# Levels 7/8 Visual Communication Design Activity

## Isometric Drawing: Licorice Allsorts

### Introduction to Numeracy in Visual Communication Design

In Visual Communication Design (VCD), students demonstrate many numeracy skills, specifically related to geometry, proportion, scale, ratio, and measurement. The visual designer’s world, consisting of a desire for constructing spaces, shapes, structures, and patterns, is only possible through the use of numbers, shapes, and measurements.

VCD students are engaged in authentic and creative construction tasks in which they are able to convey information and ideas to an audience through visual language, using symbolic and spatial reasoning. The visual, verbal, and analogue quantity coding pursued in VCD are essentially mathematics in action, as visuospatial reasoning is required (Grushka & Curtis, 2018). In VCD, students develop design thinking processes linked to mathematics that they use to apply solutions to real-world problems. In this way, VCD is ultimately structured through the application of mathematical concepts as a process to interpret designs from ideation to realisation. Students engage in understanding of symmetry, shapes (geometric and organic), and angles whilst designing solutions to real-world problems that involve considerations of geometry and other mathematical concepts.

Students create visual ideations involving measurement, calculation, and estimation skills in order to develop spatial knowledge. By invoking spatial awareness, students are able to render visual solutions such as observational, pictorial, and technical drawings, as well as three-dimensional (3D) models, through numerical calculations. Visual communications are often constructed to explicit industry regulatory requirements and exact formulae, which are also expressed in numbers. VCD students use spatial reasoning to visualise and create drawings of both two-dimensional (2D) shapes and 3D objects, and also translate these drawings using scale to create 3D representations. Whilst creating drawings, students also use fractions, decimals, percentages, ratios, and rates.

Students develop numeracy skills that allow them to use VCD practices, processes, and technologies, including understanding and skill in using measurement and drawing tools, both digital and analogue, to create design solutions. In using graphics software, materials, tools, and equipment, students work with the concepts of number, geometry, scale, proportion, measurement, and volume. Students use 3D models, create accurate technical drawings, work with digital models, and use computational thinking in decision-making processes when designing and creating solutions to specific design problems. Students measure, record, and evaluate the processes of creating visual design ideas, including testing the visual outcomes of their calculations in order to refine their design concepts.

VCD students learn to research, read, and create graphical representations of statistics by utilising scales, legends, and directional language to share information. Students recognise and read prescriptive and regulative calculations required by industry standards and render these using measurement tools such as rulers, protractors, and compasses. Understanding industry standards includes rendering scale and proportion through graphing and the creation of timetables and budgets for design projects.

### Developing Numeracy Understanding in Visual Communication Design

VCD is underpinned by a mathematical framework. Designers use a mathematical articulation of imagery to render designs to be imagined and applied in the real world through a design process. An understanding of the relationship between mathematics and VCD should be explicitly encouraged through the teaching and learning process to develop VCD students’ confidence in understanding the importance of numeracy in amplifying their creative lives. The relationship of mathematics to VCD should be recorded and assessed through the deep learning involved through the creation of a record of all processes and decision-making using a visual diary (Wolfe, 2011).

Developing numeracy by explicitly explaining the many ways that mathematical concepts relate to creativity demonstrates links that can help students to develop both enjoyment and confidence in mathematics. Students will also develop an appreciation of the nature and history of mathematics (Goos et al., 2014) and its longstanding significance for understanding the development of design practices. Students should be able to make the link between organising and creating regulated visual representations, such as pictorial and technical drawing rules and symbols (e.g., first angle projection and third angle projection), as a visual language that is based on mathematics. Students explicitly use spatial reasoning to create multiple design options that involve utilising and manipulating space, patterns, symmetry, 2D shapes, and 3D objects. Different design outcomes are produced for a single design problem through students manipulating measurements, scale, shape, and proportion, as well as evaluating placements. The development of design thinking provides opportunities for students to refine, test, cost, and create sequences for design solutions to an array of real-world problems.

