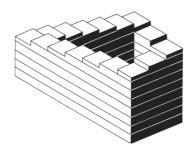


An impossible staircase is a type of optical illusion that cannot be constructed in real life (Torre 2019). The first impossible figure was drawn by Oscar Reutersvärd in 1934. The staircase has been called Penrose staircase since Lionel Penrose and Roger Penrose published their paper in 1958 influenced by Escher's print called "Relativity" (Donaldson 2017, Schattschneider 2010). Two years later, Escher used Penrose staircase in his prints called "Ascending and Descending" (Donaldson 2017).



Opus 1 by Oscar Reutersvärd (Alexeev 2022)



Penrose Staircase (Penrose, L.S. and Penrose, R. 1958)



Relativity (The M.C. Escher Company 2022)

#### Uses

Penrose Staircase has been used in various areas of art. One of the famous examples is the impossible staircase used in the film "Inception" (Harshbarger 2010). Another example is Escher's "Ascending and Descending" in LEGO built by Andrew Lipson and Daniel Shiu (Lipson 2002).



Penrose Staircase animation (Linus 2020)



"Ascending and Descending" in LEGO (Lipson 2002)

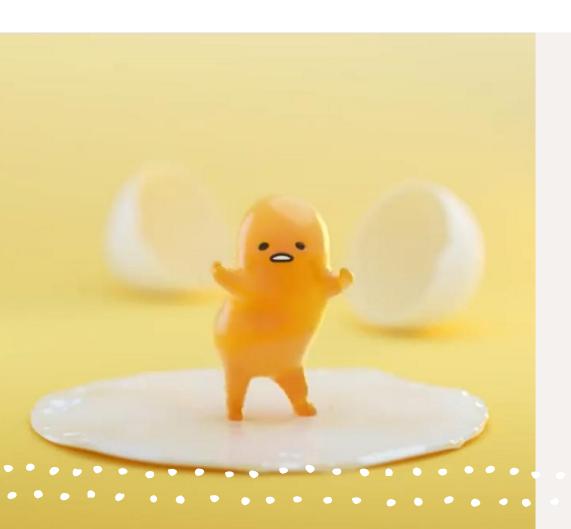


Inception's Penrose Staircase (Alexeev 2022)



Penrose Staircase photograph (Alexeev 2022)

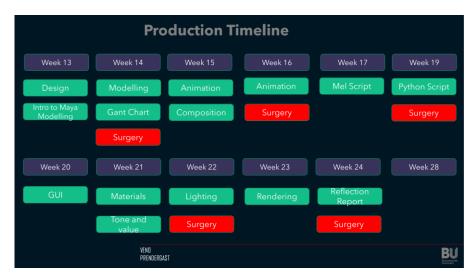
#### Idea

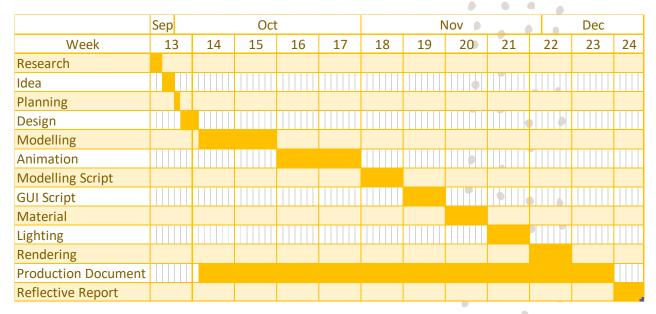


The idea of animating an egg came from an Instagram post where egg yolk is dancing on an egg white. By combining the impossible staircase with the egg animation, I decided to animate an egg yolk rolling down an egg white, which forms an impossible staircase.

