

Journey to Infinity: Escher's World of Wonder

Title: Journey to infinity: Escher's World of Wonders Educators Resource

Target Audience: An information package for educators interested in the exhibition *Journey to Infinity: Escher's World Of Wonder* and the various additional programmes developed by ArtScience Museum's Programmes Department.

Journey to Infinity: Escher's World of Wonder

Journey to Infinity: Escher's World of Wonder is a fantastic opportunity to enjoy more than 150 original works from M.C. Escher, one of the world's greatest graphic artists. Exploring the intersection between art, mathematics, science and poetry, Escher's works have fascinated and astounded generations of artists, architects, mathematicians, musicians and designers alike.

ArtScience Museum is dedicated to the playful exploration of the interconnection between art, science, technology and culture, and we look forward to sharing Escher's unique and fascinating world with both school groups and educators. We are sure it will be the starting point for many interesting conversations about art, mathematics and history, about how nothing is what it seems.

ArtScience Museum believes that some subjects are best understood by active construction and experimentation and by approaching subjects from unexpected perspectives. The exhibition itself is full of wonder, not just in the extraordinary artworks but also in the many playful activities that visitors can explore throughout the exhibition. The poetic symmetry of tessellations is understood on a large scale by physically moving huge puzzle pieces into place; the interconnectedness of baroque music and the notion of infinity are explored through papercraft and music boxes, and even the trained eye is tricked by larger than life optical illusions.

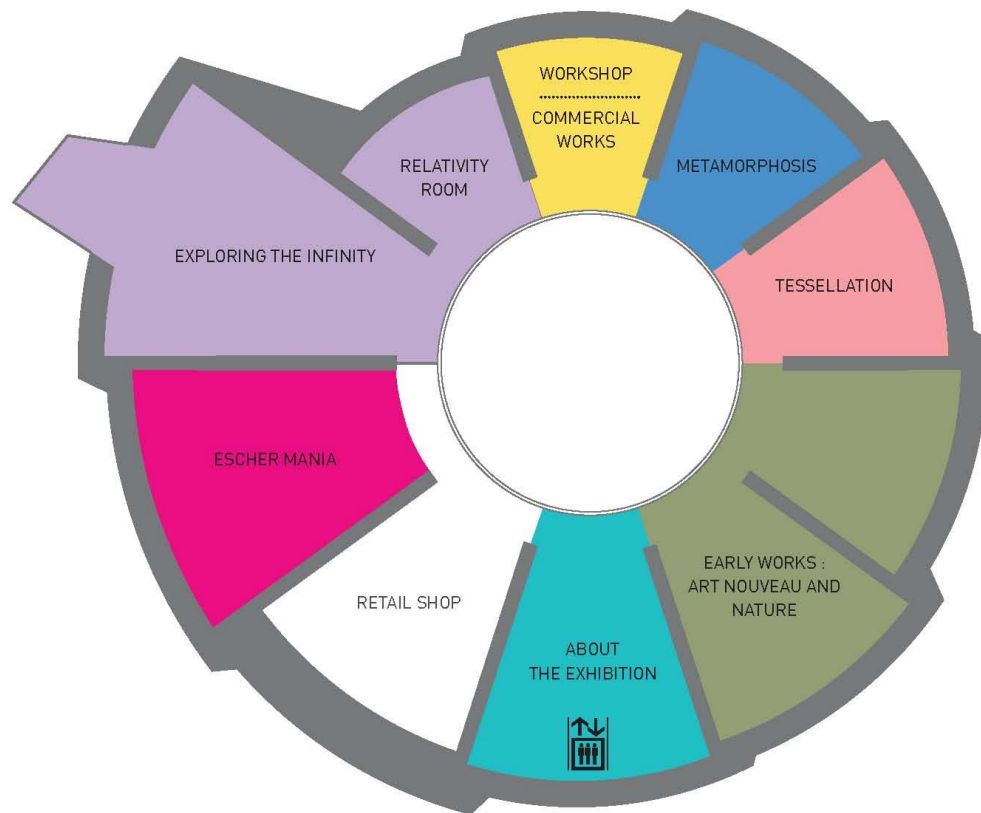
This Educators' Resource is intended to act as a guide prior and during your visit to ArtScience Museum. We hope this will help you plan your visit, and understand how a visit will fit into your teaching at the school. Whether you choose to visit us guided by one of our trained facilitators or under your own steam with a self-guided tour, this guide will hopefully help you anticipate the main themes and concepts, should you wish to explore them with your group prior to the visit.

