The Art of Deception: Color Visual Illusions and Diffusion Models -Supplementary Material

1. DDIM inversion may replicate human vision

Figure 1 complements Figure 2 of the main paper by adding results using DeepFloyd (a diffusion model that works in the original image space, not in latent space). We can see how the illusion effect also appears in this image-space diffusion model.

2. DDIM inversion stuggle with high-frequency images

Figure 2 shows how DDIM invesion struggles to invert high-frequency images. We hypothesize that the denoising process performed by the conditional U-Net of the diffusion models is not adapted to deal with images with these high frequencies. Please note that this observation is not the main focus of our study as it does not influence the intensity changes in the pixels when we measure for the appearance of visual illusions.

2.1. Profiles

Figure 3 evaluates our results using profiles (here using Deepfloyd). This is the most traditional approach to evaluating the replication of visual illusions. Profiles represent the intensity value across the line marked in the input image. We can see how the diffusion model replicates the illusion. For example, in the case of the Dungeon illusion, it correctly predicts the square on the left to be darker than the square on the right.

3. Prompts for generation of Fig.5

In Figure 4 we show the prompts used to generate images on Figure 5 in the main paper.

4. Psychophysical experiment

Figure 5 shows images used in our psychophysical study. The top row presents eight images in which we used our model to perceive a visual illusion. The bottom row presents eight control images, in which our model has not been enforced.

Table 1. Comparison of ODOG and CiWaM results across different perceptual weights. Results are computed as the percentage of detection.

	ODOG			CiWaM		
γ	0.8	0.9	1	0.8	0.9	1
0	0.29	11.19	68.49	0.46	6.27	52.31
0.3	22.9	82.67	96.57	15.24	75.31	83.29
1.0	61.04	91.24	98.60	40.12	79.27	88.48

5. Quantitative results with classical models:

Table 1 demonstrates the effectiveness of our perceptual loss weight (γ) through comparison with the two classical models—ODOG and CIWAM— across different thresholds. When no perceptual loss is applied ($\gamma = 0$), both detect relatively weak illusion effects. As we increase γ to 0.3, there is a substantial improvement in illusion strength, that becomes even more pronounced at $\gamma = 1.0$, achieving detection rates of 61.04%, 91.24%, and 98.60% for ODOG and 40.12%, 79.27%, 88.48% for CIWAM across the three thresholds. This allows us to conclude the effectiveness of our perceptual loss, as higher values of γ guide the network to generate more visual illusions that are detectable by classical vision science models.

6. Additional quantitative replication results

From Figure 6 to Figure 23 we present additional replication results of existing visual illusions. The position of the original images is always specified between brackets. We highly recommend to **watch the figures on a computer screen**.

7. Additional generation results

Figures. 24 and 25 show additional results of our generation method of visual illusions. We highly recommend to watch the illusions on a computer screen.



Figure 1. **DDIM inversion of the Brightness Contrast illusion using Stable Diffusion (first and second row) and DeepFloyd (third row)**. Top row: Image-space visualization (decoded latents) showing (left) Original illusion with two identical gray squares (marked in red) against black and white backgrounds, and inversion results using 3, 10, and 20 steps for Stable Diffusion and 3, 15, and 30 steps for DeepFloyd. Second row: Histograms of the corresponding latent representations for the Stable Diffusion case. The model gradually reproduces the perceptual difference in brightness between the physically identical squares in a (not fully Gaussian) intermediate representation.

References

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Figure 2. **DDIM inversion struggles with high-frequency images** Here we present DDIM inversion results for Stable Diffusion (SD) and Deepfloyd (DF).



Figure 3. Replication of classic visual illusions using traditional profiles



Figure 4. Prompts used to generate images from Figure 5 in the main paper



Figure 5. Sample images used in psychophysical experiment. Top row: Images where our model was used to generate a visual illusion. Bottom row: Control images where our model was not used.



Figure 6. A gray grating [6]: The low-contrast, gray grating appears to move horizontally. Actually, the gray between black diamonds and the gray between white diamonds give the same level of lightness. See the argyle illusion.



Figure 7. A scintillating LSI [8]:Illusory black spots scintillate in white squares.



Figure 8. **Eggs of a frog** [1]: The same gray of circles appears to show two levels of lightness.



Figure 10. **Gold disks [11]:** Each gap surrounded by four disks appears to be darker oe lighter.



Figure 9. More white [7]: The white in diamonds appears to be more white than the white in the surround.



Figure 11. **Induction [16]:** Hearts of the same brightness (R=127, G=127, B=127, top) appear to be darker or brighter, induced by White's effect, Bressan's dungeon illusion, White's dotted brightness illusion, and the De Valois-De Valois illusion.



Figure 12. **Munker [16]:** Hearts of the same color (R=255, G=0, B=127, top) appear to be pink or orange, induced by the Munker illusion, the chromatic dungeon illusion, the dotted color illusion, and the De Valois-De Valois illusion.





Figure 14. Eye color constancy [14]: In some images, the right eye (surrounded by color filter) appears to be different in color from the left eye, though they are the same color (top).