## Planning

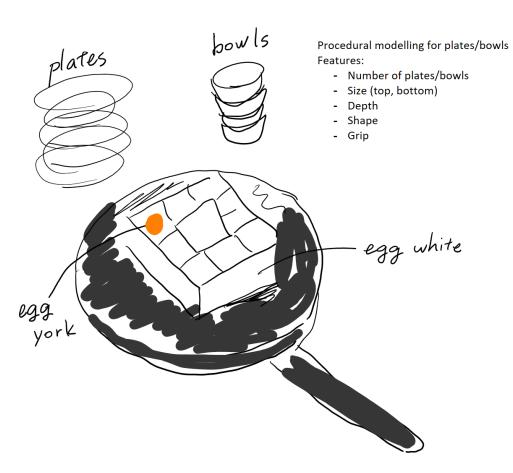
A plan was created so that I can work on the component after learning it as I have no experience in Maya.





Production timeline provided in workshop (Veno 2021)

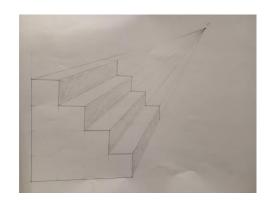
# Design

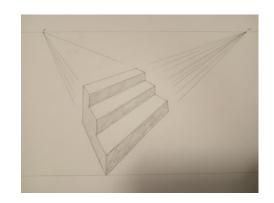


The initial design for the scene included an egg fried on a pan with tableware in the background.

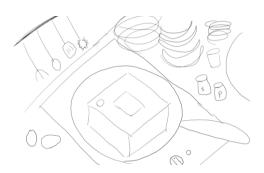


For designing stairs, I drew 1-point and 2-point perspective stairs (Figures on the top). Detailed design (Figure on the bottom right) was done with the reference image taken at home (Figure on the bottom left).



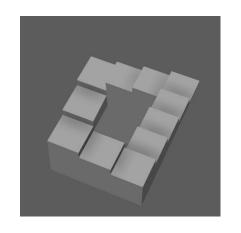


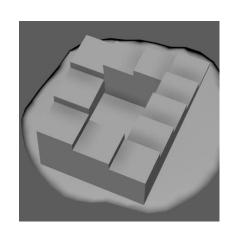


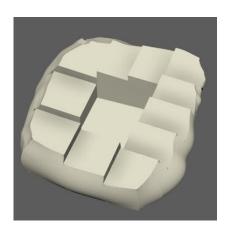


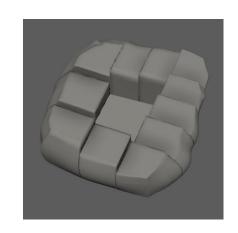
## Modelling

The staircase model was updated throughout the production to make it look closer to the egg white as can be seen in the figures from left to right.

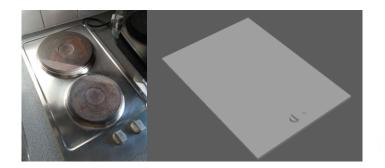








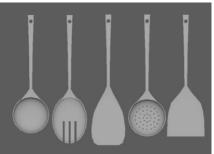
#### Both real-life and online images were used for modelling background objects.











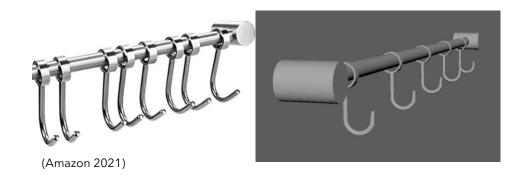
(ShopStyle 2022)



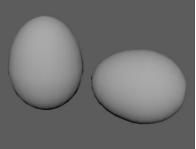




(B&Q 2022)







(Jones 2017)

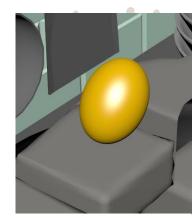
#### Animation

From the reference video, it was discovered that egg yolk does not actually bounce so it was animated to roll down the staircase.

