

# Study on the Application of Optical Illusion in Electronic Digital Games

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## Abstract

As the genre of video games diversifies, visual elements are increasingly integrated into the core mechanics of games and used to enhance the realism and immersion of the player. This paper presents an integrated analysis of several examples of games designed using visual illusions and provides a theoretical reference for future game design.

## Keywords

Digital game; Optical illusion; Gestalt psychology.

## 1. THE OPTICAL ILLUSION

The "optical illusion" is a phenomenon in which the image observed by the human eye does not correspond to the objective object, and it arises mainly from visual illusions, physiological illusions and cognitive illusions. The illusion of geometry is caused by the structure of the image itself; the physiological illusion is caused by the sensory organs and the cognitive illusion is caused by psychological reasons. The illusion of geometry, in particular, is widely known for its variety. The illusion that the geometric composition of size, length, area, direction, angle, etc., as seen visually, is significantly different from the actual measured figure is called the geometric illusion. The famous Hermann Grid (figure 1) and the Necker Cube (figure 2) are two classic examples of physiological and cognitive illusions in visual illusions

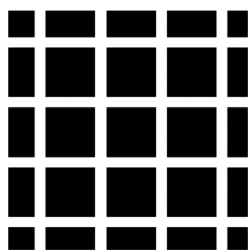


Figure 1. Hermann Grid

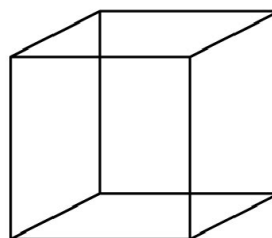


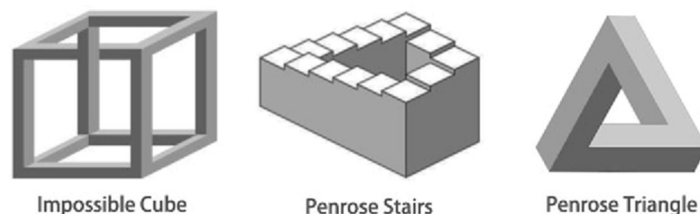
Figure 2. Necker Cube

## 2. FORMS OF VISUAL ILLUSION IN GAMES

### 2.1. Ambivalent Space

"Paradoxical space" is a type of "cognitive optical illusion", a spatial confusion caused by the human visual system subconsciously resolving two-dimensional shapes into three-dimensional objects, also known as "impossible structures". It is also known as "impossible structure". The phenomenon usually occurs within seconds of the viewer's first glimpse of a two-dimensional figure, but even when the viewer is aware of the contradiction between the resolved three-dimensional object and the two-dimensional figure in front of them, the impression of the three-

dimensional object cannot be removed. A classic example is Escher's Still Life and Street, which makes extensive use of impossible structures, paradoxes and loops, and has been described as "both artistic and scientific" due to its perfect integration of mathematical concepts (figure 3).



**Figure 3.** Escher's "paradoxical space"

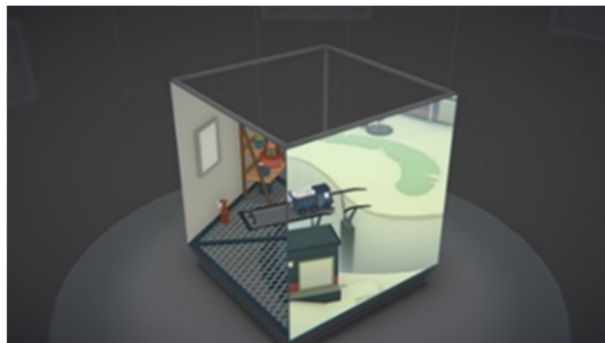
"The first use of paradoxical space in games can be traced back to the Japanese game Echo chrome (figure 4), released by Japan Studio in 2008. The mechanics of the game are modelled on Escher's "paradoxical space" work, using optical illusions to break down the boundaries between two-dimensional and three-dimensional games. The game is played by steering the character through various obstacles to get from point A to point B. As the player changes the perspective of the game, the route the character takes changes and the player needs to overcome the illusion of "seeing is believing" and use the optical illusion to find a new path to escape the maze. Echo chrome's "subjective" gameplay, based on paradoxical space, has revealed to many game designers those visual elements can be used not only to beautify a game, but also to deeply influence the design of its core mechanics.



**Figure 4.** Echo chrome

## 2.2. The Illusion of Reversal

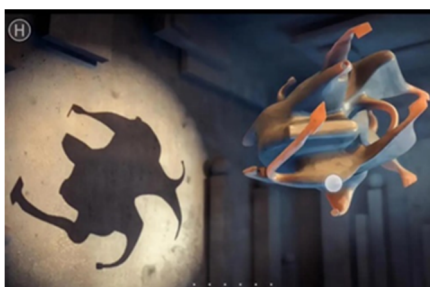
"This type of illusion refers to the fact that some figures have a dual or multiple nature in themselves, coupled with the shifting nature of the human attention, they will create two or more figures alternating from time to time; some figures have a dual three-dimensional feeling in themselves, even with the halftone light and dark while the shadow, but also because of the arrangement of the relationship, will make the illusion of two three-dimensional feeling alternating. " The game Caged Dreams (figure 5), for example, presents a multi-dimensional world in which lighthouses, factories, huts and harbors are all housed in a single cube. The different spaces intersect here, making for a wonderful visual experience. Each of the different spaces of the cube is connected. Rotating the perspective and using optical illusions to discover these hidden connections, stitching them together while connecting them closely through space to space, thus revealing its implicitly fragmented narrative, the player uncovers the truth hidden in the depths through fragmentary story clues. The gameplay is based on shifting the angle of the cube to allow the images on the cube to be stitched together with other images to unlock new scenes to advance the story.



**Figure 5.** Caged Dreams

### 2.3. Dimensional Transformation

Dimensional transformation is the interchange of two dimensions with three. In Projection Quest (figure 6), for example, the player manipulates and moves objects suspended in the air in a more abstract manner, projecting the appearance of real objects on the wall by means of light projections. The game is designed using the art of light and shadow projection: in a space illuminated by a spotlight, the game's unit tasks are completed by rotating the scattered objects hanging in the room and shining a light on them to create shadows. The dimensional shifts created by the projections are effective in providing fun and challenge to the gameplay.



**Figure 6.** Projection Quest

The game Viewfinder (figure 7) is also an example of a successful application of the 'dimensional transformation' technique of optical illusion. The core mechanic of the game is to transform a two-dimensional screen image into a three-dimensional object through visual changes. With a magic Polaroid camera in hand, the player uses the phenomenon of 'dimensional transformation' in optical illusion to recreate the scene in front of them, transforming photographic scenes into buildings and tools that pass-through obstacles.



**Figure 7.** Viewfinder

## 3. SUMMARIZE

As a graphic design language, the visual illusion has been widely used in game design. With the application of the theory of visual illusion, game design can take on more forms to express

the content and build the core gameplay, and ensure that the game itself has a richer cultural connotation, relying on the theoretical framework of "Gestalt psychology".

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