



Boffin Brainchild, the world's most advanced free-thinking robot, is bored. He's been programmed to learn like a child, so standing on a plinth in the science museum is no fun.

Along comes Tom, whose life is changed forever when he ignores a museum sign and touches Boffin's nose. Despite his best efforts Boffin escapes with him on the school bus. What can Tom do? Terrified of being accused of stealing the robot, he disguises Boffin as a real boy. But how long can Tom fool his parents – and his school?

Having the world's most valuable robot to stay is the most exciting thing ever – but also the scariest!



## Introduction

Quite apart from being fun to read, *Boffin Brainchild* addresses many aspects of the national curriculum and is especially useful in engaging with its most recent amendments. Best suited for KS2 pupils in Years 4-6 (ages 8-11), feedback suggests its humour and narrative twists are very well received by reluctant readers of both genders, while challenging underlying questions about ethics, science and social responsibility provide plenty of substance for readers of all abilities.

These notes have been designed to make structuring a project as easy as possible, each topic being divided into questions, discussions and activities. Page numbers of specific instances in the text are given where necessary, but we recommend that *Boffin Brainchild* is read for pleasure before embarking on further study.

Emphasis is given on those aspects of the curriculum to which its themes are best suited – English, Art, Design and Technology, Geography and Cultural Education, Citizenship and Robotics/STEM subjects, to which *Boffin Brainchild* has special relevance. They have been designed to stimulate reading, writing, imagination, drama, comprehension, analysis and evaluation; to encourage team skills such as collaboration and communication and to help students to develop personal skills such as empathy, questioning, creativity and responsibility.

The magical yet thought-provokingly believable world that is unlocked by reading *Boffin Brainchild* with your students forms a springboard for a host of potential projects. Here's our selection - we hope the ideas suggested within the scope of these notes prove useful. Most importantly, however, we wish both you and your class great fun as you join *Boffin* on his adventure!



**Jill Jennings** was born in County Wicklow and grew up on the west coast of Ireland. Her home is now in North Yorkshire, with her family and a dozen animals.

"Boffin" was inspired by a radio talk about how future robots, to approach human levels of intelligence, would have to learn like humans rather than be pre-programmed. But having several uncles who were inventors and engineers might have helped too. This is Jill's second children's book. Her first was "Pyjama Jones", an exciting adventure in which Toby Jones falls into a secret city of ancient Egyptians right under his bungalow home.



## English and Comprehension



Boffin often struggles with the English language! His humorous mistakes illustrate and consolidate key vocabulary, grammar and syntax skills. The book can be enjoyed at different depths of comprehension, with settings, character development, plot and subtle narrative devices providing much to talk about.

## Opening Lines

Reread the beginning of Boffin Brainchild:

'Here, at long last, was Boffin Brainchild. Tom had waited weeks for this moment. Boffin stood on a little platform in the middle of the great hall of the science museum. The white stone platform made Boffin the exact same height as Tom.'



What information is conveyed?  
Why are the opening lines of a novel important?

**Discussion:**

Compare and discuss the beginnings of other books and think about their effect.

**Activity:**

With these thoughts in mind, write your own beginning to a novel.

## Tom and Boffin

**Discussion:**

Describe Tom and Boffin, including their interests, strengths and flaws. Discuss how their characters develop through the course of the novel. Are all character traits directly told to the reader, or are some shown through their behaviour, often in difficult situations?

**Activity:**

Using the results of your discussion (above), write down a brief description of both Tom and Boffin (Note: this could be combined with drawing the characters). Use one or more short quotes from the book to back up your analysis.

**Motives:**

Why did Boffin want to come home with Tom?  
Why did Tom let Boffin come home with him?  
Why did Tom keep Boffin a secret from his parents?



Is it important that we can relate to literary characters?

**Activity:**

Write your own short scene with Tom and Boffin, using your knowledge of their characters.

## Style and Structure



What tense was *Boffin Brainchild* written in?  
Was it written in first, second, or third person?

**Activity:**

Write a synopsis of *Boffin Brainchild*.

Mr Richardson is likened to a terrier:

'Mr Richardson raised his head again, above the excited class. He was a small man, bouncy like Granddad's terrier, Tom decided – and he yapped like it too.'



Is this a simile or a metaphor?

**'Baffled Boffin' – Use of Language**

Boffin does not understand many phrases and sayings, such as:

- 'I have to find the Men's' – p11
- 'Someone's going to spot you right now' – p31
- 'Shut up!' – p39
- 'Come on, the bell's about to go' – p77
- 'Must have eyes in the back of her head' – p81
- 'I need a word' – p84
- 'Enjoy your break' – p86
- 'Cool it!' – p87
- 'Head Teacher' – p99
- 'Mr Brown has let us off the hook' – p106

'You're nearly flat!' – p128

**Activities:**

- Make a list, or table, of what these phrases really mean and what Boffin thinks they mean.
- Write down or act out a conversation between Tom and Boffin, where Tom explains to Boffin what an everyday object is.

