MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA

Visual Arts Numeracy Enhanced Plan

This resource is aligned to the New Zealand Curriculum (2007) and provides support for the teaching and learning of literacy and numeracy in preparation for the NCEA Co-requisite. It aims to support those students who are using the NCEA qualification pathway.

Exploring geometric transformations in Pacific artwork

Context

This set of activities focuses on Tongan art and the work of Dagmar Dyck. It explores the numeracy opportunities in the analysis and creation of artworks and encourages ākonga to consider how symmetry and geometric transformations such as reflection (flipping), rotation (turning), and translation (repeating/sliding) can help tell stories through art.

A similar framework can be used to analyse art from a Pacific context, including artists such as Vaimaila Urale, Sione Faletau, Sēmisi Fetokai Potauaine, Sione Monu, Telly Tuita, Fatu Feu'u, John Pule, Niki Hastings-McFall, and Darcell Apalu.

Numeracy connections

Spatial properties and representations

» Identify symmetry and geometric transformations in an artwork.

» Use symmetry and geometric transformations to create an artwork of personal significance.

Resources:

» Set of images of Tongan ngatu. These are available from the Museum of New Zealand Te Papa Tongarewa Collections Online.

» Print-making equipment

Achievement objectives

Level 4 Visual Arts

Developing ideas

Ākonga will:

» develop and revisit visual ideas, in response to a variety of motivations, observation, and imagination, supported by the study of artists' works.

Level 5 Visual Arts

Understanding the visual arts in context

Ākonga will:

» investigate and consider the relationship between the production of art works and their contexts and influences.

Developing practical knowledge

Ākonga will:

» apply knowledge of selected conventions from established practice, using appropriate processes and procedures

Developing ideas

Ākonga will:

» generate, develop, and refine ideas in response to a variety of motivations, including the study of established practice.

1

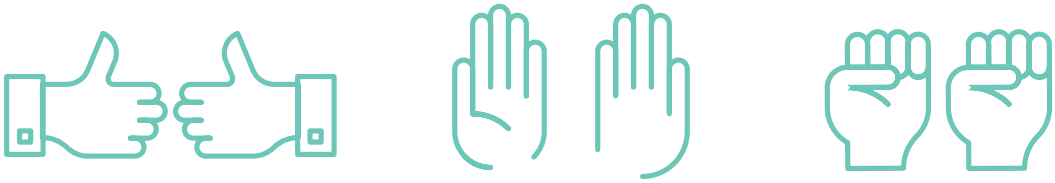
Activity 1: Sequence of learning

15 min

Geometric patterns in art

> **Activity note:** *This activity supports the analysis of composition in an artwork and leads on to exploring the work of Dagmar Dyck.*

In pairs, ākonga **use their bodies** to show:



Reflection | Rotation | Translation

Ākonga **describe to each other** how they would explain each of these movements to a younger person.

> **Activity note:** *Reflection can be described as flipping an object, like in a mirror. Rotation is turning an object, while translation is repeating the object, or sliding it over.*

Provide a set of images of Tongan ngatu to ākonga. These are available from the Museum of New Zealand Te Papa Tongarewa Collections Online.

> **Activity note:** *Ngatu are often decorated with motifs and patterns taken from the natural environment or associated with important people and events.[1] In the design of ngatu, mathematical transformations such as symmetry, reflection, rotation and translation are evident to help document the moments in time that Tongans witnessed.*

Ākonga work in pairs to **identify as many examples as they can** of reflection, rotation, and translation within their ngatu, including combinations of transformations. Ākonga use coloured markers to outline or colour the different transformations.

Circulate the room and support ākonga to **describe how they know a transformation is being used**. Remind ākonga of the terms they used to explain reflection, rotation, and translation to a younger person. This guide may also help support conversations about geometric transformations such as reflection, rotation, translation and enlargement.

Encourage ākonga to:

» make connections with art from their own culture and to share their observations with the class
» consider how a transformation can amplify the story, meaning or composition of the art.

