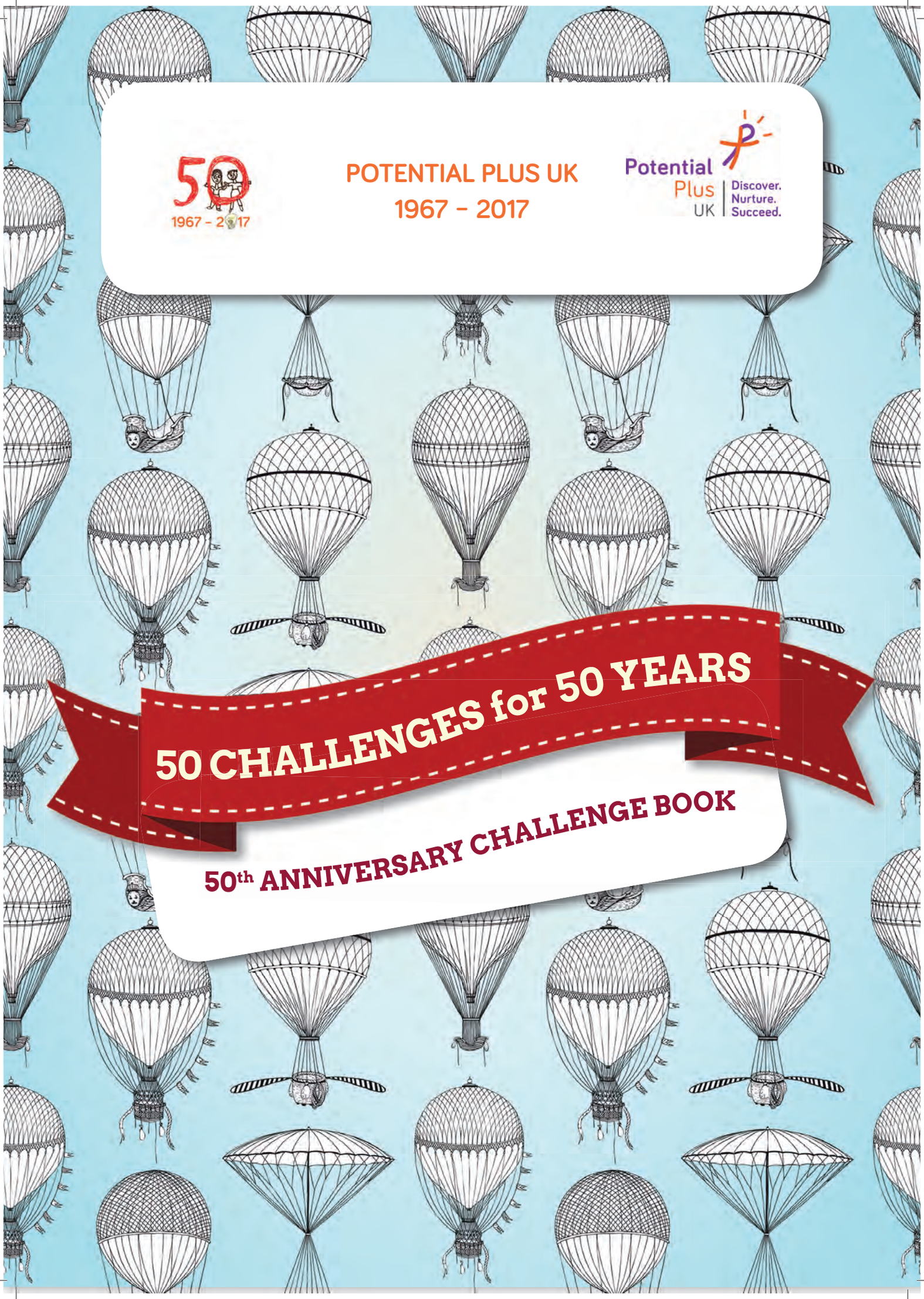

1967 – 2017
POTENTIAL PLUS UK
1967 – 2017
Potential Plus UK
Discover.
Nurture.
Succeed.
50 CHALLENGES for 50 YEARS
50th ANNIVERSARY CHALLENGE BOOK

Welcome to 50 CHALLENGES for 50 YEARS

To celebrate 50 years of amazing children, we have collected 50 amazing challenges: one for each year of Potential Plus UK.

The challenges contained in this book are sure to elasticise your brain and get the cogs of your imagination whirring: there's a riddle that will test your mind's agility; a brand new language for you to try out; and you can get creative with an innovative way of writing poetry.

The challenges are intended to engage, inspire and… you guessed it, challenge you! They will encourage you to think in new ways and consider things from different perspectives. There are opportunities to think critically, creatively and to problem-solve.

This is a resource that can be worked through independently, as a family or in the classroom. It is for all ages: from early years to the over 50s.

The beautiful thing about most of these challenges is that you can adapt them to your level by making them more accessible or delving even deeper. You might race through some of the challenges but you might get stuck on a couple! Build resilience by sticking with those trickier challenges and see if you can find ways around them. Some might enthral you and keep you entertained for a long period of time. Or you might look at one or two of the challenges and think no way is that something you'd want to try but we'd say, why not? Give it a go, you might enjoy yourself!

A challenge can be a competition; it can also be a test. In this case, we're not testing your ability to perfect these challenges; we are encouraging you to test the following:

- **Your problem-solving skills**
- **Your creative thinking skills**
- **Your critical thinking skills**
- **How willing are you to go out of your comfort zone?**
- **How willing are you to try something new?**
- **How willing are you to persevere through a challenging task and not give up?**
- **How willing are you to try your best?**

HOW TO USE THIS BOOK:

Work through as many challenges as you can!

Can you have a go at all 50? How about doing one challenge a week?

Inside this book, you will find a chart to track your progress.
Once you've completed as many as you can, send a photo of your chart to **events@potentialplusuk.org** and we'll send you a certificate!

And if you think we missed something out, see our bonus challenge!

BOB COX

PRESENTER & AUTHOR

Bob is a presenter and also author of the 'Opening Doors' series of books which are used across the U.K. to support a rich, challenging English curriculum! He also runs an enrichment centre for primary pupils called 'The Saturday Challenge'

www.searchingforexcellence.co.uk

@BobCox_SFE

CREATIVE WRITING

1

The Unending Sky

I could not sleep for thinking of the sky,
The unending sky, with all its million suns
Which turn their planets everlastingly
In nothing, where the fire-haired comet runs.

If I could sail that nothing, I should cross
Silence and emptiness with dark stars passing,
Then, in the darkness, see a point of gloss
Burn to a glow, and glare, and keep amassing,

And rage into a sun with wandering planets
And drop behind, and then, as I proceed,
See his last light upon his last moon's granites
Die to dark that would be night indeed.

Night where my soul might sail a million years,
In nothing, not even death, not even tears.

John Masefield

The poem is from 'Lollingdon Downs' by John Masefield, 1917

YOUR CHALLENGE:

Tell the story, in poetry or prose, of your sleepless night roaming the universe in your imagination.

- **What did you 'see' which was 'unending'?**
- **What was your 'point of gloss'?**
- **How could you experience a 'million years in nothing'?**
- **Did imagination and reality start to merge?**
- **How did your sleepless night end?**

How can you rise to the challenge?

Make your narrative epic, imaginative, brave and unusual!

Make the reader full of wonder at your vision of the 'unending sky'

2 TELEPATHIC TEXTING

TOM PELLEREAU
INVENTOR AND WINNER BBC APPRENTICE 2011

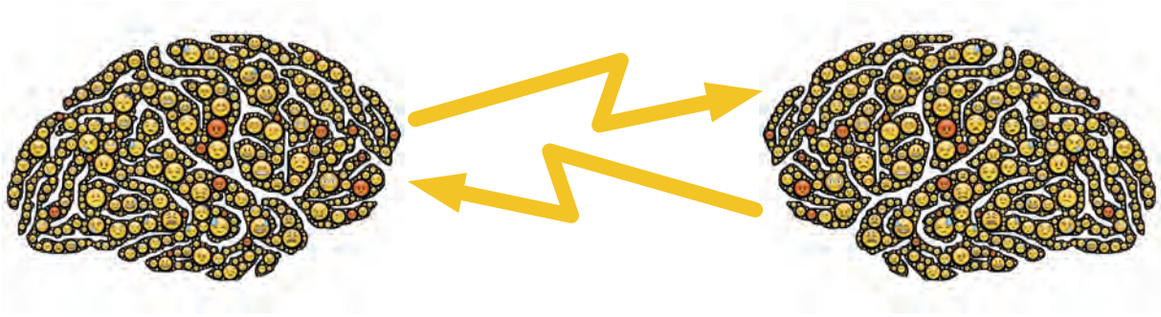
www.stylfile.com
@inventor_tom

TELEPATHIC TEXTING:

Would you like your phone to be able to understand your thoughts?

Technology and artificial intelligence are improving so rapidly that within a few years it may be possible for your phone to understand your thoughts and provide you with information whenever you want it. With the small addition of a microchip under your skin, you could be connected to your phone, Facebook, and the Internet at all times.

Given the choice, would you have a microchip inserted to remind you of people's names when you bump into them or to tell you what time the next train will be; to find out all the capital cities in the world or to allow you to talk to your friends without having to talk out loud?



- **What would you call this chip? Would it have a name?**
- **What are the most exciting possibilities for you about this possible future?**
- **Are there any things that scare you about this future?**
- **Are there any ethical implications society should start considering?**

HAROON SHIRWANI

MODERN LANGUAGES DEPARTMENT, ETON COLLEGE

Haroon is a master at Eton College, where, among other things, he teaches Arabic, French and Spanish, and runs the Debating Society.

JANGLI

3

Here are some sentences in Jangli (a made-up language) with their English meanings.

Waldan razu	I am a writer
Had waldan razu	I am the writer
Nardan razu gan	I was an athlete
Latdan razo sa pe balat lato	You are a teacher and you teach in a school
Had waldan pe had bawal raza	The writer is in the office
Pe had bawal walom wala gan	He was writing a book in the office
Pe bakaw kawu gan	I was eating in a restaurant
Pe had bawalom maka	He works in the library
Had nardantin pe had banar makan	The athletes work in the stadium
Pe bawaltin makan fa	They will work in offices

1. See if you can work out the meanings of some of the words. Write down how you express the following in Jangli.

- **writer**
- **the**
- **offices**
- **and**
- **a restaurant**

2. All Jangli verbs follow the same pattern, with no irregular forms. You can find the pattern by studying the example sentences above. Based on this, express the following in Jangli.

- **I am**
- **You are**
- **He is**
- **They are**
- **I eat**
- **You will write**
- **He was**
- **They were working**

3. Now translate the following, from Jangli into English.

- **Pe balattin pe London maku.**
- **Pe had bawalom lata fa.**
- **Walo gan sa kawan gan.**
- **Had bakawtin pe banar razan gan.**

EXTRA CHALLENGE

Based on all of the above, write some sentences of your own in Jangli and its English meaning. You can use vocabulary from the sentences above but aim to be as original as possible.

4 THE IMPORTANCE OF BEING BRIGHT!

The fact that light can travel through the vacuum of space does not seem very important but actually I think it is one of those facts, or principles, that turns out to be crucial for us all. Here's why…

Waves usually need something to travel within or on: sound needs air, vibrations need solid things, sea waves need water etc. but light waves are different, they need nothing to travel within!

Firstly, by light, I mean the waves of the electromagnetic spectrum: radio waves, heat, light, ultraviolet, X-rays … etc. If light could not travel through a vacuum, we would get no sunlight on Earth, we would see nothing: no stars, no Moon, no you or me. There would be virtually no heat (just the tiny left over heat coming up from the centre of the Earth from its ancient origins and from the radioactive decay of the rocks). The seas would be frozen, there would be little chance for life, nothing would grow, little would move or develop.

Light is also the 'information messenger' - pretty much all we know about the universe comes from the study of these electromagnetic waves of 'light'. Without light, we really would be in the dark! Let's explore.

CHALLENGE 1

I want you to think about the impact light has on the world: the way it provides heat and warmth; illumination and clarity.

For example, what role does light have on our notions of time passing; on what's 'out there' in space; on communication and the communication of information?

Does it matter that light takes time to travel – that it doesn't go instantly from one place to another?

DR JONATHAN HARE
THE CREATIVE SCIENCE CENTRE
THE UNIVERSITY OF SUSSEX

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Dr Jonathan Hare is a freelance science communicator. His PhD work with Sir Harry Kroto led to a method of making the football molecule C60, Buckminsterfullerene. He has worked as a 'Time Lord' at the National Physical Laboratory, where he worked with atomic clocks. He has also worked on developing a gas-powered car with British Gas. His many television appearances include Rough Science, Hollywood Science, COAST and Horizon. He is currently a Visiting Lecturer on Science Communication at Sussex University. He loves making things, juggling, hill walking, amateur radio and painting.