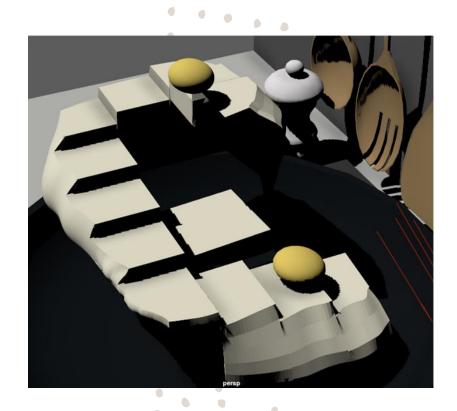
Squash deformers were used at first but it went wrong and was difficult to fix so the animation was started over using scales instead. The yolk is squashed more than the reference video to make the animation more entertaining.



Screenshot of the reference video (Me and My Coffee 2020)



Animated yolk



To make sure the loop works smoothly, the yolk size is keyframed.

Another yolk hidden by the original yolk was added to create a shadow to satisfy the illusion as shown in the figure.

## Composing

The rule of thirds is a compositional guideline that divides an image into 9 equal parts with 2 horizontal and 2 vertical lines (Rowse 2022). For this project, the staircase is placed in the central part to lead eyes to it.

The egg on the pan is scaled larger which makes the animation less realistic but it leads eyes to the staircase.

Also, extra eggs are placed in the background to emphasise that the staircase is an egg.



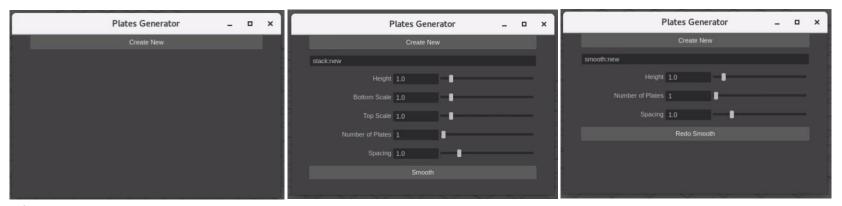
# Script

As modelling stacks of plates and bowls manually would be a repetitive process, a modelling tool was developed.

A tool can model a variety of shapes with fewer controls to keep the tool simple and easy to use.



Reference images (Www.Warehouse5.Top 2019)



#### Material

Materials were added to each object according to the reference images used for modelling. Bright, highly saturated colours were used for the staircase and the yolk. Darker colours were used for the surrounding objects to make a contrast which helps leading eyes to the main object. To avoid the scene being too dark, white was used for plates and bowls. The half-transparent shiny material was used for the yolk to match the animation and entertain the viewer.











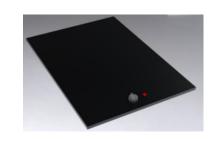








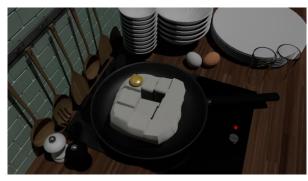




## Lighting

Directional light is used as a key light. The rotation of the light was adjusted to make a tonal variation with lights and shadows.

Indoor HDRI is used for skydome light with high intensity to make the scene looks more modern with daylight.



Scene with a directional light.



Scene after adding a sky dome light.

The steps at the back are actually further than it looks so the steps and the yolk look darker (Figure 1 and 3). Additional skydome light links to these steps and another additional skydome light with keyframed intensity links to the yolk were added to solve these problems (Figure 2 and 4).





Figure 1







Figure 4

#### Rendering & Compositing



Noises appeared after the first rendering (Figure on the left) so the light and rendering settings were adjusted to reduce the noise for the final rendering.

The shadow of the yolk that breaks the illusion (Figure on the right) was hidden by compositing in Nuke.



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21&linkCode=df0&hvadid=258766850546&hvpos=&hvnetw=g&hvrand=11182176389082574728&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint= &hvlocphy=9045712&hvtarqid=pla-431200974671&psc=1 [Accessed 05 January 2022].

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