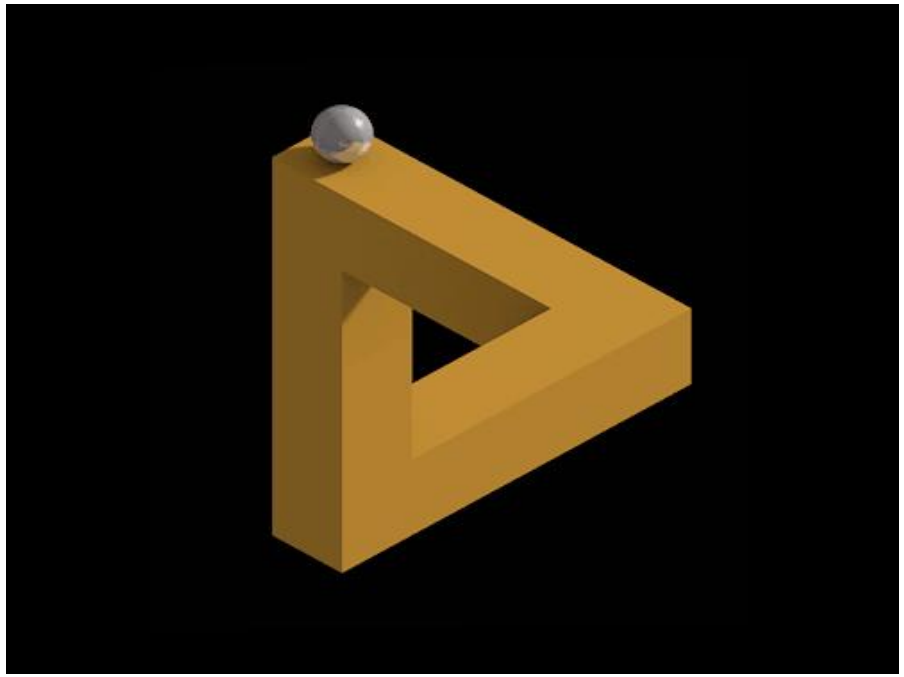
THE MAGIC OF OUR VISION: COLORS, ILLUSIONS, AND HOW WE SEE THE WORLD



COMPILED BY HOWIE BAUM

THE MAGIC OF OUR VISION
COLORS, ILLUSIONS, AND HOW WE SEE THE WORLD

Sight feels effortless — but what actually happens between light entering your eye and the moment you perceive the world, is one of nature's most remarkable processes.

This presentation travels from the basic mechanics of the eye through the brain's role as master interpreter, into the science of color, and across the wildly varied ways other creatures see.

WHAT WE WILL COVER · 8 SECTIONS · 2.5 HOURS

1. **The Miracle of Our Sight** — 20 min
2. **The Brain's Role in Vision** — 15 min
3. **The Beauty of Color** — 20 min
4. **Through Different Eyes** — 20 min

Break (~10 min)

5. **Vision Impairments** — 15 min
6. **Brain-Vision Conditions** — 15 min
7. **Optical Illusions Showcase** — 35 min
8. **Wrap-Up & Q&A** — 10 min

PART 1

THE MIRACLE OF OUR SIGHT

Before we can understand illusions, color, or brain conditions — we need to understand the remarkable instrument that makes vision possible.

In this section:

- Basic anatomy of the eye
- How light becomes a signal
- The optic nerve & visual cortex
- The blind spot
- Why we need two eyes

Basic Anatomy of the Eye

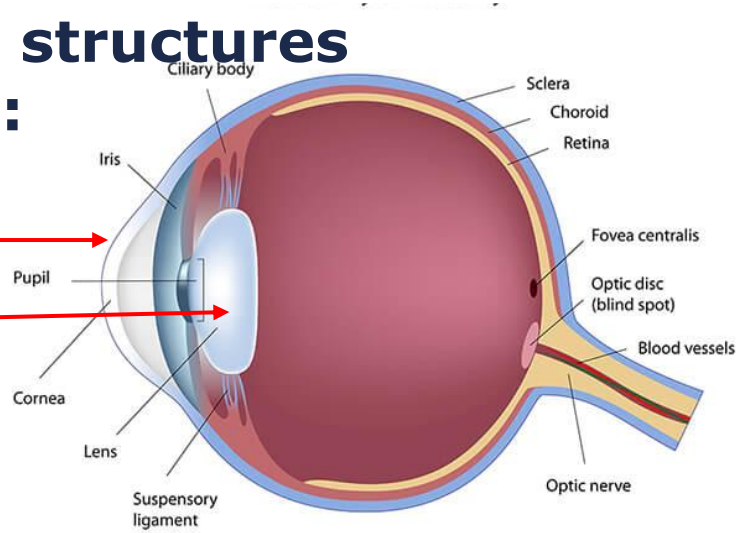
The eye is made up of several remarkable structures working in perfect coordination:

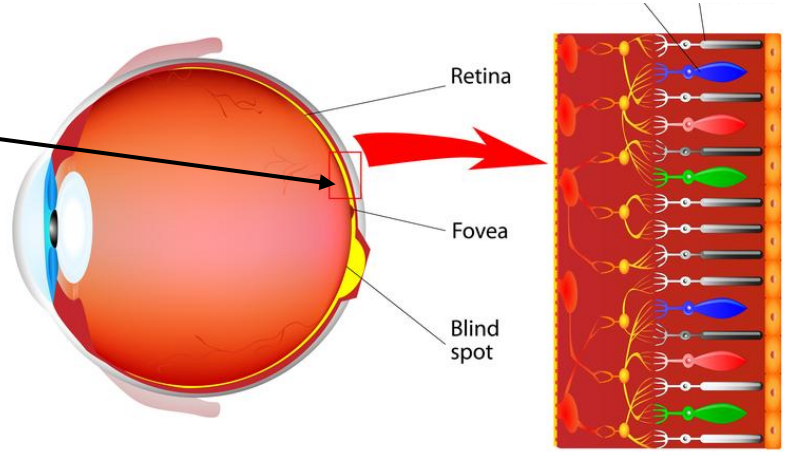
The **Cornea** at the front of the eye bends light as it enters; the **lens** fine-tunes the focus.

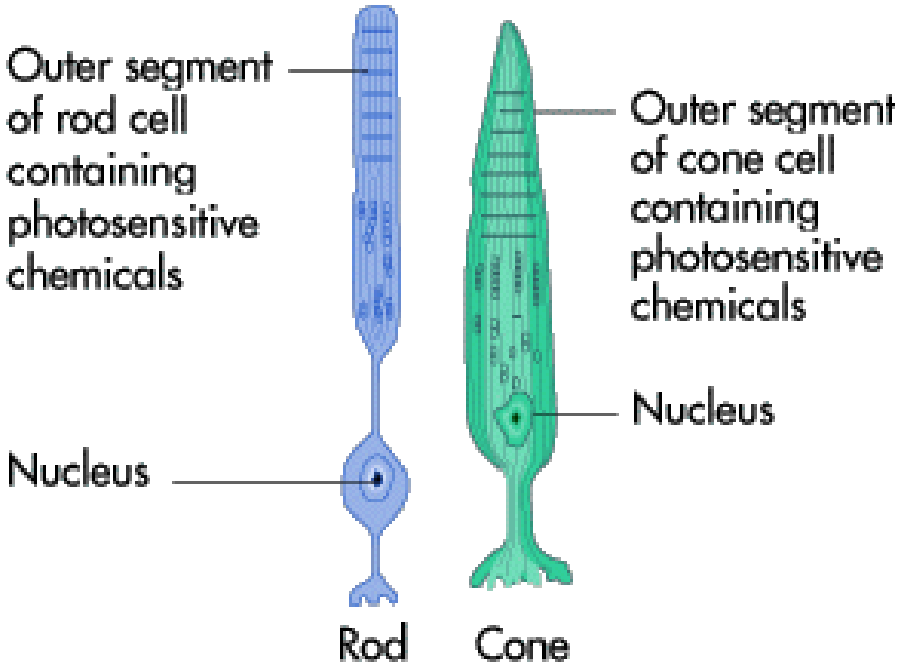
The **Retina** — a thin layer at the back of the eye, where light is detected by 2 types of photoreceptors:

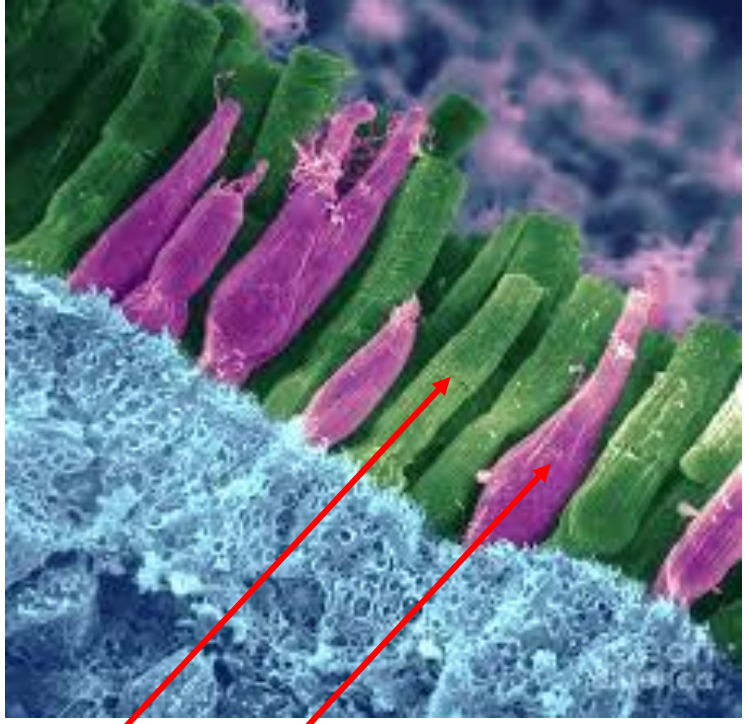
Rods, which handle low-light and motion detection

Cones, which handle color and fine detail





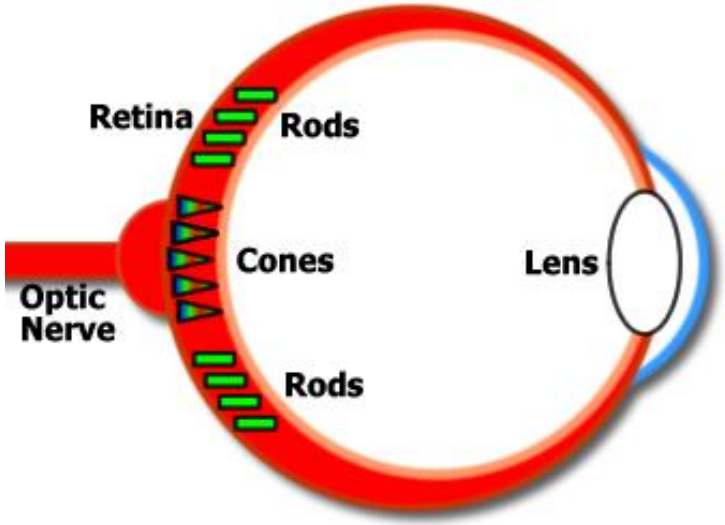




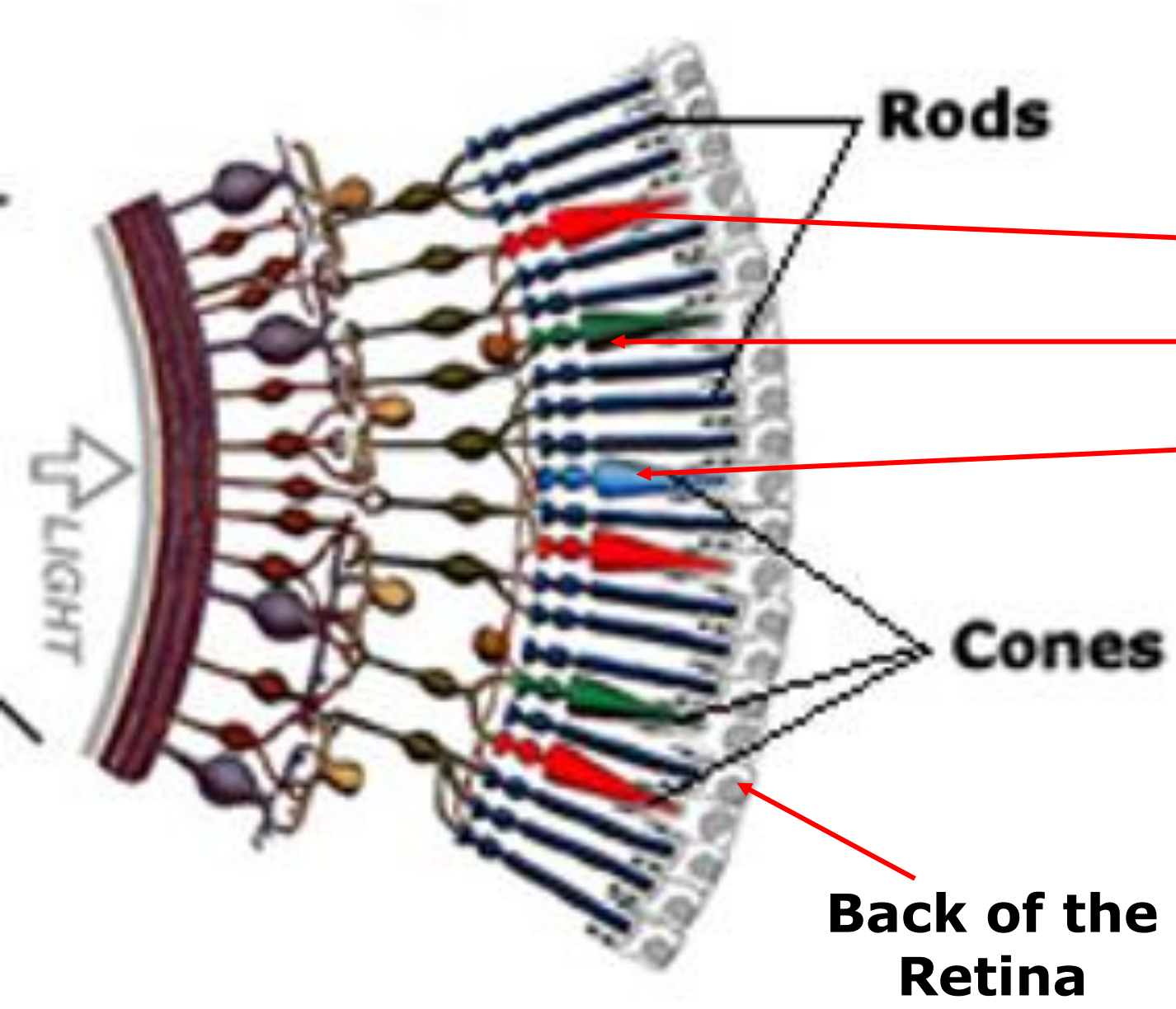
The eye contains about 120 million rods and 6–7 million cones.

Rods are responsible for our night and motion vision

Cones for our day and color vision.



THE 3 COLORS THAT CONES SENSE



There are 3 types of cones in the retina that sense colors we see.

Red

Green

Blue

They absorb those 3 specific colors and convert them into electrical signals that go to the brain, through the optic nerve.

The brain compares these overlapping signals to let us see millions of colors in clear images.