CHALLENGE II: YOUR VOICE ON A LIGHT BEAM

- The Transmitter: take a tube, say 10cm long and about 5cm in diameter and wrap aluminium foil around one end to form a tight cap or diaphragm. If you talk into the other end of the tube you can feel the foil vibrate. Allow light to fall on the foil and watch what the reflected light does when you speak into the tube. See how it jiggles around? Amazingly, much of the information in your voice (its frequencies and amplitudes) has been transferred in the process. You have "amplitude modulated" the light. It's one of those experiments you wouldn't think would actually work in real life but it does - you have put your voice on a light beam!

- The receiver: get a small solar cell from an old garden light (or from a hardware shop or online retailer) and wire it into the input of battery powered amplified computer speakers (the small voltage from the cell will not harm the amplifier). If you shine the reflected light from the transmitter onto the solar cell as you talk into the tube, you will hear your voice coming out of the speakers. You have light beam communications!

For more details see my website:
www.creative-science.org.uk/lightbeam.htm

- See how far you can get the communication to work.
- Which is best - sunlight or torchlight?
- Is the loudness best when the foil is tight or slack. What about the quality?
- Would this work for space communications?
- If we ever had the opportunity to communicate with alien life, would a light beam be better than radio?

5

JASON BUCKLEY

DIRECTOR OF STUDIES AT GIFT

www.giftcourses.co.uk provide day and residential courses for exceptionally able children

It is the Great War. **CAPTAIN EAST** is at one end of the stage, **CAPTAIN WEST** at the other. These are two separate locations at either end of a long line of trenches.

Enter two carrier **PIGEONS**, one at each end of the stage. They stand to attention.

PIGEONS *(waving their wings)*

Coooo!

CAPTAINS

Ah, a message from headquarters!

The PIGEONS pass a letter to each captain.

CAPTAINS

Thank you. Dismissed.

The PIGEONS and CAPTAINS salute each other. Exit PIGEONS. The CAPTAINS study their letters.

COLONEL NORTH *(voicing the letters, offstage)*

Dear Captain East and Captain West,

I know you'll be delighted to hear: it's time for the big push. Your regiment and West's will go over the top tomorrow, one at 0600 hours while the enemy's still napping. When you reach their trenches, you'll hoist the flag and the other regiment will join you. I'll leave it you to decide who has the honour of going first - I don't like to have favourites. Good luck.

Colonel North

CAPTAIN WEST

Dash it all! It's only two weeks before my leave. Whoever goes first will get cut to ribbons.

CAPTAIN EAST

Bother! My trench foot is coming along nicely. Another two weeks and I'd be in a nice hospital.

CAPTAIN WEST

Better ring East and sort out who's going be massacred. (Picks up phone) Get me Captain East, please. *(Aside)* East has a very quick mind, but I don't trust him.

Phone rings at Captain East's end.

CAPTAIN EAST

It's Captain West? Yes, put him through. *(Aside)* West is a clever man, but I don't trust him.

CAPTAIN WEST

Hello East. Rum show, these orders. I suppose we should toss a coin to see who goes first?

CAPTAIN EAST

(quickly) Right-ho. I've a sixpence. Heads or tails?

CAPTAIN WEST

Heads. Er... Hang on a moment. I feel awfully rum saying this, old chap, but... how the devil can I know, if you say it's tails, that it really is, and that you're not just saying so to save your own skin.

CAPTAIN EAST

(looking disappointed) I resent the accusation. However, if you have some other suggestion, I shall listen to it.

CAPTAIN WEST

How about we each choose a number and whoever is first to work out what they are multiplied together wins?

CAPTAIN EAST

That would hardly be fair. Mathematics was never my subject. And I believe you were an

accountant before the war. No, it must be something that is pure chance, 50/50, just like tossing a coin.

CAPTAIN WEST

And it needs to be something decisive. We can't keep arguing about it.

CAPTAIN EAST

And one more thing, if you don't trust me to toss a coin, I don't trust you either. So it has to be impossible to cheat.

CAPTAIN WEST

Hmmm...

CAPTAIN EAST

Hmmm...

CAPTAIN WEST

Hmmmmmmmm...

CAN YOU WORK OUT THIS RIDDLE?

I draw you in and keep you out.
I am a lock and a key.
I trap you, and you struggle to be free,
Yet you refuse escape if you are proud.
I torture you until I confess,
And then you turn torturer.

What am I?

HAPPY PUZZLING!

There are an infinite number of possible solutions, some more complicated than others, but they all share some similarities.

HEADS

The challenge is trickier than it first appears. Tossing a coin is a remarkably fair way of determining something by chance:

- It's 50/50.
- It's always one thing or the other – you know who has won.
- You can't cheat.
- Skill, knowledge and timing have no effect on the result.
- It makes no difference who tosses the coin.
- You can't dispute it.
- You cannot gain an advantage by calling heads or tails.
- You cannot gain an advantage by practising

For all these reasons, you can use tossing a coin as a decision mechanism even if both players have strong incentives to cheat and neither player trusts the other. The challenge is to find another decision mechanism that meets these criteria.

There are additional constraints in the situation:

- They can only use sound
- They cannot send human messengers to each other
- Each will cheat if he can, and each expects the other to cheat if he can

7

CALCULATING EXTINCTION

KATE SNOWDON

NG KIDS

Kate Snowdon is a Staff writer for National Geographic Kids Magazine.

National Geographic Kids is an exciting monthly magazine which gives boys and girls a whole new way to learn and explore their world.

Packed with features, posters, puzzles, quizzes and exciting things to make and do, National Geographic Kids is a great resource for children, parents and teachers.

www.ngkids.co.uk
Twitter: @NGKidsUK
Facebook: /ngkids

There are two questions to answer in this challenge:

1. **How many animals have become extinct in the last 50 years?**
2. **How many animals will go extinct in the next 50 years?**

The difficulty with answering these questions, is that they are not as simple as they first seem – because no one knows how many species are out there to begin with!

The World Resources Institute even goes as far as to say: "scientists have a better understanding of how many stars there are in the galaxy than how many species there are on Earth."

This is because scientists are discovering new species all the time.

Somewhere between 15,000 and 18,000 new species are identified each year – about half of which are insects. The State University of New York's College of Environmental Science and Forestry has been documenting thousands of new plants and animals every year, and have found that the rate at which new species are identified remains relatively stable.

YOUR CHALLENGE

- **Research figures on the number of documented species from 50 years ago.**
- **Calculate how that initial number has increased over the last 50 years, using the average rate (between 15,000 and 18,000) of new species identified per year.**

You should now have worked out the approximate number of species on the planet today. Here are a few facts that can help you to calculate the rate of the decline, and therefore the number of species that have gone extinct in the last 50 years:

- **Experts estimate that the rapid loss of species we are seeing today is between 1,000 and 10,000 times higher than the background extinction rate (meaning the rate of species extinctions that would occur if we humans were not around).**
- **Experts calculate that between 0.01 and 0.1% of all species will become extinct each year.**

How might the facts change over the next 50 years? Are the rates of discovery and extinction likely to change in the next 50 years? How may they change? Why?

How will these considerations affect your answer to question 2?

GOOD LUCK!

LYDIA ANDAL

NEW IDEALIST PUBLISHING

Lydia Andal is the Autistic Founder and Director of New Idealist Publishing.

www.newidealistpublishing.com

PATTERN POEM

8

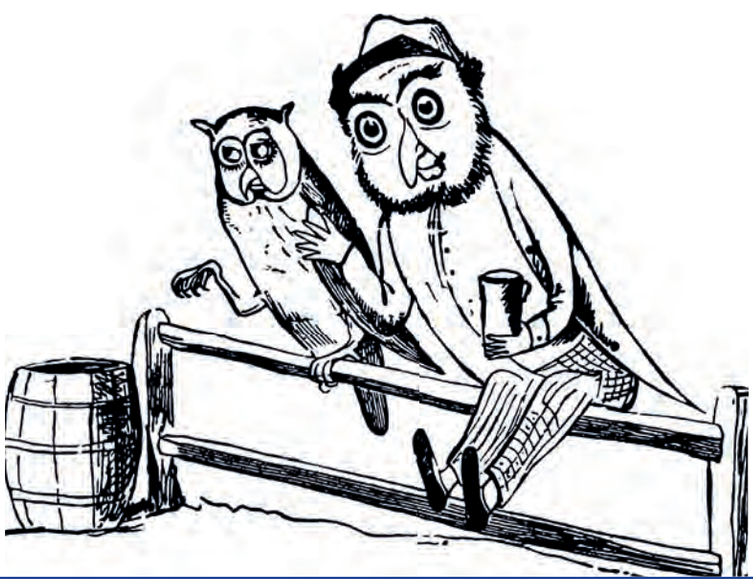
Can you create a poem from a random word pattern?

THE CHALLENGE

- Pick one of your favourite books and make a note of the word at the start of every tenth sentence.
- Keep going until you find enough words to form a short poem.

WANT TO DO MORE?

- If you enjoyed making a 'Pattern Poem', why not try a different book and make a short story using the same pattern?



9

EXPLORING THE MARIANA TRENCH

KIRSTY BERTENSHAW

STEMTASTIC
FOUNDER AND DIRECTOR

info@stemtastic.co.uk
www.stemtastic.co.uk

IN THE WESTERN PACIFIC OCEAN!

The Mariana Trench is the deepest part of the Earth, and so far unexplored! Would you explore it? What do you think you might find?

THE CHALLENGE

- Design a submersible craft that could withstand incredibly high pressure! Would you camouflage it from the sea creatures or make it brightly coloured in case you need rescuing? How many people would it carry? How long would your expedition be? What would you need to take with you?
- Predict what you might find!! A portal into a new dimension, new species never before discovered, a lost sunken city.....What could be in the Mariana Trench?

WANT TO DO MORE?

- How much oxygen would you need for the trip?
- How much water would you need to carry? Could you find a way to make drinking water from the sea around you, or from your waste?
- How much food would you need? How many calories a day would you need?
- How would you communicate with the world above? How would you record what you find – it is very dark in the trench!
- Write a story, an expedition diary, a cartoon or comic strip of your expedition! You could even film diary entries during your expedition!

ALEX BELLOS

BLOGGER OF THE YEAR
ASSOCIATION OF BRITISH SCIENCE WRITERS

Alex sets a mind-boggling puzzle every Monday in the Guardian. His new book *Can You Solve My Problems? A Casebook of Ingenious, Perplexing and Totally Satisfying Puzzles* is available from the Guardian Bookshop and other retailers. His children's book *Football School: Where Football Explains the World* was recently shortlisted for the Blue Peter Book Award 2017.

CAN YOU SOLVE IT?

10

NEW YEAR, NEW NUMBER, NEW EQUATION

Complete the countdown conundrum

10 9 8 7 6 5 4 3 2 1 = 2017

Here in Numberland, we always knew that 2016 was going to be a bad one, since:

2016 = 666 + 666 + 666 + 6 + 6 + 6

But that's last year's news. What's the story about 2017, arithmetically speaking?

Well, 2017 is a prime number - the first since 2011, and the last until 2027. (Prime numbers are those numbers that are only divisible by themselves and 1.)

More notably, 2017 is the smallest whole number whose cube root begins with ten distinct digits:

20171/3 = 12.63480759....

Wowza! At the beginning of a new year, many mathematically curious folk spend time looking for satisfying number patterns like this one involving the new date.

Just so you are not left out of the fun, this puzzle is to fill the blanks in the following equation, so that it makes arithmetical sense:

10 9 8 7 6 5 4 3 2 1 = 2017

You can use any of the basic mathematical operations, +, −, x, ÷, and as many brackets as you like. So, an answer might look something like (10 + 9 + 8) x (7 − 6 − 5)/(4 + 3 + 2 + 1) = 2017, although not this one since this is incorrect.

I do this 'countdown equation' every year. Because 2017 is prime, it is a little bit more difficult that last year's equation where the numbers had to equal 2016. In fact, there are only 652 solutions this year, compared with 890 solutions for last year, according to my computer programmer pal Zefram. (Many of these solutions are similar).

Got that? Now let's raise the stakes. Can you do the same to this equation, which is the same as above but with the 10 deleted:

9 8 7 6 5 4 3 2 1 = 2017

There are only 107 solutions to this one.

Now you have a taste for this puzzle, fill in the equation with the 9 deleted too:

8 7 6 5 4 3 2 1 = 2017

This one only has 13 solutions. It's interesting that each time we remove a number the solution space shrinks by a factor of about seven.

We have to end there, since there are no solutions when only seven digits are left.

I stipulated above that you must use only the four basic mathematical operations. But of course, if you want to show off, you can use whatever arcane or complicated mathematical operations you want.

11 RETHINKING AN EVERYDAY TASK

FIXPERTS

Fixperts is a creative social campaign and design education programme that connects people through the act of 'fixing'. We believe that fixing is a great way to develop creative problem solving skills and demonstrate the power of design to have a positive social impact on the world around us.

This two-minute story of Edna and her sock horn is one we often show to explain what Fixperts is about:

https://vimeo.com/59575065

Do you ever need to think about how you hold cutlery, brush your hair or turn the pages of a book? Probably not, right? You perform most everyday tasks hundreds of times without even being aware of how they're done.

But what would it be like to carry out these actions with a restriction to your hands?