Exhibition overview

The exhibition has 6 chapters. Each chapter will explore a new thematic subject of Escher's artistic practice and look at how different ideas developed and influenced Escher as he studied, played and experimented with geometry, architecture, perspective and impossible shapes. Along the way, mathematical ideas will come to life and find form in the many wonderful creations, and visitors will be able to follow the artistic development throughout Escher's career, culminating in his most iconic and well-loved artworks.

<u>Learn about</u>	<u>Learn through</u>
<ul style="list-style-type: none"> • Who is M.C. Escher? • The intersection of art, mathematics, design and architecture • His influence on the 21st century • Math <ul style="list-style-type: none"> - Types of Symmetry - Impossible shapes - Tessellations • Art <ul style="list-style-type: none"> - Figurative vs Abstract - Pattern formation - Metamorphosis • Design <ul style="list-style-type: none"> - Optical illusion - Architecture 	<ul style="list-style-type: none"> • Observation: To look at the exhibited item in a new light. • Exploration: To explore ideas and understand how the impossible is possible. • Creativity: To take inspiration and express creativity.

GALLERY MAP



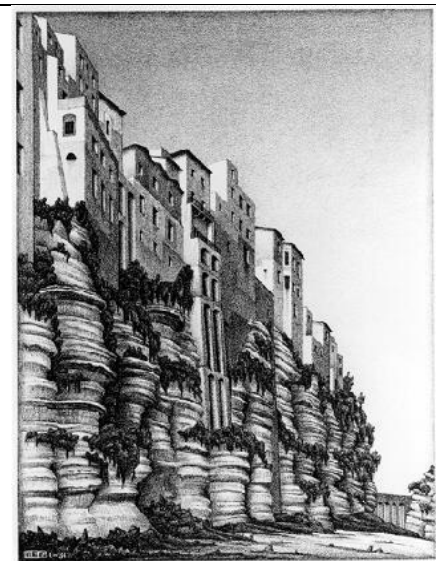
Chapter 1: About M.C. Escher

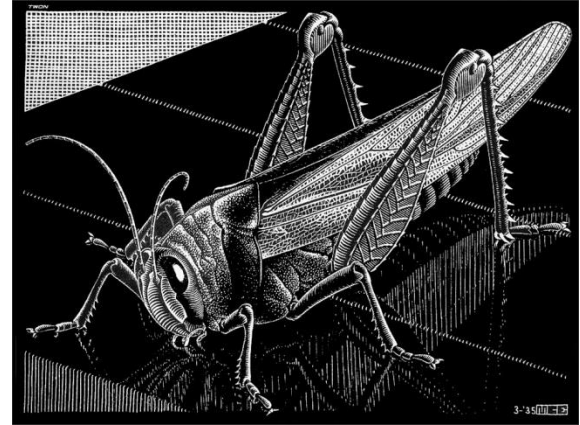
Born in 1898, Mauritus Cornelis grew up in Leeuwarden, situated in the north of Netherlands. Despite having no creative role models within his family and against his father’s wishes, Escher enrolled at the School of Decorative Arts and Architecture in Harlem after transferring from the University of Technology in Delft in 1918. Soon after, Samuel Jessurun de Mesquita; an exponent of the Art Nouveau movement became a great influence in his artistic career.

Art Nouveau a popular art style originated in the late 19th century in Europe. Its aim was to modernise design, in a move away from popular historical styles. The movement sought to abolish traditional hierarchy of the arts and allowed artists to experiment with organic and geometric forms. The movement also took inspiration from the characteristics of the natural world, enabling the artist to experiment with lines and curves through applied arts, graphic work and illustration.