THE MACULA AND FOVEA

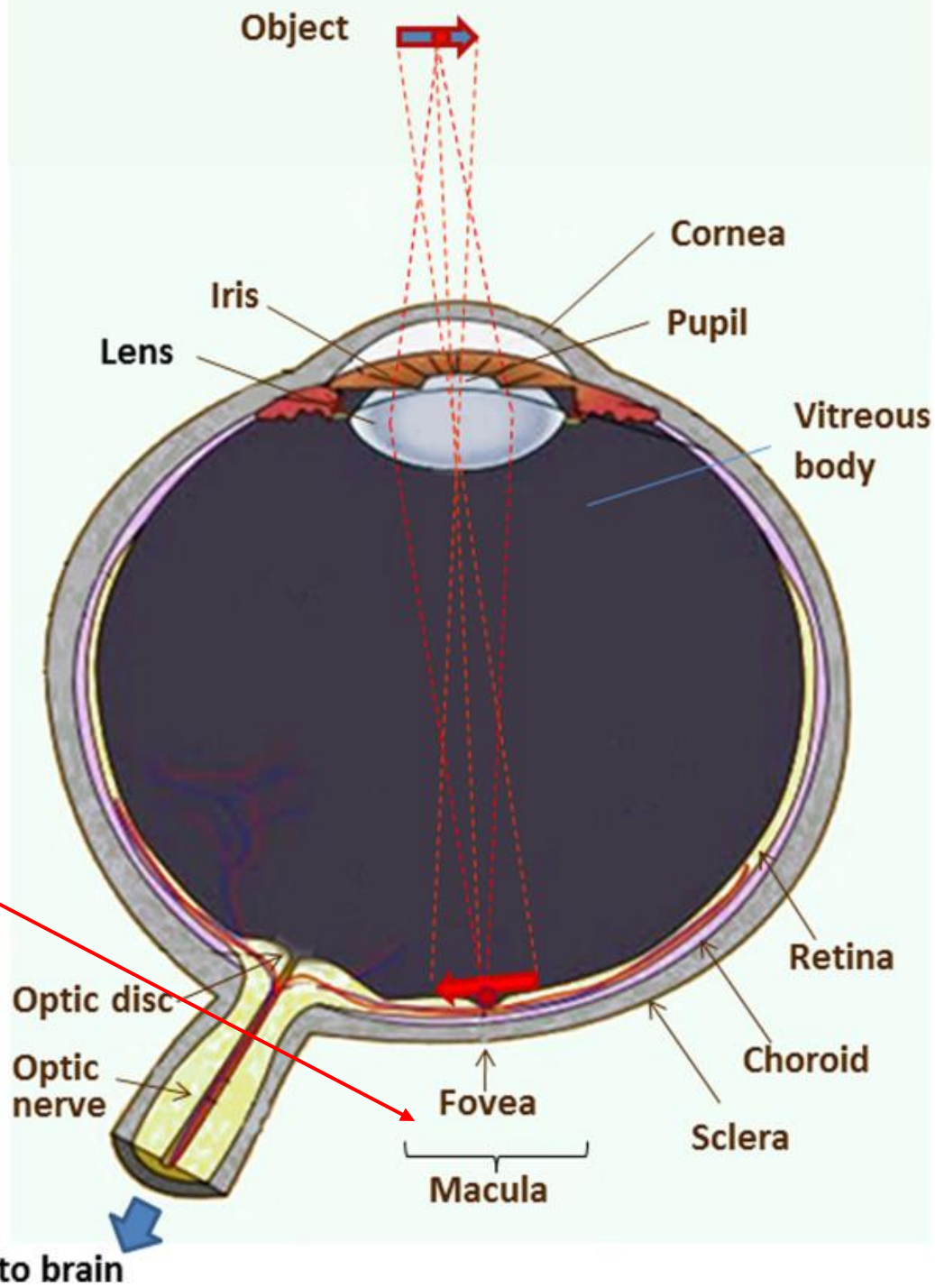
Light is focused by the cornea and lens onto the fovea, which is at the center of the macula. (macular degeneration)

6 million cones are concentrated there.

It is only 2% of the retina but responsible for all sharp, central vision.

•Our eyes have a "blind"spot on the retina where the optic nerve connects to the eye.

Any light falling there produces no visual signal, creating a small gap in your field of vision, that your brain quietly fills in.



Vision and the Brain

More than Meets the Eye

THE 5 LOBES OF THE BRAIN

The cerebral cortex has a left and a right hemisphere.

It contains 5 lobes, shown in the colors below:

1) Frontal lobe (red)

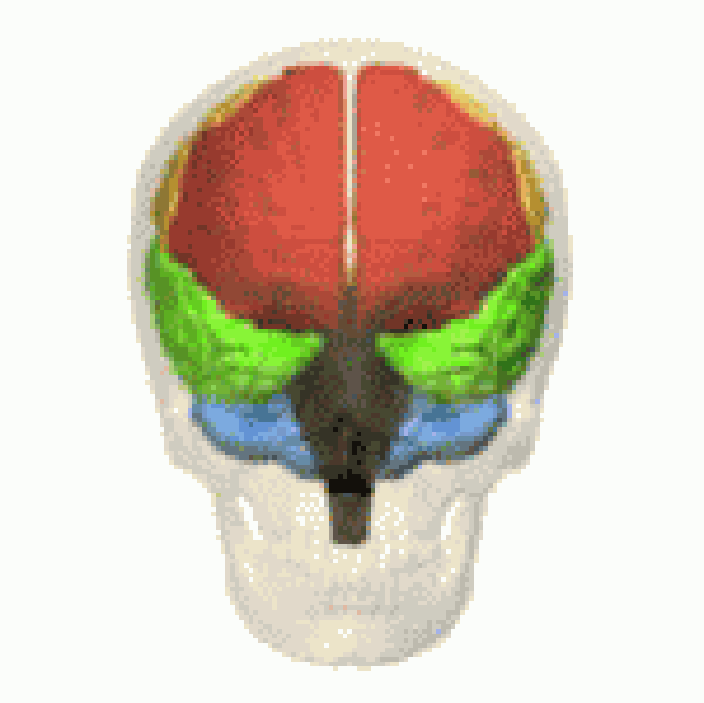
2) Temporal lobe (green)

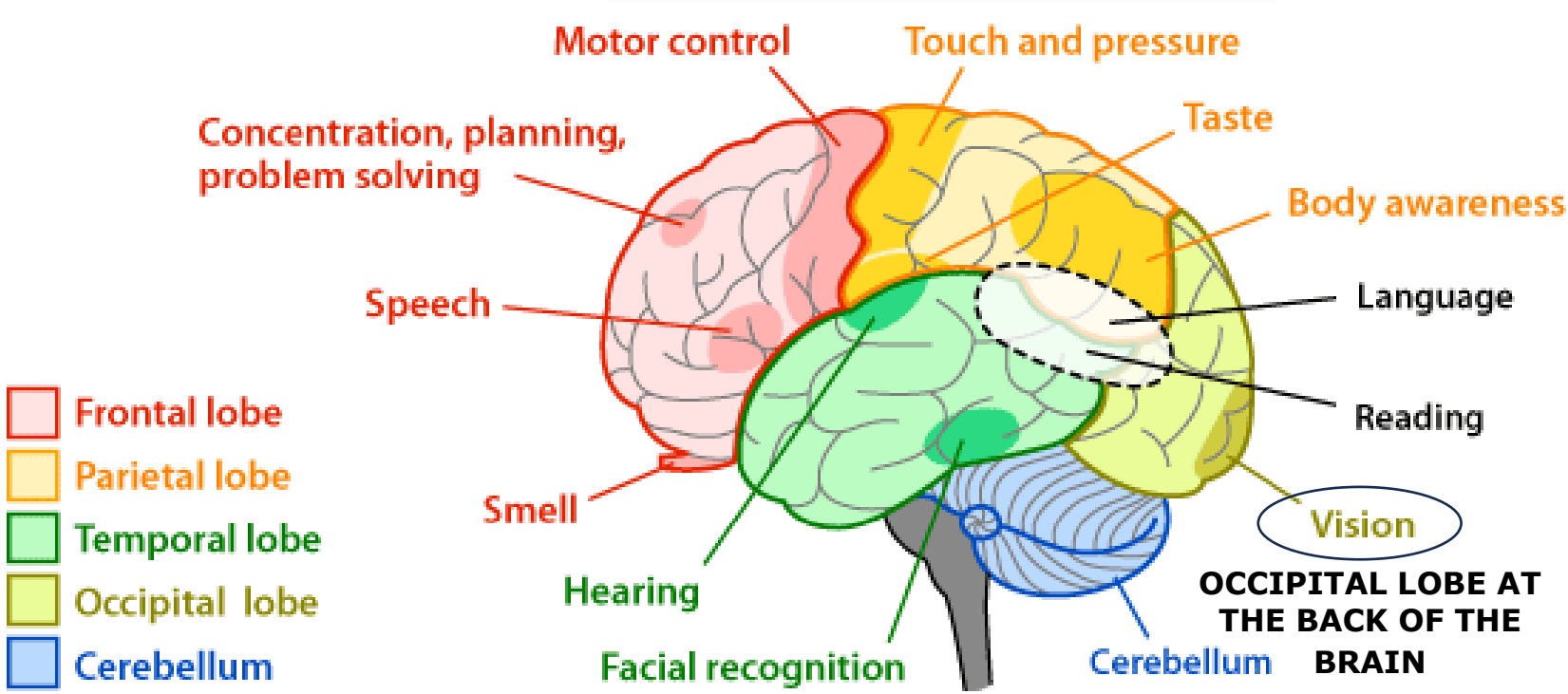
3) Occipital lobe for vision (light green)

4) Parietal lobe (yellow-orange)

5) Cerebellum (blue)

They specialize in various areas of thought and memory, of planning and decision making, and of speech and sense perception.

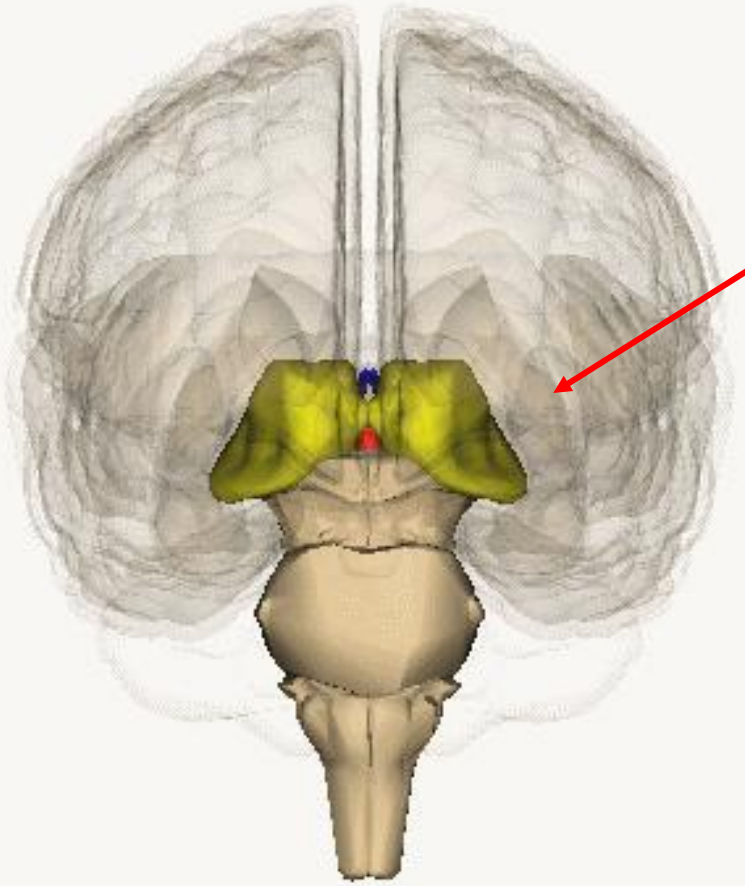


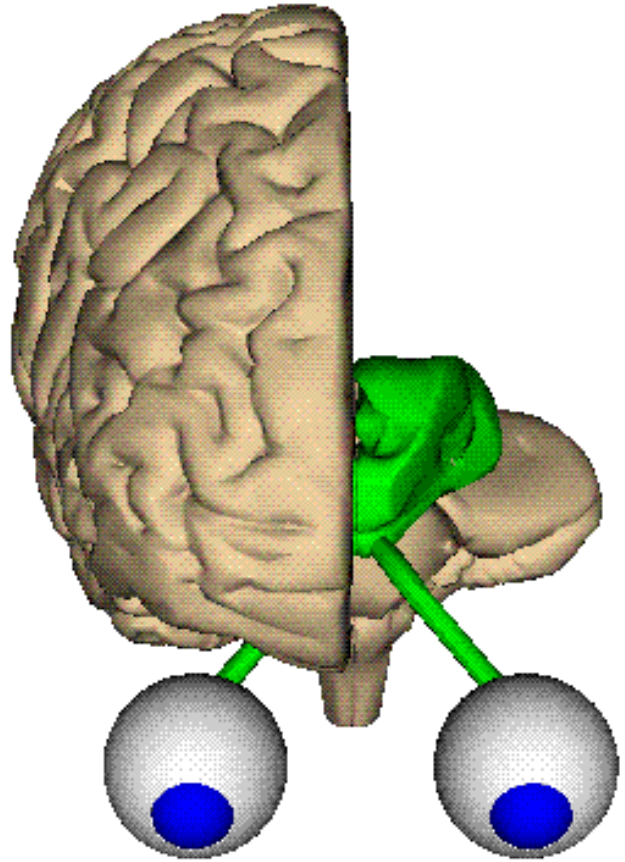


OCCIPITAL LOBE AT THE BACK OF THE BRAIN

Vision starts in the retina of the eye, where photoreceptor cells convert light into electrical signals.

These signals travel through the optic nerve) to the **thalamus** and then to the primary visual cortex in the **occipital lobe** at the back of the brain.





The **occipital lobe at the back of the brain** is one of the four major lobes of the cerebral cortex in the brain of mammals.

It is the visual processing center of the mammalian brain containing most of the anatomical region of the visual cortex.

