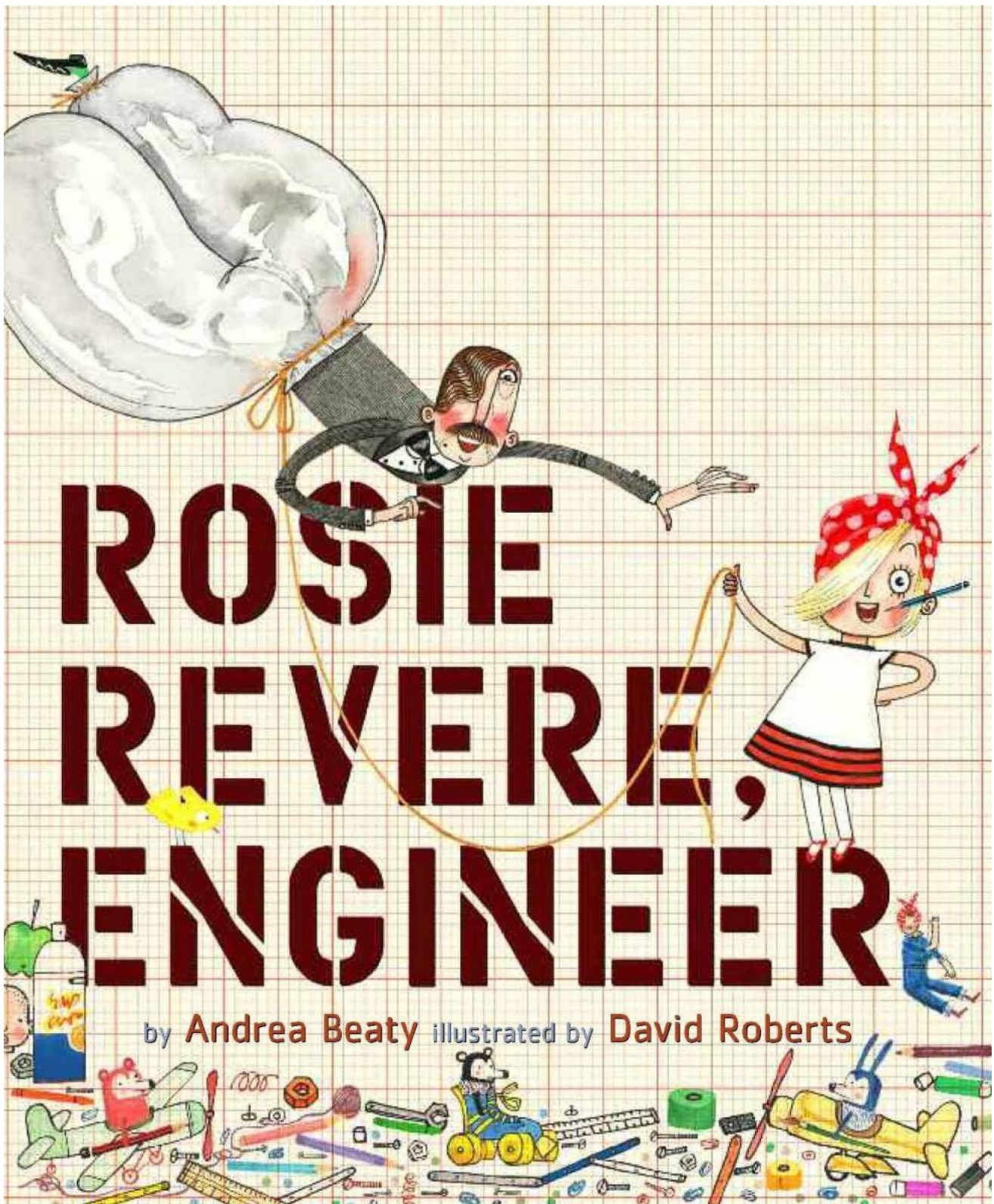
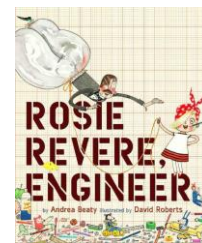


# 'STEM through a story'





The book *Rosie Revere, Engineer* by Andrea Beaty is the story of a young girl named Rosie. Rosie may seem quiet during the day, but at night she is a brilliant inventor of gizmos and gadgets who dreams of becoming a great engineer. She spends her time creating all kinds of inventions, but eventually hides them from her family and friends because she is embarrassed that they will be failures.

