
EUREKA!
the national children's museum
Spark
Gallery
Guide
Patternarium

What is Spark gallery?

Our Spark gallery, which opened in 2017, is different from the other galleries we have at Eureka! It's interactive (just like everything else) but hosts temporary exhibitions that showcase the most exciting and creative digital technology from around the world. The changing programme of exhibitions challenges pupils to think differently about art and how they interact with the digital world. It will encourage your class to be creative in new and unexpected ways. Suitable for all Primary phases, the exhibitions in our Spark gallery are mesmerising and awe-inspiring and have links to the National Curriculum.

Patternarium

Explore how digital technology and mechanical machines interact to make mind-blowing patterns in the latest exhibition in the Spark gallery. Designed and created by Halifax based arts company IOU Theatre in collaboration with Eureka!, the exhibition takes over both floors of our Spark gallery until June 2019. The ground floor hosts a sound and light installation called Volatile Light, whilst on the first floor there are a number of interactive exhibits which allow visitors to create their own patterns in lots of different ways, with each one inspired by the Volatile Light exhibit downstairs.

To get an idea of the exhibition, watch our video on our YouTube channel: **www.youtube.com/EurekaMuseum**

Accessibility

Patternarium is accessible for visitors with disabilities and physical mobility impairment, and is full of sounds, lights, images and movement for all our visitors to explore. If you have sensory sensitivities, you might find the environment a little overwhelming. There is accessibility information in this document and please get in touch if you have any further questions.

Our partner – IOU Theatre

IOU is an acclaimed arts organisation that has excited and delighted diverse audiences all over Europe. Funded by Arts Council England, IOU has more than 40 years' experience making live shows and contemporary art installations that combine art forms with new and innovative technology. All aspects of the work are originated by the company and devised for unusual indoor and outdoor locations as well as established touring venues and galleries. **www.ioutheatre.org**

What will Spark gallery provide for your class?

Spark gallery is all about learning through collaborative discovery, open exploration and play because we know that children learn best when they are engaged, curious and having fun.

Across the exhibition there are a number of links to both the Maths and Science curriculums some of which are detailed for each exhibit on the following pages. More broadly, the exhibition as a whole links with the Science, Maths and Art and Design curriculums in the following ways:

Science - Key areas of study are light, sound and forces.

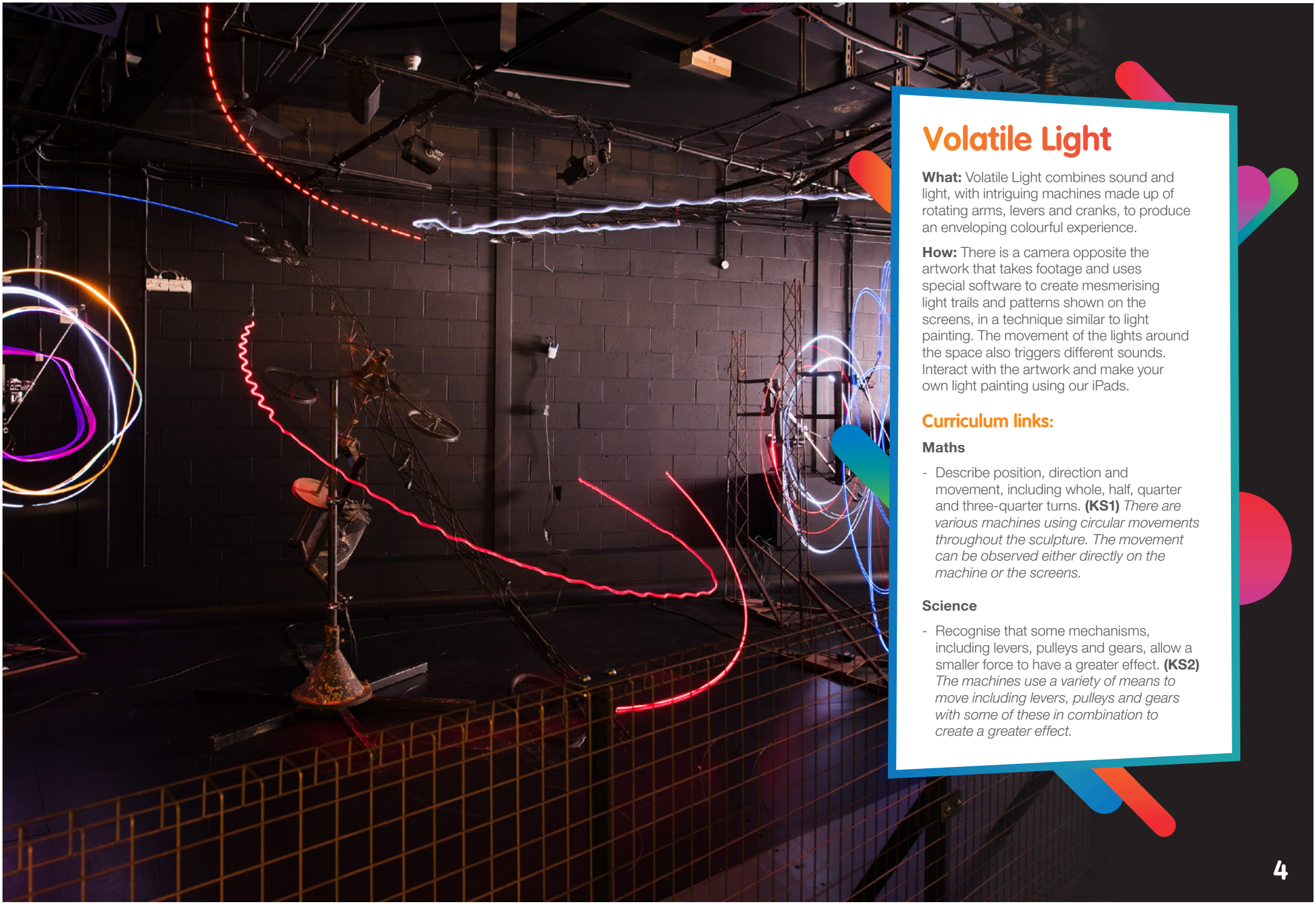
- Working scientifically – using observations and ideas to suggest answers to questions. **(KS1)** *By observing the exhibits, can the students deduce how they work?*
- Identify and name a variety of everyday materials and describe their physical properties. **(KS1)** *There are a range of materials used throughout the exhibition. Children will look at why those materials were used and the properties that made them useful.*
- Working scientifically – using straightforward scientific evidence to answer questions to support their finding. **(KS2)** *By observing the exhibits, can the students recognise simple scientific ideas and processes?*
- Recognise that they need light in order to see things and that dark is the absence of light. **(KS2)** *As the gallery is a darker space than the rest of the museum, it can be utilised to show how light is used to see things.*