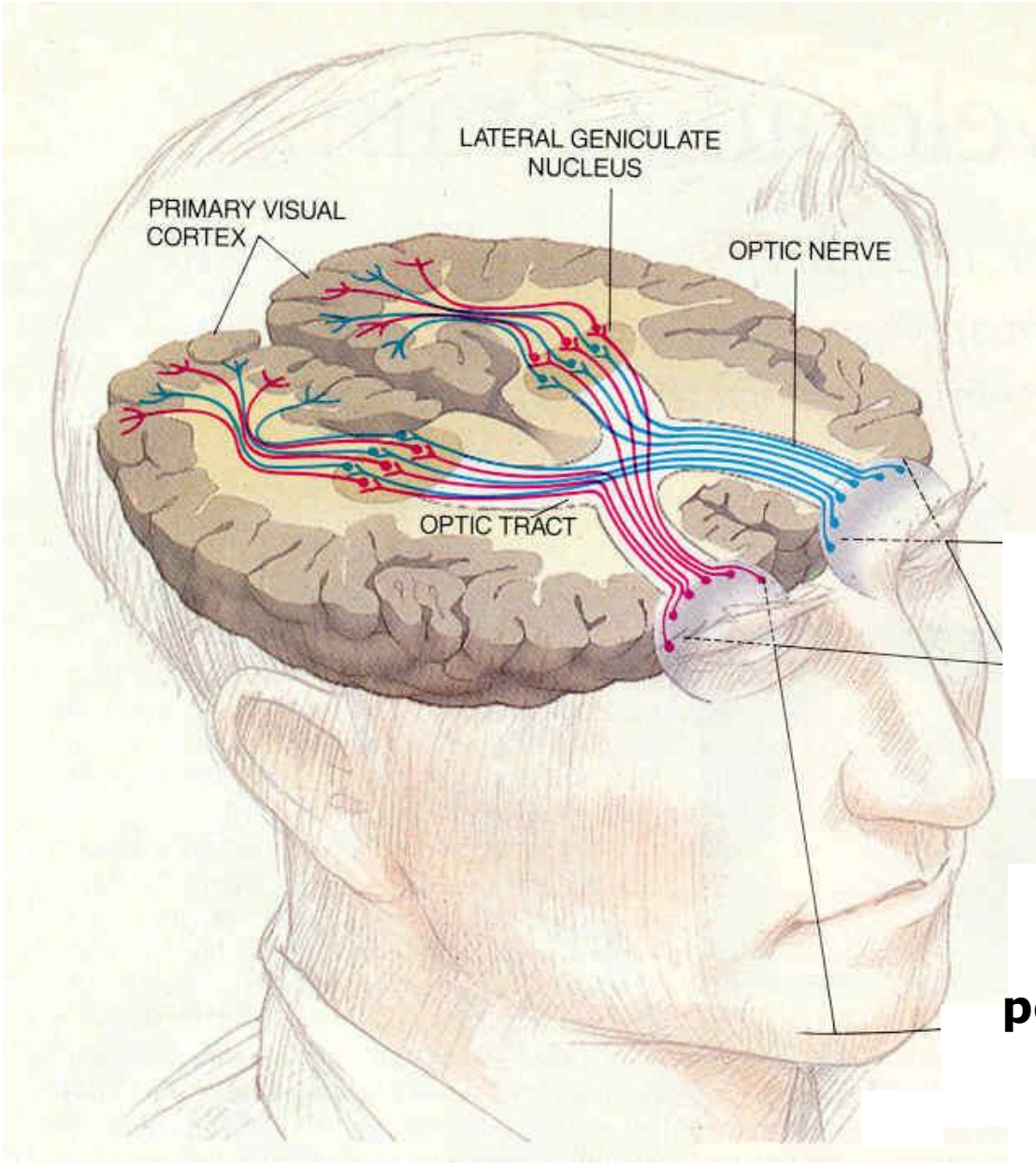
Avoid falling backwards or you can damage the occipital lobe which will affect your sight.

HOW OUR VISION WORKS

Light travels from our eye to our Brain

Optic nerve
- Made up of axons of ganglion cells, it carries neural messages from each eye to the brain.

Optic chiasm
- Point where part of each optic nerve crosses to the other side of the brain.



HOW VISUAL SIGNALS TRAVEL FROM YOUR EYES TO YOUR BRAIN

Each eye sends signals to both sides of the brain.

At the **optic chiasm**, fibers from the inner half of each retina cross to the opposite side.

The result:
Everything you see on your left reaches the right occipital lobe, and everything on your right reaches the left.

This gives the brain two views of the same scene, for depth perception.

We need two eyes for depth perception and binocular vision.

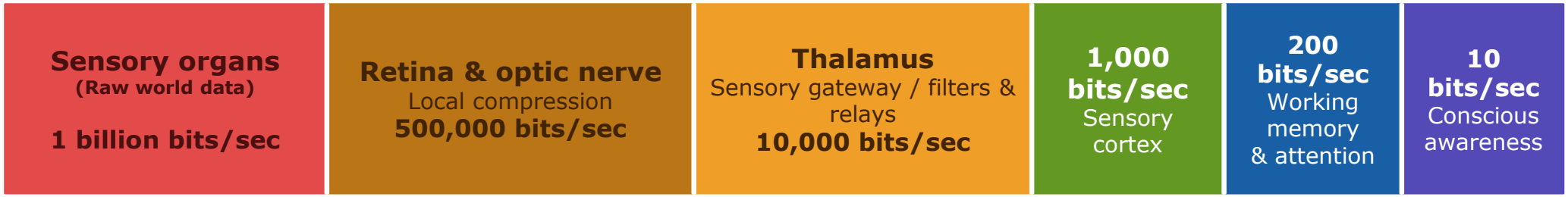
Our brains process an incredible 1 billion bits of information per second, through our 5 senses !

Only 10 bits per second make it to our conscious awareness. That's just 0.000001% of the total sensory input!

The rest is automatically filtered out by our brain, to keep us from being overwhelmed.

FROM 1,000,000,000 (BILLION!) BITS/SEC DOWN TO 10 BITS OF CONSCIOUS THOUGHT

How the brain filters sensory information at each stage



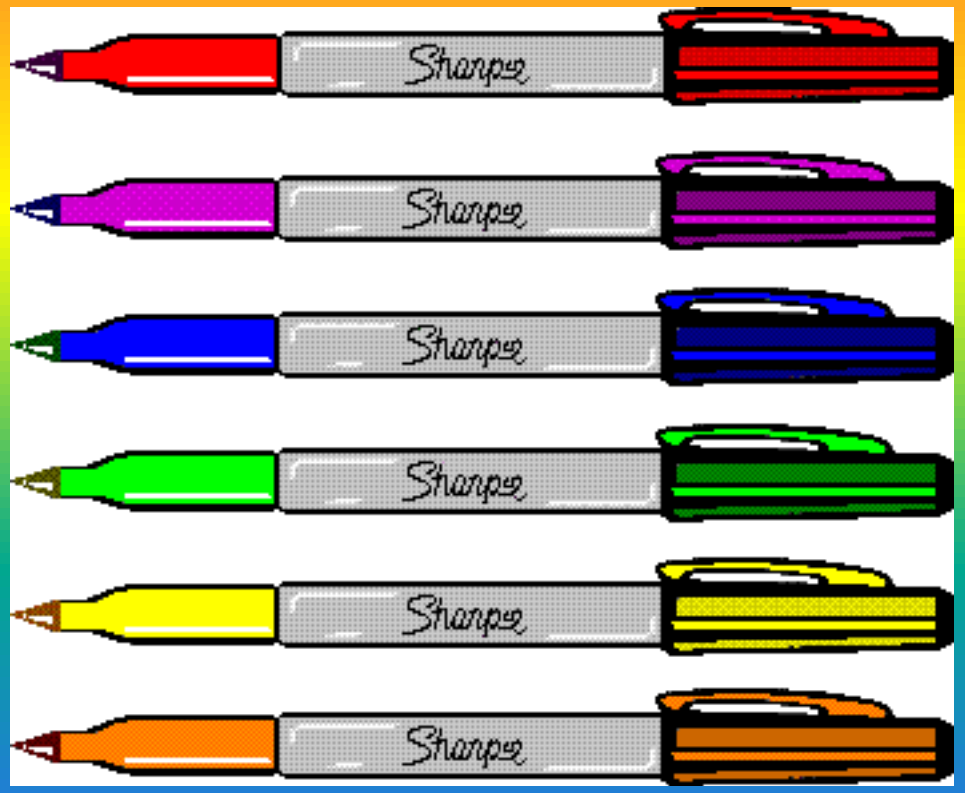
STAGE-BY-STAGE BREAKDOWN:

Sensory receptors	**Eyes, ears, skin, nose, tongue — raw environmental data**	**1,000,000,000**
Retina & optic nerve	**Edge detection; ~1M optic nerve fibres compress the signal**	**~500,000**
Thalamus	**Sensory gateway — filters noise, relays relevant signals to cortex**	**~10,000**
Sensory cortex	**Pattern recognition, object identity, feature extraction**	**~1,000**
Working memory & attention	**Prefrontal cortex selects what to hold in focus right now**	**~200**
Conscious awareness	**What you actually 'experience' at any given moment**	**~10 bits/sec**

Source: Zimmermann (1989) sensory bandwidth estimates · Updated conscious cap ~10 bits/sec: Zheng & Meister, Caltech (2024) · Bar widths proportional to data removed at each stage