You will need:

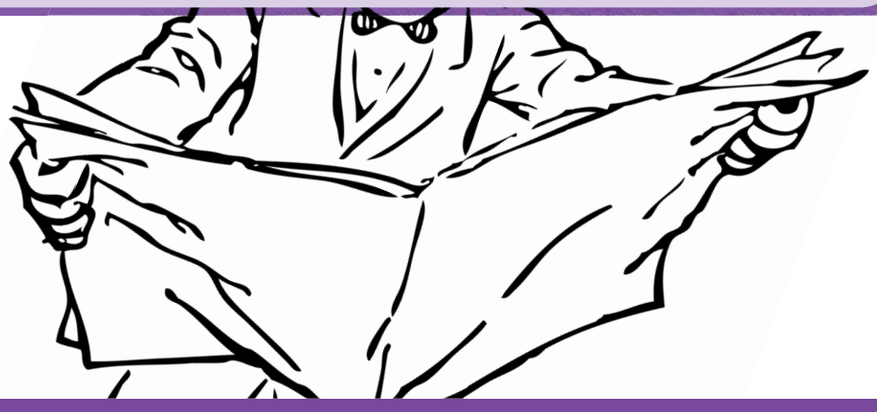
Wooden lolly sticks or any other thin wooden stick and some masking-tape.

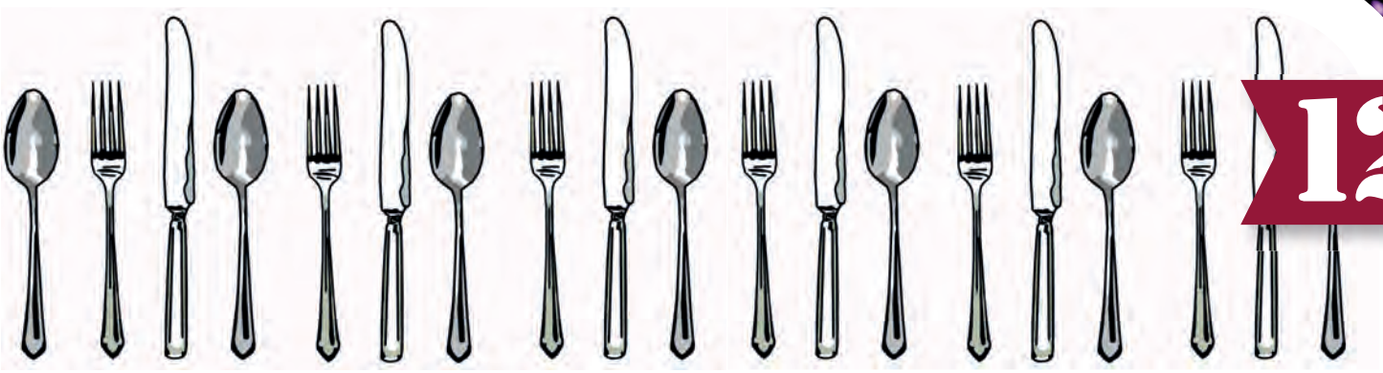
Before you start:

Ask someone to help you. Place a lolly stick on the inside of each of your four fingers, on both hands. Tape the stick to each finger so it can't bend. Now tape two pairs of fingers together on each hand.

YOUR CHALLENGE:

Try turning pages of a book or a newspaper. Not so easy, right?





12

Think:

What is making it difficult to turn the pages? Which parts of your hands are not functioning as they would without the restriction, and what makes it harder to grip the pages?

Take off your restriction and start thinking of a design that would enable you to turn the pages despite your restriction. Think about what made it difficult and how you might overcome these difficulties. Sketch some of your ideas for gadgets or aids that could be used to overcome the difficulty. Try to draw at least five different solutions to the problems you've identified

Model, Test & Improve:

If you have some bits of card, lolly sticks, paper clips, masking tape – try to build a model of your best idea.

Get someone to wear the restriction and try out your invention – does it work? Did they manage to turn the pages easily? If not, what can you do to improve your design and make it work better? Model, test and improve until you have a solution that works well. Congratulations! You are a Fixpert!

Want to do more?

Using the same restriction, try performing some additional tasks, and designing solutions to make it possible to…

- Zip up a jumper or a coat
- Eat spaghetti with a fork and knife
- Brush your hair

GET SOME INSPIRATION!

Want to see how other Fixperts have solved similar problems? Visit **fixperts.org** for lots of inspiring stories. Here are a few links to get you started:

Edna's Sock Horn
https://vimeo.com/59575065

Hingehog
https://vimeo.com/131525933

The Right Trousers
https://vimeo.com/98943960

Button Fastener for Tom
https://vimeo.com/118752792

Pen Holder for Donal
https://vimeo.com/151030342

Chair for Matan
https://vimeo.com/83916430

The Perfect Ponytail
https://vimeo.com/154862608

13 THE DIFFY SQUARE CHALLENGE

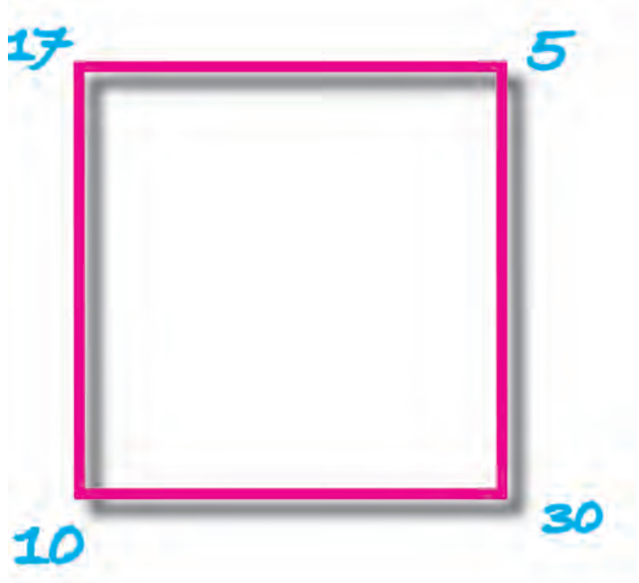
ROB EASTAWAY

Rob Eastaway is an author and speaker, well known for his work making maths accessible to children and adults. His bestselling books include *Maths for Mums and Dads* and *Why Do Buses Come in Threes?* His latest book is called *Any Ideas?* and is about how to think creatively.

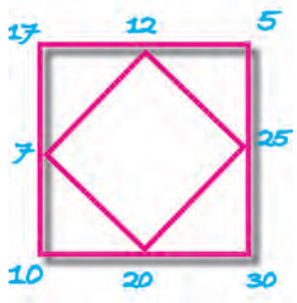
You can find out more about him at **www.RobEastaway.com**

Diffy squares are simple – and yet mysterious. Here's how to make a diffy square.

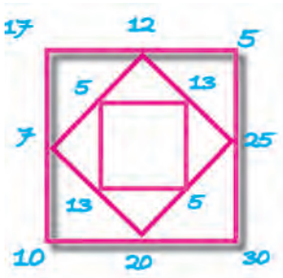
Draw a square, and then put four different numbers at the corners. For example:

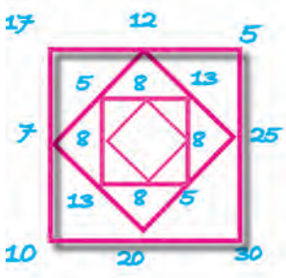


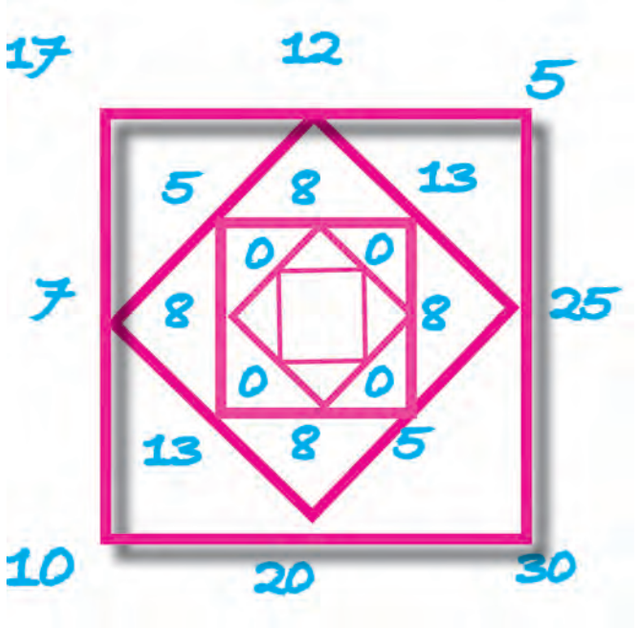
Now find the difference between the numbers at the neighbouring corners and write the answer at the mid-point between them. For example 17-5=12, so write 12 midway between 17 and 5. Join these mid-points to make a new square (which looks like a diamond), like this:



Next, find the differences between the corners of the square, and again put the answers at the mid-points and join them to make a square. Repeat this until you end up with a square in the middle that is all zeroes, like this:







In the example above, we created a total of five diffy squares if you include the first square and the final 'zero' square (count them to confirm that you agree).

YOUR CHALLENGES

1. Create your own starter square, putting four different numbers at the corners. Now 'Diffy' it. Check that you end with a zero square. (This is called 'getting Zeroed')
2. Can you find a combination of starting numbers that leads to MORE than five Diffy Squares?
3. What happens if you don't choose whole numbers (for example decimals – or even pi)? Does this create more Diffy Squares before you get Zeroed?

ULTRA-CHALLENGE

In the ultra-challenge you are only allowed to use whole numbers between 1 and 50. Can you find a combination of numbers that creates TEN Diffy squares?

GENIUS-CHALLENGE

Can you find the combination of four whole numbers between 1 and 50 that creates thirteen Diffy Squares? (There may only be one combination that works – if you can find more than one combination, give yourself extra genius points).

14 SOCK CHALLENGE

MANDY BECK MCKIM

Website: mcrblogs.co.uk/wiredandwild
Facebook: WiredAndWild
Twitter: @mbmckim

Make your own muppet style puppet from an old sock.

1. Choose an old odd sock for your character, a longer one is good although two different socks can be added together to extend the length.

2. Design a puppet around your sock. Think about the texture or patterns on the sock that may give your puppet its character. Think of features and accessories you would add. Your design may change during the making process and this is ok because you may have new ideas along the way.

3. Cut an oval shape from a piece of card (card from a cereal box works well).

4. Cut a slightly bigger oval shape from foam. Fold the cardboard shape in half. Cut the foam shape in half.

5. Turn your sock inside out. Glue the folded card around the toe part of the inside out sock.

6. Glue the curved bits of foam and card together (you will need strong glue for this so ask an adult to help you: you could use a glue gun, superglue or gaffa tape) making a pocket on either side of the fold to put your fingers in to create the mouth movement of your puppet.

7. Turn your sock the right way round so the foam and card is on the inside making the shape of the puppet's head and its opening mouth.

Inspired by a love of Nature, Mandy creates characters and their movements, experimenting with knitting, crochet and embroidery techniques. She has recently created 'Wired, Wild and Alive' a sensory, magical exhibition for children to explore and a menagerie of wonderful creatures to engage with.

Mandy is passionate about bringing her characters to life through performance and telling their stories, creating experiences that bring her love of art and nature together to create something fresh and exciting for children.

8. Add eyes and a nose: you could use ping pong balls, pompoms, buttons, recycled lids, googly eyes and beads. Ears can be made with felt or funky foam. Again, you might need super glue for these or you could even try your hand at sewing!

9. How about adding a bit of character to your puppet now? For example, you could make your puppet be a DJ with a cap and headphones!

10. Now name your puppet, this way you can use it as your inspiration for writing a story about your puppet or maybe a play if you make several puppets or get together with friends.

WANT TO DO MORE?

- Research and explore different styles of puppetry.
- If you want to do more, you could think about how you could make puppets out of other garments such as an old glove.
- Think about other things you could make with odd socks like sock monkeys or sock pigs. Once you get creative, you'll have lots of ideas!

15 MYTHICAL MAZES

CHRISTOPHER BERG

Amazeing Art™ mazes promote both structured and creative thinking, increase problem-solving skills, and are popular and fun. These puzzles have been published by HarperCollins, reproduced by the British Museum, featured on CBS and Fox television, and used in Ben & Jerry's commercials. They are great educational puzzles for home schooling or road trips and make unique presents for gifted and talented children.

www.amazeingart.com

Why mazes of ancient monuments? The same juxtaposition of order and disorder, of artistry and chaos, that is apparent in mazes is also manifest in ancient ruins. Monuments such as the Great Sphinx, the Colossus of Rhodes, or the Egyptian Labyrinth were once pre-eminent symbols of human achievement, masterpieces of technological skill and the control of vast manpower and resources. Yet now they are also vivid reminders of the inevitable triumph of time over the works of man, of the irresistible decay that gnaws away at all great things…

The Statue of Zeus at Olympia (c. 430 BC), a forty-foot tall gold and ivory statue that was the most celebrated artistic work on mainland Greece. The statue presided over the early Olympic Games.

Can you be like Theseus and trace your way out of this mythical maze with a pencil?