Her great-aunt, an engineer, gives her the encouragement she needs and shows her that failure is part of the creative process. “The only true failure can come if you quit.”

This book provides a context to explore aspects of Health and Wellbeing (resilience, Growth Mindset, self-esteem, perseverance) and promotes the themes of creative thinking, problem finding and solving, improving and adapting – which are ‘Engineering Habits of Mind’ (see page 3). The children should be encouraged to identify these traits in Rosie in the story.

The activities suggested here have an engineering focus and sit within the ‘Craft, Design, Engineering and Graphics’ part of the Technologies Es and Os, specifically the ‘Design and construct models/product’, ‘Exploring uses of materials’ and ‘Application of Engineering’ organisers.

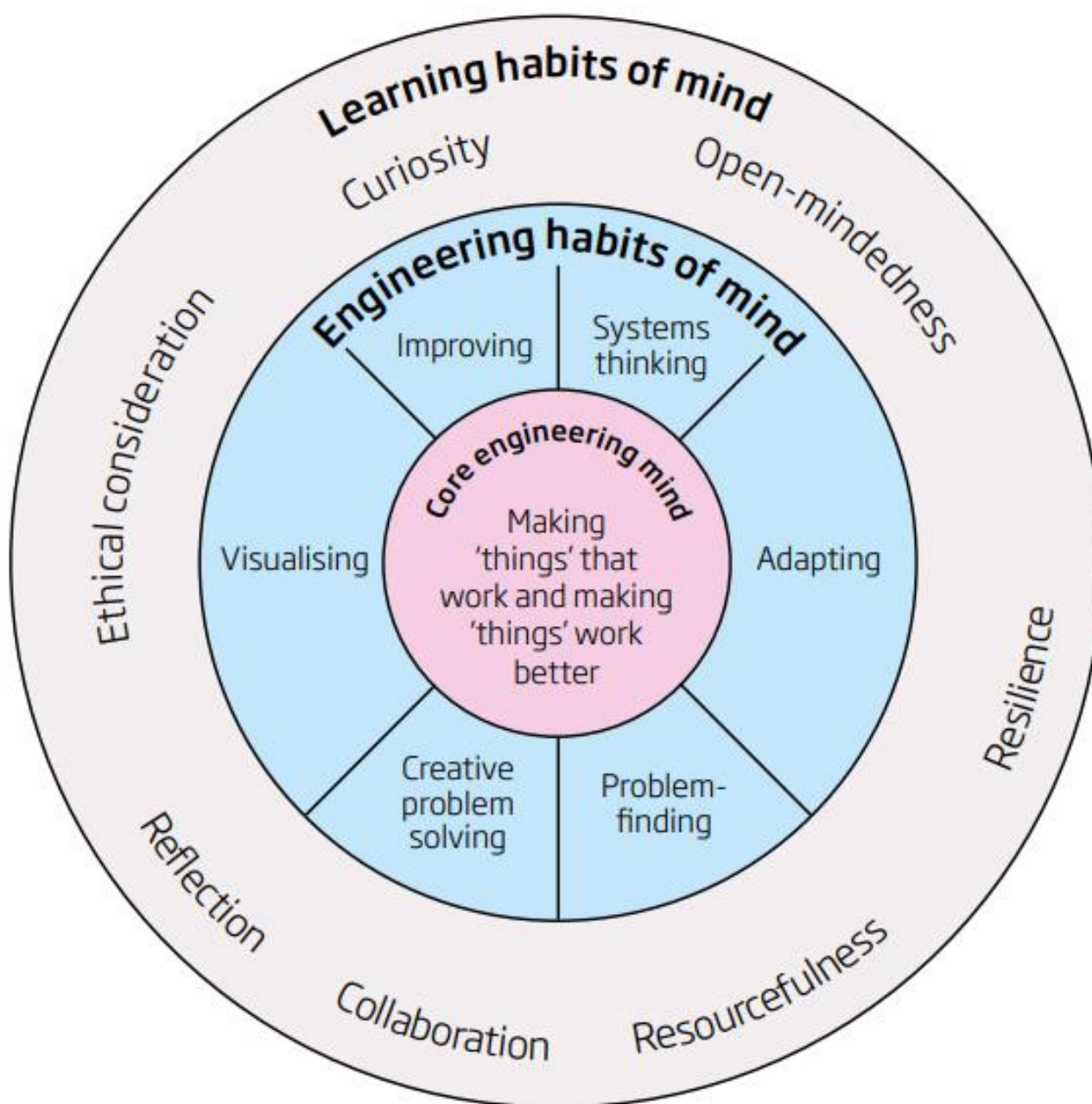
The suggested learning activities also provide opportunities for Literacy and Numeracy skills to be developed too plus also link to some science outcomes