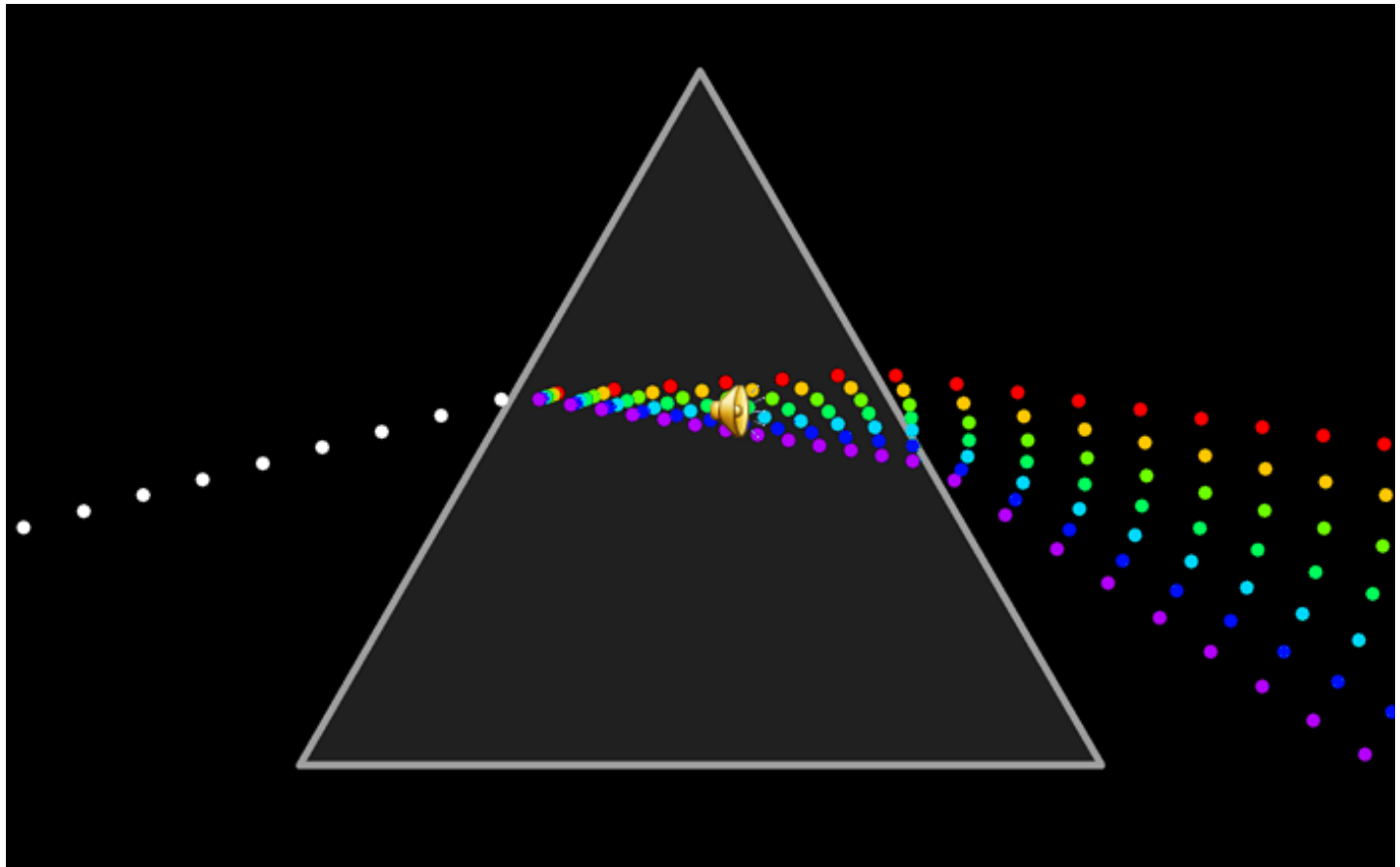
THE BEAUTY OF COLOR

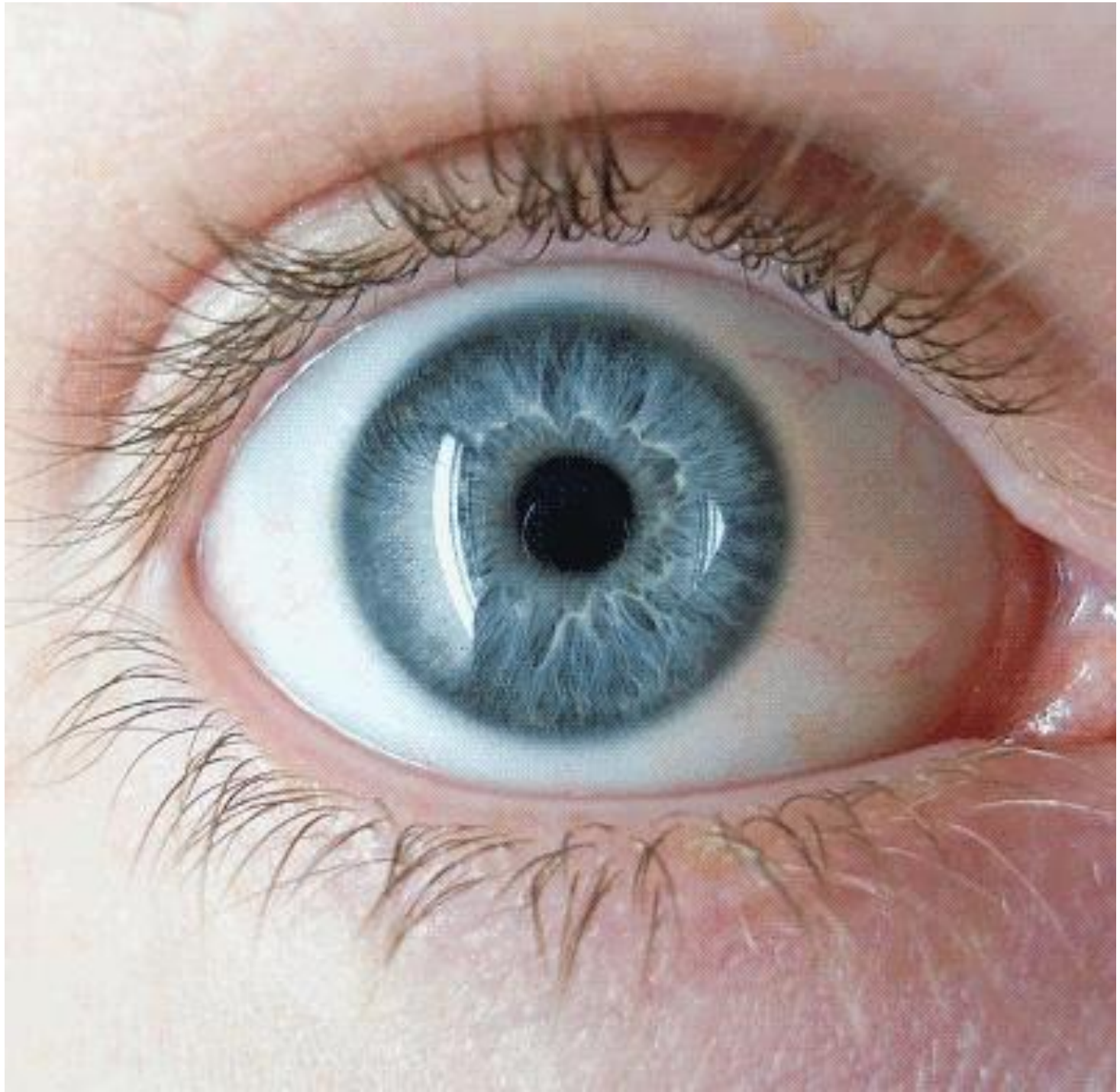
OUR SIGHT'S MOST EXCITING ELEMENT

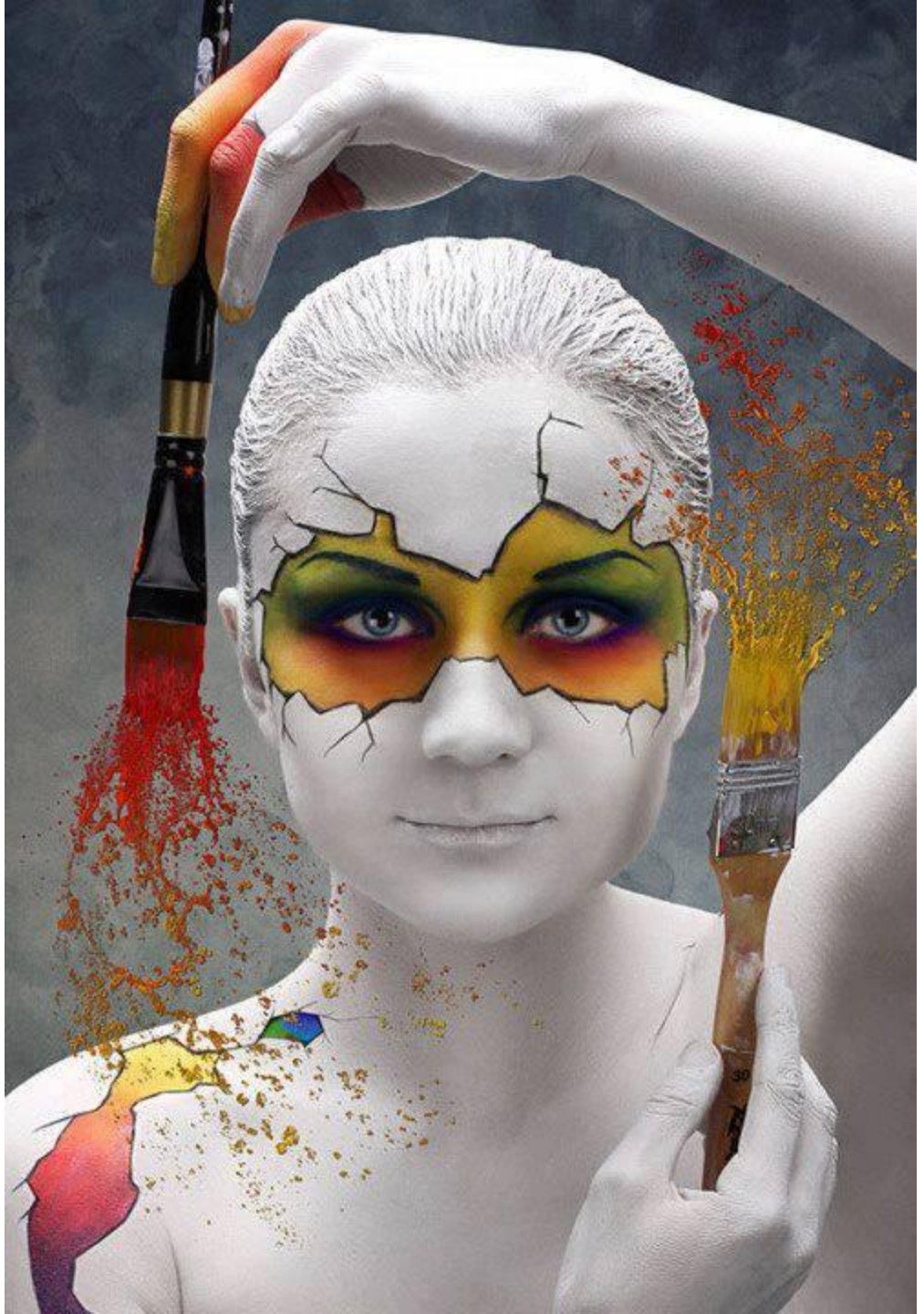


White light is not a single colour; it is made up of a mixture of the seven colors of the rainbow.

We can demonstrate this by splitting white light with a prism:







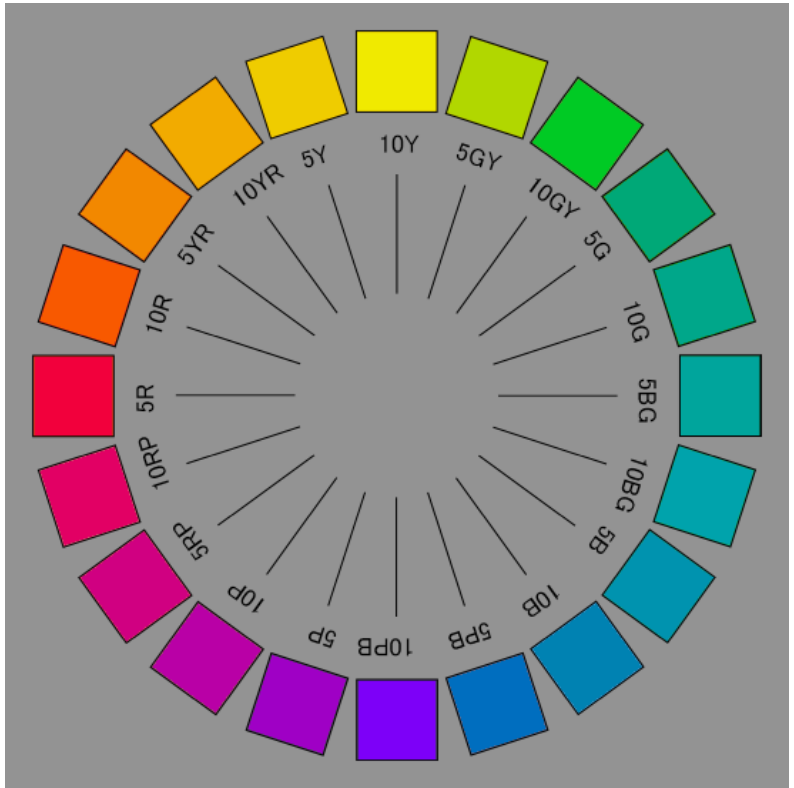
COLOR EMOTION GUIDE

COLOR HAS 3 DIMENSIONS OR QUALITIES

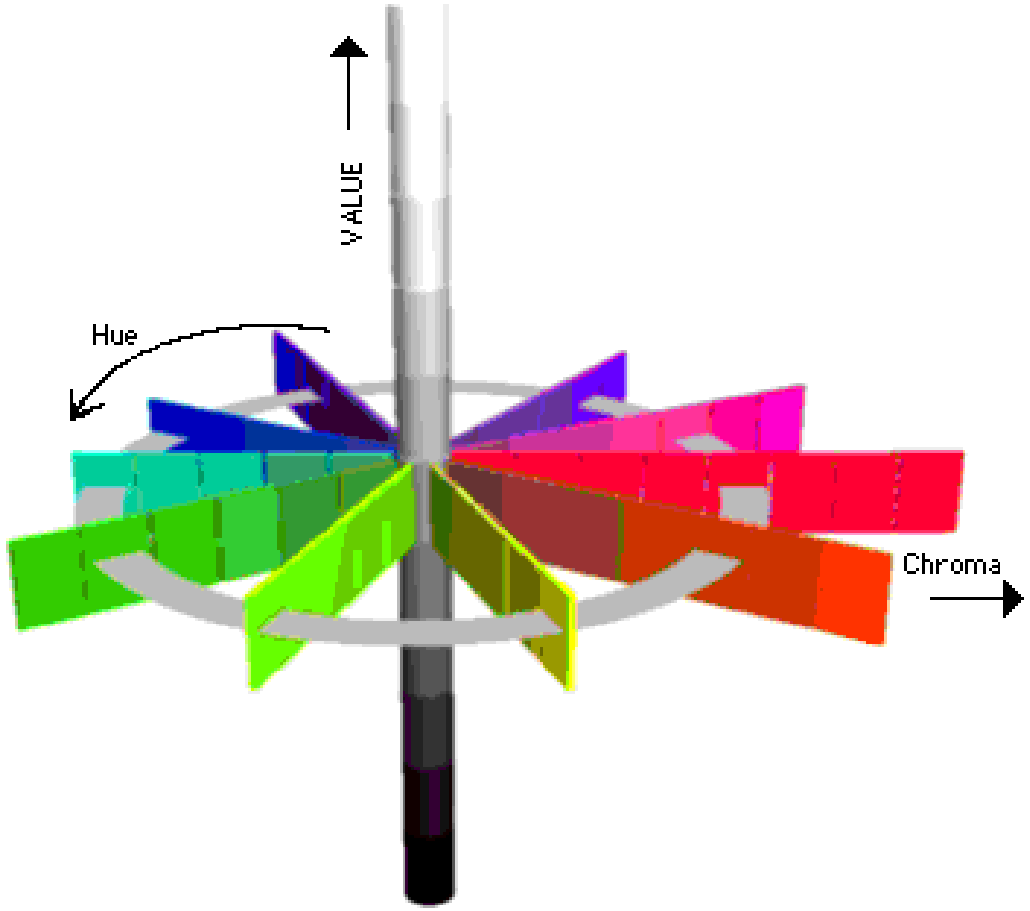
Hue

Value

Intensity (Chroma)



Hue, Value and Chroma on the Munsell Color Wheel

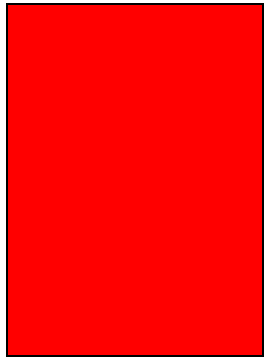


This is a computer-generated simulation of the 3-d Munsell model. The colors are not accurate.

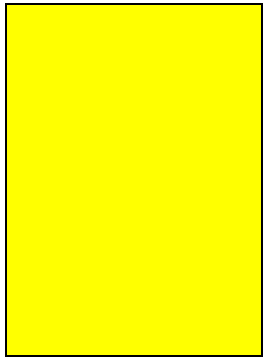
Adapted with permission from San Diego Supercomputing Center, 1991.

HUE

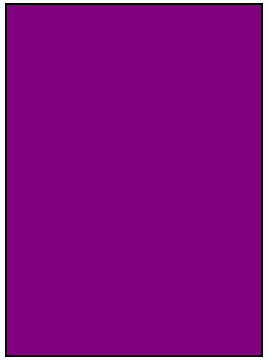
The name given to a color.



RED



YELLOW



VIOLET

VALUE

The lightness or darkness of a color

TINT

Made by adding white to a color so that it is lighter.

HUE + WHITE = TINT

SHADE

Made by adding black to a color so that it is darker.

HUE **BLACK** **SHADE**

INTENSITY

The brightness or dullness of a color.

FUSCHIA - HIGH INTENSITY

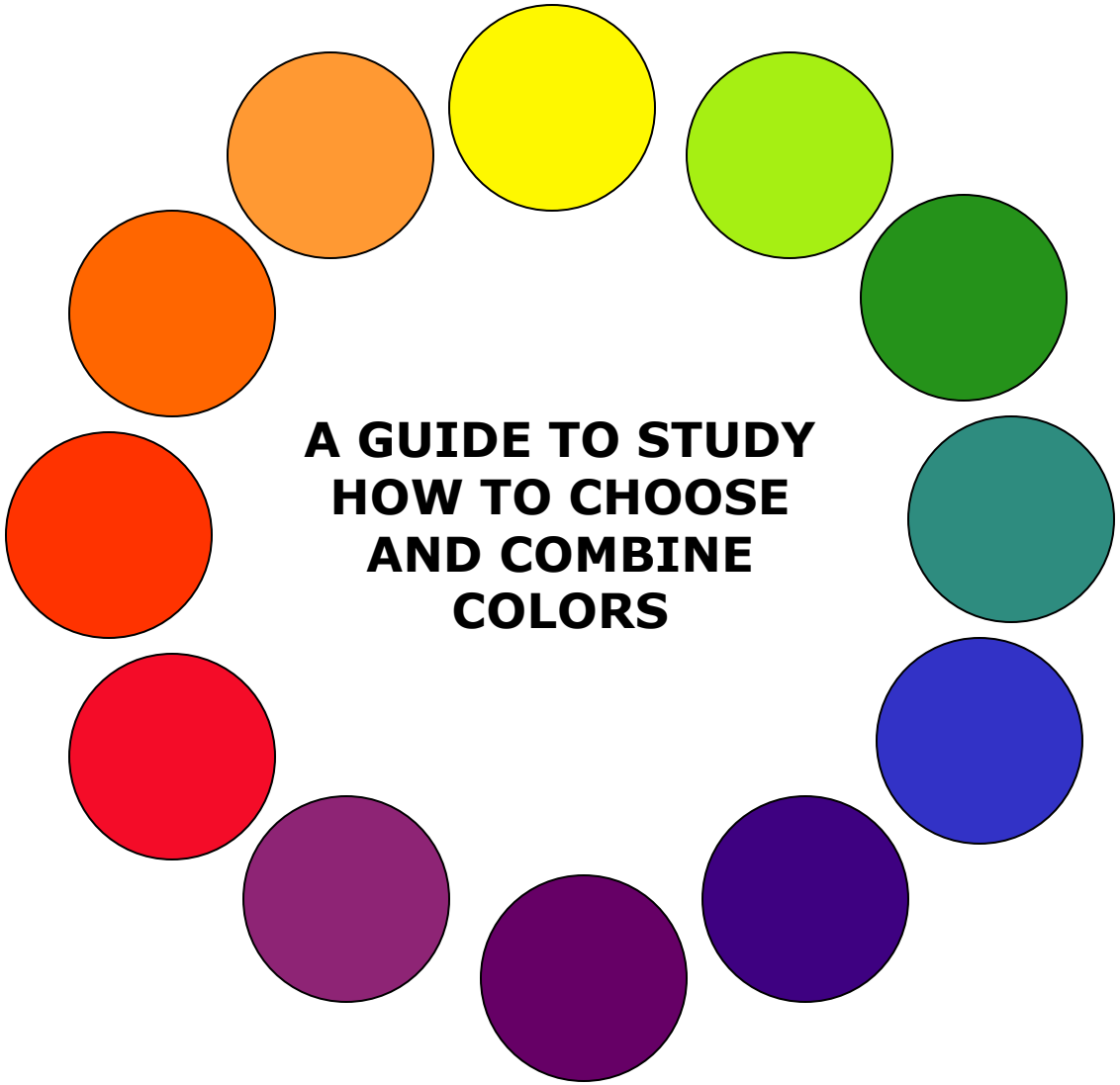
OLIVE - LOW INTENSITY

NEUTRALS

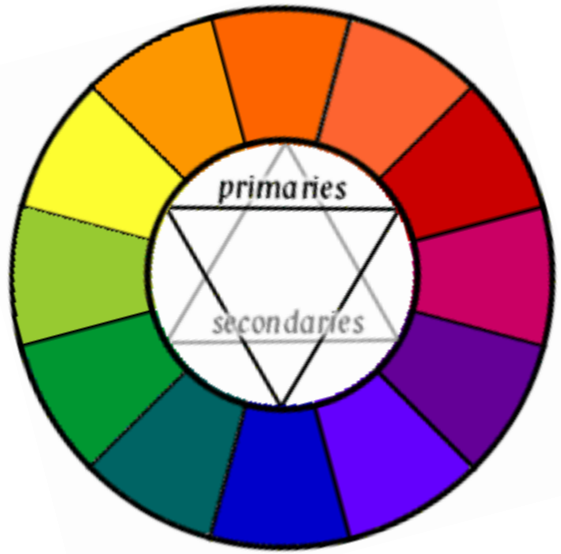
(NOT REALLY COLORS)

White		**No color**
Black		**All colors**
Gray		**White + Black**
Beige		**Can be used with most colors**

COLOR WHEEL



A GUIDE TO STUDY HOW TO CHOOSE AND COMBINE COLORS



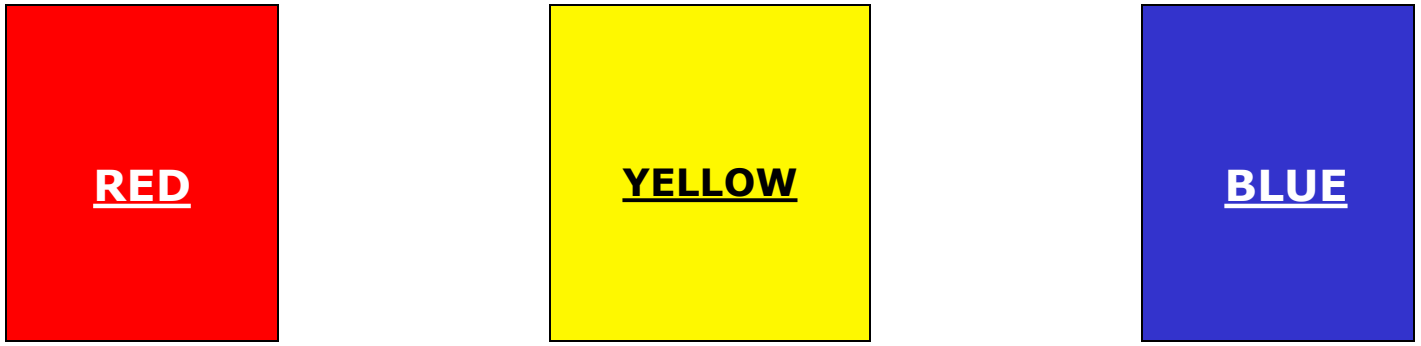
Standard Color Harmonies

Color Theory is a set of principles used to create harmonious color combinations.