When you've done that, **research mazes in myths**. Have you ever been to a maze? What was it like? How did you find your way out of it? If you've never been to a maze, see if you can visit one this year! There are lots of maize mazes about in the summer and some stately homes have them.

If you're still mad about mazes, how about **designing your very own maze on paper?** Send a copy of your marvellous maze to **events@potentialplusuk.org.**

16 IF YOU RULED THE WORLD...

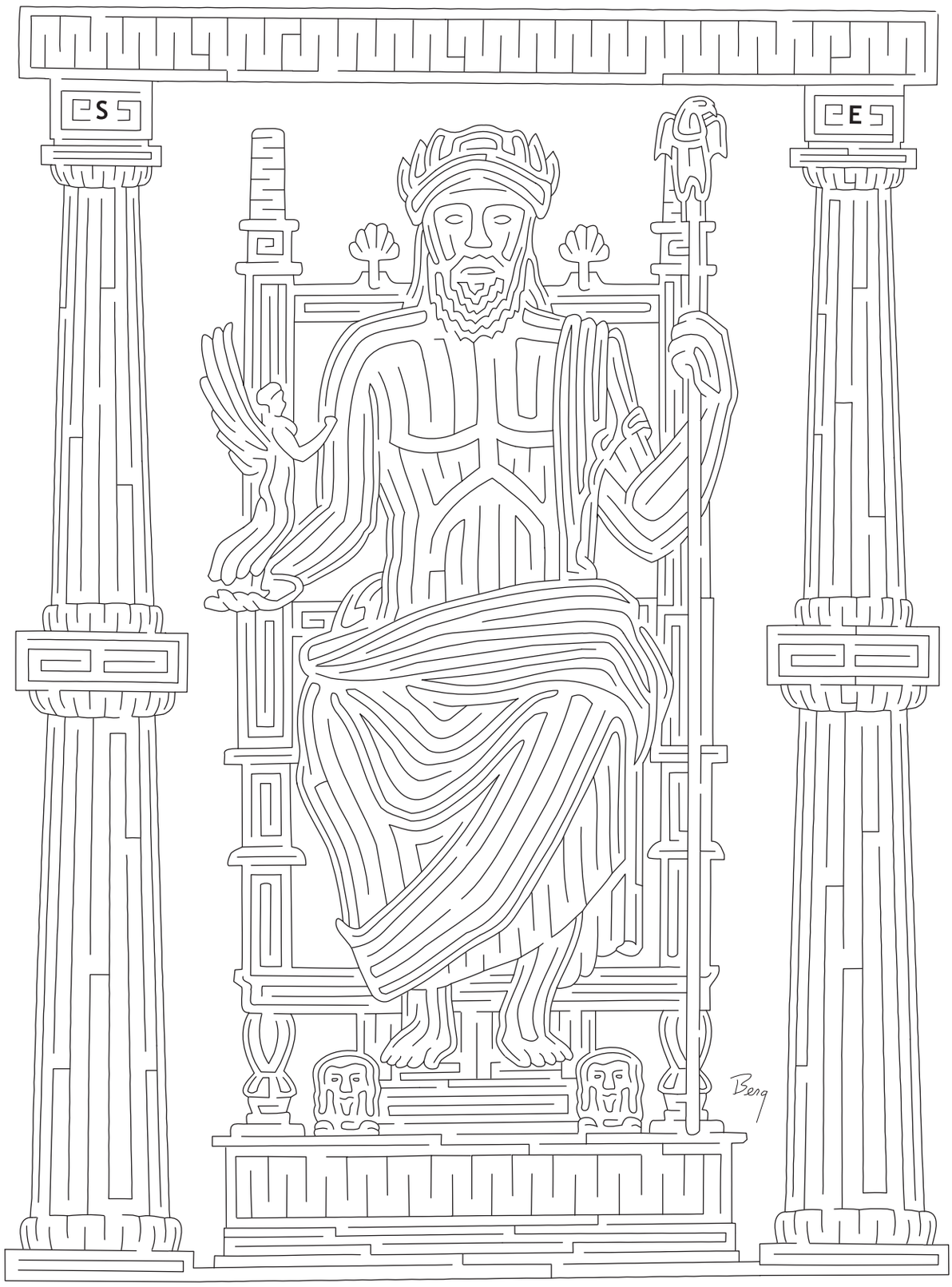
Imagine what you would do if you could make the rules.

First of all, what would you change about your life as it is now; what rules would you have at home and at school?

Now, imagine if you could make the rules the whole world lived by.

Can you come up with 50 Rules?

What would you change, what would you introduce and what would you keep the same?



S = START E = END | AMAZEING ART™ BY CHRISTOPHER BERG | WWW.AMAZEINGART.COM

THE STATUE OF ZEUS AT OLYMPIA (432 BC)

ONE OF THE WONDERS OF THE ANCIENT WORLD

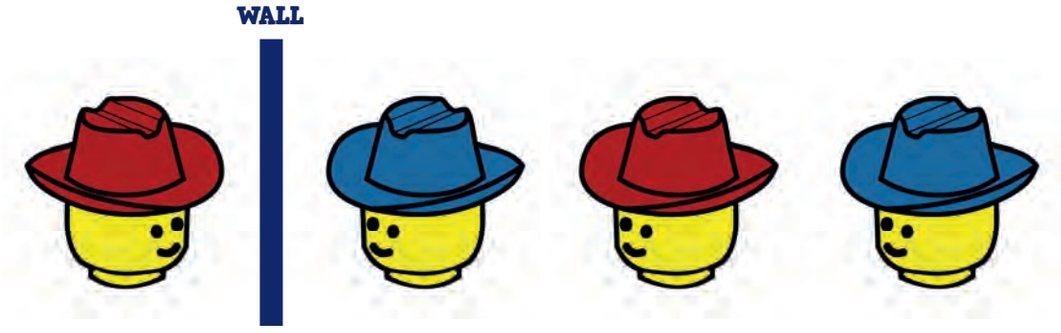
17

PRISONERS IN THE SAND

ADRIAN HARBOUR

Adrian Harbour collected these puzzles from other sources. They are not his puzzles but he hopes sharing them is interesting. Adrian found being gifted as a child and as an adult difficult but would like children to know that it's ok to be different and that things can be good in the end.

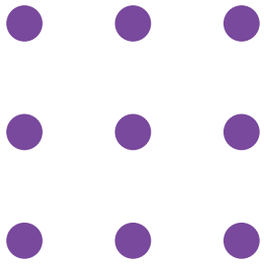
Four prisoners awake to find themselves in the situation shown below.



They are all in a line pointing towards the wall and can't move as they are buried up to their necks in the sand. They have each had a coloured hat put on their head. Their captor informs them that they cannot communicate or they will all be shot. He tells them that there are two red hats and two blue hats. He tells them that if one of them can guess the colour of their hat correctly he will let them all live but that if any of them get it wrong he will shoot them all. Remember that they are not allowed to communicate.

Who should call out and why?

The challenge is to draw four straight lines in one continuous drawing (so without taking your pen off the paper) so that the lines go through all the dots at least once. Have a go.



AROUND THE WORLD IN 50 DAYS

18

USE A GLOBE, ATLAS, OR GOOGLE MAPS TO WORK OUT WHERE YOU COULD TRAVEL IN 50 DAYS

- How far would you go?
- Where would you visit?
- How long would you stay in each place?
- How many places would you stop to see?
- What transport would you use?
- What challenges would you face? E.g. extreme weather

Work out how many miles you would have travelled!

Take that distance and work out where else you could go in a straight line from your current location.

Where does the straight line take you? Would you like to go there?

19 KEEPING SECRETS!

NATASHA RILEY & THOMAS BRIGGS

BLETCHLEY PARK TRUST

Natasha Riley and Thomas Briggs are Education Officer and Education Manager with the Bletchley Park Trust. Both have been classroom teachers in past lives and now bring STEM excitement into schools with a real Enigma machine.

www.bletchleypark.org.uk, Twitter: @BletchleyPark

Do you have any secrets? What kind of people might need to keep secrets?

GOOD SECRETS
When is it a good idea to keep secrets? What kind of secrets should you keep?

BAD SECRETS
When shouldn't you keep secrets? What kind of secret is a bad one?

HERE'S ONE WAY OF KEEPING A SECRET:

Secret alphabet	A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Real alphabet	X Y Z A B C D E F G H I J K L M N O P Q R S T U V W

The table above shows you how to swap the letters in your message for different letters so that it's not so easy for someone else to read…

… but it's easy to change it back again when you need to. You just need to know a simple piece of information called a "key". Look at the bottom row of the table: it's just the alphabet, but each letter has been shifted up 3 places, so we could say that the key is "+3". Can you draw tables for the keys "+5" and "-2"?

For example:

If I write "i can keep a secret!" the table tells me to change it to "L FDQ NHHS D VHFUHW!"

What does this say, then?

VR BRX WKLQN BRX'UH D FRGHEUHDNHU?

Can you write your own message secretly?

Can you work out which key was used to hide this message?

IYE'BO QODDSXQ ZBODDI QYYN KD DRSC! GRKD MVEOC NSN IYE PSXT? RYG MYEVN IYE RSNO DROW?

HINT: *Look at the words with double-letters in them. How might they help?*

Things to THINK about

How many different "+" keys are there?

What would the key "x 3, +2" look like? (Hint: label each letter with the numbers 0 – 25 before you draw your table)

Can you think of a different way to jumble the alphabet? Remember, you need to be able to unjumble it again!

Things to DO

- **Create a Caesar wheel or a paper Enigma**
- **Collect examples of different codes in everyday use**
- **Visit Bletchley Park!**

HINT: *If you're unsure about some of the terms in this challenge, you can look them up on the Internet!!*

Things to FIND OUT

- **What's so important about the Enigma machine?**
- **What's the earliest example of secret writing?**

Some types of secret writing are "codes", "ciphers", and "steganography":

- **What's the difference?**
- **Where are they used today?**

ORIGAMI CHALLENGE

20

An ancient Japanese legend promises that anyone who folds a thousand origami cranes will be granted a wish by the Gods.

Can you build your perseverance and resilience by making 50 cranes?

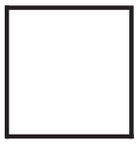
How many cranes can you make in a day, a week, a month, a year?

Let us know how many cranes you've made - let's see if we can collectively reach a thousand!

You could make a mobile out of your cranes; hang them from a tree in your garden or from the ceiling of your bedroom.

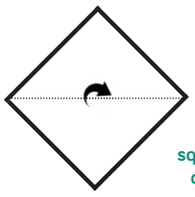
HOW TO MAKE A PAPER CRANE:

1.



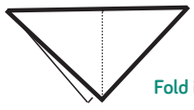
Take one square piece of paper

2



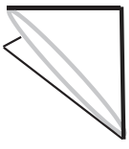
Fold the square in half diagonally

3.



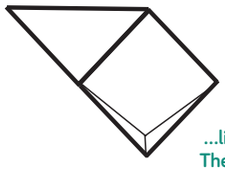
Fold in half again

4.



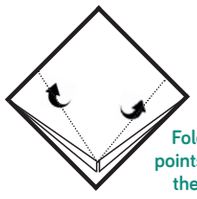
Open out the top flap and push into a square...

5.



...like so. Then turn over and repeat

6.

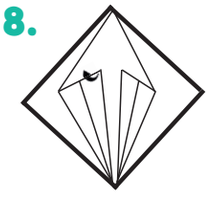


Fold the side points in to meet the middle...

7.

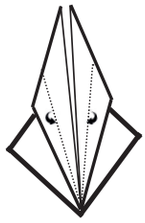
...like so... and then unfold

8.



Lift the flap upwards and, using the fold lines as a guide, bring the sides in to meet the middle

9.



Then fold the edges in to meet the middle

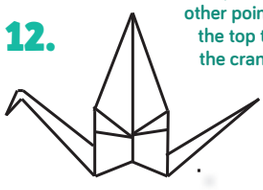
10.

Turn over and repeat steps 6-9 leaving you with this...

11.

Fold one side up, pushing the edge in between the front and back flaps as so...

12.



Repeat with the other point, bending the top to create the crane's head

21 DESIGNING THE FUTURE

C J SIMISTER

C J Simister was a teacher for many years before starting her own 'Future-Smart' consultancy business. Now she works with schools around the world, giving talks for parents, teachers and school leaders and offering practical ideas for how to help young people develop valuable lifelong qualities such as initiative, originality, resilience, flexibility of mind, collaboration and self-assurance.
More information can be found at

www.cjsimister.com

She is the author of three books: two for teachers (How to Teach Thinking and Learning Skills and The Character, Grit and Resilience Pocketbook) and one for parents (The Bright Stuff).

You may have heard news reports about how many of the jobs that humans currently do might be substituted in the future by technology. In a sense, it's nothing new to have machines replace people – that's what drove the Industrial Revolution and it's continued ever since. However, the next wave of inventions involves increasingly sophisticated computing technologies, so things are hotting up.

WHAT DO YOU THINK OF THE FOLLOWING IDEAS, FOR INSTANCE?

Restaurants without waiters

At a restaurant in San Francisco, you order and pay for your food on an iPad, then collect it from a numbered glass cubby. One London restaurant has interactive, touch-screen table-tops, allowing you not just to place your order from a digital menu but also to see images of the food projected onto your plate! True, humans are still needed to cook the food, but for how much longer?