> **Numeracy connection:** *In this activity, ākonga are using physical movements to demonstrate their understanding of geometric transformations and identifying transformations in an artwork.*

[1] For more information on ngatu, visit Te Papa's website here.

2 **Activity 2:** Sequence of learning

20 min

Exploring Tongan Art

> **Activity note:** *Dagmar Dyck is a New Zealand artist. She draws on her Tongan and German ancestry as inspiration for her artwork.*

Show ākonga this video from 3:47 – 7:04 of Dagmar discussing her artwork. Before showing ākonga this video, prompt them to listen for:

- the values Dagmar draws on for her work
- the aspects of other artists' work that she loves
- how her heritage is woven into her art.

> **Activity note:** *You may wish to show this video twice. If ākonga wish to make notes, they can do so in the second viewing of this video.*

Display on screen the work Dagmar was standing in front of in the video.

Kupesi Style by Dagmar Dyck.

In pairs, ākonga share what influenced Dagmar in her artwork, including her values and her ancestry and how this is shown in Kupesi Style.

> **Example answer:** *Dagmar specifically notes the beauty of the repeated pattern in the video, and how she finds this soothing. She also references ngatu, a Tongan tapa cloth, as an inspiration for her artwork.*
>
> *Within Kupesi Style, there are numerous patterns, with an alternating pattern of Tongan influence in one panel, to European influence in the next. The panels with a Tongan influence are coloured using a palette that is reminiscent of a ngatu and provide a colour contrast to the European influenced panels.*

2 **Activity 2:** Sequence of learning **(continued)**

Circulate the room and support ākonga in their discussions. Encourage them to **analyse the art** as a whole, before **looking at the patterns within each panel.**

Encourage ākonga to **use mathematical language to describe the art** within each panel, as ākonga complete their discussion of Kupesi Style as a whole. Mathematical language can help express more exactly what is meant in artwork that has reflection (flipped shapes), rotation (turned shapes), translation (shapes that are shifted) and symmetry.[2]

Activity note: To support ākonga to **use mathematical language**, you could:

1. Get them to **use their analysis** from activity 1 to identify the reflections, rotations and translations in Dagmar's work.
2. Use the example on the right to **model an analysis of a panel**. Within this panel, you could ask ākonga to decide if there is reflection, rotation, translation, or symmetry, and explain their reasoning.

This portion is repeated or translated vertically to create the second design below.

This panel is coloured in a way so that it is not perfectly symmetrical – if you folded this panel vertically down the middle, the colours would not match up.

If we look at the panel in the bottom right corner, there is a repeated pattern of a diamond in a rectangle – the geometric term for this is that this design has been "translated". This panel is coloured in a way so that it is not perfectly symmetrical – if you folded this panel vertically down the middle, the colours would not match up. This looks like it was deliberate, so that the colours within this panel contrast against each other.

All of the panels have a feel of symmetry to them, even if they are not perfectly symmetrical. This is the sense of balance Dagmar talks about. The two panels that have clear asymmetry are the ones coloured blue and red. They are corner panels, which means they frame the work.

Numeracy connection: *Ākonga use their knowledge of geometric transformation to identify symmetry, reflection, rotation, and translation in a meaningful context.*

Ākonga swap pairs and **summarise their conversation** to a new partner. As part of their summary, ask ākonga to share where they could see a repeated pattern (called a translation) and describe this using mathematical language. They should consider how this use of reflection, rotation, translation or symmetry helps us understand the artist and/or how viewers interpret the art.

Activity note: *To support the development of literacy, you may get ākonga to write a short paragraph on their thoughts about Kupesi Style by Dagmar Dyck based on their conversations. The paragraph could include:*

- *what this artwork tells us about Dagmar*
- *an example of where there is reflection, rotation, translation or symmetry*
- *how the reflection, rotation, translation or symmetry helped us understand what Dagmar was trying to share or how it made us feel.*

[2] Line symmetry (also called reflectional symmetry or mirror symmetry) is where one half of an artwork is the reflection of the other half. Rotational symmetry is the number of times an image can turn onto itself within one full turn (360°). This means that every object has at least one order of rotational symmetry. Total order of symmetry = number of line symmetries + order of rotational symmetry.