**Writing for Different Audiences and Arguing****Activities:**

- When Boffin goes missing from the museum, the news is reported in a newspaper (p133). Write a short newspaper article about the missing robot, as if it has just happened.
- Create an advertisement for the museum, encouraging people to come and see Boffin Brainchild.
- Imagine you are Tom. Write a letter to Ishi

Kashikoi to explain why it is wrong to take Boffin from you and to control his actions. Use a *counter-argument* to undermine his own argument; you can only change his mind by addressing his concerns and proving them wrong!

*NOTE – this activity is best approached after discussing the ethics of the story, explored in 'Robotics' and 'Citizenship'.*

- Write a short story/user manual about your design of robot (*NOTE – this forms part of the 'Design your own robot' activity given in the 'Art and Design Technology' topic notes.*)

## Geography & Cultural Education



The following notes are designed to help students build an appreciation of other places and cultures. They may also be used to encourage confidence in map-reading ability.

**Where is that?**

Boffin was built in Japan.

"How exciting." Dad let out a low whistle. "I've always wanted to go there. Would give anything to see the Bullet Train."

- Dad, p54



- Where is Japan?
- What is Japan's capital city?

**Activity:**

Research Japan, its culture and the country's world-leading robotics industry (see 'Robotics'). Research Japanese technology.

Examples include robots such as ASIMO and Kirobo and the Shinkansen 200mph 'bullet trains'.



- Is there something in the classroom that was 'Made in Japan'?

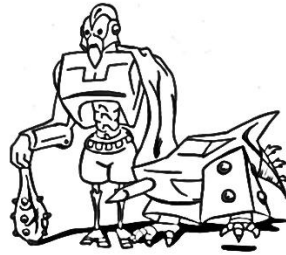
**Activity:**

The author, Jill Jennings, was born in County Wicklow, grew up on the west coast of Ireland and now lives in North Yorkshire. Find and research these places on a map, estimating the rough latitude and longitude of each.





## Art, Design and Technology



Boffin Brainchild inspires many opportunities for pupils to express themselves artistically and to appreciate the design processes that shape the human-made world we live and work in. Below are some ideas of how these may be fulfilled, including a chance for pupils to produce their own designs using teamwork and collaboration. The unusual premise of a manufactured titular character presents an opportunity to discuss product design, a key aspect of the 'Design Technology' programme of study.

### Art Projects



#### Activities:

- Draw a picture of Tom and Boffin (NOTE – this may be combined with the character analysis activity in English and Comprehension, 'Tom and Boffin').
- Tom and Boffin enjoy making their own comic strips. Create your own short comic strip, featuring your own characters. Alternatively, form teams, mutually decide on your story and characters, then allocate sketching, inking and words between team members. It may surprise students to learn that superhero comic strips and graphic novels are usually a team effort in this way, sometimes involving many people.
- Form groups of three and design composite robots or people, following the 'picture consequences' game. The first student should design the head, the second the torso and the third, the legs and feet. The design should be passed on to each player unseen, by folding of the paper. Each player should thus only know the appearance of that part of the body which they have drawn, to maximise surprise when the paper is unfolded and the strange character is revealed!
- Boffin and Tom make lino-cuts in their school (p88). Create your own lino-cut designs and print from them.

### Designing your own Robot



#### Activity:

Design your own robot. Give it a name and sketch a drawing of what it looks like (NOTE: this activity could be combined with writing a short story/user manual for the students' robot designs, suggested in 'English and Comprehension'; it may also be combined with a labelled diagram activity - see 'Robotics').

Free-thinking robots like Boffin would be people in their own right, yet they might be created using product design techniques!

A product is designed to be appealing, functional and purposeful.



#### Discussion:

What processes were likely used in designing and developing Boffin Brainchild's appearance and functions, to ensure the robot was appealing, functional and purposeful?

What skills would be needed to design a robot like Boffin?



Why is it that many different materials were used in manufacturing Boffin?

Why do you think the inventors of the robot decided to name him 'Boffin Brainchild'?





## Robotics & STEM



We live in exciting times for robotics; today's children may well meet someone like Boffin in their lifetimes. Indeed, there are plans for legislation allowing easier testing of autonomous machines, positioning the UK as the world's most welcoming country to advanced robotics research. These notes introduce many of these real-life robots through links and videos (see note below), as well as presenting the opportunity to discuss the social implications of these advances.