Shops without cashiers

We're used to seeing automated cash tills at the exits of supermarkets, allowing you to scan and bag your own food, but have you heard about Amazon's latest idea? They're piloting a new type of 'Amazon Go' shop that won't need any type of tills at all: customers download a special app on their phone, they take the products they want and as they leave the shop, sensors detect their purchases and automatically transfer the total from their bank account.

Pizzas without delivery men

Amazon again – only this time, they're developing a fleet of drones that will deliver your purchases not by land, but by air. Using 'sense and avoid' technology, the drone can see where it's going, can travel up to 15 miles, and will drop off your delivery at a safe landing site, perhaps in your garden for instance. In New Zealand, this even goes for your dinner – with Domino's Pizza recently launching its delivery-by-drone service, aptly named the 'Domicopter'!

All of which brings us to your first challenge....

CHALLENGE NO. 1
CARS WITHOUT DRIVERS*

You may know that companies like Google, Uber and Tesla are racing to get 'self-drive cars' onto our roads. These will require no driver at all, being operated entirely by super-smart computer systems that take you where you want to go.

They could potentially have all sorts of benefits in terms of reducing accidents, cutting pollution, improving congestion on the roads and making independent travel possible for the young, the elderly and those with disabilities.

Aside from this, the astonishing thing about self-drive cars is that, in theory, they don't need any of the features typically found in a car. No steering wheel, no dashboard, not even any windscreen wipers (the system that controls the car uses cameras and sensors that don't require the car to have windows). Think about it! That means the space inside the car can be entirely re-designed.

While the big companies are generally sticking to a fairly traditional design, if you were in charge, you might want to go further!

Try it now:

1. Imagine the basic shape of a car – a sort of rounded rectangle, almost like a tiny room, with space somewhere inside for the engine and technology.

2. **Then think about:**

   What will your passengers sit on? 'Seats', you might say! But does that need to be the case? And even if you do have seats, might they be different to the ones we normally have in cars?

   How will they be arranged?

   What might people want to do while they're in the car? Could you design special features to help them spend their time as usefully or enjoyably as possible?

   Could it be planned so there are different possible configurations? So the design and layout can change according to how you want to use it?

3. How could you make your car appealing to different audiences: to children, to parents, to businessmen and women, to the elderly?

   Have a go at drawing a few sketches to work out your best possible design. How will you persuade people to buy it? You might even like to create your own advertising campaign.

*** If you'd like to find out more about self-drive 'automated' cars, several articles can be found here: https://www.theguardian.com/technology/self-driving-cars**

CHALLENGE NO. 2

If that's whetted your appetite for inventing, don't stop there! Can you think of any other areas in which humans might not be as essential as we've always assumed?

If you were going to pitch the next big idea, what would it be?

22 CREATE YOUR OWN WORLD

Invent your own language or way of communicating, create a name for your world, where would it be, would it be in this solar system, would it be in any solar system? Decide on your social rules and values.

- **Create your own forms of transport.**
- **Present your world however you would like, using crafts, writing, video or graphic design.**
- **What are your inspirations for your own world?**

You could even create your own virtual world using a virtual reality toolkit. Check out this website and use the search engine to explore their virtual reality project ideas:

www.sciencebuddies.org

EXPERIMENT, FAIL, LEARN, REPEAT

"Experiments are about trying things out. They are about learning from mistakes, and from things that do not work as you expected. So, do not think of them as mistakes, instead, just ways of learning how not to do something. So, learn from all your results."

Max Parsonage

"Never regret. If it's good, it's wonderful. If it's bad, it's experience."

Victoria Holt

"Anyone who has never made a mistake has never done anything."

Albert Einstein.

MAX PARSONAGE

Max Parsonage is Head of Chemistry at a school in Oxford. He has been an examiner. He has written many books, working with Oxford University Press, the European Space Agency, as well as Hodder, Collins and Usborne Publishing. His eBook has won 5 stars on Amazon.

HOT AIR BALLOON EXPERIMENTS

23

Launch a hot air balloon using tissue paper, and a candle. Don't worry, you are not launching fire. It may be large or small, be glorious in design or plain. It doesn't matter!

Thigns you will need:

- a helpful adult to help to keep things safe
- tissue paper
  the thin strong type used to wrap presents is best (kitchen roll is too thick & heavy)
- a glue stick
- scissors
- candle or tea lights
- matches
- paperclips, if available

Extra Experiments:

- Try heating the balloon for longer. Does it go higher? Faster? Or is there no difference?
- Make another balloon using less glue, and less overlap between the tissue sheets. Does it work better? Worse? Learn from it.
- Try different coloured strips of tissue. Make it more attractive! Enjoy!
- Try different shapes. What happens if you use more or fewer petals? Out of your designs, which is the easiest to make? Note the differences in the ways your hot air balloons fly.

1. Start by drawing the shape of each balloon petal. Try making more than four.
2. Then cut out the petal shapes as shown in the diagram (See Figure 1)
3. Glue the edges together to make the balloon. The last one is tricky! Where the points come together, there should be no gaps. If there are, then cut out a circle of tissue and stick it over the gap. (See Figure 2). Use paperclips to hold the pieces together if needs be.
4. When the glue is dry, take the balloon outside, but not in the wind or rain. Put the candle or tea light on the ground – it is best on a flat rock or path, and not under a tree!
5. Ask an adult to light the candle or tea light and make sure you remove the paperclips if you used them.
6. Ask an adult to hold the open end of the balloon over the flame. Not too close as you do not want the tissue set on fire!
7. The air in the balloon will heat up and expand, making it lighter. After a time, let the balloon go – it should rise up! How high does it go? Fast is good. Slow is good. Does it spin?

Fig 1

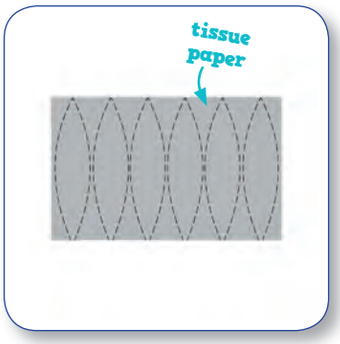
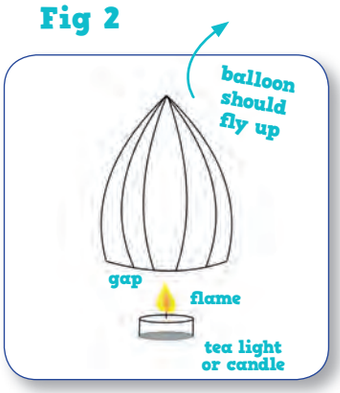


Fig 2



24

COLOUR CHANGES

WITH ACIDS AND ALKALIS

MAX PARSONAGE

Max Parsonage is Head of Chemistry at a school in Oxford. He has been an examiner. He has written many books, working with Oxford University Press, the European Space Agency, as well as Hodder, Collins and Usborne Publishing. His eBook has won 5 stars on Amazon.

HOW TO MAKE A RED CABBAGE INDICATOR:

You will need:

- an adult to ensure you work safely
- half a red cabbage
- a knife to cut the cabbage
- a sauce pan half full of water
- a heat resistant measuring jug
- an ice cube tray and a freezer
- a glass of white vinegar, a glass of water and a glass of bicarbonate of soda solution

1. Cut up the red cabbage into small pieces or let an adult do it for you.
2. Put the pieces in the saucepan and cover with water, and heat until the mixture boils.
3. Turn off the heat. Leave to cool down.
4. Pour the mixture through a strainer into a measuring jug.
5. When the solution is cold, pour into an ice cube tray and put in the freezer. (Freezing the mixture make sures that it does not go off. You could use a little of the cold solution straight away.)
6. Put out the three glasses. One has a little white vinegar. One has a little water. The third has water with some bicarbonate of soda.
7. When solid, put one cube in each glass of liquid. Vinegar is acidic. Water is neutral. Bicarbonate of soda is alkaline. What colour did they go? Note the colours. The red cabbage is indicating which is acid and which is alkali.

Extra experiments:

- Try using blackberry juice or other coloured drinks.. Try red onion skins. Some will change colour, and and some will not. Experiment.
- Try using your red cabbage ice cubes to test other liquids. Some examples: lemon juice, milk, soap, lime juice, a fizzy drink, cleaning solutions. Which of these are acid, alkali, and which are neutral?
- Make a list of each liquid, the colour it went, and whether it was acid, alkali or neutral.

MAX PARSONAGE

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FIZZY COLOURS 25

YOU WILL NEED THE RED CABBAGE SOLUTION THAT WAS DESCRIBED IN CHALLENGE 24

You will need:

- an adult to ensure safety
- a glass, a third filled with white vinegar
- sodium bicarb
  (also known as sodium bicarbonate, bicarbonate of soda, and has the chemical name 'sodium hydrogen carbonate'. All of these are the same chemical.)
- a tea spoon
- an audience would be nice

1. Put the glass which contains vinegar on a sink draining board, or on an outside table. In case of spills.
2. Add a little of your red cabbage indicator - one ice cube. What colour is the vinegar now?
3. Scoop up a spoonful of sodium bicarb.
4. Ready? Is your audience watching? Add the spoonful of sodium bicarb into the glass, and step back. What do you see? Does stirring help?
5. Is all the acid used up? The colour should tell you. If you think it is still acid, add more sodium bicarb.
6. The mixture is safe to wash down a sink.

26

If you want to try out a free, interactive version of this game, head to the New York Times website and search for set puzzle, there you will find a daily set game to try!

Here are four SET Puzzles to introduce you to the exciting card game SET. In the game, each card has 4 features:

1. Shape — oval, squiggle, diamond

2. Color — red, purple, green

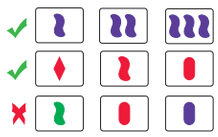
3. Number — one, two, three

4. Shading — open, striped, solid

To find a *SET* apply one simple rule: a *SET* is three cards that are either all the same or all different in each individual feature. Each feature must be looked at separately. In other words, on each of the 3 cards:

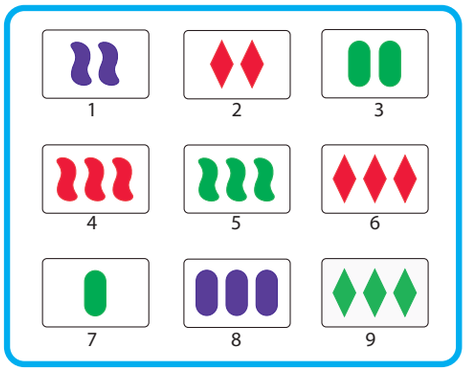
- **Shape** must be ***all the same*** OR ***all different***
- **Color** must be ***all the same*** OR ***all different***
- **Number** must be ***all the same*** OR ***all different***
- **Shading** must be ***all the same*** OR ***all different***

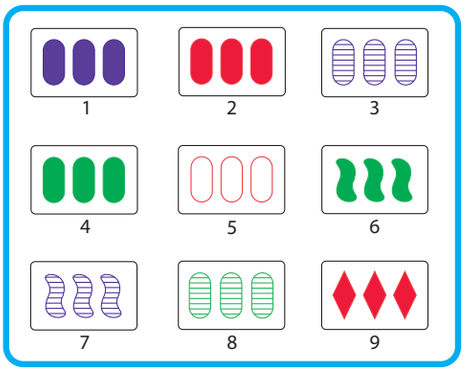
A QUICK CHECK – Is it is *SET*?

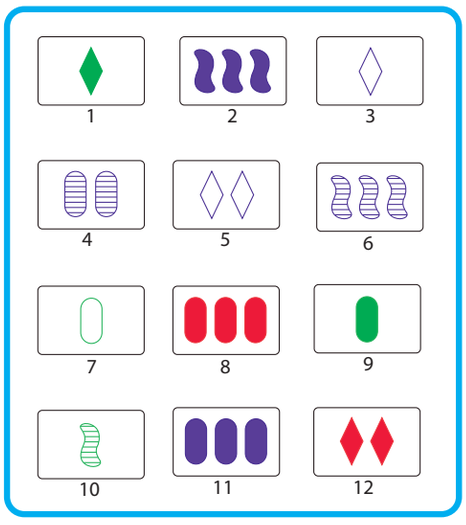


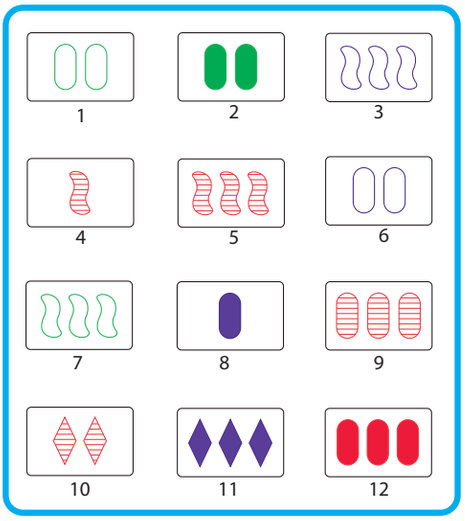
If two cards are the same and one card is different in any feature, then it is not a *SET*. For example, if two are ovals and one is not then it is not a *SET*. A *SET* must be either ALL THE SAME or ALL DIFFERENT in each individual feature.

