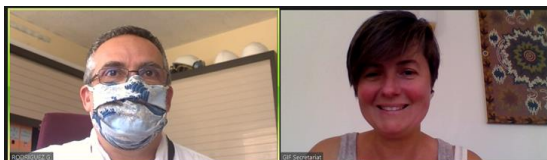


Two dimensional to three dimensional: When paintings have paved the way for Gen-IV reactor design studies and more...

Gilles Rodriguez (wearing "The Hokusai Great Wave mask") & Sylvia Anglade-Constantin



From Quattrocento to the first 3D images

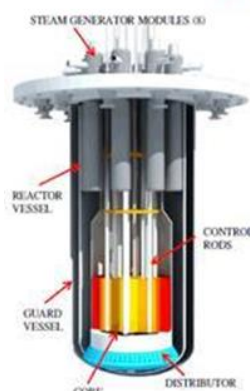
For over 20 years now, 3D modelling and reconstruction tools have been key features of nuclear reactor design, but do we know when and how it all began?



The "Ideal City" (attributed to Fra Carnevale)

In fact, it all started during the Quattrocento (Early Renaissance) period with the work of Italian painters who were also mathematicians. While techniques involving the vanishing point perspective may have been used in classical times, such techniques were rediscovered and employed once again by Paolo Uccello (1397-1475) et Piero della Francesca (c. 1470-1475), during the Quattrocento.

Take the "Ideal City", for example, that can be viewed at the [National Gallery of the Marche](#), housed in Urbino's Ducal Palace (Italy). It is not the first painting to use this type of perspective, but it is certainly a perfect example of the attempt to move from a 2D to a 3D perspective. All of the mathematical theories behind this painting were gathered in a book, which was penned to provide an explanation of the perspective theory. Today, most of these theories are still used when designing a nuclear reactor with the 3D modelling software CATIA or SOLIDWORKS.



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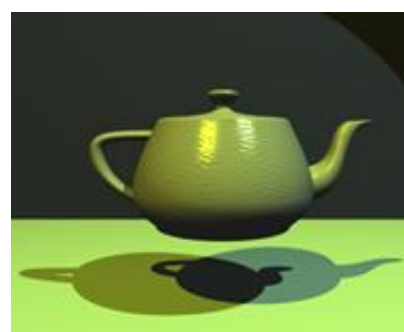
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For further details, go to
www.gen-4.org

Closer to our daily lives, one of the first objects ever to be fully modelled in 3D was the common teapot. The teapot was chosen as a model in 1975 by the computer graphics researcher, Martin Newell, a member of the pioneering graphics programme at the University of Utah (US), thus earning it the nickname of the “Newell Teapot” or the “Utah Teapot”.



Its round shape and complex features make it an ideal study. The teapot is still exhibited at the [Computer History Museum](#) in Mountain View (Ca, US).

2D-3D: When art investigates beyond 3D...

In 2002, the photographer, Jean-François Rauzier, began experimenting with perspective in a tribute to Piero della Francesca, but from a more pessimistic point of view. Rauzier used a new numerical technique that compiled thousands of numerical pictures in what he termed a “[HyperPhoto](#)” process. This process can infinitely enlarge without losing any detail and while keeping the same quality. The HyperPhoto is close to the fractal mode (not purely 3D, but far more than 2D).

These two examples of works of art (i.e. Fra Carnevale’s “Ideal City” and Rauzier’s “Cité idéale”) speak to us much more today because of COVID-19 since we have all encountered such empty cities in 2020.



Rauzier continues to work today in Paris (France). He has been invited to represent France at the [World Expo](#) in Dubai from 1st October, see #5 “The artistic journey in the Belvédère of the France Pavilion”.

The QR Code provided below can even allow you to experience the HyperPhoto depicted here. For further pictures please see his new website www.studiojfr.com.

The NEA/GIF may have the pleasure of exhibiting a couple of the artist’s creations in its offices in October or November 2021. We will of course keep you informed if such is the case.



« CITÉ IDÉALE »

(SÉRIE PREMIÈRES OEUVRES)
2007
120 X 370 CM
TIRAGE PHOTOGRAPHIQUE
SOUS DIASEC

One last example of a painter that is known to labour in the science of perception is the English painter: Patrick Hughes



Patrick Hughes has created what he defines as “Reverspective” an optical illusion on a three-dimensional surface where the parts of the picture which seem farthest away are actually physically the nearest. He adds a “new dimension” to perspective, or, as quoted:

“When the principles of perspective are reversed and solidified into sculpted paintings something extraordinary happens; the mind is deceived into believing the impossible, that a static painting can move of its own accord”.

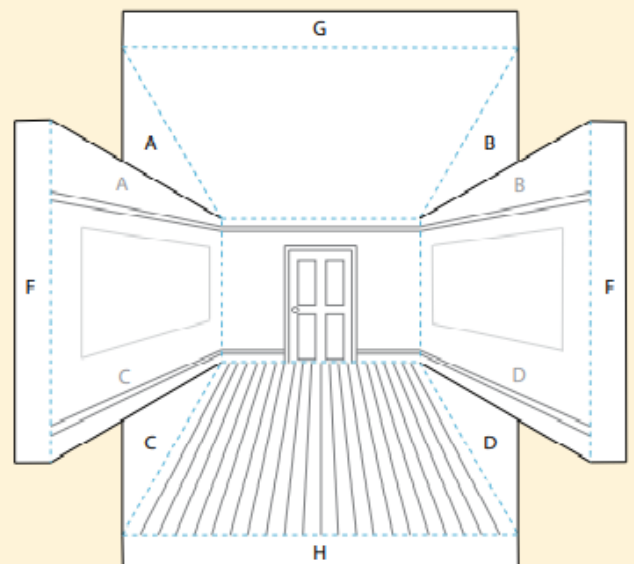
These works of art cannot be reproduced with a 2D representation. You can click on the link below to see them in video, or better yet, see these impressive works in person. The result is absolutely fascinating; the paintings come alive!