Color relationships can be visually represented with a color

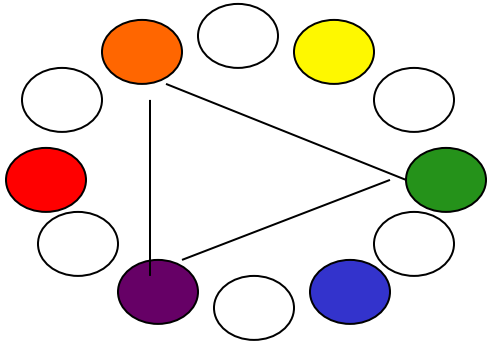
wheel — the color spectrum wrapped onto a circle.

PRIMARY HUES

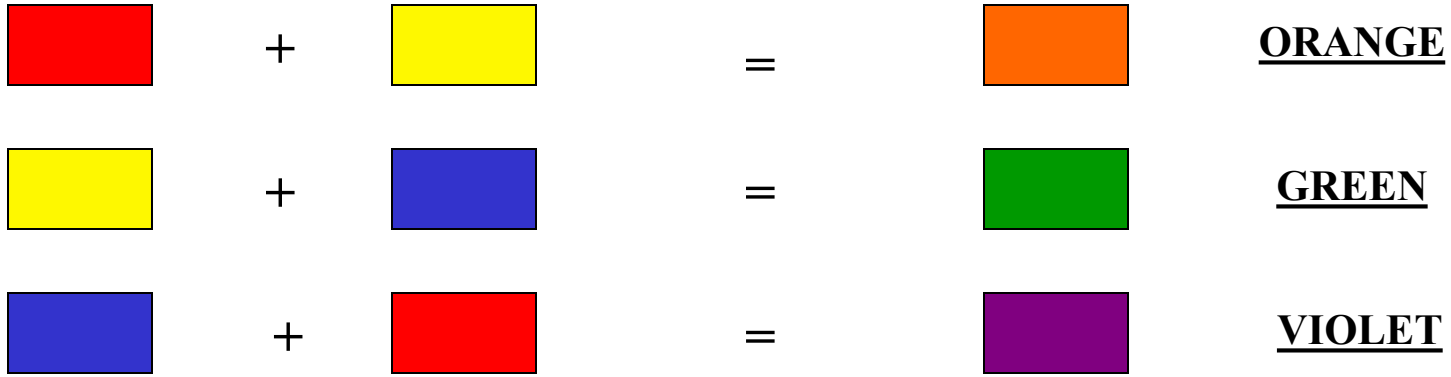


- Pure and basic
- Cannot be made from any other colors
- All other colors are made from these
- Equal distance from each other on color wheel

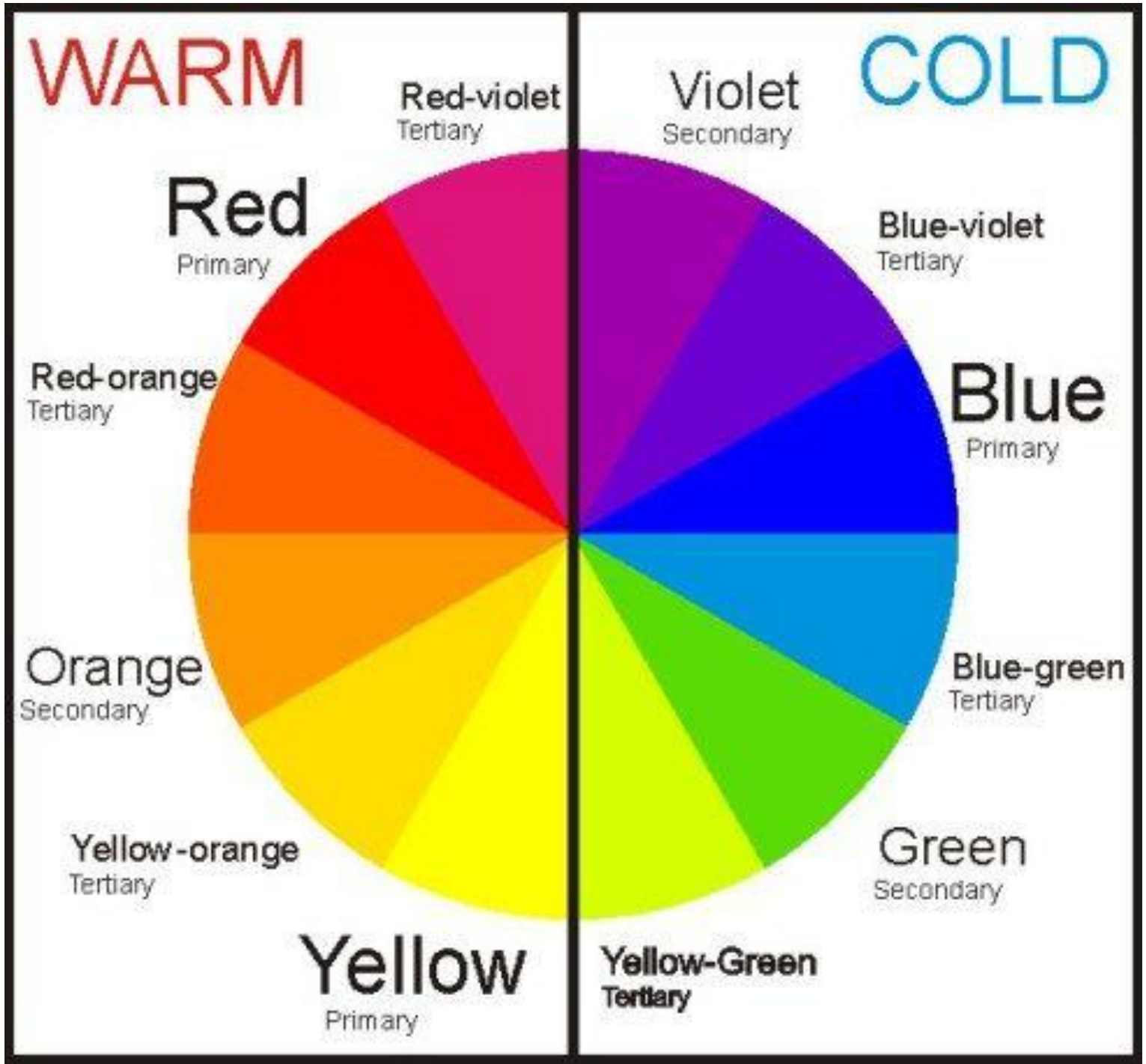
SECONDARY COLORS



- Made by mixing equal amounts of 2 primary colors
- Found halfway between the primary hues on the wheel

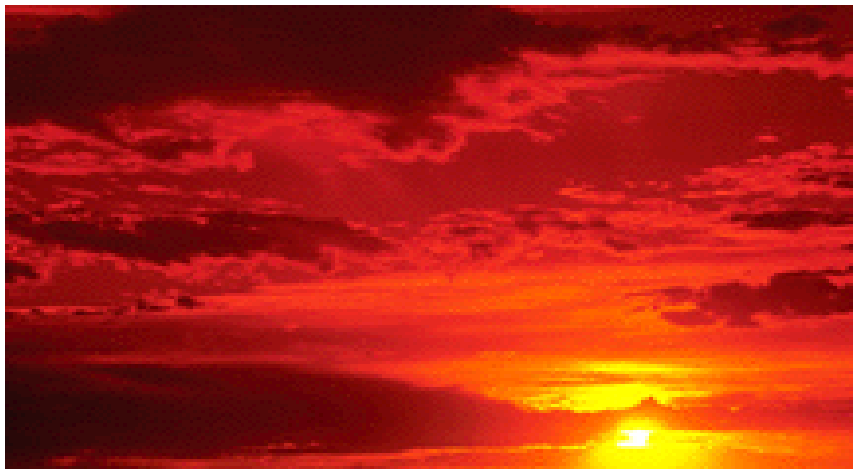


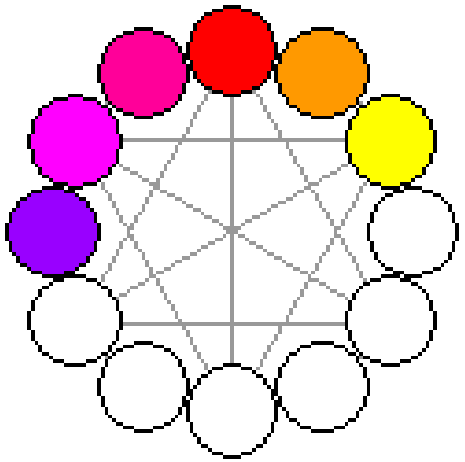
THE COLOR WHEEL CAN BE DIVIDED INTO WARM AND COOL COLORS


WARM
COLD
Red-violet
Tertiary
Violet
Secondary
Red
Primary
Blue-violet
Tertiary
Red-orange
Tertiary
Blue
Primary
Orange
Secondary
Blue-green
Tertiary
Yellow-orange
Tertiary
Green
Secondary
Yellow
Primary
Yellow-Green
Tertiary

WARM COLORS

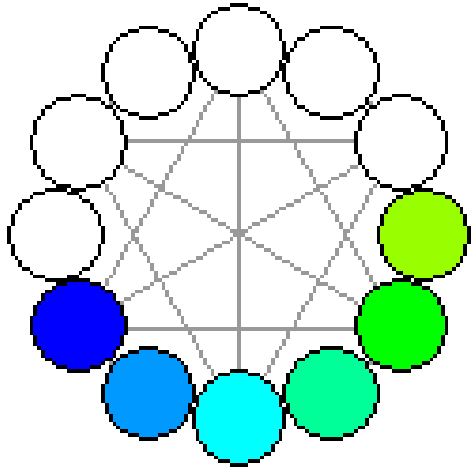
- ❖ Appear hot like the sun or like fire
- ❖ Give feelings of gaiety, activity or cheerfulness
- ❖ Appear to advance-they make body look larger
- ❖ Can give a nervous impression if overdone





COOL COLORS

- Remind us of water or sky
- Give feelings of quietness or restfulness
- Appear to recede and make body look smaller
- Can be depressing if overdone




active
range
passive
range

HARMONY OF COLORS

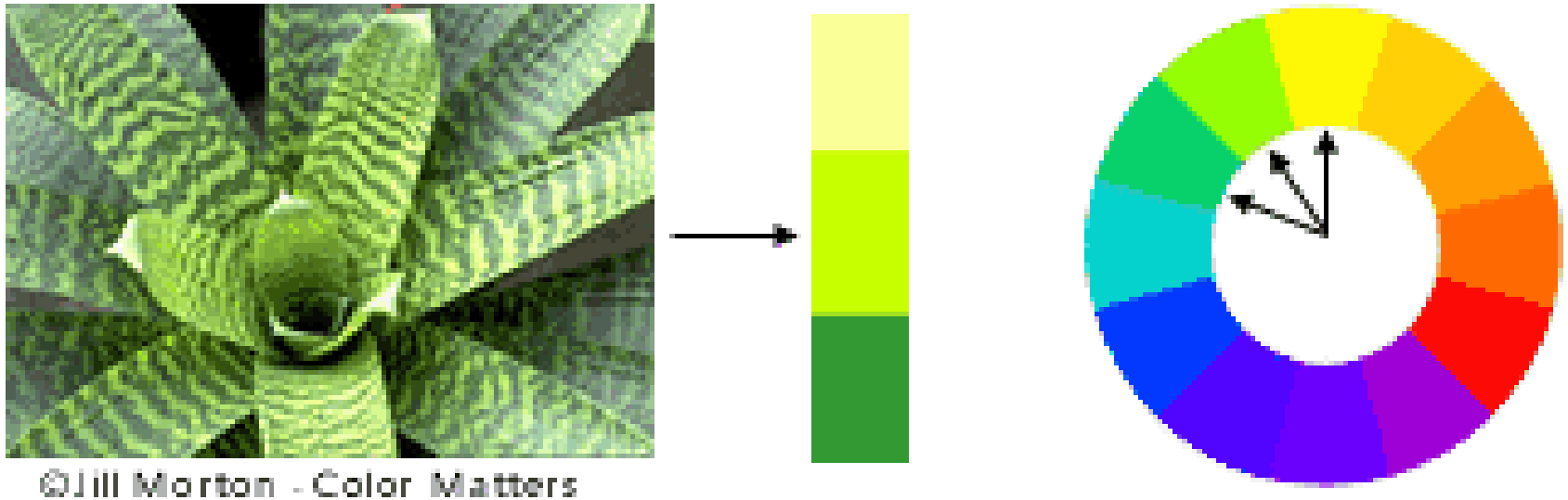
Harmony can be defined as a pleasing arrangement of parts, whether it be music, poetry, colors, or even an ice cream sundae.

In visual experiences, harmony is something that is pleasing to the eye.

Color harmony delivers visual interest and a sense of order.

There are many theories for harmony. The following illustrations and descriptions present some basic formulas .