There are two different types of puzzles here, basic and advanced. In the basic puzzles one feature of all the cards is the same throughout the puzzle. For examples, in the first puzzle all the cards are all the same shading: solid. The object is to find all four *SETs* in the nine cards. In the advanced puzzles the object is to find all six *SETs* in the twelve cards. You may reuse any card as many times as needed to complete all of the different *SETs*.









Answer Key:
Puzzle 1: 4,8,9 1,2,3 1,6,7 5,6,8
Puzzle 2: 1,2,4 1,5,8 1,6,9 3,4,5
Puzzle 3: 1,7,10 2,3,4 2,9,12 4,7,8 5,8,10 6,7,12
Puzzle 4: 1,4,11 1,8,9 2,8,12 4,9,10 7,8,10 7,9,11

27

WRITE DOWN 50 THINGS ABOUT YOURSELF

Make it as varied as possible: talk about your looks, likes, dislikes, talents, thoughts, hopes and fears.

28

BE A GAMES DESIGNER

CAROLINE HARDMAN

Caroline Hardman is an ex-primary school teacher who now works with schools and organisations in a range of ways, helping to develop and use digital content and tools to make learning more engaging for pupils and develop creativity and critical thinking skills. This can involve teacher training, writing, editing and advising on digital content and developing and delivering short-term education projects. Coding, computational thinking, game design and storytelling (digital or otherwise) are particular interests and alongside her education career she writes fiction for both adults and children.

carolinehardman.co.uk
@73caroline

Do you enjoy playing computer games? Have you ever stopped to think about how much work goes into making them? This is your chance to think like a games designer, and come up with a brand new game concept.

1 Your game needs a hero or heroine! This is the character your player will control. Make one list of adjectives (try and pick ones which describe behaviour or qualities, not appearance), and one list of nouns (people, animals, things). Now mix and match – pick one item from each list and put them together. Try a few different combinations and see which you like the best. You might end up with an evil postman, a microscopic dog, an angry granny, a robotic Father Christmas, a timid alien…or something completely different!

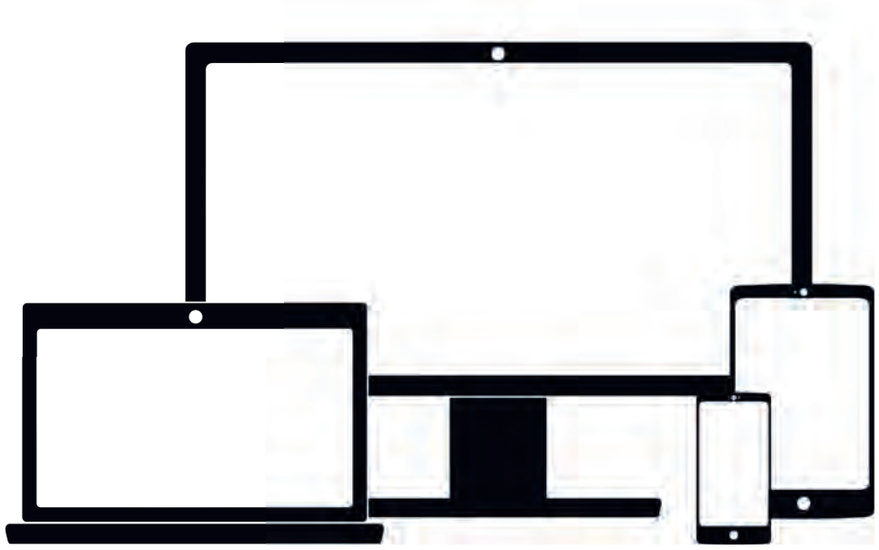
Think about what your character looks like and draw a picture or build a model of them. Do they have any special powers? How did they get these?

Do they always carry a particular object, or have a side-kick?

2 Your character needs an enemy. Pick one who is going to make your hero or heroine's life as difficult as possible! This could be their exact opposite, or someone who seems much more powerful than them. If you're really stuck, have another look at your lists of adjectives and nouns and see if anything jumps out.

3 Tell the story of how these two know each other, and why they became enemies. Has it always been this way, or were they once friends? Maybe one of them destroyed or stole something from the other, or maybe there was something they both wanted, and only one of them got? This is your game's back-story. You could write it down, or draw it as a comic

4 Use your back-story to think of a goal (or set of goals) for your main character. They could be trying to escape from somewhere, trying to find an object, trying to rescue someone, trying to stop their enemy from doing something… or you



might have a different idea. If your game is going to have several levels, you'll need a goal for each one.

5 Make a list of power-ups and obstacles. Power-ups are things which could help your character achieve their goal – speed potions, keys to secret doors, magic items, etc. Obstacles are things things which could stop them – monsters, weapons, barriers… anything which will stop them or slow them down. Try to come up with lots of ideas – you might not end up using them all!

6 Design your levels! Start with an easy goal, and choose some simple power-ups and obstacles. Draw a diagram to show what the screen will look like and what the character needs to do.

As the game goes on, the goals for each level should get harder…so save some of your really nasty obstacles for the end! The same goes for your power-ups – start with the gentle ones and save the really powerful items for later levels…when your character is going to need them.

You could think about including a Boss level where your hero comes face to face with his or her enemy and there's a final challenge. Think about what happens when the player eventually wins – what will your hero or heroine do now? In lots of games this is shown as a cut-scene, or while the credits play.

WHAT NEXT?

Show your game to a friend and ask them for their feedback. What do they like? What ideas to they have for making it better?

Why not try using free software like Scratch to build part of your game? Visit www.scratch.mit.edu where you'll find everything you need to get coding.

29 EMOJI CHALLENGE

Emojis are the new words, or are they? In many forms of non-spoken communication, such as texting and instant messaging, they have replaced words and are even used to describe situations we probably never used to feel the need to communicate.

- How often do you use emojis (if ever!)? How many do you understand?
- Can you ascribe an emotion to each of the emojis below?
- See if you can describe a situation where you would use each emoji.
- Now see if you can replace each emoji with a phrase.

DOES A PICTURE TELL A STORY OR DO WORDS PAINT A PICTURE?

30

- They say a picture speaks a thousand words, but are images a substitute for words? Is there a risk that our over-use of images today, means that we are losing our capacity to communicate with words?
- Why do you think, as a society, we are becoming increasingly image-based?
- How might an almost exclusively visual culture affect the accessibility of culture? For example, think about people with visual impairments.
- In a world where words are becoming devalued at an alarming rate, with the rise of fake news, might a solely image-based culture provide a new integrity or does the absence of words pose a risk to truth?
- Might there be a problem with images without words? Can you think of any instances of images being used to mislead people?
- Do you think an image-based culture is a reaction to a world where words are written in stone (where we are held fast to what we say and write)? Is it the sign of a culture where words have lost their meaning?
- Can you envisage a world without the written word – where every social media platform and news media platform operates uniquely in the language of images?

31 INTRODUCTION TO BLACKWORK© RSN

Your kit needs to contain:

- Fabric with design, 1x DMC stranded cotton, size 22 tapestry needle
- Instructions for Blackwork Kit – 'Blackwork View'
- General Instructions
- All patterns are worked in backstitch unless otherwise stated (see below)

- **Begin each thread with the 'waste knot' technique (see below)**
- **Use two strands of cotton for everything except the cat which is worked in three strands to make it appear darker**
- **You can iron work, but try to iron only the background fabric and not the stitching itself**

TO START A THREAD:

Tie a knot in the end of the thread. Take your needle down through the fabric about 1 cm away from where you will begin to stitch. Work two tiny back stitches close together, near to your knot, and in a position where they will be covered by your embroidery. Begin your stitching. The knot can then be cut away, close to the fabric.

TO FINISH A THREAD:

Take two tiny back stitches on the spot, again, where they will not be visible and covered by your embroidery, but close to the point you finished stitching. Bring your thread to the front surface and then cut it off close to the surface of the work. If you have run out of room to do this, turn your work over and thread your needle through the back of your stitching for about 0.5 cm, before cutting it off.

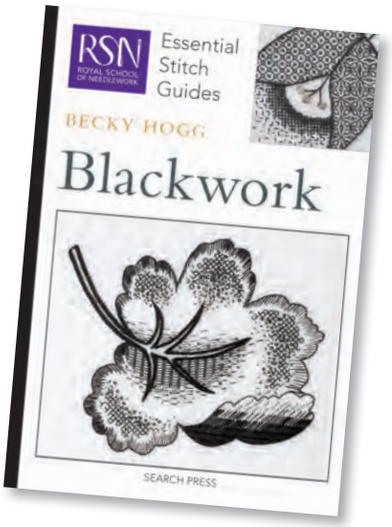
TO BEGIN:

Start by mounting your fabric with the design as centrally placed within the hoop as possible. Try to ensure your fabric is nice and tight as this will make it easier to work, and that the screw is at 12 o'clock as your threads are less likely to get caught in this position.

This design can be worked in any order you prefer. The patterns can be worked in two ways: From the chart provided, or by 'filling' the areas with pattern up to the pencil line provided as a guide. To do this effectively it may be necessary to end part way through a stitch so that you do not go over the line.

For your information, I have provided some charts of the stitches used and they can all be found with fuller explanation in the RSN Essential Stitch Guide to Blackwork by Becky Hogg.

ROYAL SCHOOL OF NEEDLEWORK



BACKSTITCH

After beginning with a waste knot as explained above, make a straight stitch in the aida between two holes. Go back down the hole at the end of the previous stitch, to fill the gap with a second back stitch. Continue as necessary to complete the pattern.

BLIND

This is worked in a pattern called OCTAGONAL STAR which is made up of small squares and octagons with a star inside. It is worked in two strands of cotton.

VASE

This is worked in a variation of octagonal star, which is slightly smaller in scale and includes a little cross stitch inside rather than a star. It is worked in two strands of cotton.

CAT

This is worked in a pattern called SMALL DIAMOND which is made up of diagonal squares with a vertical straight stitch inside. It is worked in three strands of cotton to give it a darker tone.

WINDOW FRAME

This is worked in back stitch using two strands of cotton.

WINDOW SILL

This is worked in a row of upright straight stitches using two strands of cotton.

32

MATHSBOMBE 2017

THE DAME KATHLEEN OLLERENSHAW

MathsBombe 2017 is organised by the The School of Mathematics at the University of Manchester.

www.maths.manchester.ac.uk/mathsbombe/index.php

mathsbombe@manchester.ac.uk

DO YOU LIKE SOLVING MIND-BENDING MATHEMATICAL BRAINTEASERS?

- **Can you and your friends untangle some fiendish puzzles?**
- **Would you like the chance to use your mathematical skills to win some great prizes?**
- **Then the MathsBombe is for you!**

You don't need to be a computer whizz or a mathematical genius — you just need to keep your wits about you and be good at solving puzzles!

Suppose you have a 10×10 chessboard and 10 tiles comprising the letters of MATHSBOMBE.

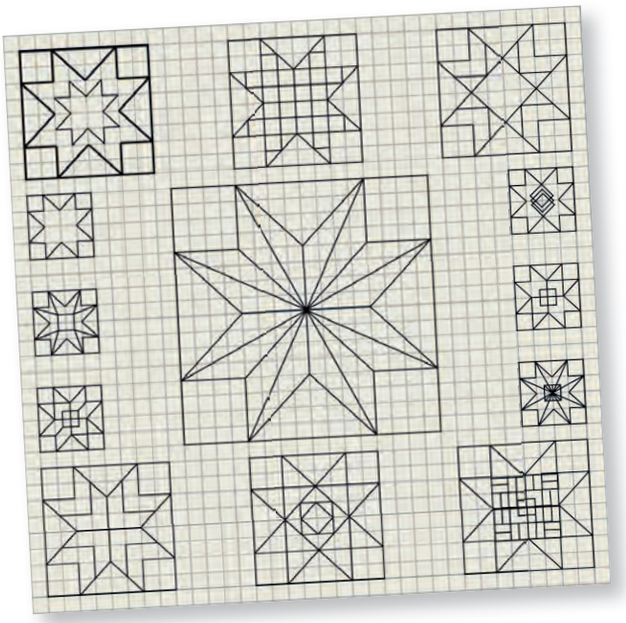
First place the M on one of the black squares on the top row. Now arrange the remaining tiles so that each letter appears on the next row on a black square diagonally below the preceding tile. One possible arrangement is illustrated below. What is the total number of different ways of arranging the tiles so that they spell out MATHSBOMBE?

(The two M tiles and the two B tiles are both considered to be the same. The arrangement illustrated below counts as just one possibility; interchanging the Ms or interchanging the Bs do not give rise to different arrangements.)

(If you think that there are 4,321 different ways of arranging the tiles then you should enter 4321.)

50 SAWTOOTH STARS

33



Take a sheet of squared grid paper and draw 50 squares: (4x4, 8x8, 12x12).

Now see how many unique sawtooth stars you can draw!

I found I could say things with colour and shapes that I couldn't say any other way – things I had no words for.

