

# Computational thinking: searching to speak

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With support from Google,  
D of E and the Mayor of London



[www.teachinglondoncomputing.org](http://www.teachinglondoncomputing.org)

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# Aims

- Give you deeper understanding of core topics
  - What is computational thinking?
  - Search Algorithms
  - Comparing algorithms
  - Computing is not just about computers!
- Give you some practical ways that computing can be taught in a fun, thought provoking way
  - away from a computer
- Linked activity sheets can be downloaded from our website:

[www.teachinglondoncomputing.org](http://www.teachinglondoncomputing.org)

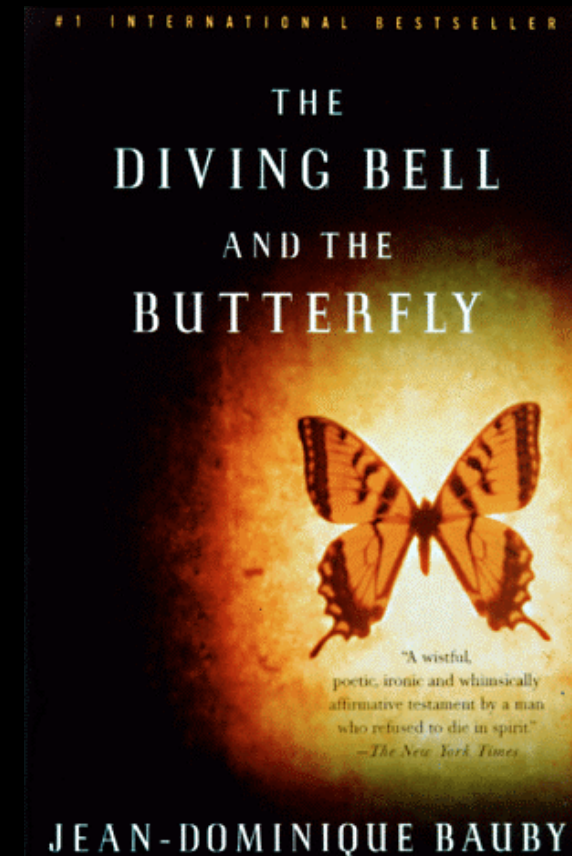
# Locked-in Syndrome

- 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?
  - With a helper
  - No technology



# Communicating with Locked-in Syndrome

- The helper reads the alphabet a letter at a time
  - Is it A?
  - Is it B?
  - Is it C? etc
- Blinking means yes, not blinking means no
- The helper writes the letter down.
- Then starts again with the next letter

# How well does it work?

- Try it...
- What problems need to be solved?
  - to make it really work
- Can it be improved?
- How fast is it?
  - How long would it take to write a book?



# How fast is it?

- It is very slow
- It takes on average 13 questions for *every* letter
- At worst it takes 26 questions
- In identifying problems, coming up with solutions and faster ways, you are doing computational thinking!

# Computer Scientists do it better

- Any Computer Scientist knows it can be done in...