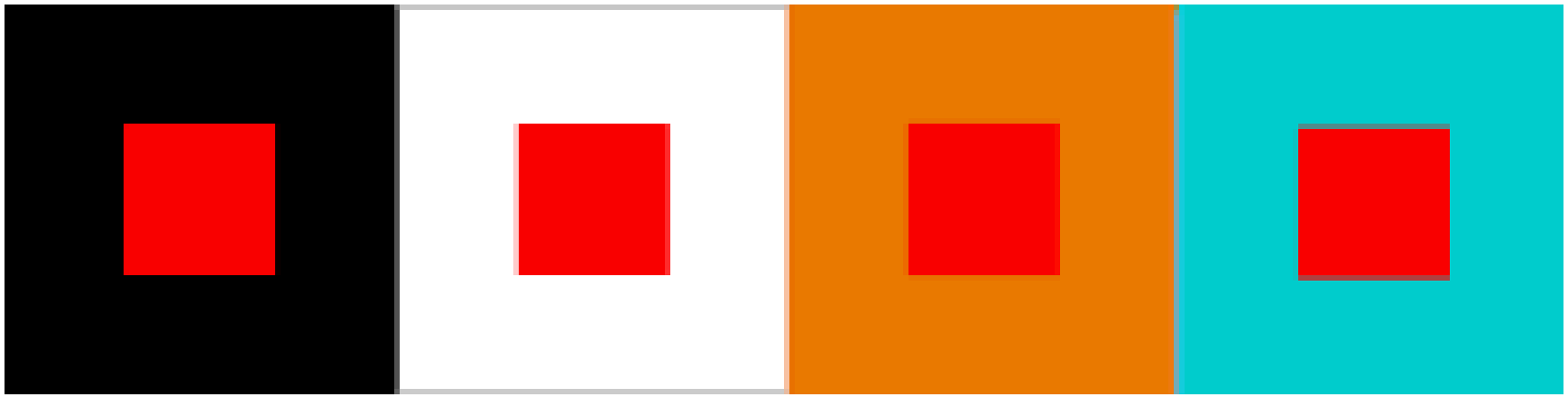
A color scheme based on analogous (those next to each other on the color wheel)



Color Context

How color behaves in relation to other colors and shapes is a complex area of color theory.

Compare the contrast effects of different color backgrounds for the same red square.



Remember that most colors carry physiological, cultural, personal, emotional, anc expressive implications.

Brands have certain colors that let people identify who they are and if different colors are used, it can be confusing

Brand Identity: Unnatural Color


HEINZ
TOMATO
KETCHUP

THE GOOGLE CHROME LOGO AND HOW COOL IT LOOKS ON HIS HAIR !!

Synesthesia is a condition in which one sense (for example, hearing) is simultaneously perceived as if by one or more additional senses such as sight.

Another form of synesthesia joins objects such as letters, shapes, numbers or people's names with a sensory perception such as smell, color or flavor.

It happens equally in 2% to 4% of men and women.

This is how someone with synesthesia might perceive certain letters and numbers.

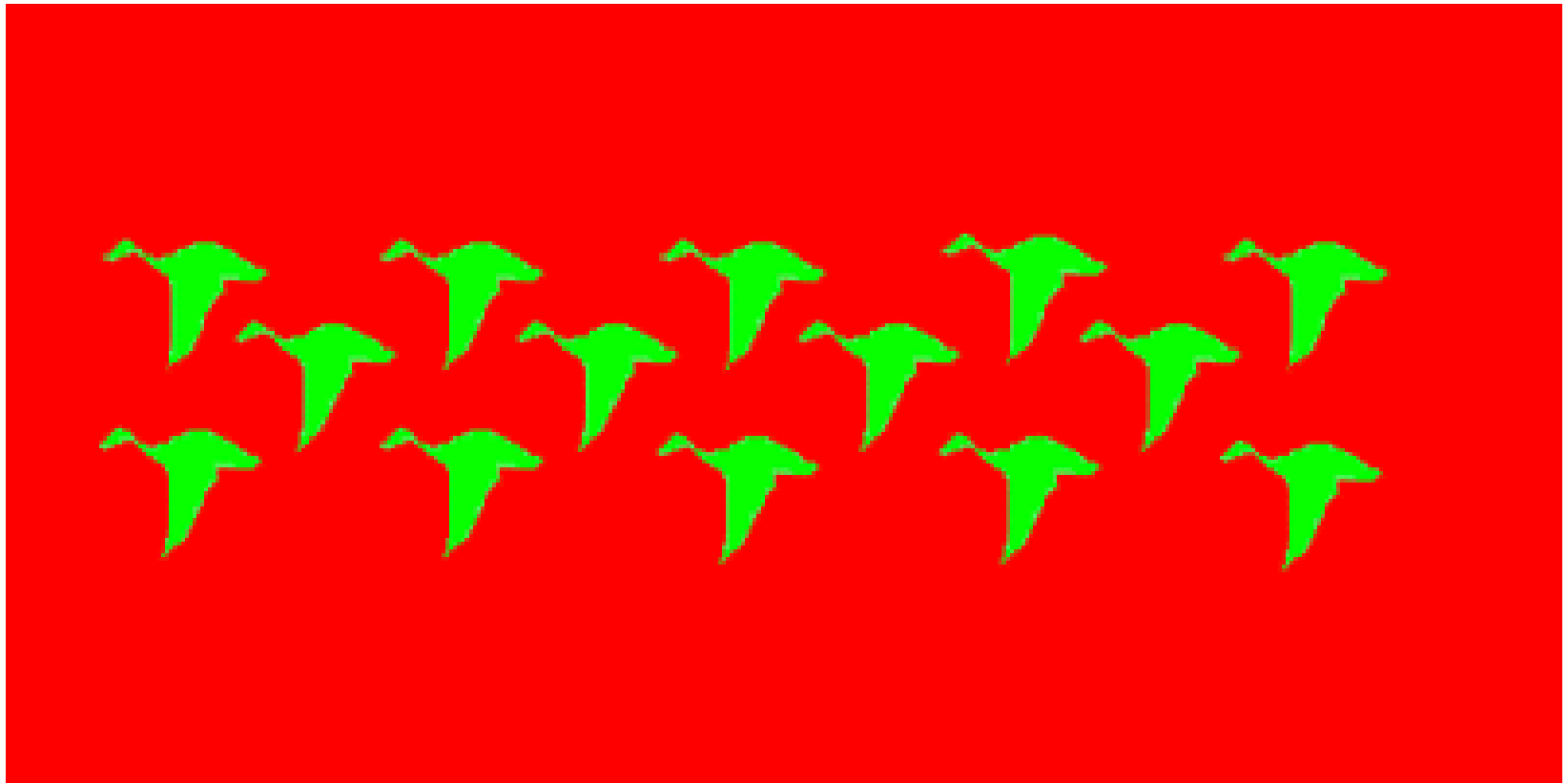
Some people even taste words or hear colors !

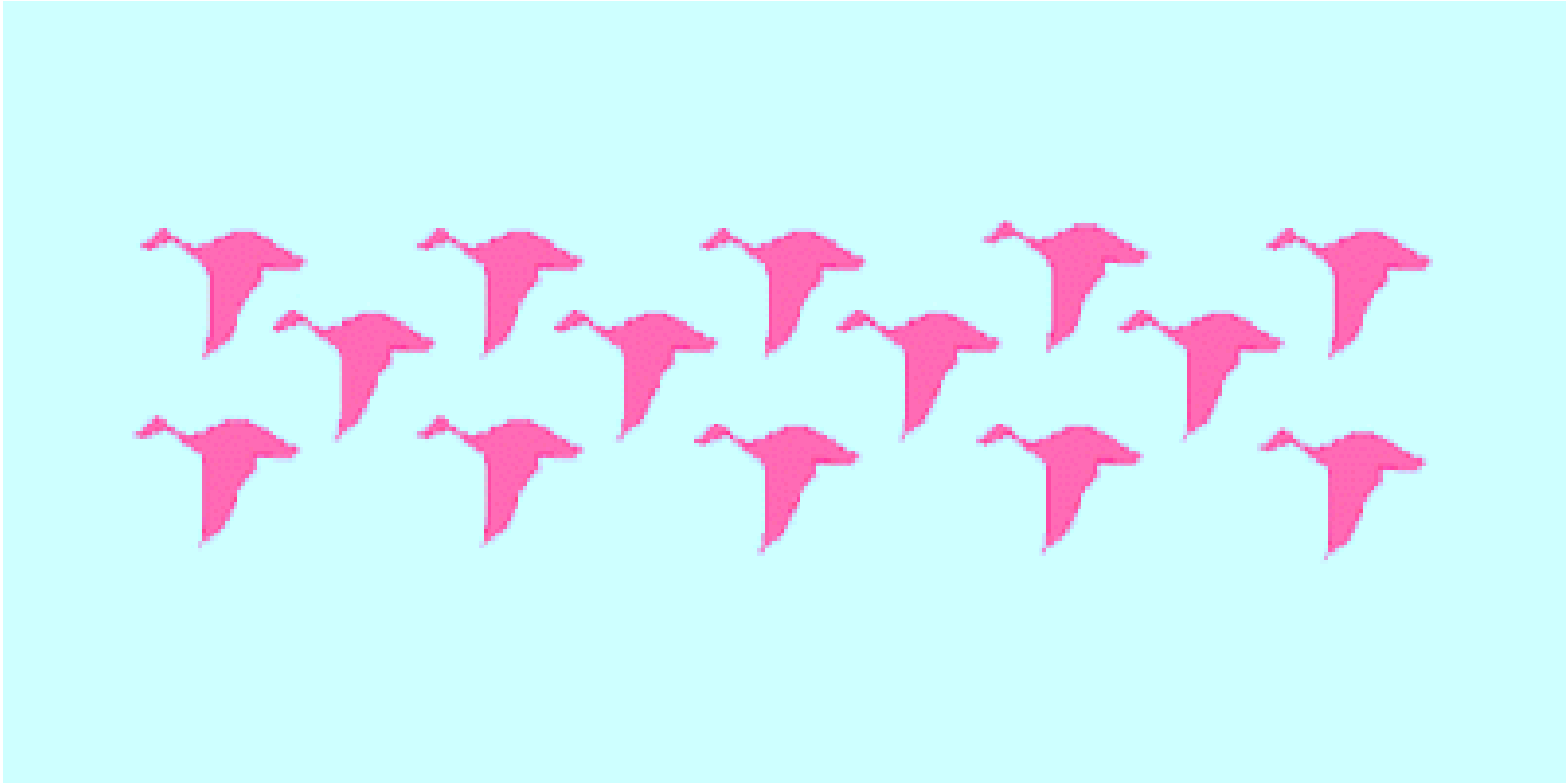
AFTER IMAGES

When our eyes are exposed to a hue for a prolonged period, the rods & cones become fatigued. You might notice this if you are reading something on colored paper and then look away—you often see the inverse, or complement, of the image.

Every color has an opposite, and although individual's perceptions do vary, the range of after images seen is consistent.

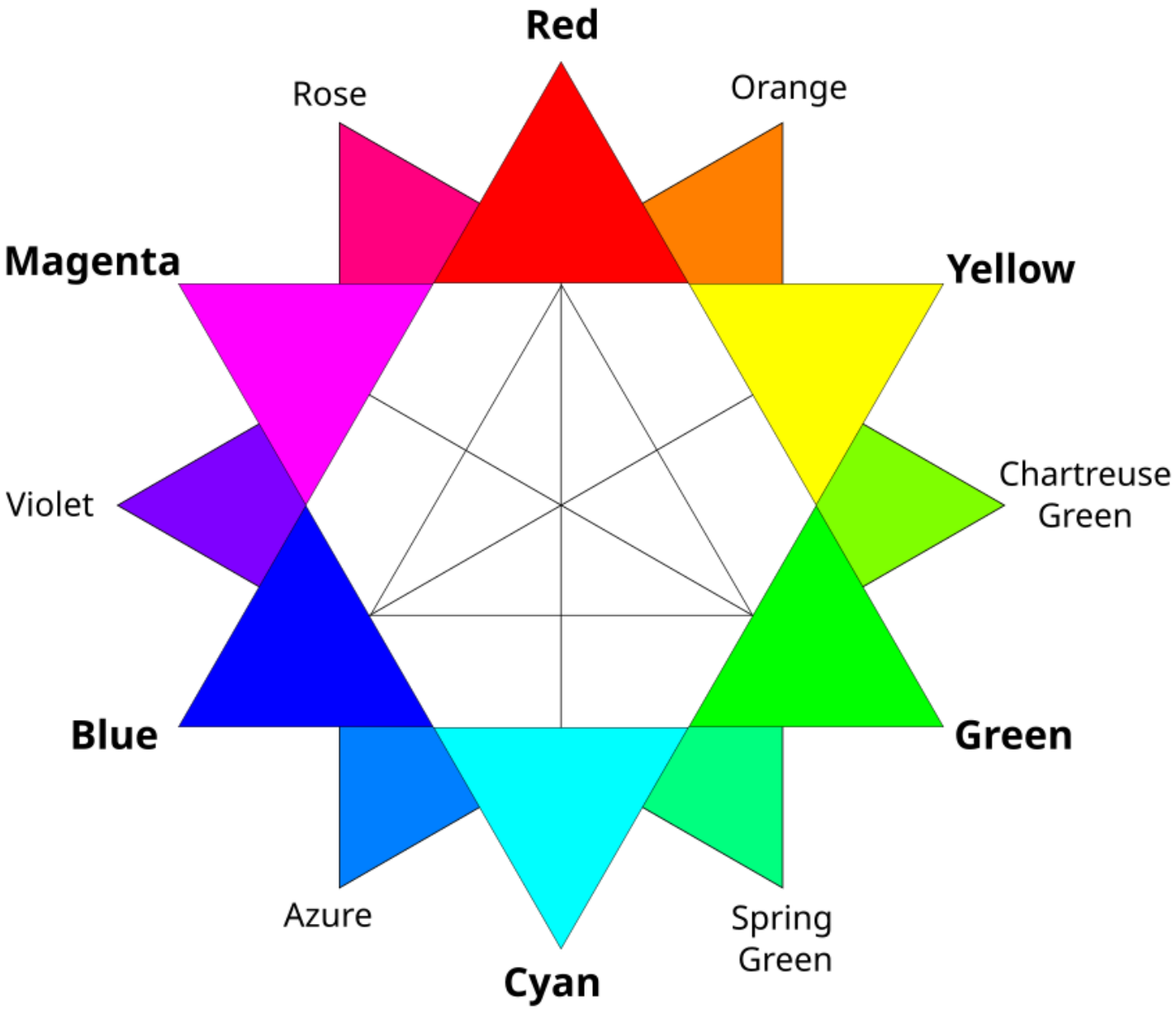
Take the After Image Test: Stare at this image for at least 20 seconds. When finished, the screen will go to a white slide and you should be able to see the opposite colors, as After Images.





THESE ARE THE AFTER-IMAGE COLORS MANY/MOST PEOPLE WILL SEE.