Georgia O'Keefe

34 PAINT 50 COLOURS

Did you think there were only seven colours in a rainbow? Think again!

• Mix paints to make 50 different colours. • How many shades of each colour can you make? • What do the colours express? • What do the colours make you feel? • Have you created a new favourite colour? • Can you give names to your colours? For example, my favourite colour is sky blue pink.

• • Send us a picture of the colours you have found • •
events@potentialplusuk.org

35 SELF-PORTRAIT

Research 50 self-portraits.
Which is your favourite? Can you describe the features of the self-portraits? Can you think why the artists chose to represent themselves in such a way?

Using a blank sketchbook, draw or paint the key features of the self-portraits that you find and label them with the artist. Look up some information about the artists; are their self-portraits similar in style to their other artworks? From what you have found out about the artists' lives, to what extent do you think their self-portraits reflect them?

Now have a go at creating your own self-portrait.

How about making your self-portrait in the style of one or several of the artists you have discovered? What materials and medium (painting, textiles, ceramics etc) will you use to create your self-portrait?

An A to Z of you
Visit the link below from the Wellcome Collection website about their exhibition *An Idiosyncratic A to Z of the Human Condition.*

wellcomecollection.org/exhibitions/idiosyncratic-z-human-condition
If the link doesn't work, search for 'Idiosyncratic A to Z of the Human Condition' in the search engine on the Wellcome Collection website

Using this as inspiration, compile an A to Z of your idiosyncrasies!

COLOURING-IN CHALLENGE

36

Colouring outside the lines is a fine art.
Stan Lee

How do you find colouring-in? Do you like it because it's calming, pretty and ordered; or do you hate it because you can never keep inside the lines and it always ends up looking a mess?

Your challenge is to challenge that love or hate relationship with colouring in, because whether you're an avid colouring-in-er or you avoid it like the plague; this challenge will get you thinking differently about colouring in.

Create a free-form colouring in page: take a sheet of A4 or if you're feeling adventurous, use a bigger sheet of paper. You will need lots of colouring pencils and a pencil sharpener. Or you could use a box of crayons. You could even use chalk or acrylics. Now colour in that page! You can make it into an image or you can make it abstract. The one rule you must adhere to is that there can be no lines! (ie. you can't draw an outline then colour it in.)

37 THE LOTTERY OF BIRTH

Birth is a lottery. We don't get to choose who our parents are, where we are born, or whether we are rich or poor.

Imagine if you were born in another country. Where would you have been born and how would your life be different? Why have you chosen this country? Would your opportunities and quality of life be better or worse in this country?

1. Discuss this topic with a friend or with someone at home.

Consider the following:

What would the weather be like?

What language would you speak?

What food would you eat and how would you get it? Would you buy it or hunt it? Where would you buy it from and who would cook it?

What would your health be like? What would your life expectancy be? How long would your parents live for?

Would you be a boy or a girl? Consider the differences that would make.

What would your house be like? Who would live there?

Would you live near lots of people, in a big city or would you live somewhere isolated and remote?

What would the political situation be like?

What would your civil rights be?

How would you get around?

Would you have an education, and if so, what would it be like? Where would it lead?

What would the nature and wildlife be like? Would you have any furry friends or enemies?

Think about the environment, what would the air quality be like and would you live on an earthquake fault line or near a volcano, what about somewhere prone to avalanches?

Would you have much money? Where would your money come from? Who would earn it and how? How far would your money go? Would you be able to buy new clothes and go on holiday?

What would your hobbies be?

What would you do in your spare time? Would you have any spare time?

2. Compare your answer with that of your friend's. What kind of lives did you imagine? Write down the lives you both imagined and compare the differences between those life-experiences and your own.

3. Now write a diary entry for a day in your imagined life and put in as much detail as you can, using the prompts above.

4. If you imagined a life much more luxurious than your own, why don't you now try and **imagine a completely different life,** in a completely different environment? What would be better and what would be worse?

5. What do you think this exercise is encouraging you to think about?

Send your diary entry and your thoughts and findings on this challenge to

events@potentialplusuk.org

YOU SAY GOODBYE AND I SAY HELLO

38

LEARN HOW TO SAY HELLO AND GOODBYE IN 50 LANGUAGES YOU HAVE NEVER SPOKEN BEFORE

- What do you notice about the different ways people greet each other? Are there any similarities between certain languages?
- Research how people greet each other in different countries. For example, in France they kiss each other on each cheek but in Switzerland they kiss each other three times.
- What do you think greetings reveal about different countries' cultures?
- What is the most interesting greeting you can find?
- Out of the greetings you have discovered, which is your favourite and why?

39

RESEARCH 50 DIFFERENT RELIGIONS: WHERE ARE THEY PRACTICED AND WHAT ARE THEIR RITUALS?

If you don't believe that there are 50 religions, watch Pete Owen Jones's series, Around the World in 80 Faiths, which was originally broadcast on BBC 2 but can be found on www.dailymotion.com

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40

RESEARCH 50 FESTIVALS AROUND THE WORLD, WHERE ARE THEY CELEBRATED AND WHAT DO THEY CELEBRATE?

- Which festival would you most like to attend?
- Create a calendar of the festivals around the world
- Create a booklet about the festival you find most interesting
- Summarise the origins of the festival, its traditions and whether, how and where it is celebrated today

41

WHAT DO THEY HAVE IN COMMON?

MENSA

Mensa was founded in 1946 in England - the original aims were, as they are today, to create a society that is non-political and free from all racial or religious distinctions. It's a place where everybody is "different" – so no-one is.

If you think you might be a potential Mensan, visit www.mensa.org.uk for more information.

WHAT DO THESE THREE MESSAGES HAVE IN COMMON?

1. DF HAR OEIT ONET TLOD CO LTCHTS

2. DEVA ORDA NEVUS ONGO TOGA FORTE EXTRA EON DABI CARTA HOSTI INGO TACTA CARMIN HUJUS AVA TECTO TOTO ONAGONA TANGO RIVA OPUS LONGA LEXITATE SCROBULOS

3.

17T	24L	1D	8E	15H
23L	5T	7E	14C	16A
4O	6F	13T	20T	22O
10C	12I	19O	21R	3N
11H	18T	25S	2O	9D

All three messages are in plain English.

- **What do you make of the arrangements?**
- **This may give you ideas for sending secret messages.**
- **What are the numbers in the third example?**

TECHNOLOGICAL SINGULARITY

42

DO YOU LIKE SCI-FI?

Read Ubik by Philip K. Dick, where the idea of digital ascension is explored.

Research this topic on Wikipedia and be prepared for your brain to explode!

It is predicted that by 2045, computer-based intelligence will have significantly exceeded the sum-total of human brain power.

Does this mean that there will be no distinction between human and machine?

THE CHALLENGE

It is difficult, even impossible, to predict what human beings' lives would be like in such a world, but we want you to have a go!

- What will humans do in a world where computer-based intelligence can do everything that humans can do? Do you think such a world is even possible?
- What things might computer-based intelligences be able to do more efficiently than humans? (Think about things we already rely on technology for)
- Are there things that humans can do that you cannot imagine technology ever being able to do better?
- Discuss the potential impact of the possibility that computers could become self-sufficient and able to make their own decisions.
- Do you think that humans may one day become immortal through digital ascension? That means that people could die in the flesh but be uploaded onto a computer and remain conscious!

'Science fiction authors cannot write realistic characters that surpass human intellect, as the thoughts of such an intellect would be beyond the ability of humans to express.'

Vernor Vinge

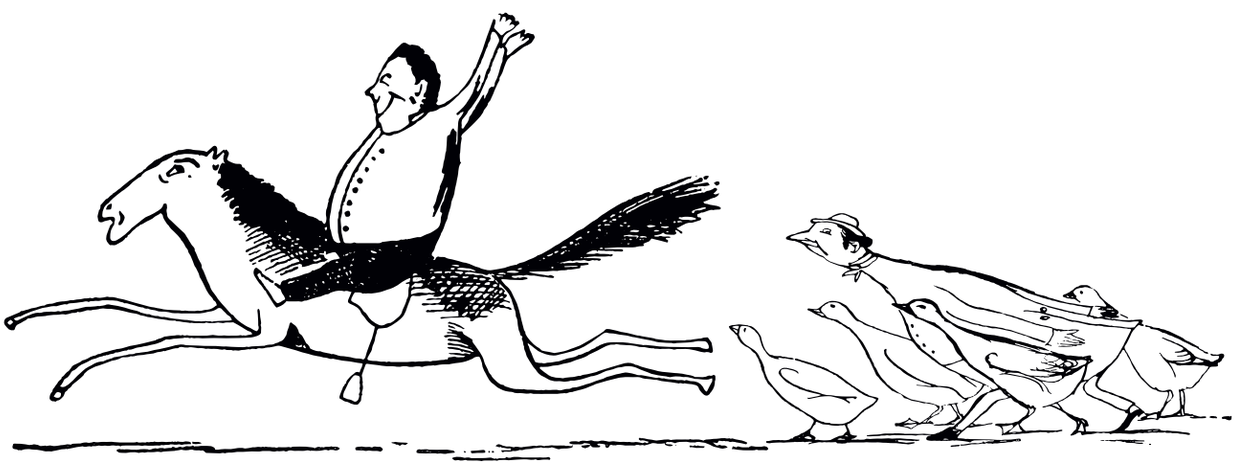
43 WHEN YOU ARE FIFTY

When you have reached the age of 50, what are the things you would like to have accomplished?

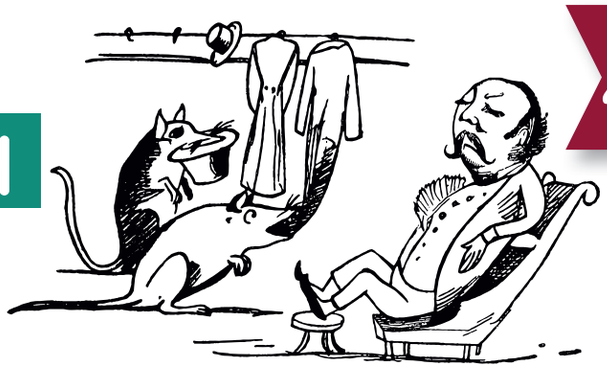
THE CHALLENGE

Try out your interviewing and reporting skills:

- Ask people in your life who are over the age of 50 what they have accomplished in their lives.
- Ask them if they can remember what they had hoped to accomplish when they were your age and how their accomplishments compare with what they had hoped for.
- Have they achieved more than they thought they would? Do they now see something as an accomplishment that they might not have expected to be proud of when they were younger?
- Note down what they have said and write an article comparing the accomplishments of the people you interviewed with your own or film yourself interviewing them.



HOW WE LIVE WITH NATURE



44

CHALLENGE Nº 1

1 **Watch** the final episode of David Attenborough's Planet Earth II, 'Cities', * which explores how human and animal-life coincide in the urban environment. Here is a description of the episode taken from the BBC iPlayer website: *'Cities are growing at a faster rate than any other habitat on Earth. They may seem an unlikely place for animals to thrive, but they can be a world of surprising opportunity. Leopards prowl the streets of Mumbai, peregrine falcons hunt amongst New York's skyscrapers, and a million starlings perform spectacular aerial dances over Rome. In Jodhpur, langurs are revered as religious deities and in Harar, locals live in harmony with wild hyenas. Many animals, however, struggle to cope in the urban jungle. As the architects of this environment, can humans choose to build cities that are homes for both them and wildlife?'*

*** you can watch the episode for free at http://www.bbc.co.uk/programmes/b0861m8b**

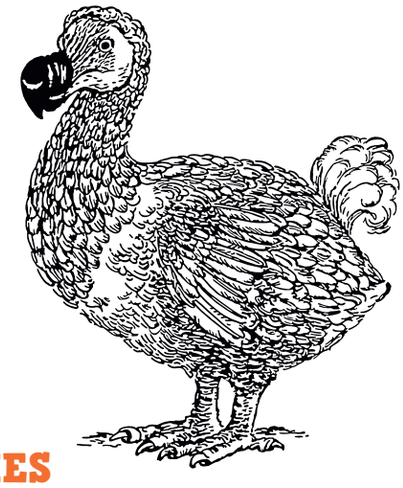
2 **Research** initiatives in cities across the world where efforts have been made to create harmony between the urban environment and nature.

CHALLENGE Nº 2

Think: Do you have any ideas about how humans could live more harmoniously with nature?

Design an urban environment which allows nature to exist alongside humans. Think about apartment blocks, office buildings, shops and markets. Also think about transport, will cars be allowed? Don't forget to think about where our food will come from – can you envisage an urban environment where food can be grown? Will everyone have their own allotment or will people grow food collectively? Think about the kind of wildlife you might want to encourage. Can you think of examples of wildlife that you would not welcome into your urban environment and which might pose a risk?

45 DR SEUSS CHALLENGE



SUMMARY OF THE SNEETCHES

In The Sneetches, by Dr. Seuss, some Sneetches had green stars on their bellies while others did not. "Those stars weren't so big. They were really so small. You might think such a thing wouldn't matter at all." However, the stars served as a source of discrimination until Sylvester McMonkey McBean came to town with a machine to add and remove stars, forcing the Sneetches to question their differences.