This story is also a reminder that professions are gender neutral, and skills are gender independent; the learners could research famous women scientist and engineers as part of this project.

Whilst this book is aimed at 5–7-year-olds, it lends itself in so many ways to be used with older primary school aged as suggested here.

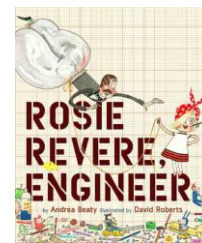
This project also lends itself to using the Makedo construction system: for more information visit their website: [Makedo](http://www.makedo.com)





From:

<https://raeng.org.uk/media/brijknt3/thinking-like-an-engineer-full-report.pdf>



## **Introduction:**

If you do not have the book, you can watch and hear the story being read here:

[ROSIE REVERE, ENGINEER by Andrea Beaty and David Roberts - Children's Books Read Aloud - YouTube](#)

A starting point with the children might be to ascertain their understanding of what an engineer is; some ideas might include a man in a hard hat or a man who fixes cars. There is a great opportunity within this project to broaden the children's understanding about the huge variety of engineering roles in the workplace for both men and women – from civil engineers to aerospace engineers, biomedical engineers, environmental engineers, agricultural engineers, software engineers etc!

A couple of useful websites about engineering jobs are these - there are many more!

<https://www.teachengineering.org/k12engineering/types-of-engineering>

<https://sciencekids.co.nz/sciencefacts/engineering/typesofengineeringjobs.html>

What is an engineer? (*An engineer is someone who uses science and maths to develop solutions to problems. Engineers do not just build machines. They also design systems to make things function better.*)

Rosie dreams of being one, so it is good to explore this more.

'What is an engineer?': <https://www.youtube.com/watch?v=owHF9iLyxic&t=2s>

A good PowerPoint from STEM Learning as an introduction to what engineers do 'Engineers don't all wear hard hats' can be found here: [What is engineering? | STEM](#)

This PowerPoint introduces engineering to primary children. The inspiration for the resource comes from the associated '[Born to Engineer](#)' video on the website which focuses on the design of a wing suit for base jumping: an extreme sport inspired by the ability of flying squirrels to glide from one tree to another.

Engineers use something called the 'engineering design process. By using this approach with the children, the learning activity becomes a real, skill focussed STEM (engineering) learning activity.

Find out about the engineering process by watching this video:

[Engineering Design Process - YouTube](#)

*Note: Different sources have slight variations in the steps identified, but they are broadly the same/very similar.*

It is also worth noting that the activities suggested here provide the children opportunities to develop some of the top ten STEM employability skills too:

Teacher guidance and the poster on the next page can be downloaded [here](#)

# Top 10 employability skills



**KEY**

- HOW YOU WORK
- HOW YOU WORK WITH OTHERS
- HOW YOU THINK
- SHOW ALL

## 10 NUMERACY AND IT SKILLS

- use numbers and data to support your work and obtain meaningful information
- apply your valuable IT skills

**HOW I CAN DEVELOP THESE SKILLS:**

- use numerical evidence in a science practical, STEM project or business idea
- help your family with budgeting or other money decisions
- learn new IT skills such as coding

## 1 USING INITIATIVE AND BEING SELF-MOTIVATED

- follow instructions, making sure you do not always have to be told what to do and when
- put forward your own ideas
- see something through to the end, and not be put off by setbacks