THE MEANING OF COLORS



Color Meanings & Symbolism: Red

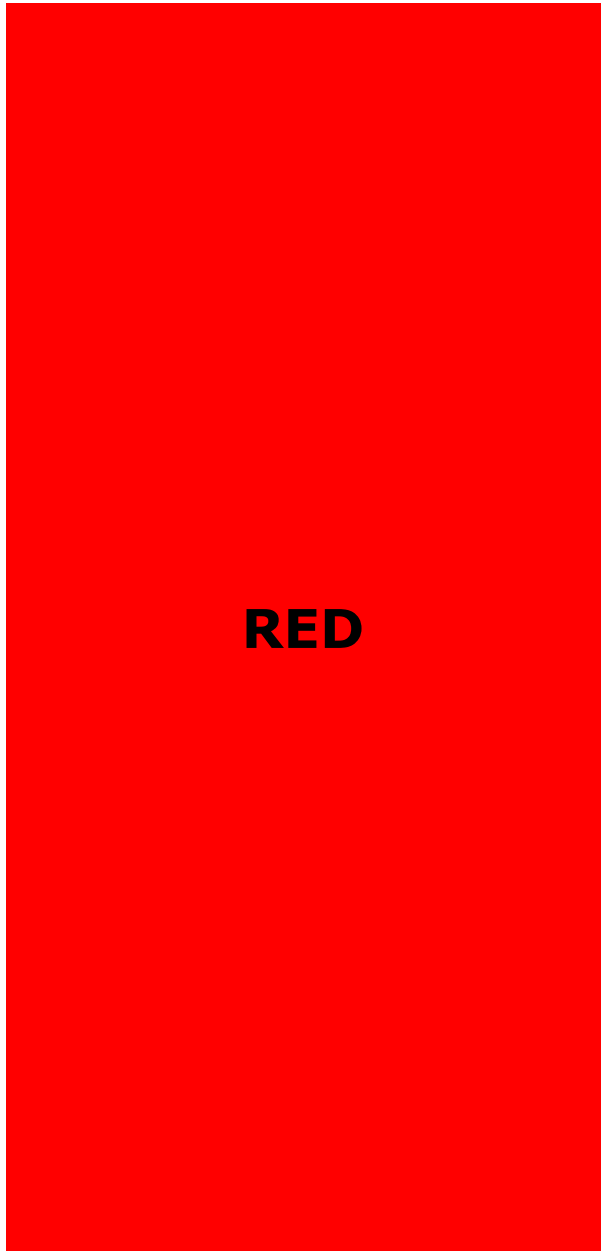
Worldly Color Meanings of Red

China & India: good luck, used in dresses, chair, parasol, cup lace, firecrackers in a wedding

Russia & China: revolution, communism

England: buses, phone booths

Spain: bull fighting, flamenco dresses

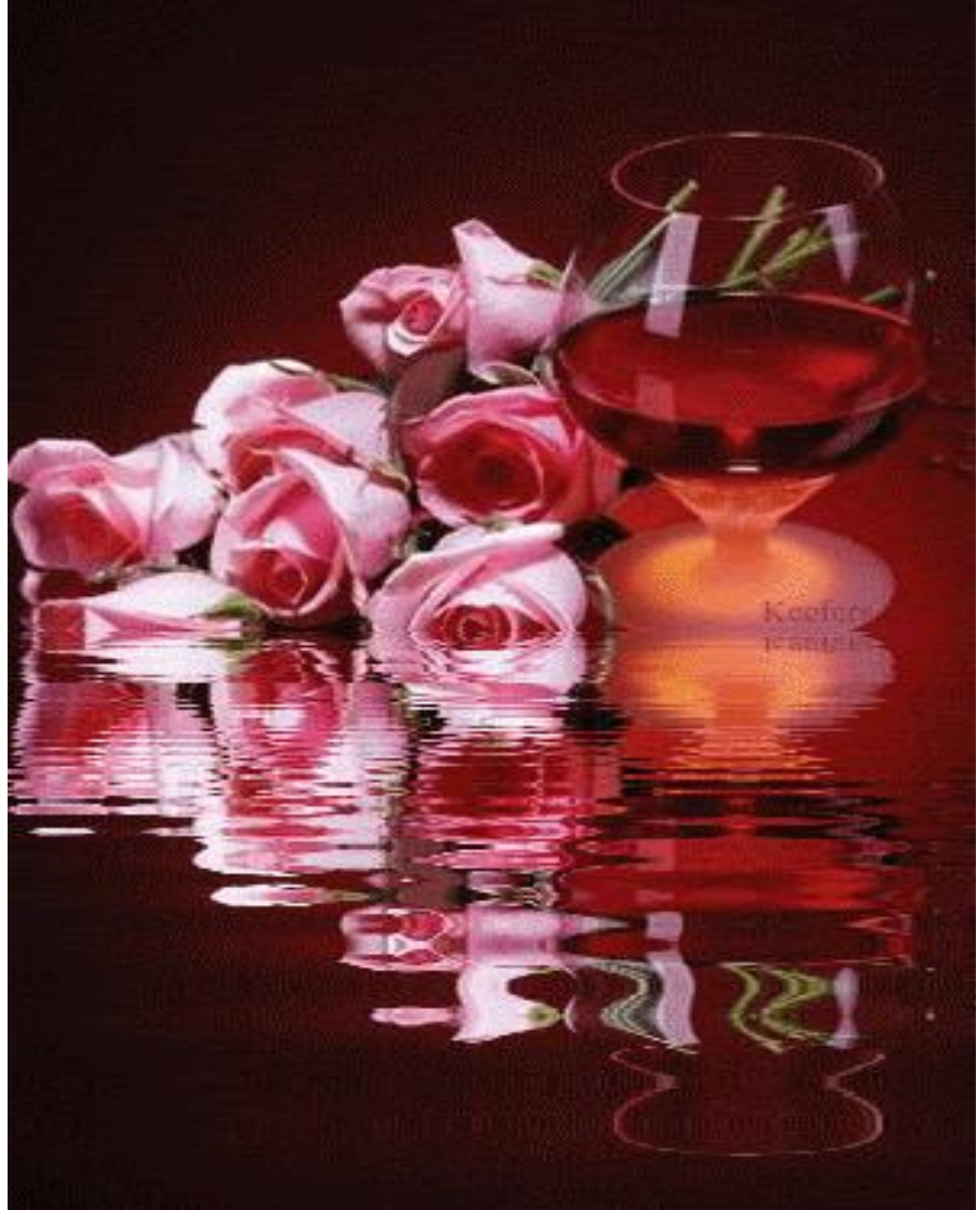


Red

- Any of various colors resembling the color of blood
- Increases pulse rate and breathing and causes blood pressure to rise.
- Infants and children respond well to red.
- Red is for the amorous, outspoken, and optimistic.
- People who love red, love life.
- The food color. Ever notice that restaurants use red a lot? It makes you hungry by increasing your body's metabolism.
- Hot, passionate, urgent, danger, blood, devil, angry, enraged, amorous, outspoken, optimistic

PINK

- A color varying from light crimson to pale reddish purple,
- Makes one feel prosperous, a bit pampered.
- Pink is also used to treat patients suffering from headache disorders.
- Femininity, sweetness, prime, left-wing



Color Meanings & Symbolism: Yellow

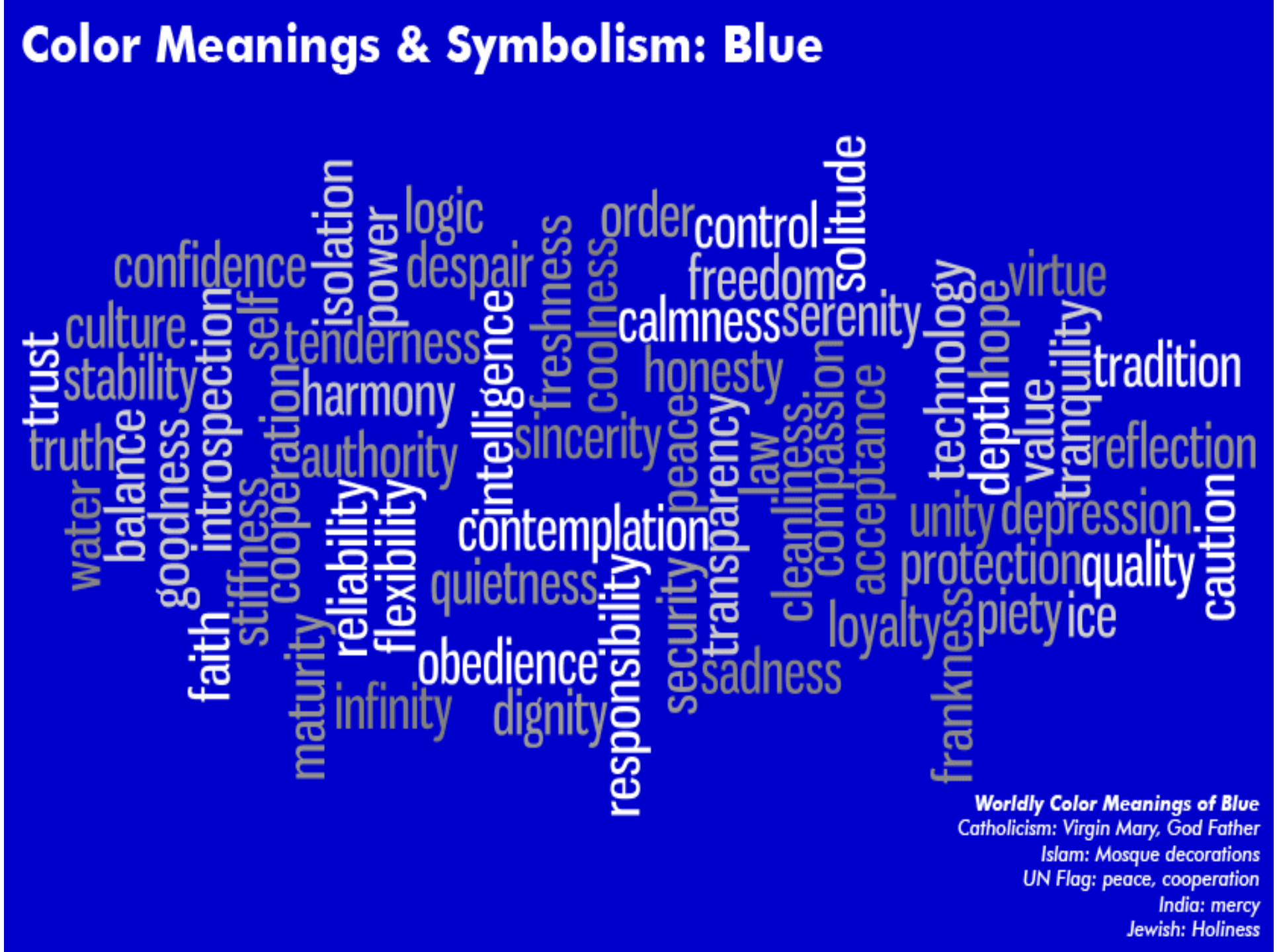
Worldly Color Meanings of Yellow

Egypt: happiness, prosperity
China: Imperial color to worship, the sky
Futbol: yellow card, warning
Other: truth

YELLOW

- A color like that of egg yolk, ripe lemons, etc.
- The color of the sunny disposition, the idealist. Intellectuals love yellow.
- **Yellow can have some negative effects -- babies cry more often and longer in yellow rooms**
- **in convalescent homes it makes older people shake as it affects their minor motor movement.**
- **As you get older you tend to dislike yellow because it can make you feel anxious or angry.**
- Warm, cowardice, caution, fearful, bright

Color Meanings & Symbolism: Blue



Worldly Color Meanings of Blue

Catholicism: Virgin Mary, God Father

Islam: Mosque decorations

UN Flag: peace, cooperation

India: mercy

Jewish: Holiness

BLUE

- The pure color of a clear sky; the primary color between green and violet in the visible spectrum
- The first color choice of the introspective and educated.
- Blue causes the brain to send off 11 chemical tranquilizers and is a wonderful calming color.
- Responsibility, trustworthiness, compassion, those are the attributes of royal blue.
- Honest, integrity, righteous, quality, first place

Several years ago, the makers of M&Ms, added a new color to its candy bag: Blue.

Why Blue? Although they reported that this was the result of a vote by M&M's fans it raises a few questions.

It may very well be the last color left in the bag after the novelty wears off.

Of all the colors in the spectrum, blue is an appetite suppressant.

Weight loss plans suggest putting your food on a blue plate.

Blue food is a rare occurrence in nature. Aside from blueberries and a few blue-purple potatoes, blue doesn't exist in any significant quantity as a natural food color.

Furthermore, our primal nature avoids food that are poisonous.

A million years ago, when our earliest ancestors were foraging for food, blue, purple and black were "color warning signs" of potentially lethal food.

BLUE SCRAMBLED EGGS
ON TOAST

Color Meanings & Symbolism: Orange

Worldly Color Meanings of Orange

Buddhism: humility, renunciation, desirelessness

China & Japan: love, happiness, plenitude

Other: treason, Halloween

ORANGE

- A color between yellow and red in the spectrum
- reddish yellow.
- Not a color that everyone loves, but those who do are generally social and fun loving.
- Confident, creative, adventurous, fun loving, sociable

Color Meanings & Symbolism: Green

Worldly Color Meanings of Green

Islam: Allah in nature

Northern Europe: The Green Man

GREEN

- Found in nature as the color of most grasses and leaves while growing, of some fruits while ripening, and of the sea.
- A good color for people in transition.
- Universal symbolism: Nature, freshness

Color Meanings & Symbolism: Purple

Worldly Color Meanings of Purple

Ancient Cultures: wealth

Catholicism: contrition, penitence, color of Lent

PURPLE

- Any color having components of both red and blue, such as lavender.
- The color of fantasy.
- Royalty, intelligence, wealth, beauty, inspiration, sophistication, high rank, exalted, imperial, princely

GRAY

- A color between white and black, having a neutral hue.
- A good color for offices. It promotes productivity and stimulates creativity.
- Neutral, ambiguous, intermediate, apathetic, dull, drab, monotonous, mature, sober, somber, mousy, smoky

BLACK

- The color at one extreme end of the scale of grays, opposite to white.
- Produces a feeling of solidarity and formality.
- Black is a natural classic.
- The color of authority and power yet also implies submission.
- Unknown, fear, mystery, dark, or night

WHITE

- A color without hue at one extreme end of the scale of grays, opposite to black.
- Most so-called whites are very light grays: fresh snow, for example, reflects about 80 percent of the incident light
- White would be an inappropriate color for a wedding in China because it is the color of mourning.
- If a bride chooses a white wedding gown, her parents would probably not allow her to get married.
- Innocence, purity, sterility, fairness, snow, frost, or milk

BROWN

- Solid, reliable brown is the color of earth and is abundant in nature.
- Light brown implies genuineness while dark brown is similar to wood or leather.
- Men are more apt to say brown is one of their favorite colors.
- Earth, nature, dirt, tanned, drab, coffee, or solid

All colors are beautiful, depending on personal taste.

Harmony results when hues, values and intensities are combined in a pleasing way.

PART 4

Through Different Eyes

One of the most mind-expanding parts of the presentation — showing how radically different the visual world is for other creatures.

In this section:

- Dogs & cats
- Bees
- Birds
- Animals
- Mantis shrimp
- Octopus
- Fish

WHAT COLORS DO ANIMALS, INSECTS, AND FISH SEE ?

