# THE HIDDEN DIMENSIONS: EXPLORING THE TIMELESS ART AND SCIENCE OF STEREOGRAMS



**Depth Map of Bee**        **Pattern**        **Stereogram Image of Bee**
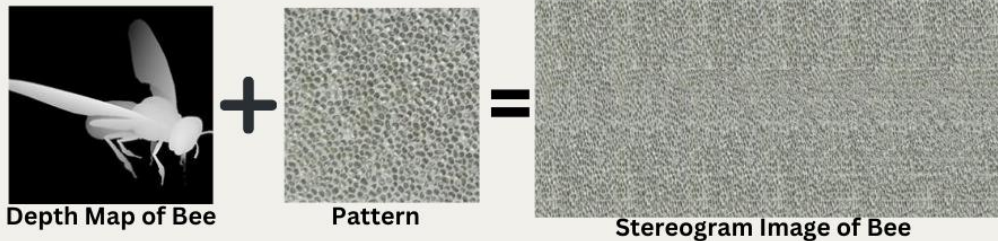
Imagine gazing at a seemingly ordinary flat image, only to uncover a hidden three-dimensional world that suddenly springs to life. This captivating phenomenon is the essence of stereograms—an optical illusion that has mesmerized people for centuries. While their popularity has ebbed with time, the principles behind stereograms remain as intriguing as ever, offering insights into how our brains perceive depth and dimension.
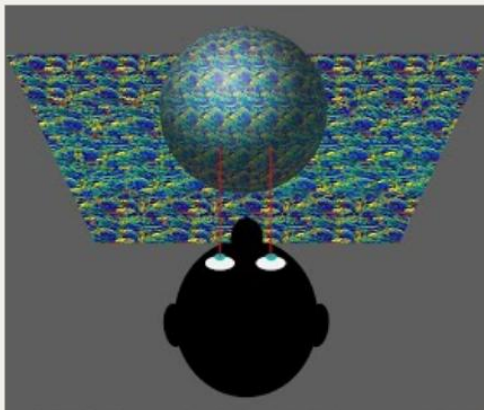


## How Stereograms Trick the Brain

Stereograms work by skillfully manipulating depth perception through subtle visual cues, tricking the brain into seeing 3D images where none actually exist. But their story doesn't end with simple amusement. With the rise of computer vision technology, stereograms have found new life in various fields, from enhancing visual training to creating immersive digital experiences.

This blog will take you on a journey through the fascinating world of stereograms, exploring their history, their unique ability to transform 2D visuals into vibrant 3D perceptions, and their potential to revolutionize how we interact with imagery in today's tech-driven landscape. Let's unravel the science and creativity behind this timeless visual art form!

Begun Exploring with two visually intriguing images: a Rubik's Cube and a penguin in a snowy environment generated using DALLE-3. The Rubik's Cube was chosen for its geometric complexity and colorful patterns, providing an exciting challenge for creating depth and structure in a stereogram. The penguin image, generated by DALLE-3, depicted a snowy, icy habitat, offering an opportunity to explore how AI-generated images could be transformed into stereographic 3D representations.

To enhance the stereogram creation process, Convolutional Neural Networks (CNNs) were incorporated for advanced depth map extraction and processing instead of relying on traditional methods. CNNs enabled intelligent analysis of these images, generating accurate depth maps and improving the stereogram generation workflow. This combination of DALLE-3's AI-generated visuals and CNN-based depth mapping demonstrates the innovative intersection of machine learning, computer vision, and creative stereogram art.

## Step 1: Generate the Depth Map

A depth map is a grayscale image where pixel brightness represents depth (white = closer, black = farther). This will serve as the blueprint for your stereogram.
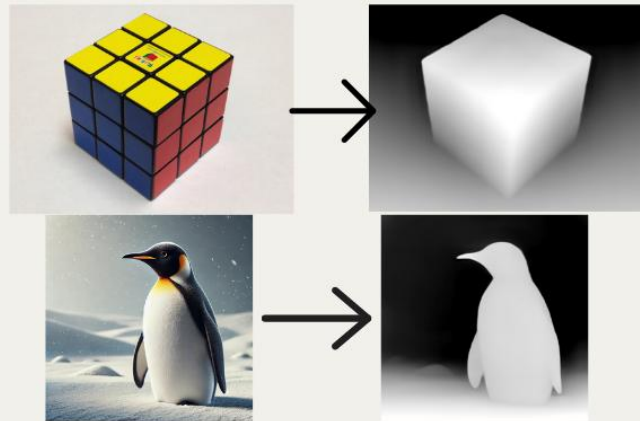


## Step 2: Selecting a Texture Pattern

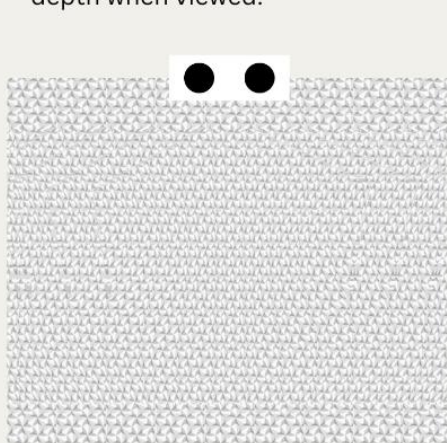A seamless texture pattern was chosen to overlay the depth map.