Students explicitly use calculations of scale and positioning within standardised layouts in their creation of drawings and models, which also includes detailed examinations of concepts such as length, area, volume, capacity, mass, and angles. Students are asked to first estimate and then collect statistics from various sources for use in their own visual communications whilst interpreting and evaluating statistics from a wide range of commercial-produced graphic representations. Students use representational (graphs, maps, drawings, etc.), physical (set-squares, rulers, T-squares, protractors, compasses, etc.), and digital (computers and software) tools (Goos et al., 2014). Students learn how to both read and create digital and graphic representations of statistics, such as bar graphs, line graphs, pie charts, statistical maps, and pictorial statistical diagrams. Furthermore, students use sequencing and scale to produce explanatory and pictorial diagrams. Students also use specialised software to render 2D and 3D visual communications such as posters, advertisements, websites, games, architectural drawings, product designs, and animations. Computer-generated visual communications involve students learning to manipulate images, aesthetics, and movement through numbers, as well as translate computer-generated designs into printed, digital, and physical outcomes.

## Lesson Plan: Isometric Drawing – Licorice Allsorts

Isometric drawing is a straightforward drawing technique that is useful to introduce students to pictorial drawing prior to teaching the more difficult technical drawing techniques. By learning to create an isometric drawing, students will develop drawing skills in order to represent an object in three dimensions. In so doing, students will create drawings that convincingly represent their 3D world and thus increase their drawing confidence through learning the isometric rules of measurement. In this series of lessons, each student will produce an A4 scaled isometric drawing of a single licorice allsort that is intended to form a display in a sweet shop. A4 is chosen as an appropriate introductory technical drawing size for this age group, as it should not be daunting for most students. The number of lessons needed will depend on the duration of the set lessons and the capacity of students.

### Prerequisite/Corequisite Knowledge: Visual Communication Design

Students need to have and/or develop the ability to:

* Create an isometric drawing
* Generate geometric shapes, angles, and lines
* Measure objects and calculate enlargements for drawing purposes
* Use drawing techniques in which 3D objects are rendered as either 2D shapes or 3D objects
* Employ aesthetic principles of colour, tone, line, and texture
* Use graph paper, rulers, set-squares, T-squares, 2H pencils, coloured markers, and fine liners

### Background Mathematical Skills and Understandings

Teachers of Visual Communication Design are not expected to teach the mathematical knowledge and skills that students will draw on when engaging with this activity. The students will have learnt and should be adept with the required mathematical knowledge and skills to complete the activity. According to the Victorian Curriculum: Mathematics, the required mathematical knowledge and skills should have been developed in earlier years of schooling, that is, by the end of Level 6.

For this activity, the background mathematical skills and knowledge are:

* Ability to use rulers for measurement
* Familiarity with and ability to estimate, measure, and compare angles
* Knowledge of 2D shapes and 3D objects, including their names
* Ability to transform, enlarge, and relocate 2D shapes on a plane
* Familiarity with co-ordinates in the Cartesian plane

N.B. Students may not know the term *ratio* or its symbolic representation (e.g., 5:1), but they should be familiar with the term *enlargement*.

## Lesson Description

Any simple cube-like object is suitable to use for an introduction to isometric drawing at this level. It is important for students to be able to see, touch, and physically rotate the object that they will be drawing. Isometric drawing involves two sets of inclined axes where the inclined axes are drawn in the same direction and are parallel to each other. By using these axes, students can produce a pictorial view of the drawn object that is easily understood by a non-technical audience. To complete an isometric drawing, a 90-degree vertical axis and two equal horizontal axes of 30 degrees are required; thus, no object face (front) is shown. Students will use the width, depth, and height dimensions of their licorice allsort to enlarge it in a true proportion (5:1) in their final drawings. Students will learn to use a set-square and T-square whilst creating their drawing. They may use graph paper to create their isometric drawing if required. They will use pencils, fine liners, and coloured markers to add tone, texture, and colour to finish the drawings for display.

Licorice allsorts are suitable for this activity since they are fun and colourful. Rather than simply completing a pencil drawing, students will complete colourful renderings of licorice allsorts; doing so may engage more creatively inspired students. Furthermore, the final drawings can be used for an inspiring exhibition in the classroom. By extending the drawing to a fully rendered poster drawing, students are given the opportunity to work with coloured markers and fine liners. Before the teacher begins the isometric drawing exercise with their students, they could also complete a hand-drawn sketch of another licorice allsort for comparison. This isometric drawing lesson could be further extended by creating a comparative digital drawing of a different licorice allsort using Illustrator or a suitable CAD program. By completing the task using three different techniques, students’ understanding of how techniques and tools are essential elements in aesthetic outcomes that intrinsically influence the style and effect/affect of visual communications will be expanded.

