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EPSRC
Engineering and Physical Sciences Research Council

cs4fn and computational thinking unplugged

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www.cs4fn.org

cs4fn has support including from EPSRC and Google

Computer Science for Fun: cs4fn

- A public engagement project supporting schools
- Aim to inspire school students about computer science
- Also supports teachers
- Tell interdisciplinary research stories
  - via magazines, shows, web …

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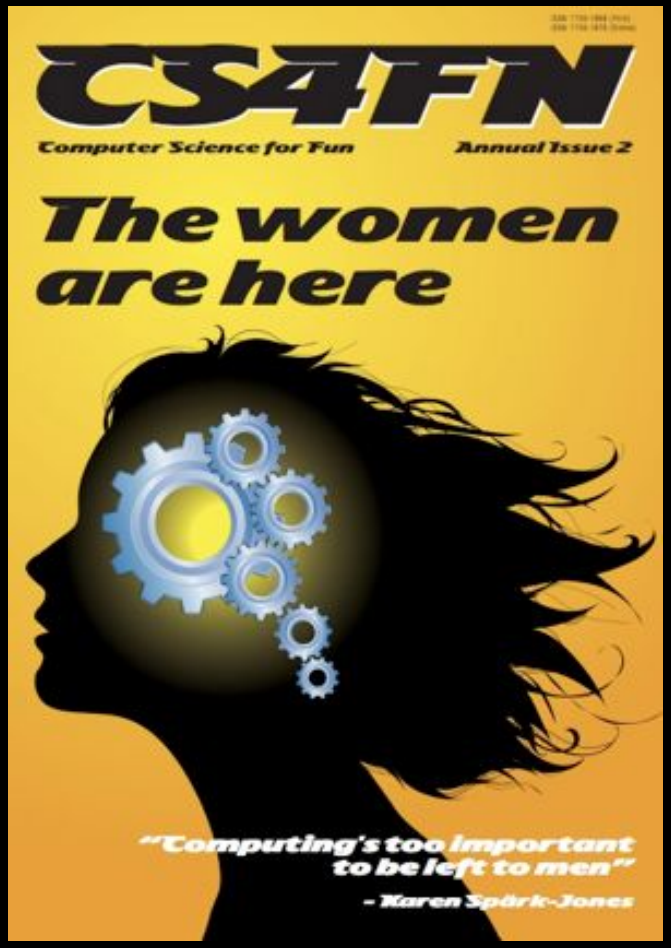
Writing up research for kids

A series of magazines & booklets

- cs4fn Magazine
- Women in Computing
- Biology Loves Technology
- Artificial Intelligence
- Magic Books
- Posters
- Audio! Magazine
- ee4fn Magazine
- Teacher resource packs

  (In progress)



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It works

- 100s of UK schools want class sets
  - 1000s of subscribers in over 80 countries
- Very positive feedback:
  - *“not just thinking out of the box - tearing it up”*
  - “*This magazine… It's simply awesome.*”
  - *“This has to be THE most inspired bit of literature/content for getting youngsters switched on to Computer Science!” - teacher*

- 98% teachers positive about magazine
- 77% agreed would use ideas/activities
- 100% would recommend our talks

