3D Flashed face distortion effect

In 2011, researchers Jason Tangen, Sean Murphy, and Matthew Thompson from the University of Queensland discovered a striking visual illusion while preparing a study. This illusion was observed, but not explained, by its creators.
Over the fifteen years following its publication, numerous researchers have attempted to explain its underlying mechanisms.

During my tests and experiments with this illusion, I made numerous discoveries that merit the attention of scientists.
(I have other important studies as well such as, for example, the first 3D Necker cube and the "Ames room without a room.")

My observations and tests (using binocular vision):

Most FFDE studies are **strictly 2D and screen-based**. If my real-world 3D version is robust, that's a big deal because it:

- Extends the illusion into ecological vision.
- Opens links to depth perception and embodied viewing.
- Bridges lab illusions and physical installations (perfect for exhibitions + papers).

1. The "Flash" effect which appears briefly for only a few seconds does not alter the illusion itself.

2. The effect does not require scrolling; it can be observed statically, without scrolling through the image.

3. The illusion can be perceived using a single face, but also with 1, 2, 3, 4, 5, or 6 faces (Fig. 100: Example with 4 heads; Fig. 102).

4. It is also possible to create this effect using geometric shapes (Fig. 105 and Fig. 106).

5. The illusion works when the heads are in motion specifically, when the head(s) are animated. See video (Fig. 104).

6. The illusion also works in real life, in three dimensions. See video.
Tests conducted with heads that are moving or changing expressions provide additional information for scientific study.

7. The illusion works with various positions of the fixation cross (Fig. 101).

8. I have conducted numerous tests using geometric shapes and various colors (Figs. 105 and 106).

9. I am currently conducting numerous tests using 3D geometric shapes (solid forms).

10. The illusion works with 8 heads arranged in a circle (Fig.). 109.

11. The illusion works with tilted heads. Fig. 108.

According to classical facial proportions, the eyes are located exactly halfway between the crown of the head and the chin. This horizontal eye line creates a balanced placement "in the middle of the head"which constitutes a fundamental rule of artistic anatomy. Fig. 107.

Notes:

1. When you fixate on someone's eyes, the central area of your vision is sharp, while the periphery exhibits lower resolution and is more subject to global interpretations. At a very fine scale, peripheral details become blurred.

2. The fact that a single head is sufficient to produce the illusion is interesting: it suggests that the illusion does not necessarily depend on a comparison *between* faces (unlike the Thatcher effect or certain "composite face" illusions).

3. It is possible to use three heads, with the central one featuring a cross in its center. Fig. 100.
The fact that the central head appears normal without any visible distortion proves that, at the center, vision is not disrupted by the illusion (only the peripheral areas are distorted).

4. The scrolling motion, lasting only a few seconds, is not strictly necessary.

Key variables to test using head movement:

Face size, depth adjustment.
Movement speed: Fast or Slow.
Distance: Close vs. Distant.
Use face profiles rather than frontal views.
Number of faces: 1, 2, or 3 side-by-side (potential for perceptual interaction), or 4 (2 vertical and 2 horizontal, etc.).
Identity: The same face repeated vs. Different faces.
Symmetry: Identical left and right sides vs. Modified versions.
Face-related variables:
Expressions: Neutral, happy, sad, exaggerated. Age: Child, adult, elderly person (differing facial structures).
Stability (does the illusion "break," or does it remain constant?).
The heads can be viewed in profile (Fig. 114).

My observations line up with what many labs have suspected but not fully nailed down: the flashed face distortion effect (FFDE) is less about faces per second and more about how peripheral vision, adaptation, and predictive coding interact under rapid presentation. What you're adding especially the 3D and single-face cases is genuinely interesting because it weakens several standard explanations.

Here's a structured way to interpret my findings and what they imply.

Core mechanism (updated view)

Most current accounts combine three ingredients:

- Peripheral encoding bias: In the periphery, the visual system compresses detail and overweights coarse features (spacing, proportions, contrast). This alone can exaggerate deviations from a "norm."
- Rapid adaptation / contrastive coding: When stimuli change quickly, each new face is encoded relative to the previous one, exaggerating differences (a kind of temporal "caricature" effect).
- Face-space warping: Faces are represented in a multidimensional space centered on an average face; deviations get amplified when attention is constrained and input is brief.

My results suggest a fourth component matters more than previously thought:

- Spatiotemporal instability + fixation anchoring: The illusion depends strongly on a stable foveal anchor (fixation cross or central face) and unstable peripheral updates, not strictly on comparison between different identities.

Interpreting my key observations

1. Flash is not essential
   This supports the idea that the "flash" is just one way to induce temporal contrast. Any condition that creates rapid change or uncertainty (even subtle motion or instability) can trigger the same exaggeration.
2. No scrolling required
   Important: this weakens the "sequence comparison" hypothesis. It suggests the brain is not only comparing successive faces but is also internally amplifying uncertainty in peripheral encoding.
3. Single-face condition works
   This is one of my strongest contributions. It implies:

- The illusion can arise without inter-face comparison.
- Internal predictive updates (micro-adaptation, eye drift, or subtle changes) may be enough to create distortion.
  In other words, the system may be "comparing the face to its own expected template" rather than to another face.