- The texture was carefully selected to ensure it repeats consistently, making it suitable for creating the stereogram.
- This texture will act as the visual base of the stereogram, providing the hidden 3D image when viewed correctly.
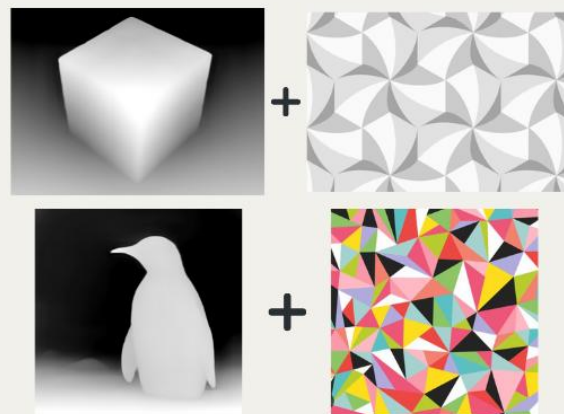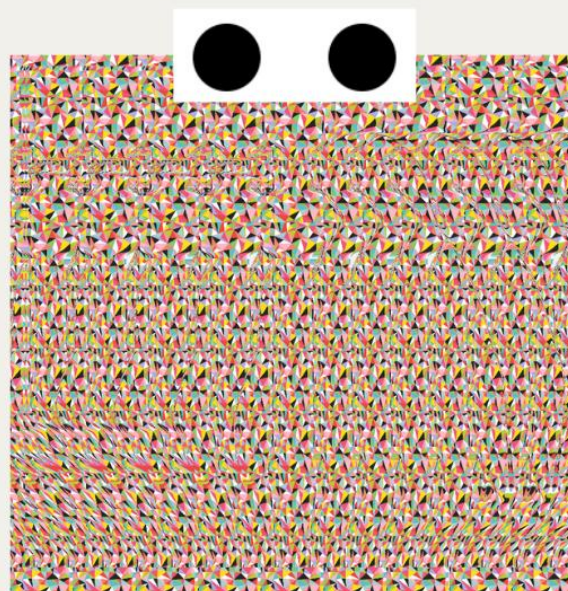


## Step 3: Mapping the Texture onto the Depth Map

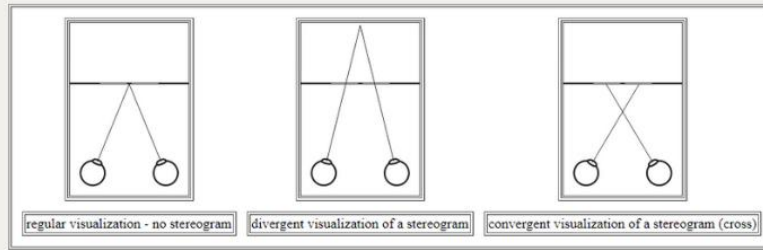The depth map of the Rubik's Cube was combined with the texture pattern.

- This step involved horizontally displacing parts of the texture based on the depth values in the map.
- Brighter regions of the depth map caused larger shifts in the texture, creating the illusion of depth when viewed.



**Rubrix cube Stereogram**

**Penguin Stereogram**

| regular visualization - no stereogram | divergent visualization of a stereogram | convergent visualization of a stereogram (cross) |

**How to See a Stereogram /Magic Eye**
Think of it like looking through a window at something far away, not at the window itself. Here's how:

1. **Relax Your Eyes:** Pretend you're daydreaming and let your eyes go soft, like you're staring into space.
2. **Get Close, Then Move Back:** Put your face very close to the picture until it's blurry. Slowly move back without focusing on the image.
3. **Use a Pen Trick:** Hold a pen to the side of the picture, behind it. Stare at the pen and slowly move it to the center, keeping your focus "past" the picture.

If the picture feels strange but you can't see 3D yet, you're getting close!
For practice, look at a simple image with dots. Relax your eyes, and you might see an extra dot appear in the middle!



# Stereogram Decoder
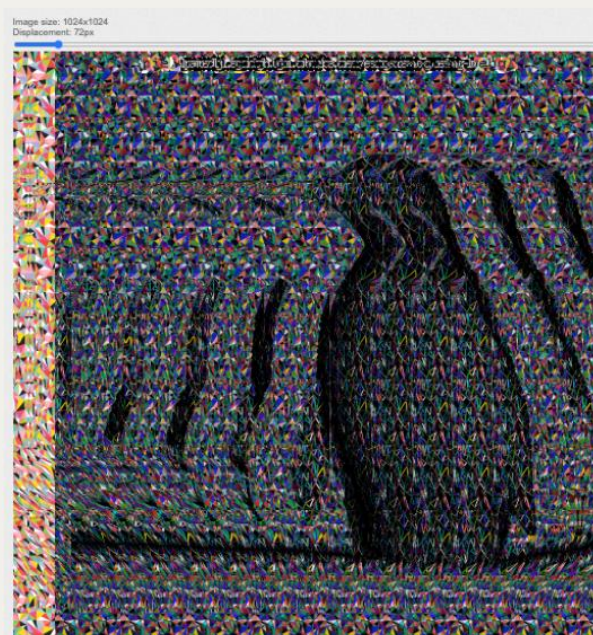


A stereogram decoder is a tool that reveals the hidden 3D picture within a stereogram. A stereogram is like a puzzle with patterns that repeat and shift slightly to create the illusion of depth. The decoder works by taking a copy of the stereogram and sliding it horizontally over the original image. As the patterns overlap in just the right way, the hidden 3D image becomes visible, showing the depth information encoded in the design.
Here's how it happens: The repeating patterns in a stereogram are shifted based on how close or far different parts of the 3D scene are. When the decoder slides the image, it aligns the matching patterns step by step. The closer parts of the hidden image appear first, followed by the farther sections as the sliding continues. This process helps the brain piece together the hidden 3D picture, making something flat look as if it pops out in three dimensions!