From 1927 to 1935, M.C. Escher travelled from Rome to southern Italy to make sketches and drawings of the landscape. While sketching, he noticed the geometrical regularity in nature and found that it can be magical and playful. From there, he developed his drawings into prints on various mediums such as wood and linoleum. His keen eye for details through observation became a starting point for the ideas and principles he will soon develop in his artistic career.

Have a closer look: Encourage students to notice the works in the first galleries, and let them describe what they see. The works are naturalistic landscapes or close observational studies. Draw their attention to how the artistic method influences the look of the artwork, for instance in the wood engraving, notice straight lines of the cutting tool, or how shading is achieved in the monochrome prints.

	<p>Tropea, Calabria</p> <p>1931</p> <p>Lithograph</p>
<p>All M.C. Escher works © 2016 The M.C. Escher Company – the Netherlands. All rights reserved. www.mcescher.com</p>	

	<p>Grasshopper March 1935 Wood Engraving</p>
<p>All M.C. Escher works © 2016 The M.C. Escher Company – the Netherlands. All rights reserved. www.mcescher.com</p>	

Curriculum Links

Subject	Level	Links
Art	Primary	<ul style="list-style-type: none"> • Gather information from visuals and what they see • Make informed links between the use of visual qualities and intentions of the artist. • Develop an interest in looking at and creating art.
	Secondary	<ul style="list-style-type: none"> • Identity various elements of art e.g. visual characteristics like Dot, Line, Shape, Form, Colour, Texture, Space, Tone
Science	Primary/ Secondary	<ul style="list-style-type: none"> • Provide students with experiences which build on their interest in and stimulate their curiosity about their environment
History	Secondary	<ul style="list-style-type: none"> • To develop an interest in the past and the forces that shaped human activities, institutions and ideas over time

Chapter 2: Tessellations

M.C. Escher continued to draw inspiration from his travels. In 1936, he was embarking on his second trip to the South of Spain and to Moorish architectural landmarks, such as the Alhambra Palace in Granada and the Mezquita Cathedral in Cordoba. During these visits, he was inspired by the intricate patterns decorating the monuments throughout.

This led to a number of geometric explorations of shapes such as triangles, hexagons or rectangles and eventually developed into a set of different tessellation motifs. M.C. Escher meticulously produced over 100 watercolours showing different motifs of tessellation in an exercise book. These motifs represented 17 different ways of filling a flat surface with regular patterns and his study of various colouring possibilities.

A tessellation is an arrangement of geometrical shapes fitted on a regular plane without any gaps or overlaps between each shape. These shapes can be translated to make a pattern as evident in everyday items such as tiles, wallpaper designs and computer graphics. In Escher's work, he uses irregular, non-geometric shapes to illustrate the figurative element of the pattern using colours, adding details to the tessellation such as colours, facial features and directions, etc.

Have a closer look: Ask the students to observe the prints in this gallery, and reflect on how they are different from what they saw in the first gallery. Does the print still feel naturalistic? What words can we use to describe these works instead? Stylised, clear graphic forms? Can you see the influence from Moorish architecture in the tessellation prints? Encourage the students to choose a print and investigate how shapes interact and lock together. Is it possible to detect the underlying geometry? At this point, you can refer to the activity book which has a number of tessellation activities to enjoy.



Mezquita Cathedral

Photo Credits: Planet Ware

<http://www.planetware.com/tourist-attractions-/cordoba-e-and-cord.htm>



Alhambra Palace

Photo Credits: Lonely Planet

<http://www.lonelyplanet.com/spain/things-to-do/spain-s-architectural-wonders>



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Regular Division of the Plane II
1957



Plane Filling II
1957 Lithograph.