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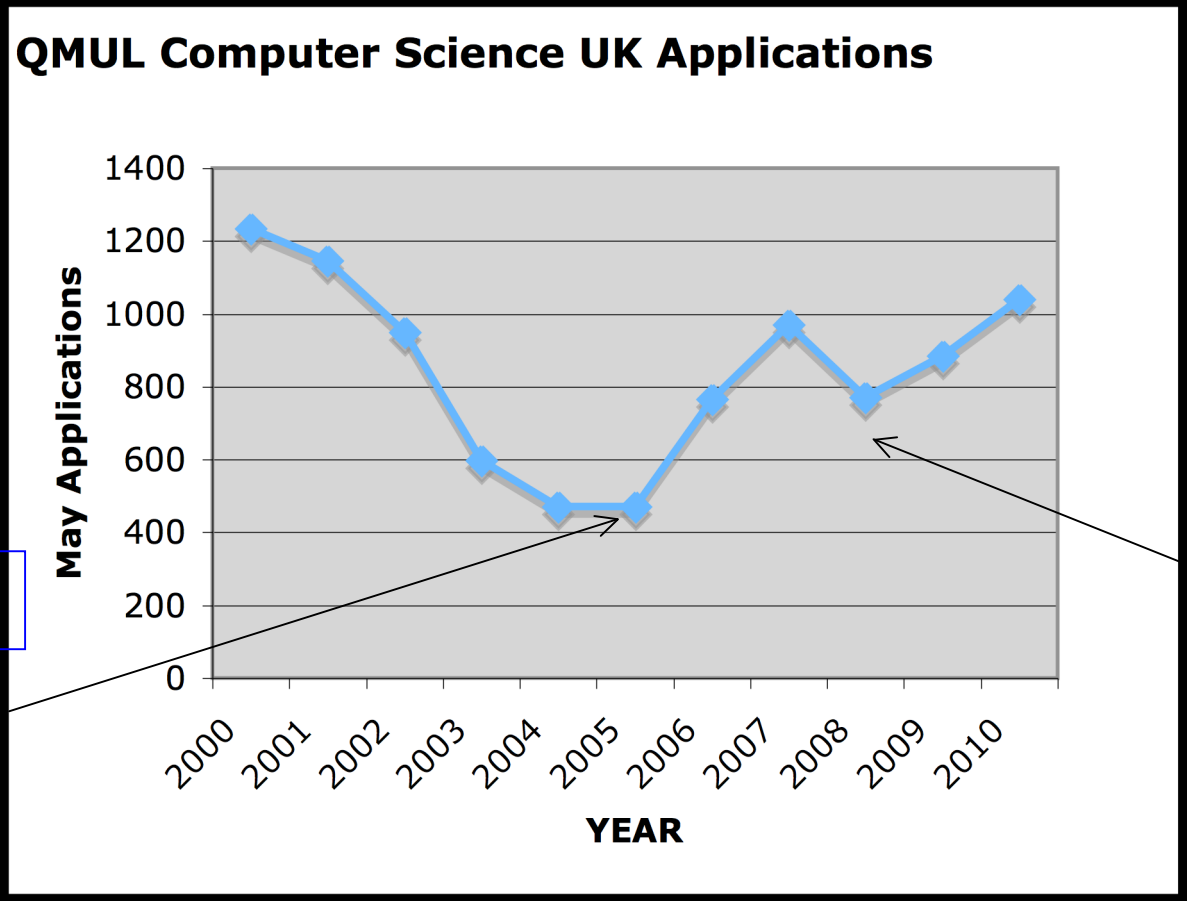
It has impact



Start cs4fn

5 not 6 UCAS choices

cs4fn increases take-up

Some keys to success

- Filled with enthusiasm
- Linked talks, magazines and web
  - an immediate place to go deeper if inspired
- Altruistic gift giving
  - About subject, NOT Queen Mary
- Flexible use by schools
  - Used for “talented” and “problem” students
  - As reading, activities, posters
  - Specialist classes + whole year groups
  - Supporting literacy
- Not just “for kids”
  - write accessibly not patronizingly
  - Supports teachers too
- Interdisciplinary
  - Wider interest so larger audiences
  - \+ opportunity to convert!

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Computational thinking

- How do you teach it to younger children?
- Can you teach it separately from programming?

  - algorithmic thinking
  - translating solutions between domains
  - Analytical thinking
  - logical thinking,
  - rigorous argument and proof
  - computational modeling
  - abstraction
  - understanding people

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Computational thinking: how to teach it?