### Resources Required

Licorice allsorts – check for food allergies; A4 graph paper, drawing board, 30/60 degree set-squares, T-squares, rulers, tape, pencils, coloured markers, fine liners, Kahoot quiz, sample pictorial drawings, student A4 visual diary [Note: The visual diary is a record of process for all work. This record of process should also form part of the assessment (Wolfe, 2011).]

### Teacher Introduction

The teacher should introduce the topic by showing various 3D (pictorial) drawing examples and explaining their purpose to students.

Types of pictorial drawings to show students include: oblique drawing (front view, 45-degree angles); axonometric drawing (isometric, 30-degree angles); and architectural axonometric drawing, which is sometimes called planometric drawing (no front view, 45-degree angles). Students should be able to discuss the differences between these types of drawings.

### Teacher Discussion

The teacher should ask questions such as the following:

* What is a 3D object? How does it differ from a 2D shape?
* What are the three dimensions?
* All drawings are actually two dimensional, but we create the illusion of three dimensions. Why would designers create pictorial drawings? When and why would you use an isometric drawing technique?

At this point, it would be a good idea for students to complete a short diagnostic quiz (such as a Kahoot) in order to quickly review the learning so far regarding different pictorial drawing techniques.

The teacher should sketch an example of a 2D shape (from one of the example images) and then create a 3D drawing from the same image by adding the dimensions. The students should discuss the differences in the outcomes.

### Student Activity

1. In their visual diary, students need to collect three drawings that are drawn as 2D and three drawings that are drawn as 3D and annotate them by evaluating their technical drawing qualities and aesthetic qualities. Students are to label the drawings as isometric, planometric, etc. Students should use set-squares to measure the angles.
In so doing, students will begin to learn how to use the set-squares and start to understand the uniformity of pictorial drawing. Students need to find a nearby item that is a geometric shape (pencil box, orange, whiteboard duster, etc.) and draw the object freehand as a 3D shape. Students will annotate their drawing by evaluating the techniques used and the aesthetic qualities. Students will share their research about pictorial drawing and their practice freehand drawings in groups of four, and get peer feedback on difficulties and successes, as well as share thoughts about the processes used.
2. Students are to ‘square’ their paper (using T-squares) and tape it on their drawing boards. Students are then required to measure their A4 paper and create a 10 mm border in pencil (No title strip is required unless the teacher would like students to do this). When students have completed the isometric drawing, they can define the border more permanently by using a fine liner.
3. The teacher will demonstrate the use of the T-square and set-square to create lines and 30-degree angles. Students will practise using the T-square and set-square to make lines and angles in their visual diaries before they begin their isometric drawings.
4. Students will measure the width, height, and depth of their licorice allsort. Then, they will calculate a ratio of 5:1 (in their visual diary) in order to re-scale the dimensions of the licorice allsort to adequately fill the A4 portrait format page. Depending on the class level, students may be asked to calculate what enlargement is needed or the teacher could just suggest the 5:1 ratio. This enlargement measurement could be calculated as a class or in smaller groups. If using group or individual calculations, the teacher should discuss the findings with the class to ensure that all students are using the correct enlargement calculations before they begin their isometric drawing.
5. In their visual diary, students will draw (using a set-square and a T-square) a front facing 2D drawing of the licorice allsort to scale. By completing this task, students will practise using tools and comparing 2D and 3D drawing techniques for when they complete their isometric drawing. The result will be a simple rectangle or square shape.
6. Students will need to measure with a ruler to find the centre of their isometric A4 page and then lightly draw in pencil the 90-degree vertical axis of their licorice allsort at this centre point. Students then need to calculate the height of their licorice allsort (to centre the drawing). Once they establish the position in the layout, they can add the two equal horizontal axes of 30 degrees in pencil on which they mark the width and depth, using the set-square and T-square. Students should add the measurement details as dotted projection parallel lines (in pencil) to form the back and top of the object (90 degrees for rear height and 30 degrees for top) to complete the three dimensions. All calculations should be recorded in the students’ visual diaries. Once the correct dimensions are drawn, then the students can firm up their 3D drawing with solid pencil and erase any other lines.
7. Students will then draw two quartered 12 cm squares in their visual diaries. In each quarter of one square, students will experiment with creating texture using fine liners, creating a variety of dots and lines for visual effect. In the other quartered square, students will experiment with coloured markers. From these experimentations, students will select the colours, tones, and textures to use on their licorice allsort isometric drawing. These exercises in colour and tone should be annotated with a description of the materials and aesthetic techniques used. Students will then be able to select their most successful renderings to add to their isometric drawing.
8. Students will add the selected details of colour and texture with coloured markers to their final artwork. They will use fine liners to finish the outline of the drawing and fine line the border.
9. Students will complete a self-reflection in their visual diaries. The self-reflection needs to include an evaluation of (a) the techniques that they have learnt and (b) the aesthetic qualities of their final visual communication.