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Curriculum Links

Subject	Level	Links
Mathematics	Primary	<ul style="list-style-type: none"> • Recognise patterns and relationships in mathematics • Using Mathematical language, symbols and diagrams to represent and communicate Mathematical ideas • Develop an inquiring mind through investigative activities
	Secondary	<ul style="list-style-type: none"> • See and make linkages among Mathematical ideas, between Mathematics and other subjects, and between Mathematics and the real world • Connect ideas within and between Mathematics and other subjects through application of Mathematics • Develop an inquiring mind through investigative activities
History	Secondary	<ul style="list-style-type: none"> • To develop an interest in the past and the forces that shaped human activities, institutions and ideas over time

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Chapter 3: Metamorphosis

M.C. Escher created the world in which whirls of transformations are based on different kinds of tessellations and where abstract shapes can change into concrete forms. You can identify various patterns and where birds can gradually transform into fishes or a lizard morph into the cell of a honeycomb. At times, transformations lead to opposite combinations such as day and night, or good and evil as depicted. M.C. Escher has also made comparisons to the rhythm and transformation of his motifs to a musical composition, showcasing the parallel references made between J.S. Bach and himself.

Metamorphosis II is 4m long, making it the longest art piece in the exhibition. Notice how the black and white cubes have evolved into reptiles and as the rhythm change, the motif has then transformed into a hexagon then depicting a honeycomb cell.

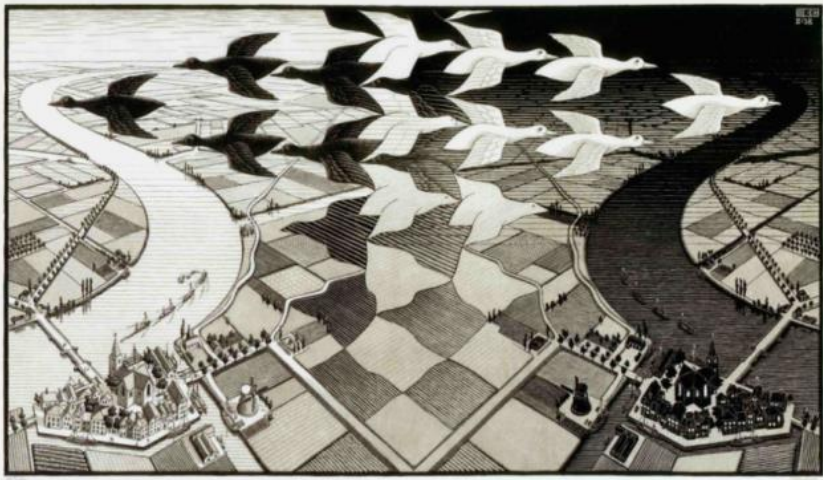
Escher did not limit his research to the regular division of the plane; he was also fascinated by reflective surfaces as depicted in his famous self-portrait *Hand with Reflecting Sphere*. The inspiration for the work was his fascination with reflecting spheres which bring the viewer to the centre of the scene no matter where he positions himself. Full of transformational qualities, such works explore many fundamentally mathematical principles: mirroring, symmetry, reversal and opposites.

Metamorphosis is a word derived from ancient Greek to describe a process of transformation. It is used in science to describe significant biological developments or changes of the physical form.

Have a closer look: Choose a metamorphosis print and ask students to count a certain shape – is it possible to determine where one shape stops and another one starts? What are their impressions of it? Do they agree that it is evolving from geometric shapes to abstract?

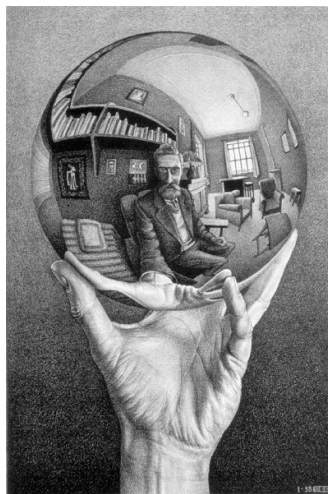
Also, start a discussion with the students on if they were to create their own artwork based on metamorphosis, what would their artwork be? What other opposition elements do they want to showcase?

Have a closer look at *Hand with Reflecting Sphere*, Escher was very fascinated about the characteristic that the sphere had. What was it about the sphere that allowed the viewer to be in the centre of the scene no matter where he positions himself? What are the characteristics of the sphere that may create such an effect?