- cs4fn storytelling and unplugged activities give a way to explicitly introduce computational thinking ideas

- We have been trialing the idea in teacher CPD workshops

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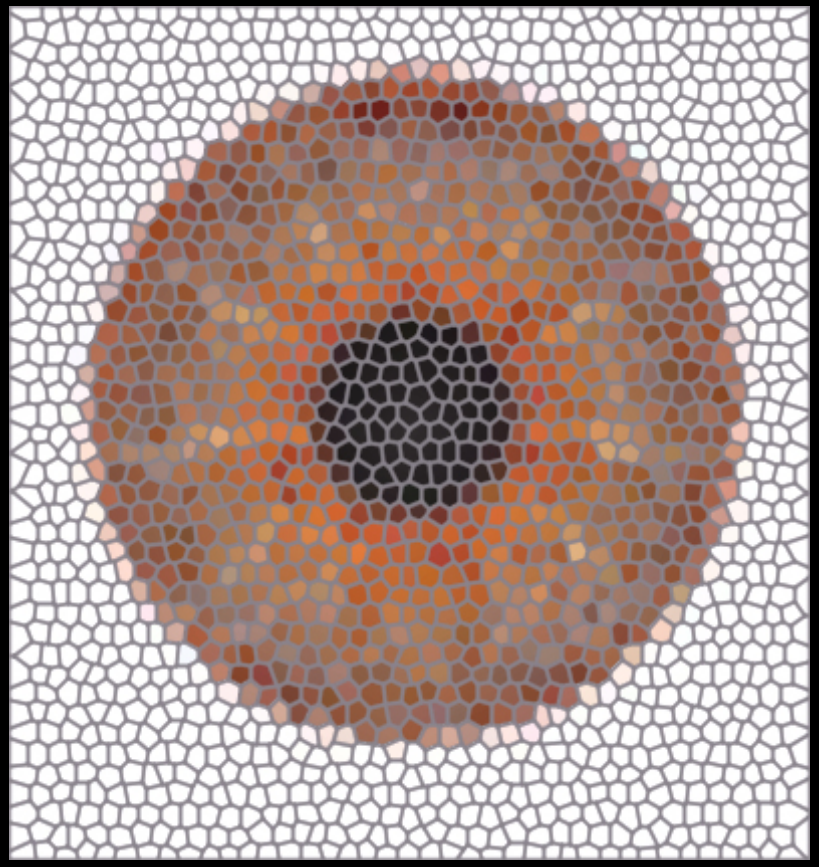
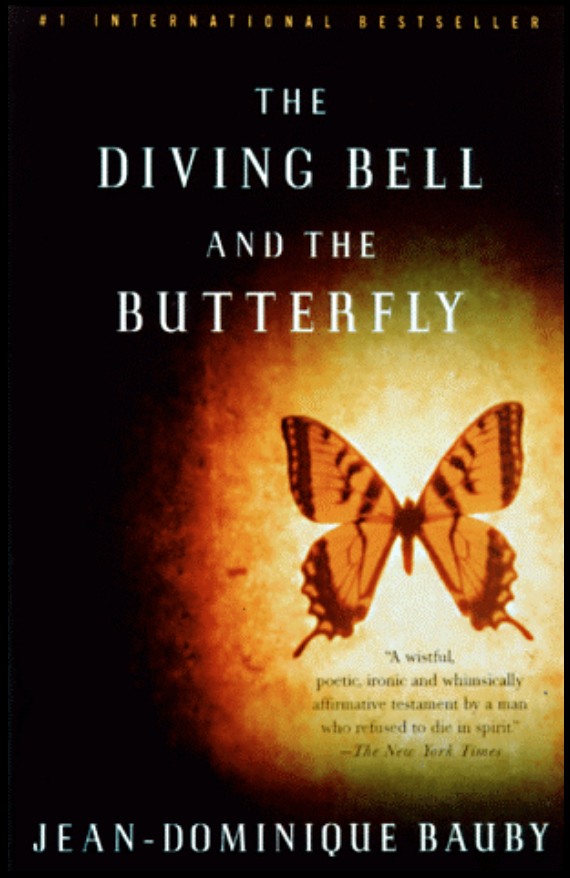
Locked-in Syndrome

- A person with locked-in syndrome is totally paralyzed except perhaps being able to move an eyelid.
- They can see, hear and think but they cannot communicate back.
- **Their intelligent mind is trapped inside a useless body.**



Could you write a book if you had locked-in syndrome?