**HOW I CAN DEVELOP THESE SKILLS:**

- finish work without being asked
- work without help—but know when to ask for it
- suggest new ideas

## 9 PROBLEM SOLVING SKILLS

- identify key issues in a problem
- use your knowledge and experience when tackling problems
- develop and test possible solutions

**HOW I CAN DEVELOP THESE SKILLS:**

- design objects and materials in design and technology
- plan a STEM Club project
- analyse results in maths or science
- evaluate evidence in science or humanities

## 2 ORGANISATIONAL SKILLS

- plan your work to meet deadlines and targets
- organise your own time and coordinate with others
- monitor and adjust the progress of your work to stay on track

**HOW I CAN DEVELOP THESE SKILLS:**

- help organise an event or project
- plan your revision timetable
- calmly change plans if you run out of time, or something unexpected happens

## 3 WORKING UNDER PRESSURE AND TO DEADLINES

- meet deadlines and targets
- handle the pressure that comes with meeting deadlines and targets
- ensure that you are seen as a reliable person

**HOW I CAN DEVELOP THESE SKILLS:**

- finish work before the deadline, using that time to check and improve it
- plan and make the most of available time
- prioritise your commitments inside and outside school or college

## 8 VALUING DIVERSITY AND DIFFERENCE

- respect others
- value the skills and experience that different people have
- show consideration for the needs of different people

**HOW I CAN DEVELOP THESE SKILLS:**

- work with people who have different skills
- make sure everyone is involved in conversations and activities

## 4 ABILITY TO LEARN AND ADAPT

- learn new things
- learn from successes and failures
- adapt and do things better

**HOW I CAN DEVELOP THESE SKILLS:**

- think how to make your work even better
- put yourself forward when there are chances to learn new skills
- share your ideas and use feedback to improve your work

## 5 COMMUNICATION AND INTERPERSONAL SKILLS

- explain and present what you mean clearly, whether written or verbal
- do your best to understand others

**HOW I CAN DEVELOP THESE SKILLS:**

- do a presentation or speak with an audience
- take part in debates
- give instructions to others

## 7 NEGOTIATION SKILLS

- think about what you and others want and need
- give and take fairly when working with others

**HOW I CAN DEVELOP THESE SKILLS:**

- look for ideas that benefit others as well as yourself
- carry out a school/college enterprise or STEM project that involves agreeing prices
- ask a favour of someone, supported by offering something in return

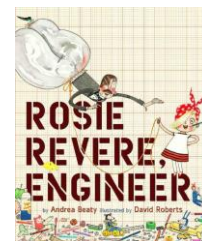
## 6 TEAMWORK

- understand how you and others work best together
- get things done when working with people with different skills, backgrounds and personalities

**HOW I CAN DEVELOP THESE SKILLS:**

- plan ahead when working with others
- take account of how your team are feeling when you work together





### **Activity One: Be an engineer!**

Set up an area with lots of recycled materials and e.g., string, masking tape, newspaper, 'lollypop sticks', paper etc. that the class can't see/don't have access to.

When Rosie was young, she made fine inventions for an uncles and aunts including a hot dog dispenser and helium pants. She made things out of anything she could find.

The task is for each child to come up with an invention. It is designed to be a short task and an introduction to using some of the steps of the engineering design process.

**ASK/IDENTIFY THE PROBLEM:** what/who is their invention for and how does it solve a problem or improve something for someone?

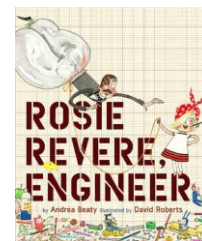
**IMAGINE/DESIGN/PLAN:** The pupils should first draw their design and once the teacher has seen the design, they are allowed access to the materials.

**CREATE:** They then build a model of their invention; the build time should be short-about 15 minutes. This is to ensure that the models are ready for sharing with others.

**TEST/SHARE:** The pupils then share their models with a partner, demonstrate them and talk about their designs and receive feedback.

**IMPROVE:** They are then given 10 -15 more minutes to change/improve their designs





## Activity Two: Design and make a snake repelling hat

In the book, the uncle that Rosie loved the most was Zookeeper Fred, and she makes him a hat to keep snakes off his head using unusual objects.