**5 questions per letter at worst**

**How?**



# 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.



# Winning at 20-Questions

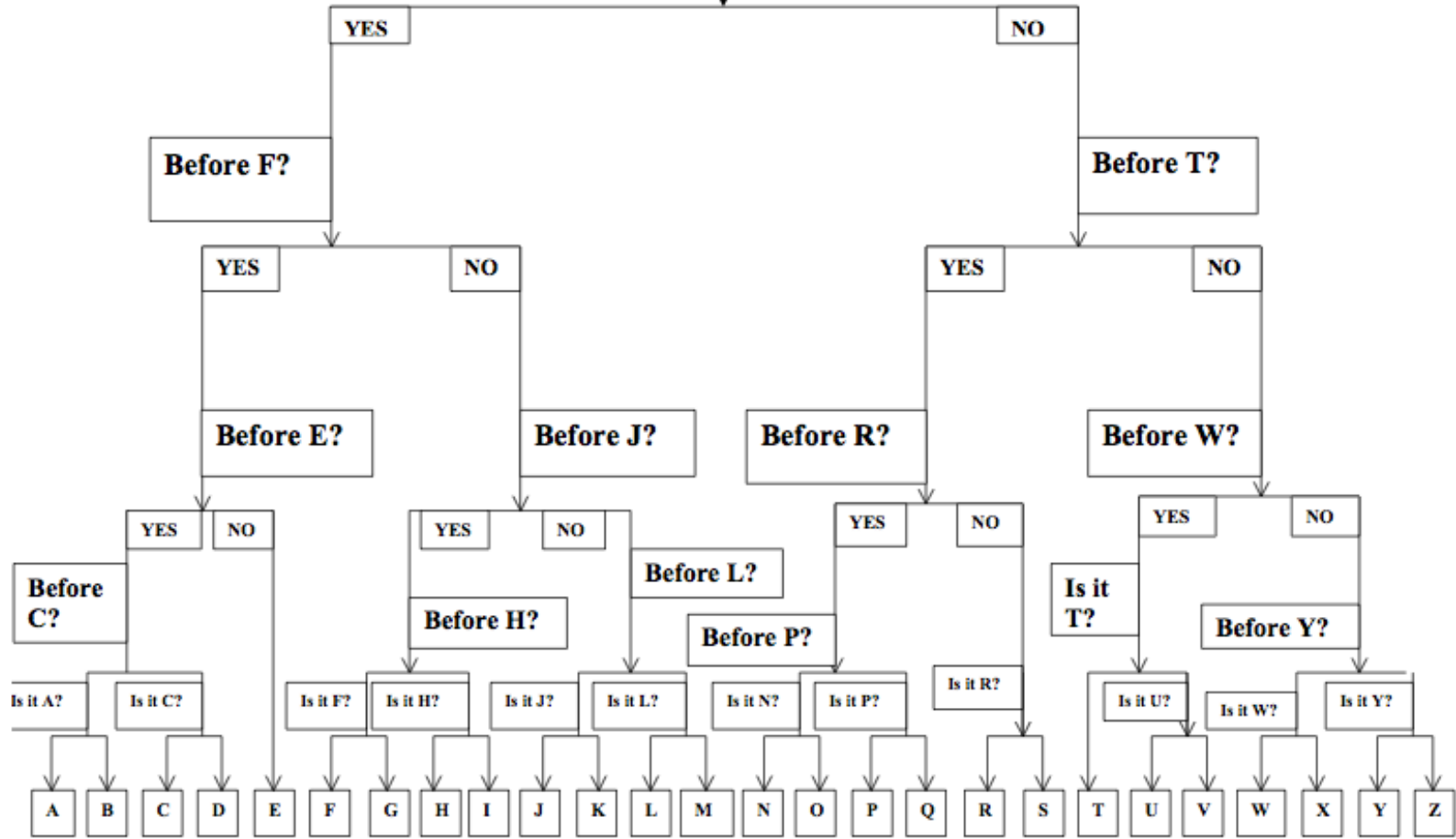
- Do you ask questions like
  - Is it Adele?
  - Is it Gandhi?
  - Is it Usain Bolt?
- That takes millions of questions
  - you have only 20!
- Instead you try to ask halving questions...
  - Are they female?
- Apply that solution to Locked-in communication



Answer the Question.  
 Take the left branch if the answer is Yes.  
 Take the right branch if the answer is No.  
 Answer the Next Question on that branch and continue as above.

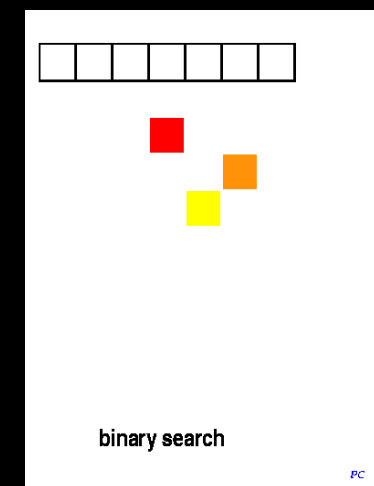
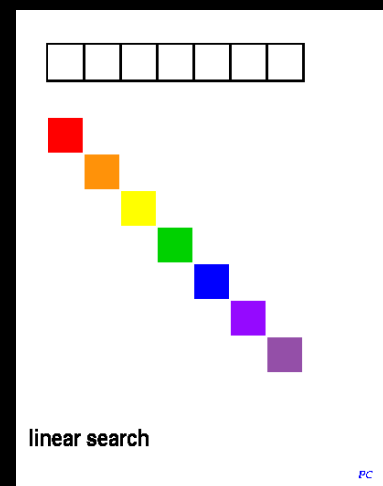
START HERE

Does it come before N in the alphabet?



# Search Algorithms

- We have looked at two different ways of searching for information
- Two different algorithms
  - Linear search
    - One by one
  - Binary search
    - Divide and conquer
    - Halving search



Does everyone agree we  
would have improved things  
for Bauby?

# 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.**

# What is computational thinking?

- Computing is about thinking skills
  - Algorithmic thinking
  - Abstraction
  - Translating solutions
  - Generalisation
  - Analytical thinking
  - Understanding people
- Not just about computers!
  - Solutions for people



Activity sheets at  
[www.teachinglondoncomputing.org](http://www.teachinglondoncomputing.org)  
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# Thank you!

On our website to support this session:

- Activity sheets
- Story sheets
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- free unplugged sessions
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