- Jean-Dominique Bauby did…
  - "one of the greatest books of the century".
- Describing his life with locked-in syndrome.
- How did he do it?
- How might he have done it if he'd known some computational thinking?
- Try it…



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Let's play a game

- 20 Questions…
- I think of a famous person.
- You have to guess who I am thinking of by asking questions.
- I can only answer yes or no.

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Winning at 20-Questions

- Do you ask questions like
  - Is it Adele?
  - Is it Will Smith?
  - Is it Gandhi?
  - Is it Usain Bolt?
- That would on average take billions of questions
  - you have only 20!
- Instead you try to ask halving questions…
  - Are they female?
- Linear Search? or
- Divide and conquer?
- Apply that solution to Locked-in communication

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Does everyone agree we would have improved things for Bauby?

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Did we get it right?

- Did we count the right thing?
- What if blinking is hard work for him?
  - We should have found out first.
- Have we made his life better or worse?

Computing is about understanding people too.

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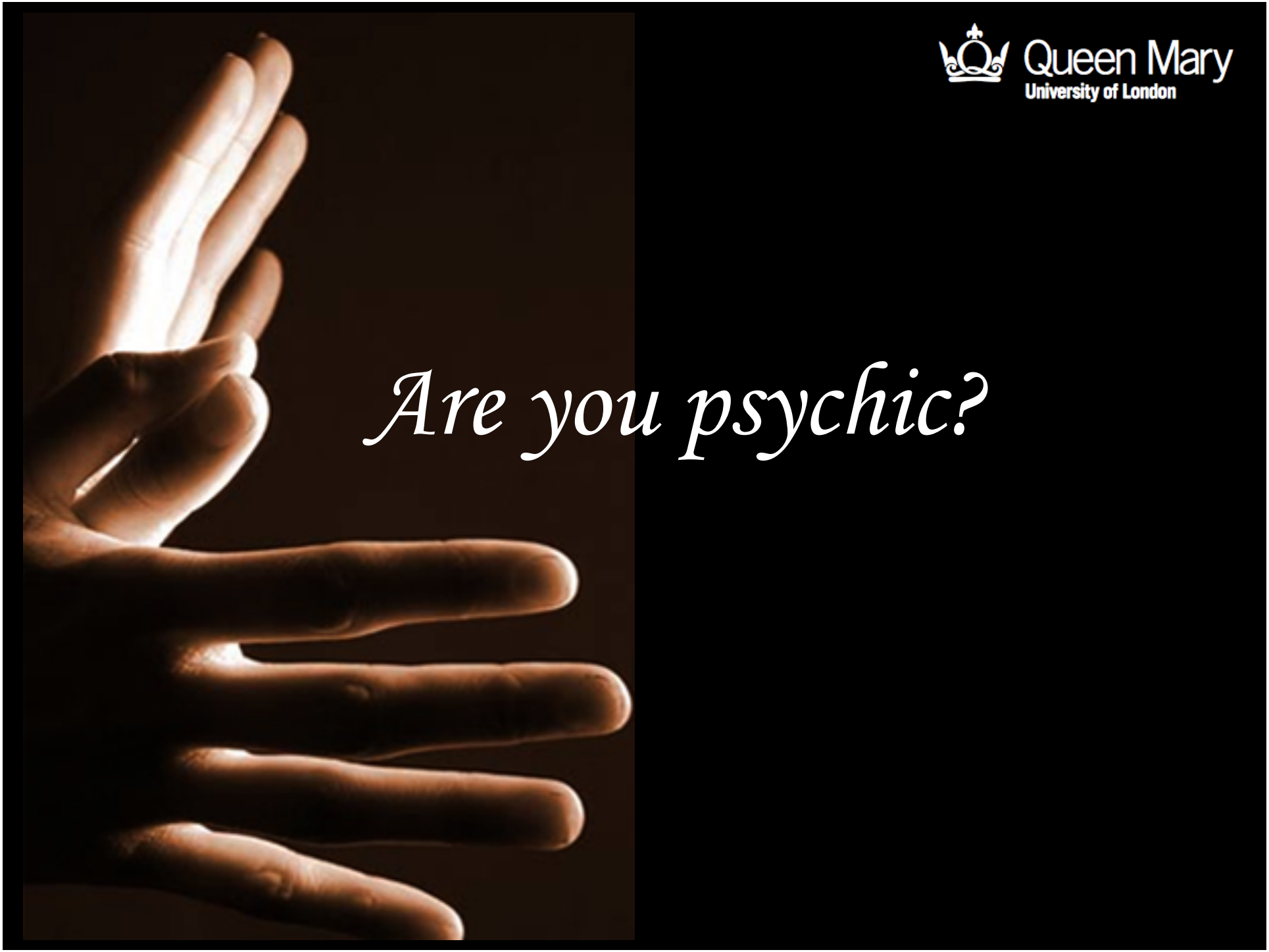
Computational Thinking Lessons

