Unit 4.5: We are artists
Fusing geometry and art

Software: Inkscape (alternatives: Vectornator X for the iPad or Google Draw on Chromebooks) and Scratch (alternative: Logo)

Hardware: Laptop/desktop/Chromebook computers or tablets

Overview

In this unit, pupils explore and create pieces of geometric art and a Scratch computer program for drawing shapes. In:

- **Session 1** they create simple **tessellations** using Inkscape
- **Session 2** they create more complex tessellations using Inkscape
- **Session 3** they create Islamic-style art using Scratch
- **Session 4** they create a repeating pattern using Scratch
- **Session 5** they create art, inspired by Bridget Riley's late works, using Inkscape
- **Session 6** they create art, inspired by Bridget Riley's early works, using Inkscape.

Alternatives

The tessellation and Bridget Riley inspired sessions work well in Inkscape, but could, with some modification, be done using Vectornator X on iPads or Google Draw on Chromebooks. The turtle graphics sessions can be completed in Logo as an alternative to Scratch.

Knowledge, skills and concepts

In this unit, pupils will learn to:

- develop an appreciation of the links between geometry and art
- become familiar with the tools and techniques of a **vector graphics** package
- develop an understanding of **turtle** graphics
- experiment with the tools available, refining and developing their work as they apply their own criteria to evaluate it, and receive feedback from their peers
- develop some awareness of computer-generated art.

Progression

In Key Stage 1:
- Pupils create digital art in **Unit 1.3: We are digital artists.**
- They program in Scratch in **Unit 2.1: We are astronauts**.

In Key Stage 2:
- Pupils program in Scratch in **Unit 3.1: We are programmers, Unit 4.1: We are software developers, Unit 5.1: We are game developers** and **Unit 6.2: We are computational thinkers.**
- They use other digital media in **Unit 5.3: We are architects** and **Unit 5.6: We are VR designers.**

Assessment – by the end of the unit:

All pupils can:
- create a **tessellating** pattern
- write a program to draw a simple shape
- create a pattern using overlapping shapes
- create a pattern using repeating, varied shapes.

Most pupils can:
- create a tessellating pattern using more complex shapes
- use repetition in a program to draw a more complex geometric figure
- create a pattern using repeating, varied shapes using the tile clone tool or similar.

Some pupils can:
- use blocks of script they have written themselves to create a complex geometric figure in Scratch.

Background information

While much of the time we work with **bitmap** images, recording the colour value of each **pixel**; images on computers can also be represented as **vector graphics**, in which the properties of each line or curve are described. Typically, this produces a much more compact file for simple drawings. The properties of lines, curves and shapes can also be controlled through a drawing program's user interface.

The Logo programming language introduced the idea of '**turtle**' graphics, creating instructions for the distance and turn angle for a small robot, or screen representation of a turtle, to follow in order to draw a shape. Scratch makes this available through its optional *pen tool* blocks.

Key vocabulary

Abstraction: a process of managing complexity by setting to the side irrelevant detail and concentrating on function rather than form

Bitmap: an image represented by a large, rectangular grid of pixels, each having its own colour value, typically in the range 0 to 255 for each of red, blue and green

Fractal: a self-similar repeating (or almost repeating) structure in which ever greater detail becomes apparent as the structure is examined more closely

Pixel: picture element – one of the small, square dots that makes up a digital image

Repetition: programming construct which allows a group of instructions to be repeated a number of times, or until a certain condition is met

Sprite: a graphical character in a program that can be given its own sequence of instructions

Tessellation: a regular pattern of one shape that fills a space without overlapping or leaving spaces between

Transform: to change the shape of an image or part of an image

Turtle: a small floor robot (or a representation of one on screen) that draws by moving forward and turning, under the control of a program, for example in Logo or Scratch's pen commands

Vector graphics: a way of representing an image by specifying the lines, arcs and regions from which it is made

Differentiation

See each session (pages 53–58) for ways to increase support and add challenge to this unit. Much of this unit will require precise mouse skills, so some pupils may benefit from access to alternative interfaces such as tablets, trackballs or even the IWB. Pupils with visual impairment may need additional assistive technology (see **www.abilitynet.org.uk**), or you may wish to explore ideas of pattern, **repetition** and change through other media, such as music and sound. Some pupils may struggle with the mathematical demands of the **turtle** graphics work, and may need additional support. Pupils wanting more challenge can be encouraged to take the ideas introduced here and produce their own original computer-based art, using these sessions as a starting point for creative exploration.