In this video, the engineering design process is demonstrated as the imagined snake-repelling helmet from the book is recreated.

[Rosie Revere, Engineer: Building a Better Snake-Repelling Hat - YouTube](#)

The challenge is to design and build a snake-repelling hat from basic craft and recycled materials using the engineering design process.

**ASK/IDENTIFY THE PROBLEM:** Uncle Fred works in a zoo and needs a hat to protect his head.

**RESEARCH/BRAINSTORM:** What things are snakes scared of or would keep them away? Can you include any of these in the design?

### IMAGINE/DESIGN/PLAN

CREATE

TEST

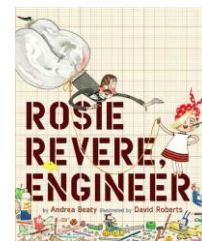
IMPROVE

SHARE



### Zookeeper Hats:

An alternative, possibly depending on the age of the children, could be to design and create a hat for the zookeepers who work with Uncle Fred. The hat must be functional and have a design feature for a particular zookeeper. For example, a giraffe keeper might need a hat with a long ladder as part of it to reach the giraffe's head; a penguin keeper might need a waterproof pocket to carry the fish at feeding time. The engineering design process could be followed, just as above.



### **Activity Three: Design and make an enclosure for the chimpanzees**

#### **Part One:**

The chimpanzees at Uncle Fred's zoo need a new enclosure. The zoo is trying to be more sustainable and 'environmentally friendly'. The animals need heating, light, water, and food. Your design must include things that make the enclosure more sustainable and 'environmentally friendly' (*after some research, the children might consider including things in their designs/models such as solar panels, wind turbines, or recycling plant and animal waste into biomass energy for the enclosure ?*)

Using the engineering design process, design and make a model of a new enclosure for the chimpanzees.



#### **Part Two:**

Uncle Fred is having a problem keeping the chimpanzees in their enclosures because they have learnt how to open the doors and let themselves out!

Can you engineer a solution that will keep the chimpanzees from escaping from their enclosure and incorporate it into your design?

*A few suggestions but the children will have many more ideas! Some might not even involve circuits or programming a device!*

*It could be an alarm system that goes off when the door is opened*

[Build | Hidden Alarm . DESIGN SQUAD GLOBAL | PBS KIDS](#)

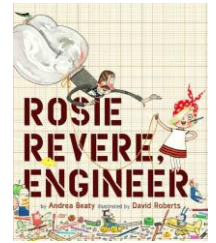
*It could be an alarm that lights up and plays a tune created using a micro: bit and works when the micro: bit is moved*

[Simple tilt alarm | micro: bit \(microbit.org\)](#)

*It could be a light sensor that lights up when light falls below a certain level because a chimpanzee has passed by creating a shadow*

[Nightlight | micro: bit \(microbit.org\)](#)



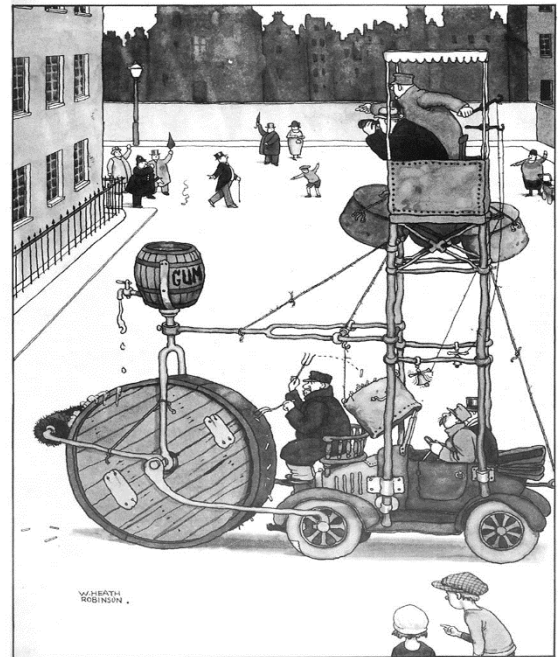


## Activity Four: Whacky Inventors and Inventions:

*(Possible home learning /family learning task?)*

**Heath Robinson** (1872 – 1944) was an English cartoonist and is famous for his absurd drawings of ridiculous, imaginary contraptions and machines which were very complicated and designed to do something very simple. These kinds of machines are known as Heath Robinson Contraptions