**NOTE** – An introduction to the fascinating world of robotics would be enhanced by the resources given in the 'Taking it Further' notes, giving students the opportunity to learn about today's robots, the people who make them and what part they will play in our future.

### Engineering Boffin



- Why are Boffin's wires plastic-coated?
- Why did Tom think that water would stop Boffin working?
- Why does the lifeguard tell Tom off for 'risking electrocuting everybody in the pool'?

Boffin has a FART (Forced Air Refrigeration Technovalve; p34) to prevent overheating.



#### Discussion:

What might cause him to overheat? Discuss electrical resistance – the reason why phone chargers, game consoles and other electrical devices are often warm to the touch when in use. How do modern laptops, for example, avoid overheating?



- Why are Boffin's arms in four parts?
- Ishi Kashikoi's laboratory is very clean. Why do you think this is?

Why can't boffin eat? Could a robot be designed to obtain enough energy from food to function? [This could be combined with a discussion about chemical energy, illustrated by the classic 'lemon battery' experiment]



#### Discussions:

- Discuss what coding is and its importance in programming robots. Could you programme a robot to carry out basic

tasks? [NOTE – although not covered in depth in these notes, there are kits available to give students this opportunity. See 'Taking it Further' section for more information]

- Research and discuss modern robotics, such as Asimo, Kirobo and driverless cars (see 'Taking it Further' section for videos and information to compliment this discussion). Have a go at predicting the advances that may be possible in the next 10, 20, 50 and 100 years.
- Discuss what skills would be needed to be a roboticist.

#### Activities:

- Make and programme simple robots (See 'Taking it Further' for information on kits). Form an after-school robot-building club to encourage this.
- Once you have designed your own imaginary robot (see *Art and Design Technology*), draw a basic schematic diagram of how it works. Remember to include key components such as a battery, wires in a circuit and different types of sensors (touch, sight, etc). Give rough dimensions of length and height (the drawing needn't be to scale). Define each component with explanatory notes and use numbers or arrows to label them clearly. Feel free to invent your own imaginary technology as you go!



### Artificial Intelligence, Thinking Freely and Ethics

Many life-like robots are being made today with 'Artificial Intelligence' (AI); each one far more advanced than the last. However, none of them can act or think independently; that is, their thoughts and actions are confined by what they have been programmed to do. Unless mistakes are made in programming, their behaviour is predictable - they are not 'free-thinking', like a human, having no emotions or consciousness.

Some scientists think the secret behind building a free-thinking robot is waiting to be discovered; others think if you only make a robot's programming complicated enough the ability to think freely will naturally follow, while still others think it can never happen. However, many agree that, given the speed at which robotics is advancing, the exciting possibility that today's students will meet a free-thinking robot like Boffin in their lifetimes is greater than ever. It is exciting to consider what the scientific and social implications of this might be.



#### Discussions:

- Discuss the concept of artificial intelligence. Compare computers and human brains – both use electrical pulses to carry information, such as instructions to blink an eye or delete a file. Both can store information. How are they dissimilar?
- Boffin is the world's first free-thinking robot. Discuss what is meant by 'free-thinking'. Do you think a free-thinking robot will be made in your lifetime?

A smartphone connected to the Internet can access enormous amounts of information. It can hear (microphone), see (camera) and is sensitive to touch (touchscreen).



Which of our senses is it missing?



Tom finds it very difficult to describe what smell is on p43. Why doesn't Boffin know? Can you

describe it? Some senses are tricky to define!

The smartphone can access enormous amounts of information using the Internet, can work out complicated calculations and has an excellent memory. Some smartphones can even understand your voice and hold a conversation with you!



Does it have artificial intelligence?

Is it free-thinking? If not, why?

A free-thinking robot will learn from experience; a number of modern robots are designed to do this already.



Boffin learns by copying. Is this how humans learn?

Why doesn't Boffin know that poking Tom in the eye will hurt him?



#### Discussions:

- Boffin is free-thinking and decides that he wants to live like a real boy, but Ishi Kashikoi thinks he should have control over Boffin, since he invented him. Who is right?
- Do you think that the world's first free-thinking robot should be given the same rights as a human?
- Discuss the concept of ethics. Can you think of other instances where scientists need to consider ethics?



#### Activity:

This activity needs a brave volunteer to be Ishi Kashikoi! The other students should draft questions with which to grill him, before interviewing 'Ishi Kashikoi' about the ethics of his actions.

### Astronomy and Light Pollution

*'But you can't even see the stars properly from here. The street lights are too bright. All you'll see is a yellow glow.'*

- Tom, p119



Why couldn't Boffin see stars from Tom's house? How many stars can you see from your house?



What does The Plough look like? Can you see it from your house?