Cross-curricular opportunities

Art and design: Pupils can learn about famous artists.

Maths: This unit draws on pupils' knowledge of angles, 2-D shapes, translations and that angles at a point total 360°.

PE: Pupils can explore **turtle** graphics instructions within a PE or dance context.

RE: Pupils can explore Islamic art.

Preparation for teaching the unit

Things to do

- Decide which software/tools are most accessible/appropriate for use with your class.
- Download your chosen software/tools (see *Useful links*) and spend some time familiarising yourself with them.
- Read pages 50–51 to get an overview of the unit.
- Read the steps in the unit sessions (pages 53–58) and look at the associated online resources, printing out worksheets as required.
- Watch the video walkthroughs for this unit (see *Online resources*).
- Watch the CPD and software in 60 seconds videos (see *Additional resources*).
- Ensure you have sufficient computers/laptops/tablets and other equipment booked in advance.
- Ensure that you have art and maths equipment ready.
- Find the examples of geometric patterns and tessellations that you want to show the class.
- Work through the unit yourself so you know what is expected of the pupils.
- If you will be going off site for this work, make the necessary arrangements.

Resources needed

- **Software:** Inkscape and Scratch (See *Alternatives* page 50)
- **Hardware:** Laptop/desktop/Chromebook computers or tablets

Online resources provided

Session resources

- Worksheet 4.5a: End-of-unit quiz
- Worksheet 4.5b: Pupil self-assessment
- Teaching slides 4.5a–4.5f
- Walkthrough videos 4.5a–4.5g
- Interactive end-of-unit quiz 4.5

Additional resources

- CPD video: Introducing vector graphics
- CPD video: Producing algorithmic art
- Software in 60 seconds: Inkscape 1–3
- Software in 60 seconds: Scratch 7

Online safety

- If pupils use Google image search to study examples of artists' work, ensure that SafeSearch is locked to 'strict'.
- Precautions over the protection of identity and intellectual property should be in place if pupils upload work they create for others to see – you may wish to limit this to the school learning platform or website.

Collaboration

This unit offers pupils a variety of opportunities for collaboration, for example when looking at artists and discussing the work and the techniques used. Pupils also work together when programming in Scratch, as well as when creating their art, evaluating pieces and suggesting improvements.

Useful links

Software and tools

- Inkscape: **www.inkscape.org/release/inkscape-1.0/**
- Scratch: **www.scratch.mit.edu**
- Vectornator X on the App Store
- Google Draw: **docs.google.com/drawings**
- Logo: **www.calormen.com/jslogo/**

Online tutorials

- Inkscape: **www.inkscape.org/en/doc/tutorials/basic/tutorial-basic.html**
- Inkscape: **www.inkscapetutorials.wordpress.com**
- Snowflake in Inkscape: **www.youtube.com/watch?v=XnUH-k8zGbY**
- Turtle graphics in Scratch: **www.youtube.com/watch?v=JO2BTc7s38I**

Information and ideas

- Geometric Islamic art: **www.patterninislamicart.com**
- Escher's art: **www.mcescher.com** **www.mcescher.com/gallery/symmetry**
- Bridget Riley's art: **www.karstenschubert.com/bridget-riley** **www.op-art.co.uk/bridget-riley**
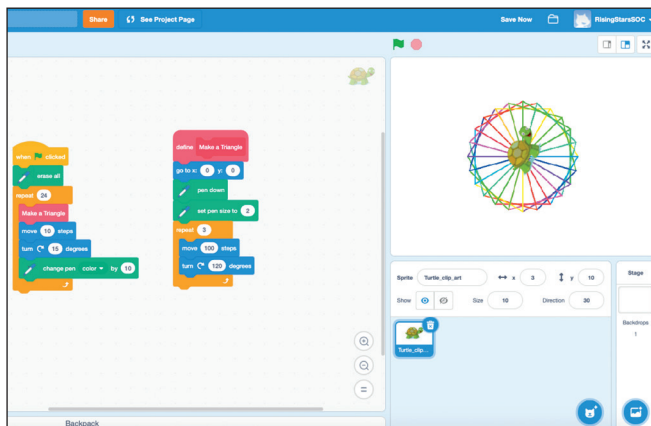
Unit outcomes