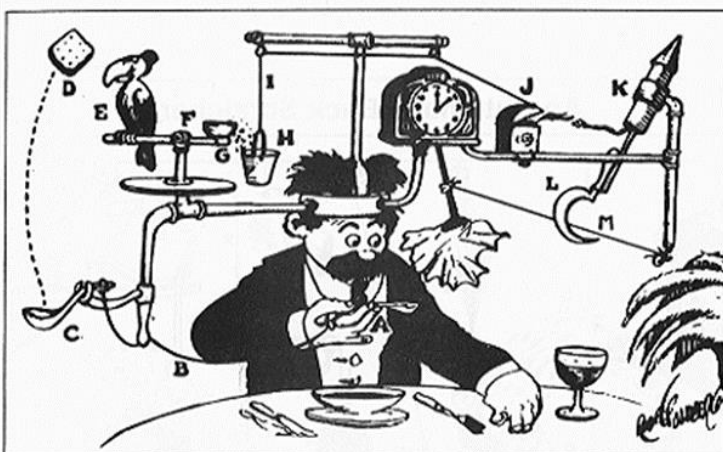
Here is a machine he designed to pick up litter:



Anti-Litter Machine

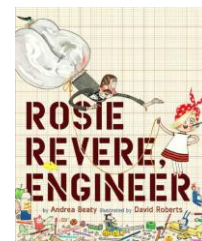
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### Self-Operating Napkin



**Reuben Goldberg** (1883 – 1970) was an American cartoonist, engineer, and inventor. He liked to use his imagination to design complicated machines to do simple tasks.

Now these kinds of devices are called Rube Goldberg Machines.



**Wallace and Gromit:** Wallace is a cheese-loving inventor, who lives with his dog Gromit. Wallace has created lots of inventions to do all sorts of jobs to try and make life easier:

- '525 Crackervac', with a built-in cracker sensor designed to help save Gromit's time and take the strain out of cleaning:



<https://www.youtube.com/watch?v=mmgJxSICYLA&t=24s>

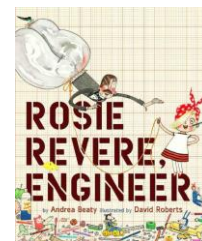
- The Bed-Waking Lever (also known as the Bed Launcher or Wake Up Machine): to get Wallace out of bed and into the dining room. It is usually pulled by Gromit, as Wallace is in bed. After sliding him out of bed he lands in the dining room where he would eat his breakfast.

[Bed-Waking Lever | Wallace and Gromit Wiki | Fandom](#)

More of Wallace's inventions can be found here:

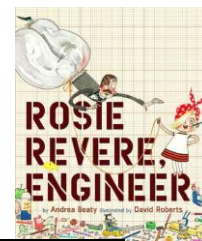
[Cracking Contraptions Compilation - Wallace & Gromit - YouTube](#)

Draw and/or make your own 'whacky invention' from recycled materials. Remember the machine must be designed to carry out a simple task! E.g., watering a plant, buttering a piece of bread, closing a door or to feed the chimpanzees in activity 3!