Maths

- Geometry - properties of shapes – number of sides and line of symmetry in a vertical line. **(KS1)** *The artworks are made up of 2D and 3D shapes. How many can pupils identify? Can they find the lines of symmetry on shapes in Kaleidoscope?*
- Geometry – position and direction – use mathematical vocabulary to describe position, direction and movement, distinguishing between 'turn' by applying rotations, including in practical contexts. **(KS1)** *There are dials, cranks and bicycle pedals that the pupils can rotate to identify turn for their group leader.*
- Geometry - properties of shapes – recognise angles as a property of shape or a description of turn. **(KS2)** *Can pupils describe for you the angle of the laser in Laser Drum? Or turn the cranks and dials to specified degrees you tell them?*

Art & Design

- Evaluate and analyse creative works using the language of art, craft and design. **(KS1&2)** *Students experience an interactive art exhibition created by an Arts Council funded arts organisation. Can they critique the installations using artistic vocabulary? Can they explain how they think the cameras and software create the special effects? What if there were no digital technology added to the artworks?*



Volatile Light

What: Volatile Light combines sound and light, with intriguing machines made up of rotating arms, levers and cranks, to produce an enveloping colourful experience.

How: There is a camera opposite the artwork that takes footage and uses special software to create mesmerising light trails and patterns shown on the screens, in a technique similar to light painting. The movement of the lights around the space also triggers different sounds. Interact with the artwork and make your own light painting using our iPads.

Curriculum links:

Maths

- Describe position, direction and movement, including whole, half, quarter and three-quarter turns. **(KS1)** *There are various machines using circular movements throughout the sculpture. The movement can be observed either directly on the machine or the screens.*

Science

- Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. **(KS2)** *The machines use a variety of means to move including levers, pulleys and gears with some of these in combination to create a greater effect.*

Cycloid Drawing Machine

What: Turn the dials to trace patterns of light.

How: Three dials control separate parts of the drawing machine, two rotating arms and a rotating canvas of light sensitive paper. These all contribute to the movement of the central light in circular motions. Small changes to any dial can completely alter the pattern created.