Day and Night
1938 Woodcut

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Hand with Reflecting Sphere
1935 Lithograph

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Curriculum Links

Subject	Level	Links
Art	Primary	<ul style="list-style-type: none"> • Discuss artworks using basic art vocabulary (elements of art and principles of design) • Make informed links between the use of visual qualities and intentions of artists • Identify various principles of design e.g. ways to arrange the elements like scale, variety, balance, contrast, rhythm, harmony, dominance, proportion, pattern/repetition
	Secondary	<ul style="list-style-type: none"> • Convey experiences and ideas with images • Achieve a sense of confidence and self-esteem through the making and critique of art.
Mathematics	Secondary	<ul style="list-style-type: none"> • Develop thinking, reasoning, communication, application and metacognitive skills through a mathematical approach to problem solving.
Science	Primary & Secondary	<ul style="list-style-type: none"> • Provide students with opportunities to develop skills, habits of mind and attitudes necessary for scientific inquiry
Design	Secondary	<ul style="list-style-type: none"> • Develop basic design thinking and communication skills

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Chapter 4: Commercial Works and workshop activities

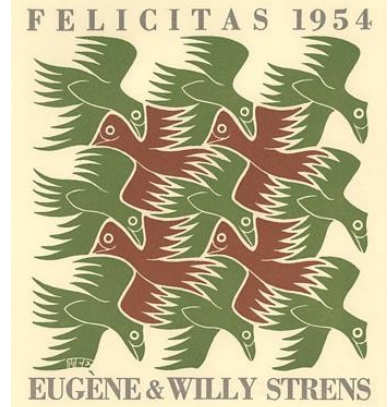
M.C. Escher depended on the revenue generated from his commissioned works to sustain a living.

His main income did not derive from the most important engravings such as *Metamorphosis*. Instead, most of his income was generated from smaller commissions. He was able to use his talent to satisfy the most diverse requests, from the programme cover for a concert of the St. Matthew Passion by Johann Sebastian Bach, to simple greeting cards and ex-libris. The key to sustaining his revenue was his ability in putting in the same effort into the smaller creations as he did with his major works, applying the same solutions but adapting it to suit the smaller format.

M.C. Escher thus gave great art to everyday objects.

Have a closer look: Despite being known as a graphic artist or a printmaker, this gallery highlights the reality of the living hood of an artist; they are dependable on their works to generate revenue for a living. Pick out an item and visualize the creative process M.C. Escher was going through, what do you think his feelings were?

Ask your students to observe the exhibits inside this gallery. Can they make any principal and ideology links to the other galleries in the exhibition? What principals and ideology links are they? After seeing Escher’s works from the earlier galleries, what kind of an artist do they infer him as? Is M.C. Escher more than a print artist in their opinions?

 <p>All M.C. Escher works © 2016 The M.C. Escher Company – the Netherlands. All rights reserved. www.mcescher.com</p>	<p>M.C. Escher Air: New Year greetings card 1952 Woodcut</p>
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Curriculum Links

Subject	Level	Links
Art	Primary	<ul style="list-style-type: none"> • Able to describe, analyse, interpret, evaluate art (Visual Inquiry). • Identity various elements of art e.g. visual characteristics like Dot, Line, Shape, Form, Colour, Texture, Space, Tone. • Generate ideas for their artmaking from observing visuals and the

		<p>world around them</p> <ul style="list-style-type: none"> • Discuss the intentions of their own artworks and interpret those of others • Able to describe, analyse, interpret, evaluate art (Visual Inquiry) • Able to express ideas visually and orally
	Secondary	<ul style="list-style-type: none"> • Recognise that art reflects, records and plays a role in culture. • Record from observation and experience
Design & Technology	Secondary	<ul style="list-style-type: none"> • Aesthetics - Appreciate the role of line, shape & form, colour, texture, proportion and ergonomics in relation to design needs • Understand the link between ergonomics, function and aesthetics • "Design in Society-Show an awareness of societal and cultural influences on design " • Develop an awareness of design in the made-world • Develop an appreciation of function, aesthetics and technology in design