## Table 1: Links to the Victorian Curriculum – Visual Communication Design

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| Strand and Sub-Strand (if applicable) | Content Description (Code) | Elaboration(s) |
| * Visual Communication Design Practices
 | Use manual and digital drawing methods and conventions to create a range of visual communications (VCAVCDV002) | Using observational drawing to represent form, materials and surface texturesUsing visualisation drawings by making a series of quick freehand sketches that communicate ideas in relation to a target audience, for example, a package for a fragile object, or a typography designDiscussing the purpose of drawing in visual communication design, for example, how can a two dimensional shape be depicted visually to represent a three dimensional form?Using paraline and orthogonal drawing systems to illustrate simple packaging formsDemonstrating the relationship between manual and freehand drawing conventions, for example, developing a series of concept drawings for a mobile application and then refine them in a computer vector-based program |

## Table 2: Links to the 21st Century Numeracy Model (Goos et al., 2014)

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| Aspect of the Model |  How This Aspect is Addressed by the Lesson |
| **Attention to Real-Life Contexts*** Citizenship
* Work
* Personal and Social Life
 | In this lesson, students discuss the uses of pictorial drawing and how it can visually depict the 3D world around them. Students understand that there are prescribed rules and regulations established to assist them in their drawing and/or that are required for a career as a visual communicator. The licorice allsort was chosen as the item to render, as it is an engaging yet simple object with which most students will be familiar. The exhibited final works will form a stunning community display in the classroom. Peer review of experimental work early in the lesson assists in socialisation and participation in affirmative critique. |
| **Application of Mathematical Knowledge*** Problem Solving
* Estimation
* Concepts
* Skills
 | Students are asked to problem solve by creating a drawing of a 3D object on a 2D paper surface. Students are required to use measurement to centre their drawing whilst also allowing room for a border. They employ proportional reasoning skills to enlarge the 3D object to fit a prescribed layout and measure and apply prescriptive 30-degree and 90-degree angles relevant to the isometric rules. Students use terminology relating to shapes, angles, and parallel lines while completing the task. |
| **Use of Tools*** Physical
* Representational
* Digital
 | Students learn to measure using specific measuring tools of the graphic designer (ruler, T-square, and 30/60 set-square), combined with aesthetic consideration of the design elements and principles relevant to rendering using colour, texture, and tone. Students use the numbers obtained from their measurements to calculate (addition and subtraction) the placement and scale of elements within a composition.  |
| **Promotion of Positive Dispositions*** Confidence
* Flexibility
* Initiative
* Risk
 | Students gain confidence in numeracy by understanding that drawing is a learnt skill that in VCD is underpinned by mathematical concepts. Students learn that they can follow specific mathematical rules in order to render specific outcomes. Students become aware that pictorial and technical drawing require numeracy skills. They gain confidence through developing skills in using measurement tools (set-squares, T-squares, graph paper, rulers, etc.) and applying mathematical concepts to render a creative isometric drawing that is realistic. Students show initiative as they experiment and practice techniques with measurement tools to create different visual effects. Students take risks through experimenting with new tools such as set-squares and T-squares to create lines, shapes and patterns.  |
| **Critical Orientation*** Interpreting Mathematical Results
* Making Evidence-Based Judgements
 | Whilst planning and producing their isometric drawings, students continually reflect on and evaluate the processes undertaken, which involve the mathematical concepts of scale, proportion, and angle, within the prescribed measurements and layout. All processes are recorded by students in their visual diaries to ensure that evidence of calculations are recorded, including a final judgement as a self-reflection. By keeping a record of processes and calculations, including mistakes made and skills learnt, students are able to refer to and build on their personal learning experience when creating visual communications in the future.  |

**References**

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