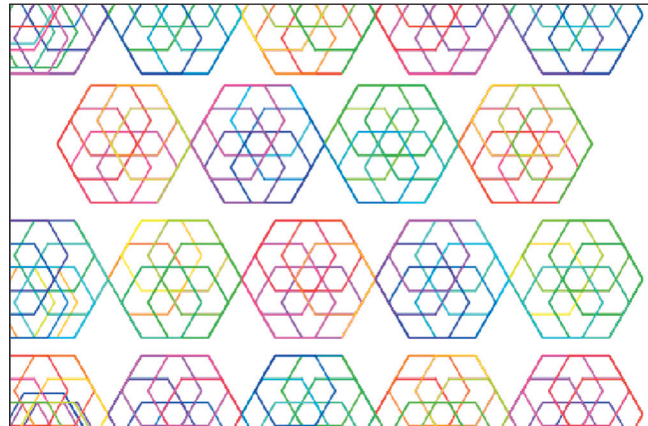Below are some examples of the outcomes you could expect from this unit.
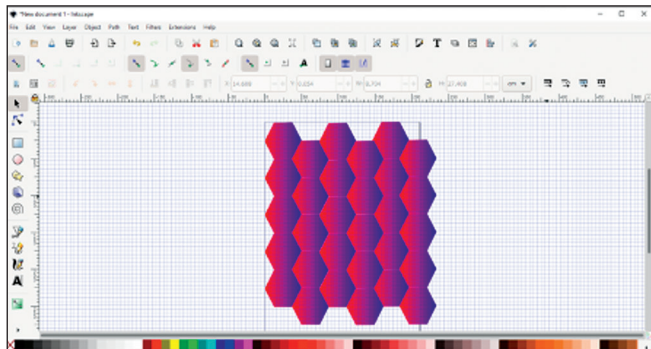
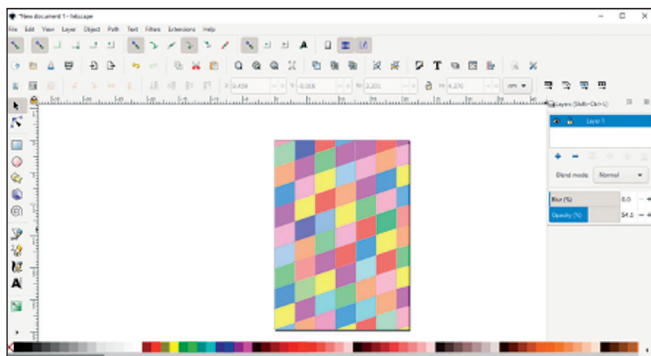

Session 1: Creating a simple tessellation in Inkscape
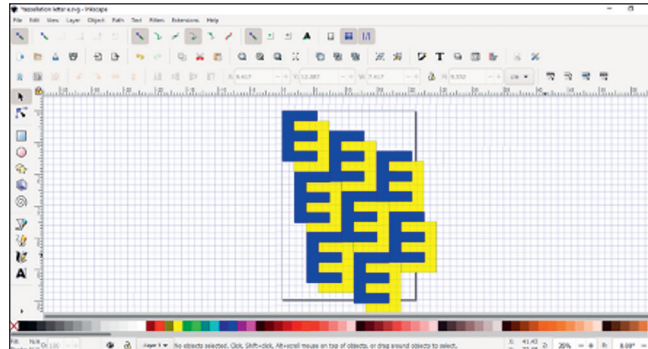
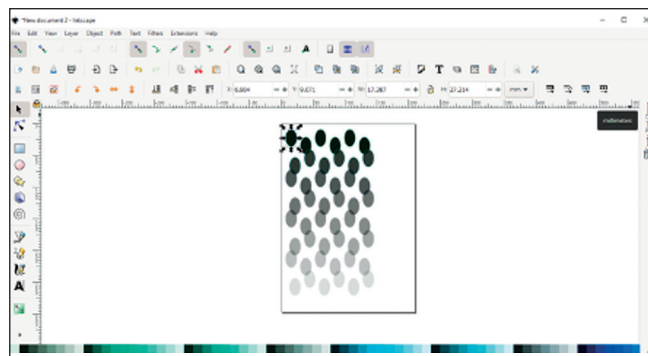**Session 2:** Creating a more complex tessellation in Inkscape

Session 3: Creating a pattern in Scratch

Session 4: Creating a repeating pattern in Scratch

Session 5: Creating art in the style of late Bridget Riley in Inkscape

Session 6: Creating art in the style of early Bridget Riley in Inkscape