Guidelines for Philosophical Discussion by Lena Harwood

The Sneetches by Dr. Seuss is excellent for discussing issues of prejudice and discrimination with children. When the Star-Bellied Sneetches and the Plain-Bellied Sneetches treat one another disrespectfully because of simple stars on their bellies, one is forced to question the absurdity of such prejudice. Though most people would agree that discriminating based on stars on a creature's belly is silly, we can come to a better understanding of the nature of prejudice and discrimination through discussing questions of metaphysics.

Metaphysics is the branch of philosophy that attempts to discern the nature of the world. One particular subset, ontology, looks to determine what types of things there are in the world, and what makes a particular thing distinctive. Some metaphysicians have suggested that objects have essential properties, meaning that every object has a distinct essence. What makes a spoon a spoon is that it has the essence of "spoonhood," whatever that might be. Others suggest that we should focus more on particular attributes or functions. In this view, the most important thing about this philosophical introduction, for example, is that it helps you understand the philosophical issues in the story.

At first, this seems far removed from the world of the Sneetches. However, understanding metaphysics aids in our understanding of the Sneetches' situation, and actually helps clarify the issues underlying prejudice and discrimination. For example, metaphysics prompts us to ask what makes a Star-Bellied Sneetch distinct from a Plain-Bellied Sneetch. Is there an essential difference between them, or are they ultimately they same, with the simple exception that they have some different properties? Two yellow Labradors may look different from one another, but that doesn't necessarily make them different types of dogs. However, if they have different personalities or quirks, you might suggest that makes them distinct, and that's what gives each of them their own "self."

This raises another interesting metaphysical question – which distinctions are useful in determinations of worth? We might agree that having a star on your belly does not make you superior, but what about intellect? Historically, it has been the linking of physical attributes with internal attributes that has perpetuated prejudice. An important question that The Sneetches raises is whether or not the Sneetches are fundamentally different, and if so, what of their internal characteristics are different, and to what extent does that justify discrimination. If we say the Sneetches are not that different from one another, can we think of instances in which two creatures would be different enough from one another that we are justified in treating them differently? What qualifies something as "different enough"? Certainly job recruiters have no problem choosing certain candidates over others based on particular merits – to what degree is that justified? How is that different than what took place with the Sneetches?

THOMAS WARTENBERG

SENIOR RESEARCH FELLOW IN PHILOSOPHY.

teachingchildrenphilosophy.org
www.wgby.org/bigideas

Thomas Wartenberg is Senior Research Fellow in Philosophy at Mount Holyoke College and President of PLATO (Philosophy Learning and Teaching Organization). He has published numerous books and articles, including *Big Ideas for Little Kids: Teaching Philosophy Through Children's Literature* (Rowman and Littlefield, 2nd Edition 2014), and *A Sneetch is A Sneetch* and *Other Philosophical Discoveries: Finding Wisdom in Children's Literature* (Wiley Blackwell, 2013). He is the founder of *Teaching Children Philosophy*.

QUESTIONS FOR PHILOSOPHICAL DISCUSSION

Prejudice

1. What makes the Sneetches different from one another?

2. How do the Sneetches treat those who are different from them?

3. Do you think it is all right to treat those who look different than you differently? What about those who act differently?

Difference

1. What makes a Sneetch a Sneetch – what makes it different from other animals or things?

2. How do you know one thing is different from another thing? Is it based on things you can see, things you cannot see, or both?

3. Based on the qualities we chose for deciding what makes something different, are the Star-Bellied Sneetches and the Plain-Bellied Sneetches the same or different?

4. Are there things that make people different from one another? Do any of these things make certain people better than others? (Think about physical differences and personality/characteristic differences.)

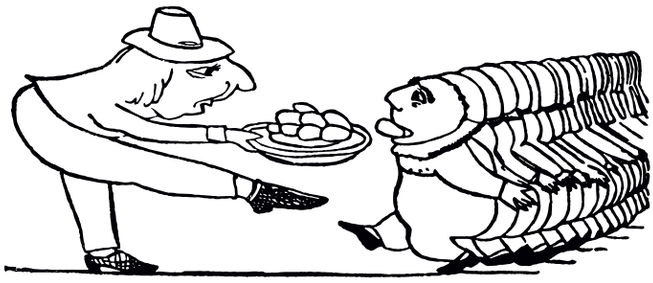
5. Are there any situations in which it is okay to treat two things differently because they are different? Imagine that one person in class is really smart. Should they be treated differently? If not, are there any examples you can think of where you would treat someone differently?

After the Plain-Bellied Sneetches go through the machine the first time and come out with stars, the Star-Bellied Sneetches say, "We're still the best Sneetches and they are the worst."

- What makes the Star-Bellied Sneetches think that there is still something different about the Plain-Bellied Sneetches since they now have stars on their bellies?
- If there was something that made the Sneetches different, other than their appearance, would it be okay for them to treat each other differently? Are there any qualities that would make that okay?
- Is there a rule we can apply to determine when it is okay to treat others differently and when it is not? How does this rule apply to the Sneetches? Based on the rule you develop, is it okay for the Star-Bellied Sneetches to treat the Plain-Bellied Sneetches differently?

This module is taken from the Teaching Children Philosophy website www.teachingchildrenphilosophy.org/BookModule/TheSneetches

46 VIRTUAL REALITY



What are the possibilities and what are the potential disadvantages of virtual reality?

For example, imagine if we all had chips placed inside our brains and at 9am every week day we would find ourselves in school or at work, no matter what, no excuses! You could be in the safety of your bedroom, but there would be no escape from the classroom!

What other scenarios can you think of – positive and negative?

47 MEDICINE

What do you think the most pressing medical problem of today is? Wait a second, that's a far too general question because so much depends on what country we're talking about. OK, so what do you think the most pressing medical problem in the UK is? What do you think the most pressing medical problem is in the world?

Now let's fast forward 50 years into the future:

- What diseases have been eradicated?
- What are the new challenges for medicine in the UK and in the world?
- Do you think life expectancy will continue growing and what are the implications of this on our health?

Things to consider: ageing populations, climate change, growing or declining populations – there are so many variables! How will you go about tackling these questions?

NRICH MATHEMATICS PROJECT

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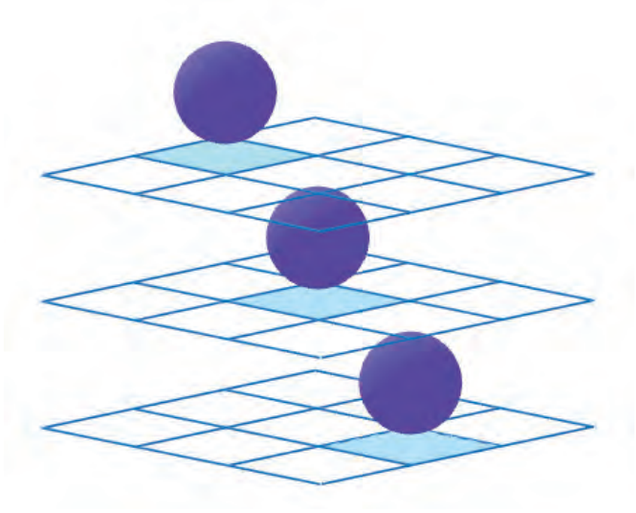
MARBLES IN A BOX

48

Imagine a three dimensional version of noughts and crosses where two players take it in turn to place different coloured marbles into a box.



The box is made from 27 transparent unit cubes arranged in a 3-by-3-by-3 array.

The object of the game is to complete as many winning lines of three marbles as possible.

How many different winning lines are there?

49 CHALLENGES FOR EARLY YEARS OR ANY YEARS

SARAH BOX

EDITOR, SPARK

The following challenges come from Sarah Box, editor of Spark, inspired by her daughter and also her brother's love of bus timetables!

spark@potentialplusuk.org

CHALLENGE Nº 1

Instead of playing "eye-spy" on a car journey, why not make up crazy sentences using words which start with the same first letter?

For example:

Toby tasted terrible toffee teacakes!

Darcey's dog delicately did disco dancing.

CHALLENGE Nº 2

Impressive Squares:

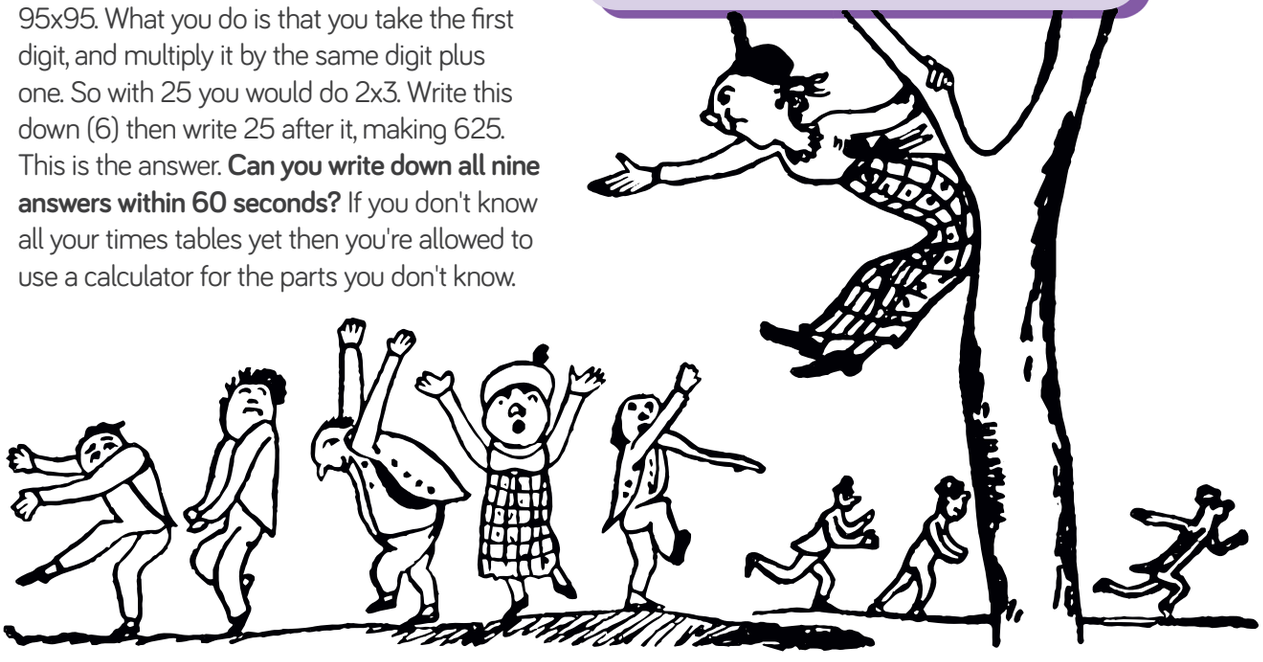
A bit more interesting than times tables! Did you know there is a secret way to calculate the square of two digit numbers ending in 5?

For example, 15x15, 25x25, and so on up to 95x95. What you do is that you take the first digit, and multiply it by the same digit plus one. So with 25 you would do 2x3. Write this down (6) then write 25 after it, making 625. This is the answer. **Can you write down all nine answers within 60 seconds?** If you don't know all your times tables yet then you're allowed to use a calculator for the parts you don't know.

CHALLENGE Nº 3

Alternative Collecting Box:

- Fill a cardboard box with unusual items but please go to no expense: try bottle tops, train tickets, ribbons, colourful paper, pebbles or snippets of information about a person you admire.
- After you've filled your box, research the things you've put there. How and why are they essential? How and why were they created? How might your items be useful in the future?



THIS TIME TOMORROW...

50

WHAT WILL THE WORLD BE LIKE IN 50 YEARS' TIME?

- What will the climate be like (in the UK and globally)?
- Will we still be eating food, if so, what?
- How will we do our shopping?
- How will we spend our leisure time?
- What form will entertainment take?
- What will our houses be like?
- What will cities look like?
- What will be happening in the news?
- Who will be at war with whom and which conflicts of today will have been resolved?
- What jobs will people be doing?
- Will humans still have jobs or will robots have replaced us? If humans aren't working, what will we be doing instead?
- What subjects will they be teaching in schools?

MAKE A DREAM PILLOW

What do you wish for in 50 years' time?

Decorate a pillow case using:

- fabric pens
- embroidery
- needle and thread
- sequins
- buttons

Stuff your pillow. Write your wish for 50 years' time on a piece of paper and place it inside your pillow.

Potential Plus UK | Discover. Nurture. Succeed.

1967 – 2017

50 AMAZING CHALLENGES FOR 50 AMAZING YEARS

Inside this book, you will find 50 engaging and stimulating challenges.

They may not keep you going for the next 50 years, but they should keep you occupied for a while!

2017 marks the 50th Anniversary of Potential Plus UK, formerly The National Association for Gifted Children.

NAGC was founded in 1966 and formally established as a charity in 1967 when Margaret Branch, a psychiatric social worker, and others, found that there was a pressing need for society to become aware that gifted children (whom we now call children with high learning potential) whose potential is not realised may become frustrated and misunderstood.

Take a look at our website and see the services we now provide to support children, young people and families. Why not support us in this work?

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