_R9wQY4G5I

Big Ideas in DT

Diversity – broadening participation

http://techblog.nz/689-TheITGirls

http://au.tv.yahoo.com/sunrise/video/watch/21339850/blind-genius-building-apps-for-google/

Big Ideas in DT

Computing systems create virtual representations of natural and artificial phenomena

https://www.kiwinet.org.nz/images/success-stories/AugmentedReality.jpg

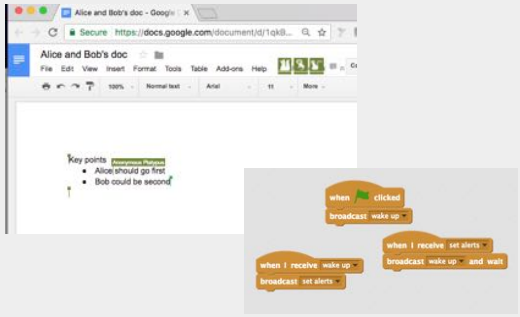
Big Ideas in DT

Protecting data and system resources is critical in computing systems.

https://blogs.technet.microsoft.com/seanearp/2007/08/01/layers-defense-in-depth-part-1/

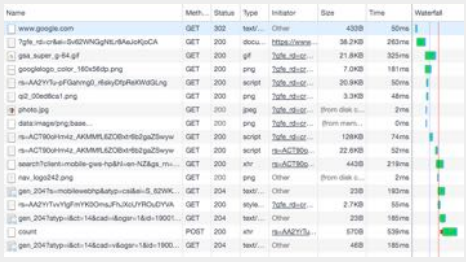
Big Ideas in DT

Time dependent operations in computing systems must be coordinated



Big Ideas in DT

Protocols facilitate communication between computing systems



Big Ideas in DT

The big ideas

1. Data is represented in digital form on a computer.
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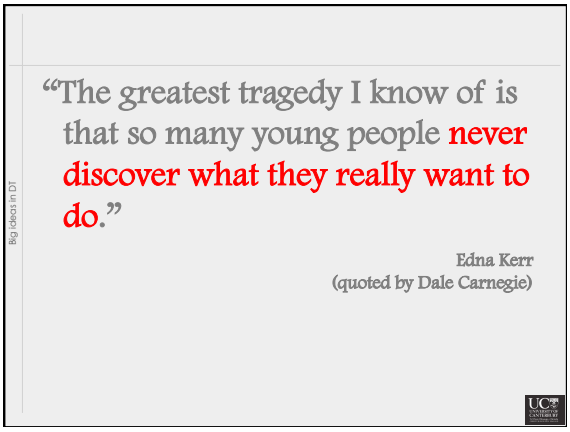
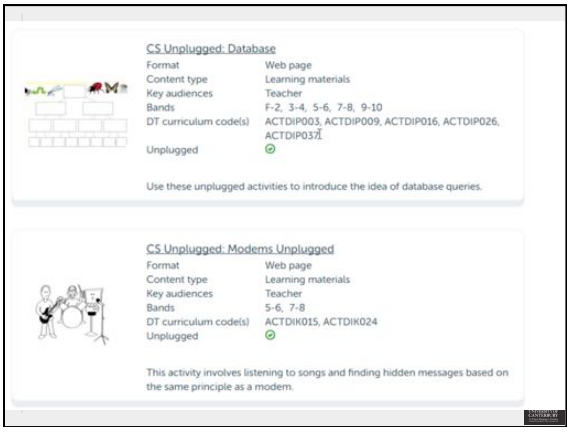
Big Ideas in DT