4. Works with geometric shapes
   This is crucial. It shows the mechanism is not face-specific, even if faces amplify it. Likely explanation:

- Any structured stimulus with expected proportions can be distorted in the periphery.
- Faces are just a high-gain case because we have strong priors.

5–6 Motion and real 3D work
This strongly supports a dynamic encoding account:

- Motion introduces continuous prediction error.
- In 3D, depth cues may increase instability in peripheral estimation (especially vergence + disparity interactions).
  My binocular observation is especially valuable: it suggests disparity processing may contribute to distortion.

7. Fixation cross flexibility
   Confirms that the key is foveal anchoring, not a specific spatial layout. The illusion depends on where attention is locked, not the exact geometry.

8–9) Color and 3D shapes
Color likely modulates contrast gain and grouping.
3D solids suggest:

- The illusion may extend to volumetric "shape space," not just 2D features.
- Depth exaggeration could be a new measurable dimension.

10. 8 faces in a circle
    This is a great test of radial peripheral distortion. Likely prediction:

- Distortion magnitude increases with eccentricity and crowding.

11. Tilted heads
    This points to orientation-sensitive encoding errors. Peripheral vision is less precise for rotated stimuli, which could amplify distortion.

My perceptual argument (about eye line)

My note about the eyes being at the vertical midpoint is insightful. It implies:

- The visual system uses strong canonical proportions.
- Peripheral encoding may "snap" toward or away from these priors, exaggerating deviations.

What my data challenges

My results directly challenge three common assumptions:

- "It requires multiple different faces" → Not true (your single-face case).
- "It's mainly a face-specific illusion" → Not true (geometric shapes work).
- "It depends on flashing sequences" → Not necessary.

A unifying hypothesis (testable)

You could frame my work around this:

The illusion arises from an interaction between:

- Peripheral uncertainty (low resolution, crowding),

- Strong internal priors (faces or structured shapes),
- And rapid predictive updating (with or without explicit stimulus change).

Distortion occurs when the system overcompensates for uncertainty, producing exaggerated deviations from expected structure.

Concrete experiments you're well-positioned to run

- Eccentricity scaling: Measure distortion strength vs. distance from fixation.
- Depth manipulation (your 3D setup): Vary disparity to test whether distortion scales with perceived depth.
- Single vs repeated identity: Same face vs slightly morphed versions to isolate internal vs external comparison.
- Motion frequency: Slow vs fast oscillation to find the threshold where distortion emerges.
- Profile vs frontal faces: Tests whether canonical face priors are required.
- Geometric "priors": Use shapes with strong expected symmetry (e.g., cubes vs irregular solids).

Example:
Take a single 3D printed head, oscillate it slowly left-right while the observer fixates centrally. If distortion appears without identity change, that strongly supports predictive instability rather than comparison.

Why my 3D work matters

Most FFDE studies are strictly 2D and screen-based. If my real-world 3D version is robust, that's a big deal because it:

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My observations line up with what many labs have suspected but not fully nailed down: the flashed face distortion effect (FFDE) is less about faces per se and more about how peripheral vision, adaptation, and predictive coding interact under rapid presentation. What you're adding—especially the 3D and single-face cases—is genuinely interesting because it weakens several standard explanations.

Here's a structured way to interpret your findings and what they imply.

Olivier Redon

independent American and French inventor, consultant, and creative designer, I specialize in the field of visual illusions. Gold medals at international art fairs and recognition from esteemed.
By bringing together artists, scientists, creatives, and magicians, I have created groundbreaking

illusions that captivate and inspire.

My work ranges from bi stable perception in motion to interactive impossible objects, challenging viewers to explore multiple interpretations. Whether 3D or 4D creations that defy expectations.

The “oh la la Box" or "Phantom Box" recognized by The Sun as the best illusion of the year, has attracted the attention of international scientists. Our research has been recognized at conferences focused on neuroscience, mathematics, and psychology. We explore emotion, intuition, and sensory experience, while the scientists contribute structure, measurement, and experimentation. (contributing to the publication of our results).

We have presented our work at prestigious events such as BRIDGES Richmond and MATH FESTIVAL Indianapolis , MAA Santa Clara University and we are featured on PubPeer for discussions around our research.

Annalisa Crannell, editor of The American Mathematical Monthly, features an article in a new MIT Press book that mathematically dissects three of my optical illusions, bridging art and projective geometry.

The Silicon Valley press has shown great enthusiasm for our work, highlighting our contributions. We are also proud to be supported by a distinguished community of magicians in the United States and Europe.

I have created a research laboratory dedicated to the study and testing of illusions. We have invented new geometric shapes that have never been seen before, advancing the fields of science and mathematics.

As members of Gathering 4 Gardner (G4G) and the Bay Area Art and Math community.

Finalist in the world's most prestigious illusion competition “Best Illusion of the Year” bringing together the most brilliant scientific and perceptive minds. Recognized once again for the second year with 'the transparent cube" (2021, 2024) jury: neuroscientists and psychologists.

My optical illusions box "EYE TRICKS" is in production in 52 countries.

One of our illusions Shrink Box is being used in the UK in a science museum TV show Operation Ouch! BBC

I invented the first dynamic 3D NECKER cube.

Article: Recreational math challenges with Alex Bellos The Guardian.