2

Activity 3: Sequence of learning

120 min

Design Your Own Motif

> **Activity note:** *Based on the analysis of Dagmar's work, and her use of patterns, balance, and contrast, ākonga design and develop their own piece of art that has significance to them and their whānau, in the form of a wallpaper print.*

Provide ākonga with a brief to develop a print that is inspired by Dagmar Dyck's work.

> **Activity note:** *The brief to ākonga could require them to:*
>
> - *explain the key ideas that can be seen in Dagmar Dyck's work that mean something to them*
> - *identify conventions (ways of doing things) that they can use in their own work. This could include her use of colour, composition, arrangement of objects, texture, and concepts.*
> - *identify materials or processes they have not seen before that help them try something new*
> - *explain how they will go about this by drawing some brief outline sketches (thumbnails) showing how these ideas could be used in a plan or plans for their print.*

Ākonga **develop their design** into a woodcut, lino, or cardboard stamp. They can use their stamp to **create a print** that has a repeated pattern that involves translation or rotation. *(A design could also be created by doing a rubbing of a shape cut from a piece of card. If using this option, they may like to include reflection as one of the transformations they use).*

Ākonga should also consider that when they develop a print, **any wording needs to be cut so it is reflected** (mirrored).

Invite pairs of ākonga to **add an additional layer to their print** by swapping stamps and adding a second motif in lighter coloured ink.

> **Numeracy connection:** *In this activity, ākonga are applying their understanding of transformations to create artworks.*

Ākonga **reflect on their motif and print**, discussing their choice of colour, use of rotation or translation, and what they would do differently next time. For example, they might discuss which colours they might use to create a stronger contrast between the two motifs, what they could do to create a greater sense of harmony or discord and whether to use a smaller or larger motif. A potential learner response might look like this (see appendix).

> **Next steps in Numeracy learning**
>
> To build on this learning, ākonga could:
>
> - explore geometry in kōwhaiwhai patterns (see Kōwhaiwhai Tuturu Māori for ideas)
> - explore the use of symmetry in designs (see Patterns in the art of Samoan Siapo for examples).
>
> **See the Numeracy Pedagogy Guide for Visual Arts for additional ideas on how to integrate Numeracy learning into your teaching practice.**

A

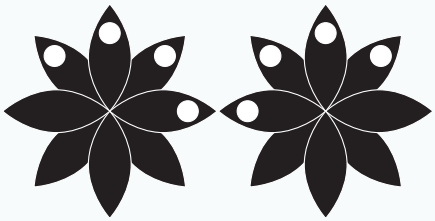
Resource A

Designing your own motif

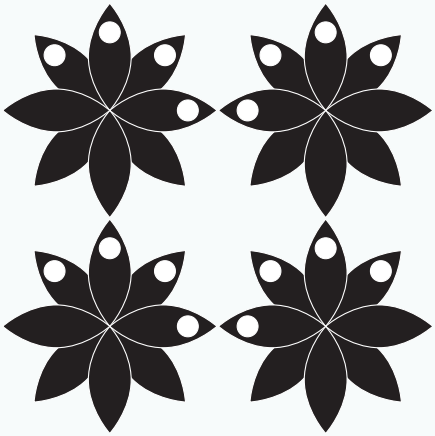
A potential learner response to their artwork might look like this:

This is my original design. It has one line of symmetry down the middle. The circles at the top give some colour to the design.

I have rotated my original design 45° clockwise. It gives my design more layers so it doesn't just look flat. My life is in 3D, and I want my design to show that.



I have reflected my design. Dagmar talks about balance in her artwork, and I like how this has made my art look more welcoming – as if the two halves could part like an entryway. In my culture, manaakitanga, being hospitable, is really important, and I think this shows this.



I have translated my design to create a repeated pattern. I think the message in my design is important, and I agree with Dagmar that repetition can be soothing and really emphasise what I want to say.

I like the contrast of black and white in my design. If I was to do this again, I might explore different complementary colours to make each individual piece stand out.