Curriculum links:

Maths

- Describe position, direction and movement, including whole, half, quarter and three-quarter turns. **(KS1)** *The machine uses rotation to create the drawings so there are a variety of turns that can be observed.*
- Recognise angles as a property of shape or a description of a turn. **(KS2)** *The dials can be turned using 90°, 180°and 360° angles.*

Science

- Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. **(KS2)** *The machines are driven by gears. These combine in different ways to create the effects seen on the drawings.*

Kaleidoscope

What: Add different objects to create unique patterns on our larger-than-life kaleidoscope.

How: Put objects on the glass top of our giant kaleidoscope to create a unique pattern using symmetry. At the bottom of the kaleidoscope, there is a camera that films the objects and their reflections in the mirrors of the kaleidoscope. The images created are displayed on a screen above the artwork.

Curriculum links:

Maths

- Identify line symmetry. **(KS1)** *With multiple mirrors inside the artwork, line symmetry can be observed on the screen above at multiple angles.*
- Describe position, direction and movement, including whole, half, quarter and three-quarter turns. **(KS1)** *The mirrors rotate, so a turn can be observed in the machine and by tracking an object in the screen above the machine.*
- Identify lines of symmetry in 2D shapes presented in different orientations. **(KS2)** *With the rotation of the mirrors, the shapes change position.*
- Identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed. **(KS2)** *By placing regular shapes in different positions on the machines, reflections can be observed in different parts of the image on the screen above.*

Laser Drum

What: Make a vibrating laser pattern using sound.

How: Dials on each machine control the pitch of the sounds coming from the speaker in front. A laser then bounces off a mirror on a surface over the speakers to create patterns on the wall, with the pattern dependant on the pitch of the sounds. With two dials controlling a sound each they can be combined to create many different patterns.

Curriculum links:

Science

- Notice that light is reflected from surfaces. **(KS2)** *A small mirror has been placed on the surface above the speaker to reflect the laser light.*
- Identify how sounds are made, associating some of them with something vibrating. **(KS2)** *The vibrations produced by the speaker can be seen on the wall and a link made to the sound being generated by the speaker. At lower frequencies the vibration of the surface above the speaker is also clearly visible.*
- Recognise that sounds get fainter as the distance from the sound source increases. **(KS2)** *By experimenting with the distance the students stand from the artwork, they can observe the difference in volume this will make.*
- Recognise that light appears to travel in straight lines. **(KS2)** *The light produced by the laser can be observed reflecting off the mirror on the surface above the speaker in a straight line onto the wall in front.*

Maths

- Identify right angles, recognise that two right angles make a half-turn, three make three-quarters of a turn and four a complete turn. **(KS2)** *The dials on each machine can be turned to identify angles.*
- Identify acute and obtuse angles. Estimate acute, obtuse and reflex angles. **(KS2)** *The laser hits the surface of the mirror at an angle equal to that reflected onto the wall.*

Pedal Powered Volatile Light

What: Use pedal and crank power to generate patterns of light.

How: Pedal a bike or turn a hand crank to move the machines. Lights are attached all over the machines. A camera captures the lights' movements, turning them into light trails and patterns on the screens above.

Curriculum links:

Maths

- Describe position, direction and movement, including whole, half, quarter and three-quarter turns. **(KS1)** *Similar to the main Volatile Light artwork downstairs, the machines rotate in circles and so different turns can be observed and, with this artwork, controlled by the user.*
- Identify acute and obtuse angles. Estimate acute, obtuse and reflex angles. **(KS2)** *As the parts of the machines turn, they create different angles.*

Science

- Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. **(KS2)** *The machines use a variety of means to move including levers, pulleys and gears with some of these in combination to create a greater effect. What happens when the children turn the crank 90° degrees? Half a turn? A whole turn? Can they predict what effect it will have?*
- Notice that light is reflected from surfaces. **(KS2)** *There is a large mirror placed below the machine allowing the light to be reflected from below.*