Drop In Activity Space/ Workshop Space

Behind Commercial Works, students are invited to explore the workshop space. This space is used for workshops and when not in use, it is a drop in space with a sequence of related activities; from constructing an infinite repetitive Moebius strips to creating their own music strip and testing it out by inserting into a music box where they can experiment what happens to the music strip by reverse, increasing or decreasing the speed of the crank notion. They can punch the holes onto a printed music strip or experiment freely with a blank piece of music strip and create their own composition. After participating in the activities, students can explore the themes of infinity and also reflect about how the concept of infinity is present in today's day and age before embarking on the second half of the exhibition.



Mobius Strip II, 1963, Woodcut in Tree Colors

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Exploring the Infinity

One of the components that M.C. Escher was famous for was his ability to produce prints and artworks that looked like it was impossible to create. Such artworks such as *Relativity*, *Ascending and Descending* show various elements of infinity and impossible architecture and design.

M.C. Escher was not a trained mathematician but his understanding of mathematics was largely visual and intuitive. He experimented and explored errors in perspective through structures that at first sight seemed perfectly plausible, but upon closer inspection turned out to be impossible to create.

Then in 1954, it led to an interaction with a scientist where M.C. Escher was inspired to embark on a research focusing on impossible constructions, optical illusions and representation of the infinity.

Relating to the Art Nouveau movement; Art Nouveau Movement is where organic and geometric forms were used in the artworks relating to that movement and abstract art comes to play depending on how the artist wants to experiment with lines and curves. Escher then explored using abstract ideas based on infinity, eternity and the impossible in apparently realistic prints, making it relatable and easy for all to understand as abstract art can be interpreted quite differently by individuals. As a result, M.C Escher has created his own principal theme of perspective-mangling worlds through the inspiration of the Art Nouveau Movement.

Through serial formation and playful exploration, he attempted to represent the limitless and infinite until his very last creation Snakes, in 1969, which became a symbol of his art.

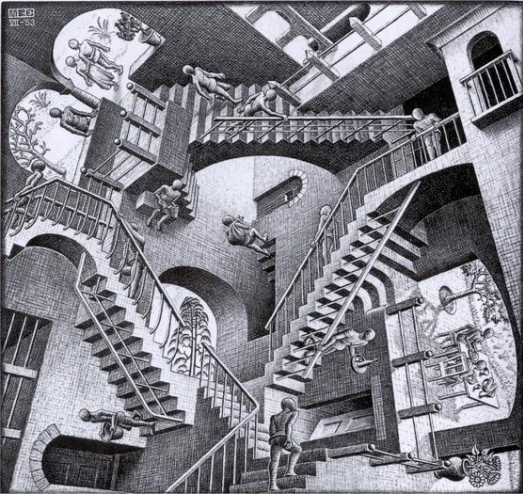
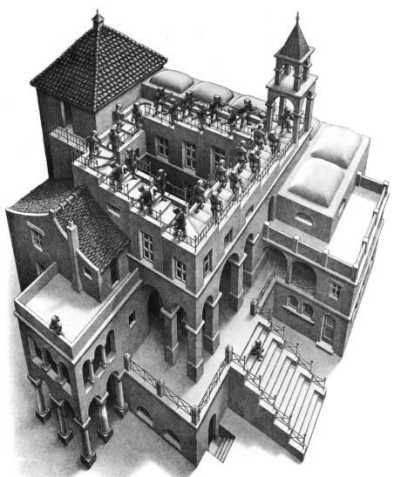
Escher had a quote on “the impossible” in a 1963 lecture where he said “if you want to express something impossible, you must keep to certain rules. The element of mystery to which you want to draw attention should be surrounded and veiled by a quite obvious, readily recognisable commonness.”

Have a closer look: After going through this gallery, abstract themes and ideas are highlighted such as infinity, optical illusion, impossible construction. Ask the students, what does infinity mean to them and what is its relationship with mathematics, physics and designs? What about optical illusion? Is it a scientific discovery or just merely an artistic enhancement? What does an impossible shape mean to them? Is it impossible to construct or not realistic to be developed?