Can you see the Milky Way, during the summer?



## Citizenship



Boffin Brainchild raises some interesting and challenging questions about our responsibilities as citizens, the choices we make and how they affect others. It also provides material to discuss police procedure and the justice system, to openly discuss the bullying and insecurities which feature prominently in the book and to think about key life skills such as cooking and emergency response. Perhaps most intriguingly, however, it questions the true meaning of citizenship – is Boffin a citizen at all?

### The Long Arm of the Law

When Boffin Brainchild went missing from the museum, he was reported as missing.



If you were the museum, would you treat Boffin as being 'lost property', or a 'missing person'?



#### Discussions:

- Discuss police procedure, such as appealing for information, questioning and the concept of being innocent until proven guilty.
- Discuss police ranks in the United Kingdom (Police Constable, Sergeant, Inspector, Chief Inspector, Superintendent, Chief Superintendent) and research the insignia associated with them.

"We'll give you a call tomorrow and let you know what the next steps will be. It might be a good idea to have a word with a solicitor." – Sergeant Sanchez, p157.

Why does Sergeant Sanchez advise Dad to speak to a solicitor?

If Ishi Kashikoi had not dropped charges, the case would have gone to the law courts to determine whether Tom was responsible for theft.

#### Activity:



Imagine the court case. You will need a judge to keep order, a prosecution to represent Ishi Kashikoi, a defence to represent Tom and a jury. The barristers for both prosecution and defence should give the jury their closing speeches, allowing two minutes for each. Then the jury can deliver their verdict!

### Bullying and Discrimination

As Tom passed, Jack whispered in his ear. "Think you can hide behind your friend, do you? Watch your back. When you least expect it, I'll get even."

- p77



#### Discussions:

Discuss bullying. Imagine you were being bullied by Jack, like Tom. What would you do?

"Boffin not boy then, not same as Tom."

"Hey, don't worry about that. All boys are different." - p30

Boffin feels insecure about being different to 'normal' boys and longs to have hair.



What if Boffin was in your class? Would you treat him differently to other children?

#### Discussion:

Discuss discrimination, acceptance and the value of diversity.



**Life Skills****Activities:**

➤ How many careers can you find in *Boffin Brainchild*? Make a list, then decide on which one you would like the most and why.



What sort of career would you like when you grow up?

- Tom's favourite meal is 'Bella Pasta'. Think about what ingredients you would use to make the dish and write them down.

Tom tells countless lies in *Boffin Brainchild*!

**Discussion:**

Is Tom right to lie as much as he does? Discuss instances in the book when telling the truth may have been better in the long run, though perhaps difficult to do.

"No pulse!" said the lifeguard bending over Boffin, feeling his neck. "We're going to have to do CPR."

p141



What is CPR?

How would you respond if a non-swimmer fell into the deep end of a pool?

**Taking it Further**

Below are links to online content introducing the exciting world of robotics. If you are reading a printout and have a smartphone, QR codes have been made available to make accessing the content easier. Naturally, some online content may become out of date, while videos uploaded to YouTube risk featuring inappropriate advertising and comments.

**Robots for Kids**

An excellent New Zealand website with facts, videos, photos, games and quizzes.  
<http://www.sciencekids.co.nz/robots.html>

**Robot Astronaut Kirobo Has Historic Talk on International Space Station**

A 6-minute video of Japanese robot Kirobo chatting to an astronaut on the ISS.  
[https://www.youtube.com/watch?v=ofolW2M2S\\_I](https://www.youtube.com/watch?v=ofolW2M2S_I)

**Robot Musician**

A short *New Scientist* video about a robot musician who can interact and collaborate with humans.  
<https://www.youtube.com/watch?v=cOJZs75CnUs>

**iCub – Humanoid Platform**

Designed by the 'RobotCub Consortium' of universities across Europe (including in the UK), iCub is a humanoid robot designed to look like a four-year-old. iCub's development exemplifies how international cooperation is integral to science. In this video, it learns from experience, just like a human child; demonstrating that *Boffin Brainchild* may be closer to reality than you might think.  
<https://www.youtube.com/watch?v=ZcTwO2dpX8A>

**Mechanisms: Robot Building**

Resources from the National STEM Centre to be used to help children explore mechanisms and robotics, by creating a series of challenges for their 'mechanical kangaroos' to overcome.  
<http://stem.org.uk/rx96k>

**Asimo Robot Runs, Hops and Uses Sign Language**

Here's a short *New Scientist* video of Asimo – the world's most advanced humanoid robot, made by Honda in Japan. Impressive, but if you need a glass of juice in a hurry, don't ask Asimo!  
<https://www.youtube.com/watch?v=Jz-kuA2m6UE>