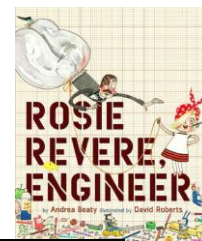


### Links to Es and Os

| <u>Activity</u>   | <u>Es and Os</u>   |
|---|--|
| Introduction  | <p>I explore a variety of products covering a range of engineering disciplines. <b>TCH 0-12a</b></p> <p>I explore and discover engineering disciplines and can create solutions. <b>TCH 1-12a</b></p> <p>I can extend my knowledge and understanding of engineering disciplines to create solution. <b>TCH 2-12a</b></p>   |
| Be an Engineer!<br><br>Design and make a snake repelling hat<br><br>Zookeeper hats<br><br>Whacky Inventions | <p>I explore ways to design and construct models. <b>TCH 0-09a</b></p> <p>I explore everyday materials in the creation of pictures/models/concepts <b>TCH 0-10a</b></p> <p>I can design and construct models and explain my solutions. <b>TCH 1-09a</b></p> <p>I can recognise a variety of materials and suggest an appropriate material for a specific use <b>TCH 1-10a</b></p> <p>I explore and discover engineering disciplines and can create solutions. <b>TCH 1-12a</b></p> |
| Design and make an enclosure for the chimpanzees Part One:  | <p>I explore ways to design and construct models. <b>TCH 0-09a</b></p> <p>I explore everyday materials in the creation of pictures/models/concepts <b>TCH 0-10a</b></p> <p>I can design and construct models and explain my solutions. <b>TCH 1-09a</b></p> <p>I can recognise a variety of materials and suggest an appropriate material for a specific use <b>TCH 1-10a</b></p> <p>I explore and discover engineering disciplines and can create solutions. <b>TCH 1-12a</b></p> |



|   |   |
|---|---|
| <p>Design and make an enclosure for the chimpanzees Part Two:</p>                         | <p>I can describe an electrical circuit as a continuous loop of conducting materials. I can combine simple components in a series circuit to make a game or model. <b>SCN 1-09a</b></p> <p>Through exploring non-renewable energy sources, I can describe how they are used in Scotland today and express an informed view on the implications for their future use. <b>SCN 2-04b</b></p> <p>I have used a range of electrical components to help to make a variety of circuits for differing purposes. I can represent my circuit using symbols and describe the transfer of energy around the circuit. <b>SCN 2-09a</b></p> <p>I can demonstrate a range of basic problem-solving skills by building simple programs to carry out a given task, using an appropriate language. <b>TCH 1-15a</b></p> <p>I can create, develop and evaluate computing solutions in response to a design challenge <b>TCH 2-15a</b></p>  |
| <p>Other possible Es and Os that might be included depending on activities undertaken</p> | <p>I can describe some of the kinds of work that people do, and I am finding out about the wider world of work. <b>HWB 0-20a / HWB 1-20a</b></p> <p>I am investigating different careers/occupations, ways of working, and learning and training paths. I am gaining experience that helps me recognise the relevance of my learning, skills and interests to my future life. <b>HWB 2-20a</b></p> <p>I can estimate how long or heavy an object is, or what amount it holds, using everyday things as a guide, then measure or weigh it using appropriate instruments and units. <b>MNU 1-11a</b></p> <p>I can use my knowledge of the sizes of familiar objects or places to assist me when making an estimate of measure. <b>MNU 2-11a</b></p> <p>I can use the common units of measure, convert between related units of the metric system and carry out calculations when solving problems. <b>MNU 2-11b</b></p> <p>As I listen and talk in different situations, I am learning to take turns and am developing my awareness of when to talk and when to listen. <b>LIT 0-02a / ENG 0-03a</b></p> <p>I listen or watch for useful or interesting information, and I use this to make choices or learn new things. <b>LIT 0-04a</b></p> |



When I engage with others, I know when and how to listen, when to talk, how much to say, when to ask questions and how to respond with respect. **LIT 1-02a**

When listening and talking with others for different purposes, I can exchange information, experiences, explanations, ideas and opinions, and clarify points by asking questions or by asking others to say more. **LIT 1-09a**

Using what I know about the features of different types of texts, I can find, select, sort and use information for a specific purpose. **LIT 1-14a**

When I engage with others, I can respond in ways appropriate to my role, show that I value others' contributions and use these to build on thinking. **LIT 2-02a**

When listening and talking with others for different purposes, I can: · share information, experiences and opinions; · explain processes and ideas; · identify issues raised and summarise main points or findings; and · clarify points by asking questions or by asking others to say more. **LIT 2-09a**

Using what I know about the features of different types of texts, I can find, select and sort information from a variety of sources and use this for different purposes. **LIT 2-14**

I can use digital technologies to explore how to search and find information. **TCH 0-02a**

Using digital technologies responsibly I can access, retrieve and use information to support, enrich or extend learning in different contexts. **TCH 1-02a**

I can use digital technologies to search, access and retrieve information and are aware that not all of this information will be credible. **TCH 2-02a**

*This resource was created by Kim Aplin, PSDO, Aberdeenshire Council*