- Algorithmic thinking
- Analytical thinking
  - efficiency
- Abstraction
- Translating solutions between domains
- Understanding people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Are you psychic?

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Ponder break

How on earth do they do that?

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It's just an algorithm

1. Put two sets of 5 cards in the same order together
2. Cut the cards several times
3. Deal out the top 5 into a pile
4. Place the rest on to the table in a second pile
5. Set a counter n to be 4 and REPEAT the following until n is 1
    1. Ask a volunteer to pick a number k from 0 to n
    2. Move k cards to the bottom of the first pile
    3. Move n - k cards to the bottom of the second pile
    4. Put the top card of each pile as a pair to the side
    5. Subtract 1 from the counter n
6. Reveal that all cards match

Magic = Computation

- Magic = secret method + presentation
- Software = algorithm + interaction design

- Programmers and magicians have to think in the same way
  - creating new tricks,
  - creating new programs
- It's all about computational thinking

Computational Thinking Lessons

- Algorithmic thinking
- Logical Thinking
- Rigorous argument/proof
- Translating solutions between domains
- Understanding people
- Abstraction

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The Four Aces

Ponder break

How on earth do they do that?

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chi+med

Medical device design?

Magicians use distraction: they engineer the system so that something in open view is not noticed.

Computer Scientists have to design systems so things that matter are noticed.

Just because something is on the screen …doesn't mean the nurse will see it - even if he's looking

If it is important, then you must design the interaction so they do!

Computer Science is about understanding people too

- Computer Science needs:
  - algorithms and interaction design.
- Magic needs:
  - secret methods and presentations.

- Without good presentation based on an understanding of people even a brilliant trick/algorithm may not ‘work’!

Computational Thinking Lessons

- Algorithmic thinking
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Serious fun works

The cs4fn approach

– linking fun physical research magazines with storytelling "unplugged" shows

works

- to inspire kids (worldwide)
- to support teachers
- to increase take-up

Provides a non-programming way of explicitly introducing computational thinking

- very positive feedback from teachers

cs4fn now focussing on teacher CPD

- We would welcome advice on teaching teachers!

For more Computational Thinking for fun …

Computer Science

www.cs4fn.org

Women in Computing

www.cs4fn.org/women

Magic

www.cs4fn.org/magic/

Support for teachers including unplugged activities and more on computational thinking at

www.cs4fn.org/teachers/

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