Following on from gathering their opinions on these abstract ideas, which artwork stands out to them? Why does it stand out to them?

Encourage discussion and investigation between the students on what mathematical concepts are presented in this gallery? Do they think that there are elements of symmetry and angle placement? How has Escher been able to create the impossible? What is the inter-relationship between mathematics and art that they can identify in this gallery?

Relating back to the 21st century, what other impossibly constructed architecture or sculptures have the students seen before? Was it in Singapore or overseas? What was their impression of it? What have they noticed that makes it an impossible architecture?

 <p>All M.C. Escher works © 2016 The M.C. Escher Company – the Netherlands. All rights reserved. www.mcescher.com</p>	<p>Relativity 1953</p> <p>Lithograph.</p>
 <p>All M.C. Escher works © 2016 The M.C. Escher Company – the Netherlands. All rights reserved. www.mcescher.com</p>	<p>Ascending and Descending 1960</p> <p>Lithograph.</p>

Curriculum Links

Subject	Level	Links
Art	Primary & Secondary	<ul style="list-style-type: none"> • Identify various principles of design e.g. ways to arrange the elements like scale, variety, balance, contrast, rhythm, harmony, dominance, proportion, pattern/repetition • Make informed links between the use of visual qualities and intentions of artists

Mathematics	Primary	<ul style="list-style-type: none"> • Recognise patterns and relationships in mathematics • Develop an inquiring mind through investigative activities • Develop thinking, reasoning, communication, application and metacognitive skills through a mathematical approach to problem solving • Build confidence and foster interest in Mathematics
	Secondary	<ul style="list-style-type: none"> • Develop thinking, reasoning, communication, application and metacognitive skills through a mathematical approach to problem solving • See and make linkages among Mathematical ideas, between Mathematics and other subjects, and between Mathematics and the real world
Design & Technology	Secondary	<ul style="list-style-type: none"> • "Aesthetics- Appreciate the role of line, shape & form, colour, texture, proportion and ergonomics in relation to design needs • Understand the link between ergonomics, function and aesthetics " • "Design in Society-Show an awareness of societal and cultural influences on design "

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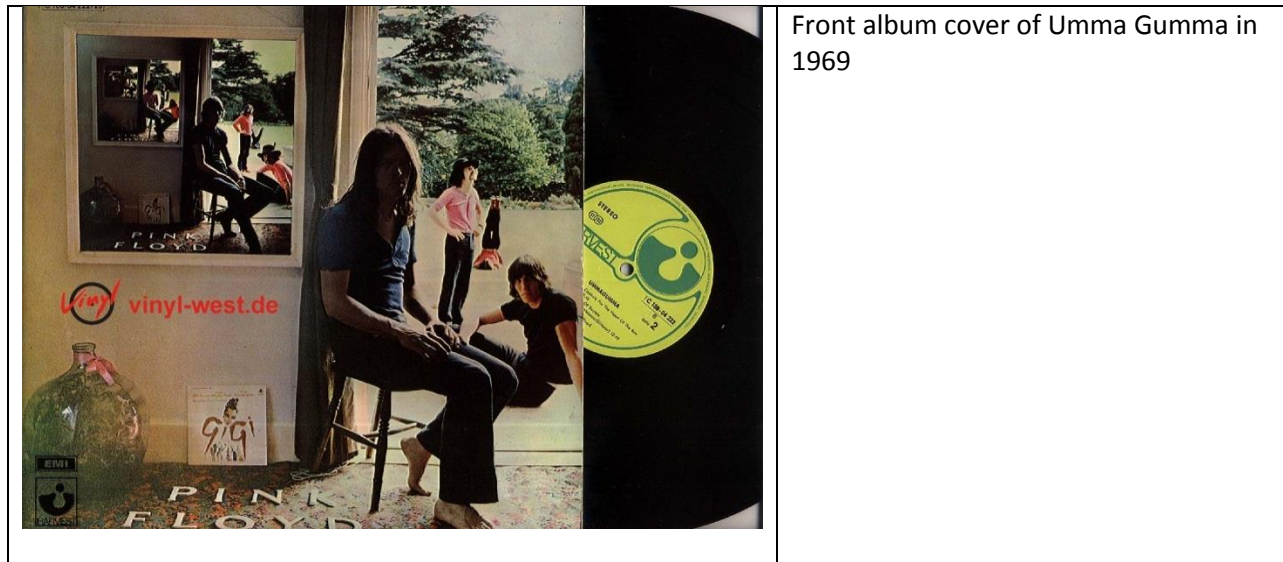
EscherMania