Pendulum

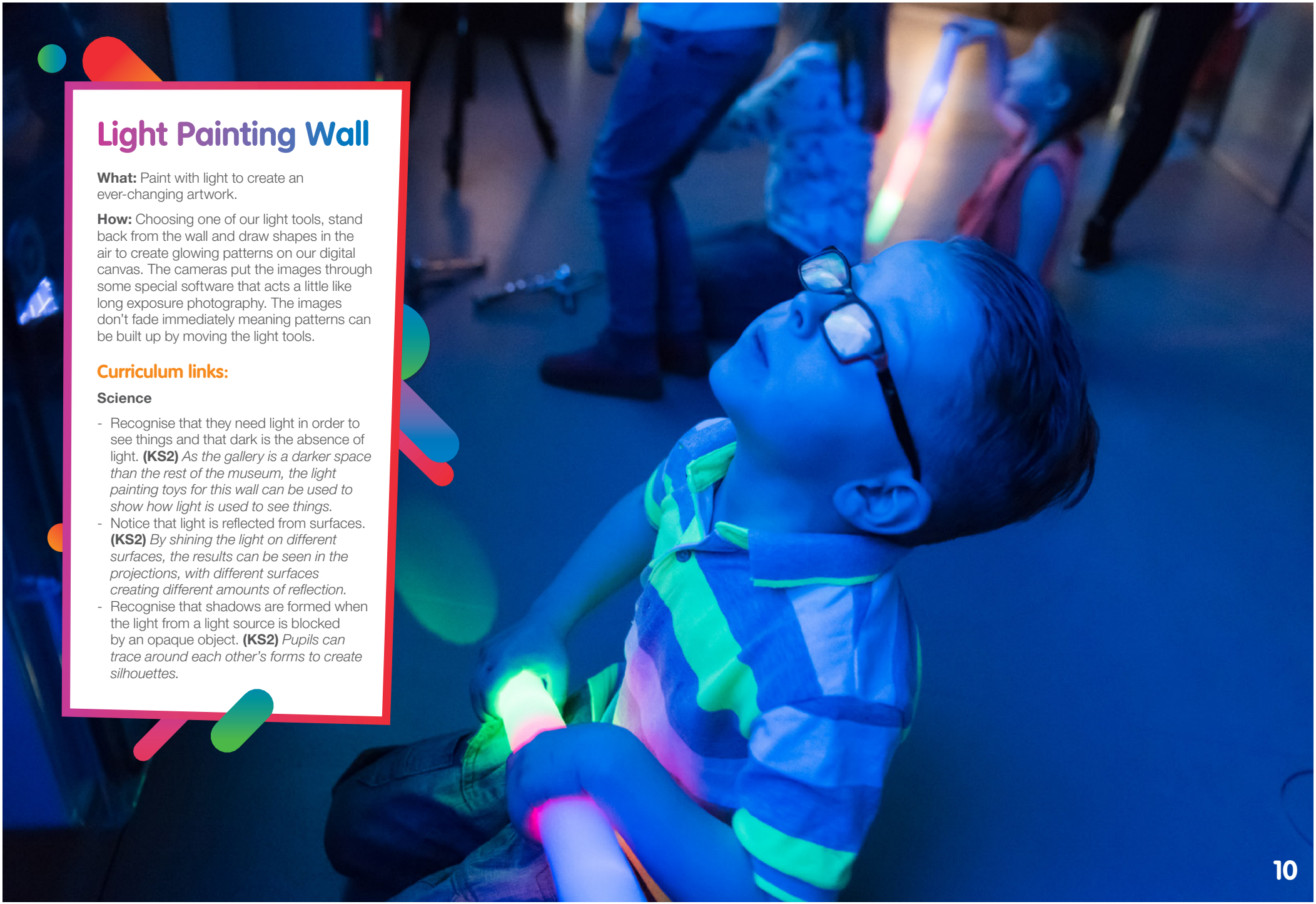
What: Watch the laser pendulum trace a glowing pattern with light.

How: The pendulum traces its path using a beam of light projected onto a light sensitive surface. Press a button to see the pattern build up over time as the pendulum swings across the surface.

Curriculum links:

Maths

- Measure and begin to record the following: time. **(KS1)** *As the pendulum has a regular period (the time it takes to complete one full swing), this can be measured.*
- Compare duration of events. **(KS2)** *A pendulum has a regular period (the time it takes to complete one full swing), no matter how far it is swinging. Two different periods can be timed and compared to see this relationship. Can children estimate when a minute has passed?*



Light Painting Wall

What: Paint with light to create an ever-changing artwork.

How: Choosing one of our light tools, stand back from the wall and draw shapes in the air to create glowing patterns on our digital canvas. The cameras put the images through some special software that acts a little like long exposure photography. The images don't fade immediately meaning patterns can be built up by moving the light tools.

Curriculum links:

Science

- Recognise that they need light in order to see things and that dark is the absence of light. **(KS2)** *As the gallery is a darker space than the rest of the museum, the light painting toys for this wall can be used to show how light is used to see things.*
- Notice that light is reflected from surfaces. **(KS2)** *By shining the light on different surfaces, the results can be seen in the projections, with different surfaces creating different amounts of reflection.*
- Recognise that shadows are formed when the light from a light source is blocked by an opaque object. **(KS2)** *Pupils can trace around each other's forms to create silhouettes.*

Digital Light Painting Activity

Activity Guide:

Activity:

Create Light Paintings in the classroom, using a camera and light sources.