Figure 13. **Kimono lightness constancy [15]:** The kimono in the left image appears to be white, though the luminance is the same as the gray of the kimono in the right image (top).



Figure 15. Green spirals [3]: There appear to be spirals of two different types of green. Actually, they are identical (top).





Figure 18. **Sheep [2]:** Half annuli appear to show two different levels of lightness but they are actually identical (left).



Figure 16. Enhanced brightness contrast [5]: Center squares are the same intensity (top).



Figure 17. Adelson's checker-shadow illusion-like gradation lightness illusion [9]: bottom squares are the same gradient (left).



Figure 19. Chromatic snake illusion [13]: In each block, the three diamonds in the upper half appear to be tinted the color opponent to the sorrounding color, though they are the same gray (R=127, G=127, B=127) as the two diamonds in the lower half (top).



Figure 20. Ajisai [10]: The three squares aligned diagonally in the left are actually the same color as those aligned diagonally in the right, but the latter appear to be more reddish (top).

Figure 21. **info** [12]: The left 'i' and the right 'i' are identical gray, but the former appears to be yellowish while the latter appears to be bluish (top).



Figure 22. Skin lightness constancy [17]: The skin the left image appears to be light, though the luminance is the same as the dark skin in the right image (top).



Figure 23. Enhanced color contrast [4]: Central squares are the same color (top).

"serena from poskemon | | fine detail!! anime!! realistic shaded Slighting!! poster by ilya kuvshinov katsuhiro otomo, magali villeneuve, artgerm"



"portrait of a man with gray and green mohawk wearing a gray headset and brown tank top, gray and green mohawk, gray headset, brown tank top. art by



"magical scene from a non - existent movie



"still from the movie'the birds ', stanly kubrick, donato giancola, tim hildebrandt, wayne barlow, bruce pennington, larry elmore



"movie poster, game about deep caves and void monsters, cinematic light, clean linework, finely detailed, 4 k, trending on artstation, concept art by stanley lau"



"a blue little pony with white hair, a picture by an gyeon, featured on derpibooru, booru,



wes anderson movie, steven universe

"dog sleeping on giant

fruit, screenshot from



logo'

"segmented 2d laser cut earrings, star wars rebel



johnson"





Figure 24. More generation of visual illusions using the proposed method.



generation of kids"

"Moon Priestess,

caricature in Piet

Mondrian style,

Polygonal, Neon,

colorful and vibrant,

Metallic Colors"

"the moment in a new

disney movie that

traumatized a

worlds extremely detailed claymation art, dark, moody, foggy'

"the war between

"a ship sinking in the

ocean with poseidon

watching, concept art,

moddy, god rays,

atmosphereic, 8 k

render"

"wizard holding a cage, with a swarm of butterflies fluttering out, digital 2d fantasy art, Wayne Barlowe"

"cyberpunk guy fieri, side portrait, striking, defiant, spotlight, vibrant colors, paint splash, beautiful eyes, by marco paludet and gianni strino and marion bolognesi '

"chest gear digital mechanical military tactical armor digital painting highly detailed render 4 k 8 k hd trending on artstation"



"a dystopia soviet brutalist city background for grand theft auto 5 loading screen, very detailed, high quality photo, designed by zaha hadid, sculped by Norman foster



"woman romantic date at restaurant, sinister grey alien, nice restaurant, photography, specular highlights "



"an illustration of a forest, summer, sunrays, trees, lush green forest, very high detail, realistic, dan mumford"

"utopian city made out

of glistening, white

marble, fusion between

historical and modern

futuristic architecture,

digital art"



"zeppelin by salvador dali, trending on artstation, favorites on deviantart, high quality art. artwork masterpieces, award winning"



"hd art by rene magritte. three goths loitering in the shade, talking beneath a cherry tree outside a blockbuster video store"

Figure 25. More generation of visual illusions using the proposed method.

"emma watson wearing

traditional kebaya bali

in bali. iconic monkey

place in bali. front view.

instagram holiday photo

shoot, perfect faces '

"expansive view of

hyper photo realistic

gritty massive modern

tank battle from a

ground level view, in

the style of black hawk

down, octane render"



"phoebe bridgers by

ryan smallman,

graveyard in the

background, very

detailed, fog through

"hd 8 k photo of a terrifying entity in the desert"

"sailor on its boat,

fantasy, highly detailed,

digital painting,

artstation, concept art,

wallpaper, smooth, sharp

focus, illustration, art by

artgerm and greg

rutkowski and alphonse

"children book illustration of boy with dog reading a book. zoomout. by beatrice blue, by julia sarda, by loish. classic, guache, crayons, traditional. artstation. behance. intricate"



"spiral galaxy cupped within giant claws, hyperdetailed, hyperrealistic, digital art, artstation, concept art, 4 k, 8 k"



"heavenly summer sharp land sphere scallop hamburger soda auslese , by Peter Paul Rubens and Eugene Delacroix and Karol Bak , Hyperrealism , digital illustration , fauvist"