In the last gallery of the exhibition, EscherMania introduces the fun and whimsical part of the exhibition, serving as the conclusion of Journey to Infinity: Escher World of Wonder. Using observation skills, students would be drawn to explore and understand the impact of Escher's influence in the 21st century. It may also serve as an inspiration for them to explore other mediums that they can apply M.C. Escher works' principals and ideas on. EscherMania will showcase various exhibits ranging from different industries and mediums, indicating that Escher's principles and ideas are still relevant in today's age. Some examples include the Penrose Rectangle developed and carved by research scientists of the Singapore University of Design and Technology and Massachusetts Institute of Technology Design Centre and Pink Floyd's album cover of "Umma Gumma" of 1969.

Have a closer look: After observing and interacting with some of the artefacts, what were the students and your thoughts of it? Ask the students to pick out an artwork and discuss their opinions on it. What are some of the industries that they may have identified from? What does it speak about M.C. Escher's influence? Do you agree that M.C. Escher's ideas and principles expand from mathematics and art? If they do, what other genres have they identified with?

Ask the students to reflect and identify any other artefacts that they have seen before that has an M.C. Escher essence to it? What and where have they seen it on?

At the end of the exhibition, how do they feel about the exhibition that they have just visited? Has their perspective and views changed? Were they able to point out the inter-section of mathematics and art from the galleries and exhibits? What was their experience like?



Front album cover of Umma Gumma in 1969

Curriculum Links

Subject	Level	Links
Art	Primary	<ul style="list-style-type: none"> • Generate ideas for their artmaking from observing visuals and the world around them.
	Secondary	<ul style="list-style-type: none"> • Recognise that art reflects records and plays a role in culture. • "Show an appreciation for different art forms e.g. Fine Art (2-dimensional e.g. drawing, painting, collage, print and 3-dimensional e.g. sculpture, assemblage) Design: graphic design, product design, etc. Digital Media: video, animation, photography, etc."
Design & Technology	Secondary	<ul style="list-style-type: none"> • Understand the link between ergonomics, function and aesthetics " • "Design in Society-Show an awareness of societal and cultural influences on design " • Develop an awareness of design in the made-world • Develop an appreciation of function, aesthetics and technology in design • Develop basic design thinking and communication skills

Guided tour 45mins

Guided by our trained facilitators, students can enjoy an interactive tour of the exhibition which aims to introduce the ideas and principals that M.C. Escher has developed and its relevance to the 21st century. Students also would understand the inter-section of art, design and mathematics, realising that each genre is not isolated from one and another. Along the exhibition, students can participate in various enhancement activities situated in the galleries, acting as the “touch and play” element of the exhibition.

A printed resource will be provided for all students, which include engaging activities to introduce the overview of the intersection of art, mathematics, design and architecture.

Workshop Description

Make Your Own Tessellation Print

As part of the educational offerings, the Education team is pleased to present a workshop to complement the exhibition in allowing the students to learn through an interactive hands-on experience about the various ideas and principles that M.C. Escher was known for. During the workshop, students can discover the poetry of mathematics in this hands-on art-making workshop. With a starting point in grids and shapes, students will experiment and design their own tessellation prints, drawing inspiration from M.C. Escher’s tessellation artworks and emblematas. Following on, they would carve the pattern on a rubber medium and develop their prints through stamping on a piece of paper. They would also learn about the different types of symmetry and be able to put their creativity to great use and showcase the intersection of mathematics and art through their takeaway print and medium.