Resources required:

- A camera capable of taking long exposure photographs. This can be a tablet, phone or proper cameras. Compatible apps for phones and tablets are listed below. For guidance on the settings for proper cameras, as every camera is different, search for 'Long Exposure photo settings' online.
- Light sources, these can be torches or colourful LEDs.
- A dark space, as you want to make the lights as clear as possible on the photo.

iPad/iPhone Apps:

Night Cap Pro:
https://www.nightcapcamera.com/

Slow Shutter Cam:
https://itunes.apple.com/gb/app/slow-shutter-cam/id357404131?mt=8

Android Apps:

Camera FV-5 Lite:
https://play.google.com/store/apps/details?id=com.flavionet.android.camera.lite&hl=en_GB

Instructions:

1. Find a dark space.
2. Set up your camera/tablet with the app enabled. A tripod is useful to keep the camera steady but not essential.
3. Set the camera/tablet going and start moving the light sources around in the front of the camera.
4. Experiment with colours and types of lights, and moving them in a variety of ways to create different patterns.

Curriculum links:

Science

- Recognise that they need light in order to see things and that dark is the absence of light. **(KS2)**
- Notice that light is reflected from surfaces. **(KS2)**

Art & Design

- Evaluate and analyse creative works using the language of art, craft and design. **(KS1&2)**

Follow-on Activities

Investigate Pendulums: What Affects Their Speed

Activity Guide:

Introduction for teachers:

Pendulums have been used for hundreds of years to keep time. The time they take to swing back and forth will always stay the same, as the speed changes relative to the swinging distance. The longer the length of the pendulum, the longer it takes to swing back and forth.
Mass will not affect it.

Resources required:

- A clear space with something to hang your pendulum from, a doorway for example or for a shorter one, the underneath of a table.
- A length(s) of string.
- A variety of weights for the bottom of the pendulum.
- A method to attach the string at the top. This could be a hook or even some tape if you don't have a heavy weight.
- A timer.

Activity

Agree the variable to test – mass of weight or length of string. (With older children, you could change the angle of trajectory.) Which variable will we change? So which variables need to remain the same in order for it to be a fair test?

1. Find your clear space to hang your pendulums.
2. Attach a weight to one end of the piece of string.
3. Attach the other end of the string to the surfaceit's hanging from.
4. Make sure there is a clear path for the pendulum to swing.
5. Pull the bottom end of the pendulum up and drop it so that it starts to swing.
6. Time how long it takes to swing back and forth once, or until it comes to a standstill and record the result (agree whether only timing once or three times).
7. Repeat with different lengths of string or different weights depending on hypothesis. Record result.
8. Conclusion.

Further tasks:

- Time how long it takes for a pendulum to swing all the way back and forth. Does this time change as the pendulum slows down? This time will stay the same as the distance a pendulum travels and the speed of the pendulum are directly related.
- Why is the pendulum slowing down? Can the children think of other times when object will slow down for the same reason? The pendulum will lose energy to the air slowing it down, and friction at the top of the string where it is attached. Lots of object lose their movement energy due to air resistance and friction.

Follow-on Activities

Curriculum links:

Maths

- Measure and begin to record the following: time. **(KS1)**
- Measurement: compare, describe and solve practical problems for lengths and heights, mass/weight, time. **(KS1)**
- Measurement: measure and begin to record lengths and heights, mass/weight, time. **(KS1)**
- Measurement: choose and use appropriate standard units to estimate and measure. **(KS1)**
- Measurement: compare and order lengths, mass. **(KS1&2)**
- Record and compare time in terms of seconds. **(KS2)**
- Estimate, compare and calculate different measures. **(KS2)**
- Compare duration of events. **(KS2)**

Science

- Working scientifically: asking simple questions and recognising that they can be answered in different ways; observing closely, using simple equipment; performing simple tests; using their observations and ideas to suggest answers to questions; gathering and recording data to help in answering questions. **(KS1)**
- Working scientifically: asking relevant questions and using different types of scientific enquiries to answer them; setting up simple practical enquiries, comparative and fair tests; making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment; gathering, recording, classifying and presenting data in a variety of ways to help in answering questions; recording findings using simple scientific language; using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions; identifying differences, similarities or changes related to simple scientific ideas and processes; using straightforward scientific evidence to answer questions or to support their findings. **(LKS2)**
- Working scientifically: planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary; taking measurements, with increasing accuracy and precision, taking repeat readings when appropriate; using test results to make predictions to set up further comparative and fair tests; recording and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree pf trust in results; identifying scientific evidence that has been used to support or refute ideas or arguments. **(UKS2)**