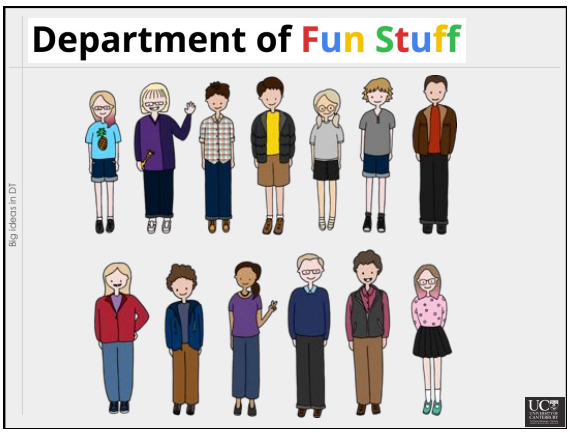
Tim Bell

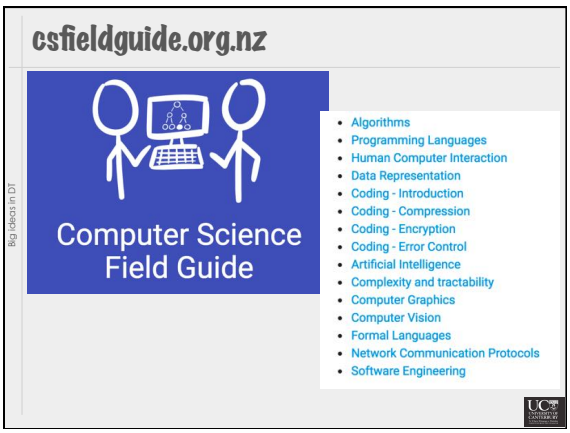

"The greatest tragedy I know of is that so many young people never discover what they really want to do."
Edna Kerr
(quoted by Dale Carnegie)
Big Ideas in DT


Digital technologies is about... people
Communication
Information
Interfaces
Privacy
Safety
Solving real problems
Careers
He aha te mea nui ki tenei ao? Maku e ki atu. He tangata, he tangata, he tangata.
www.orionhealth.com
Google
www.youtube.com/watch?v=cdgQpa1pUUE
Big Ideas in DT

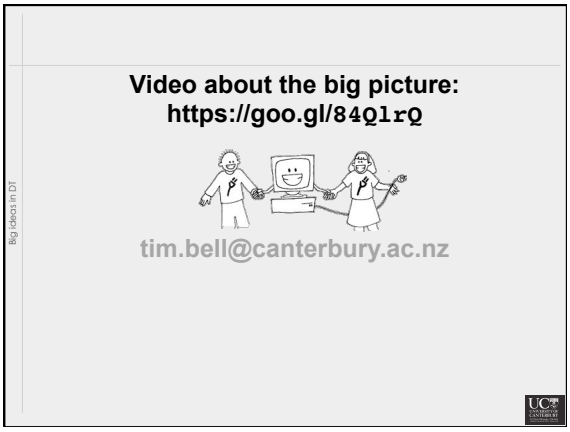

CS UNPLUGGED
Computer Science without a computer
Home The Book Activities Videos Community Promotional About
Free activities for classroom or home
Update: New version of CS Unplugged in development
Search
People talking about #CSUnplugged
Tweets
Big Ideas in DT


CS Unplugged: Database
Format Web page
Content type Learning materials
Key audiences Teacher
Bands F-2, 3-4, 5-6, 7-8, 9-10
DT curriculum code(s) ACTDIP003, ACTDIP009, ACTDIP016, ACTDIP026, ACTDIP037
Unplugged
Use these unplugged activities to introduce the idea of database queries.
CS Unplugged: Modems Unplugged
Format Web page
Content type Learning materials
Key audiences Teacher
Bands 5-6, 7-8
DT curriculum code(s) ACTDIK015, ACTDIK024
Unplugged
This activity involves listening to songs and finding hidden messages based on the same principle as a modem.


Department of Fun Stuff
Big Ideas in DT


csfieldguide.org.nz
Computer Science Field Guide
Algorithms
Programming Languages
Human Computer Interaction
Data Representation
Coding - Introduction
Coding - Compression
Coding - Encryption
Coding - Error Control
Artificial Intelligence
Complexity and tractability
Computer Graphics
Computer Vision
Formal Languages
Network Communication Protocols
Software Engineering
Big Ideas in DT

Tim Bell


Video about the big picture:
https://goo.gl/84QlrQ
tim.bell@canterbury.ac.nz
Big Ideas in CT