[Patrick Hughes Reverspective](#)

His first reverspective, *Sticking-out Room*, was made in 1964. Hughes' original painted reliefs are concerned with optical and visual illusions, the science of perception and the nature of artistic representation. The work of Patrick Hughes can be found in public collections, for example at the Baker Museum, the Birmingham Museum and Art Gallery, the Denver Art Museum, the Würth Museum, or in several hotels around the world (i.e. in private collections).

CONSTRUCTION GUIDE

- 1) Print the second page on thick paper.
- 2) Cut out the figure along the solid lines.
- 3) Fold the sticking out room model on the dashed lines as shown in the diagram to the right.
- 4) Tape or glue tabs A-D to their corresponding edges so that the dashed lines are not visible.
- 5) Tape tabs E-H at the corners to secure the figure.



<https://www.bu.edu/lite/inkjet-science/pdfs/ProjectLITEHughesStickingOutRoom.pdf>

2D-3D: When art uses perspective techniques to create emotion

Vanishing point perspective techniques became the rule in Europe beginning in the Renaissance period, therefore making it standard in art across all of Europe. It was then exported to Japan at the same time as Prussian blue. This could perhaps explain why one of the most famous prints in the Western world is the “The Great Wave off Kanagawa” by Hokusai. In this woodcut print, the artist uses the vanishing point perspective to great effect: the mythical Mount Fuji appears so small next to this giant wave that it enhances the feeling in the foreground of the wave engulfing the boat, and even of Mount Fuji itself!



Several copies of this work of art are kept in collections around the world. Follow [this link](#) for more curious and captivating information on both the wave and the pigment.

Did you know, for instance, that Prussian blue acts as a barrier in our gut by stopping radionuclides from going into our blood? In fact, Prussian blue is on the World Health Organization’s list of essential medicines under “antidotes and other substances used in poisonings”.

In an entirely different field, impressionist painter Gustave Caillebotte used perspective ostentatiously to depict a sad and lonely Paris. The painter made use of vanishing perspective point techniques skillfully to paint buildings and wet cobblestones, but also to express his discontent with the city’s major modifications brought about by Baron Haussmann (who also had perspective in mind) in the second half of the 19th century. For Caillebotte, the huge boulevards had an unmistakable impact on Paris’ festive atmosphere, with the people in the painting alienated from the dreary architecture and avoiding each other under the protection of their umbrellas. A far cry from the Montmartre “guinguettes”, or open-air cafés!



A total of 12 French and 25 American museums expose one or more of Caillebotte’s paintings, among these the Musée d’Orsay in Paris, the Minneapolis Institute of Art, the Texas Kimbell Art Museum, Milwaukee Art Museum, Norton Simon Museum or the Art Institute of Chicago.

Did you know that Caillebotte was also deeply involved in engineering and naval architect activities for his own personal enjoyment?

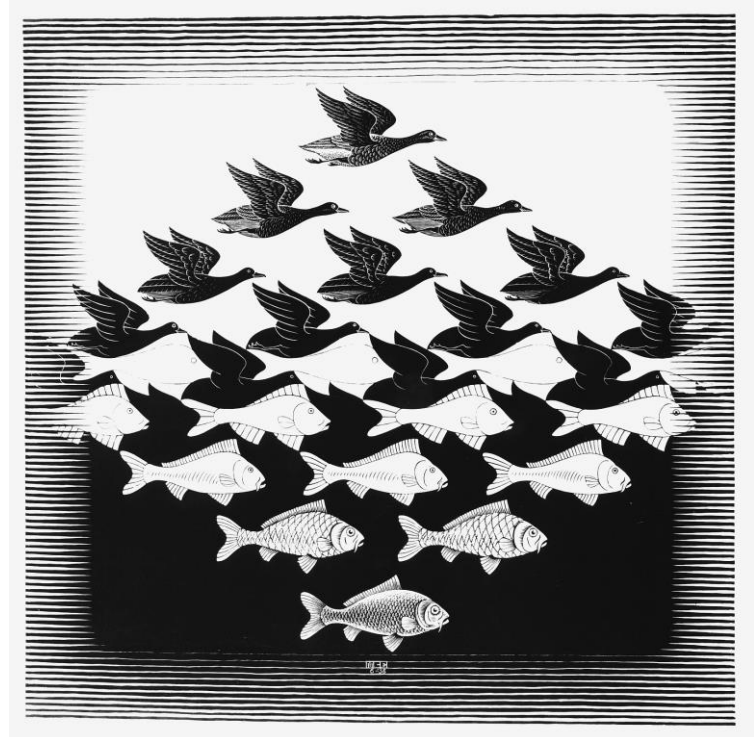
When art becomes optical illusion...

One cannot mention “new dimensions”, perspectives and mathematics without alluding to the work of the Dutch artist M. C. Escher. The world he draws is physically impossible, but it is rendered with such emotion that it nevertheless makes us want to live in such a world. Escher’s collection of work is exhibited at the Escher in het Paleis museum in The Hague (Netherlands). One floor of the museum is dedicated to fun attractions: hands-on experiments of Escher’s work.

We will end this voyage through multiple realms with the following sentence, which so perfectly connects art to science:

“We adore chaos because we love to produce order”, according to Escher.

It is our hope that this little tour through art and techniques for the special summer edition of the GIF newsletter has encouraged you to see all of these artworks in real life, or at least from a different...perspective.



See you “à la rentrée”!

Sources:

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