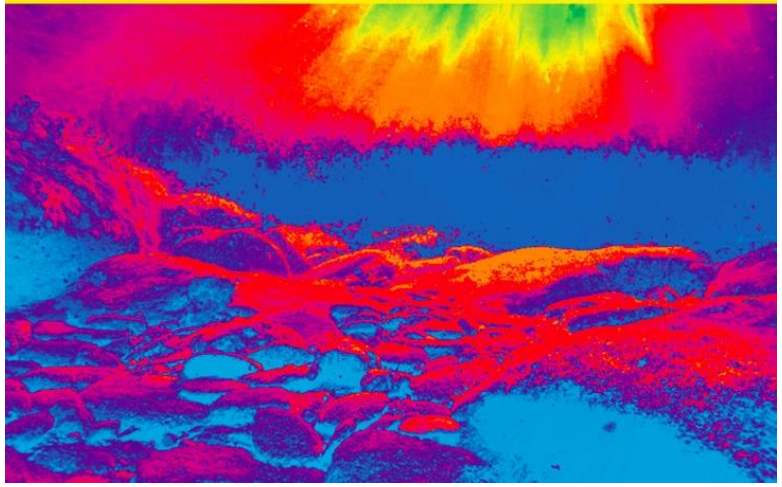
PEOPLE

PEOPLE

PEOPLE

CATS

SHRIMPS



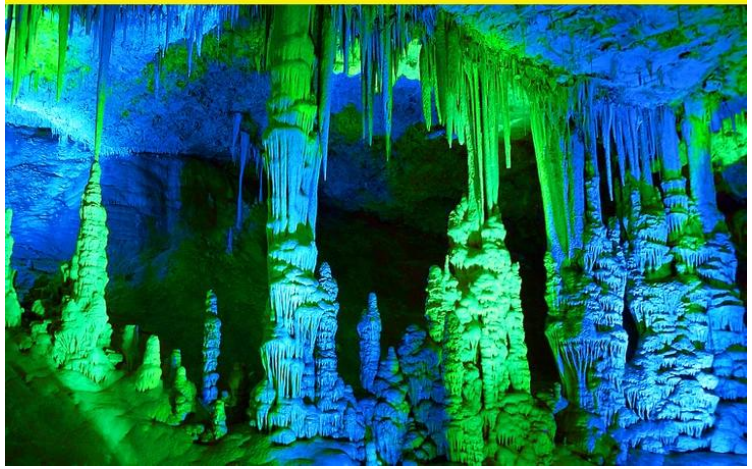
BIRDS

PEOPLE

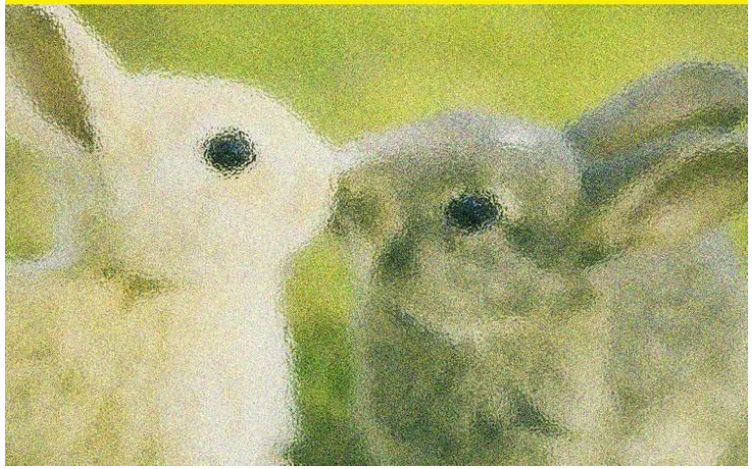
PEOPLE

PEOPLE

MOLE RATS



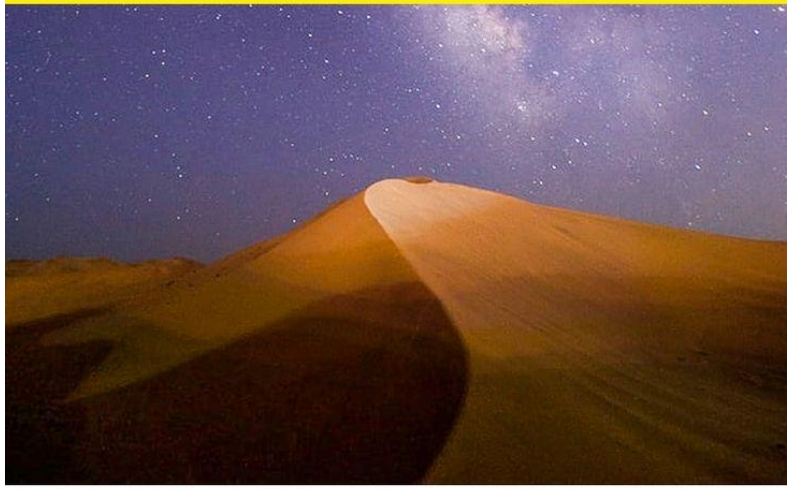
RABBITS



SQUIDS

PEOPLE

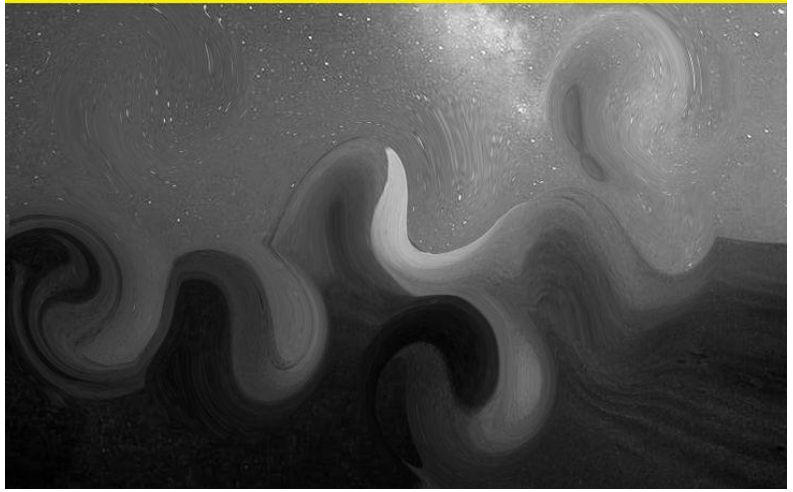
PEOPLE



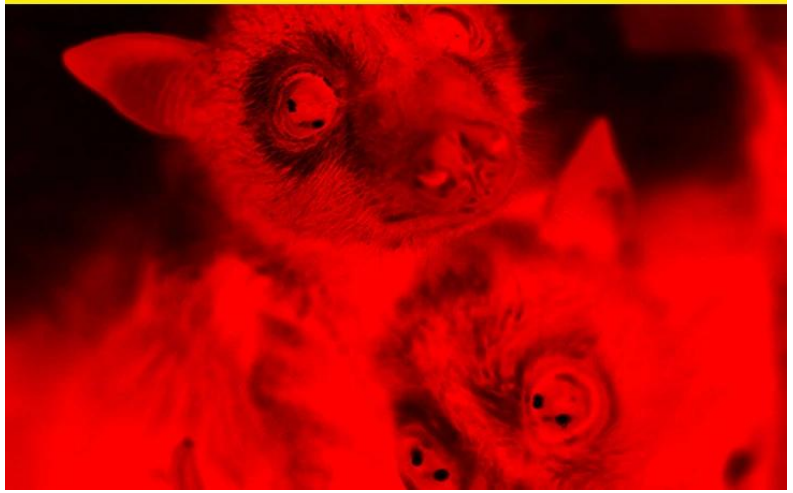
PEOPLE

GOATS

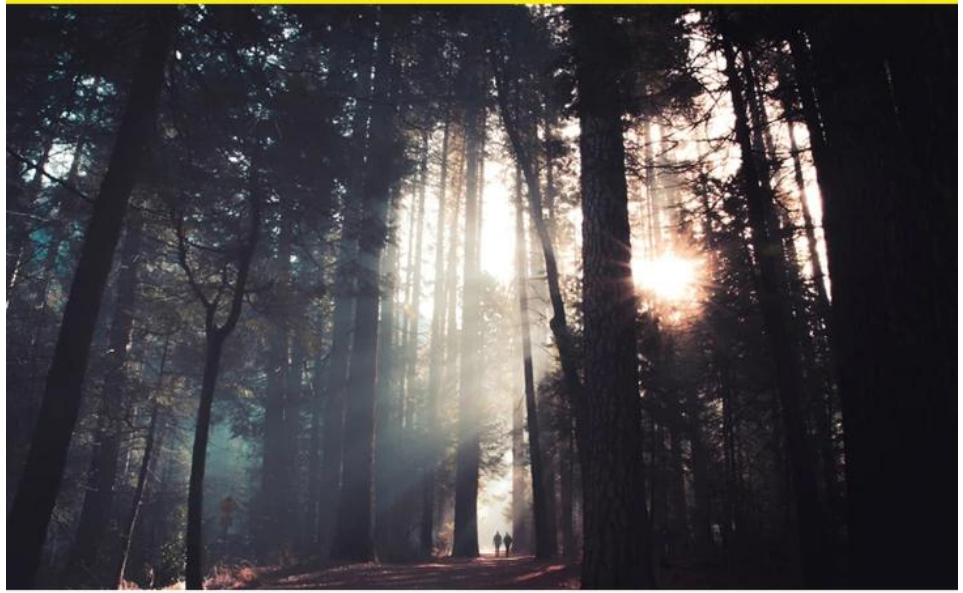
SCORPIONS



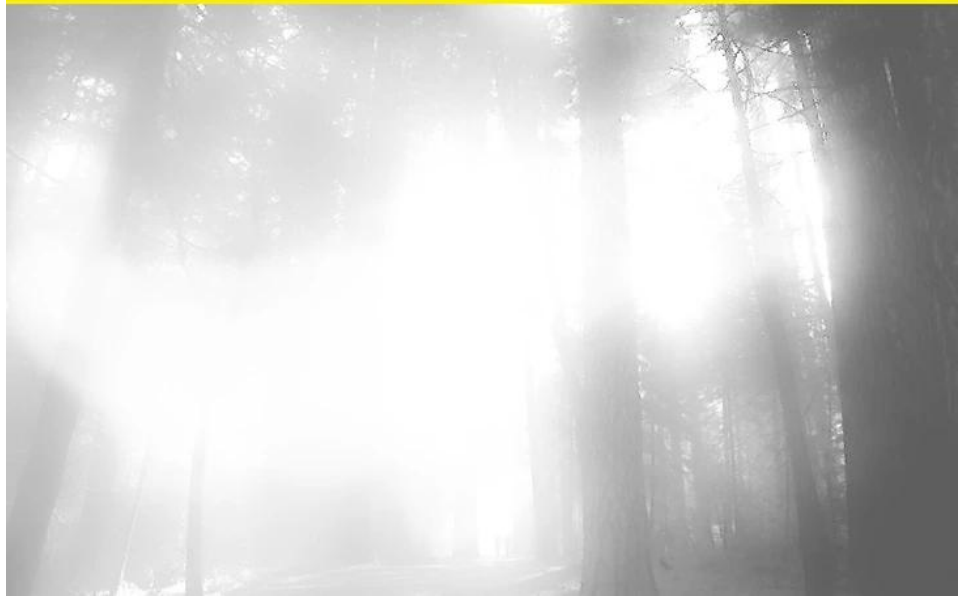
BATS



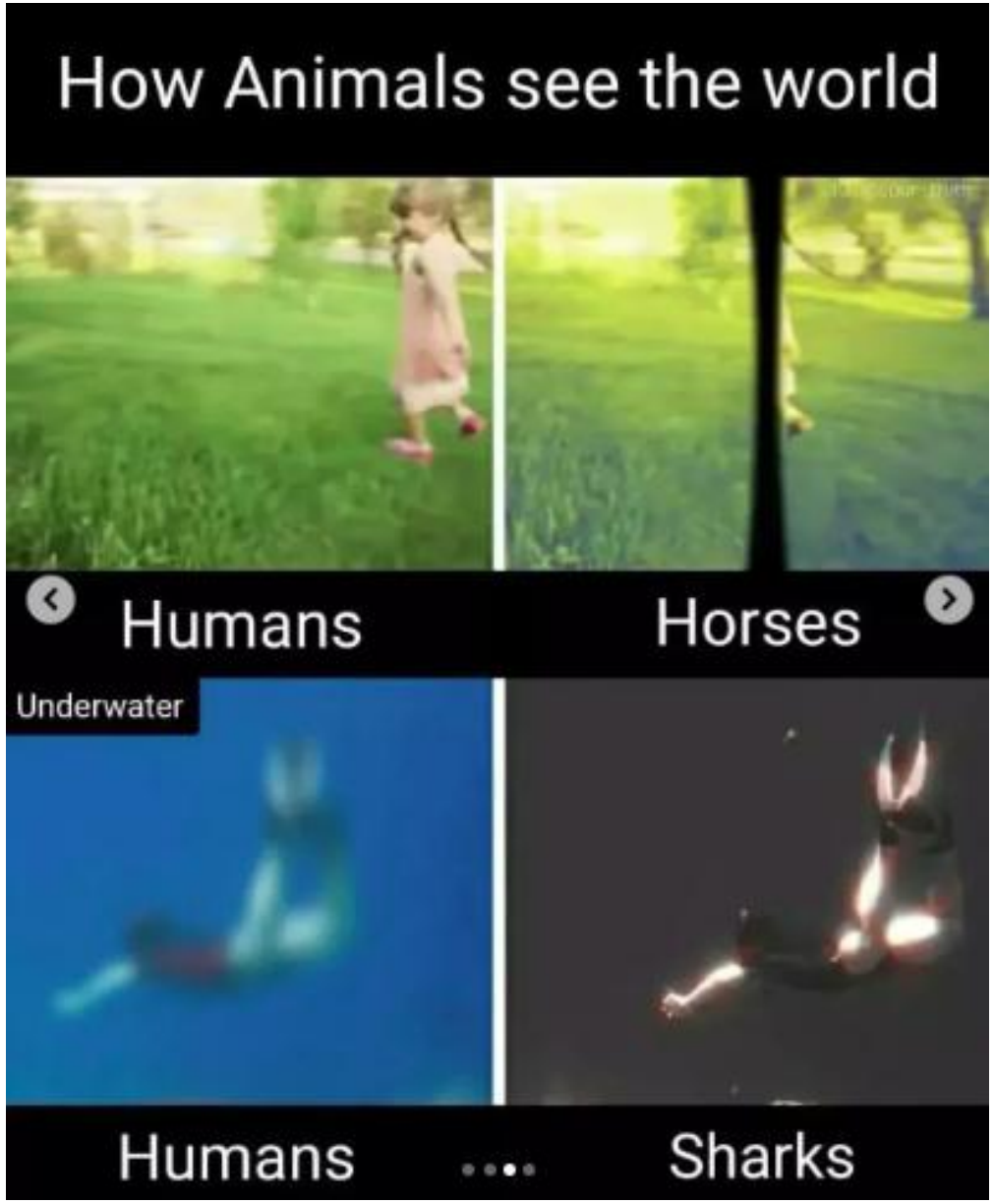
PEOPLE



WORMS




How Animals see the world
Humans
Eagles
Humans
Pigeons


How Animals see the world
Humans
Horses
Underwater
Humans
Sharks

BIRDS

SNAKES

FISH

BEES

BUTTERFLIES

RATS AND MICE


Human Vision
Octopus Vision

THE TAPETUM LUCIDUM AT THE BACK OF THE EYE

It is a thin reflective layer at the back of the eye — bounces light back through the retina, giving photoreceptors a second chance to capture it so they can see better.

Causes the "eyeshine" effect in photos and at night.

Found in dogs, cats, deer, horses, alligators, and even some fish (walleye, kelp fish).

The color varies by species: green, blue, orange, or yellow.


Time to take a break
10 MINUTES!!

PART 5

Vision Impairments & Solutions

This section covers conditions in the eye itself — structural and mechanical problems with the hardware, as opposed to the brain-based processing differences coming in Part 6.

In this section:

- Refractive errors
- Cataracts
- Glaucoma
- Macular degeneration
- Vision changes with age
- Modern solutions
- Assistive technology

MEDICAL ISSUES OF THE EYES

Refractive errors

The 4 common refractive errors are:

Myopia, or nearsightedness - clear vision close up but blurry in the distance

Hyperopia, or farsightedness - clear vision in the distance but blurry close up

Presbyopia - inability to focus close up as a result of aging

Astigmatism - focus problems caused by the cornea

Cataracts - clouded lenses

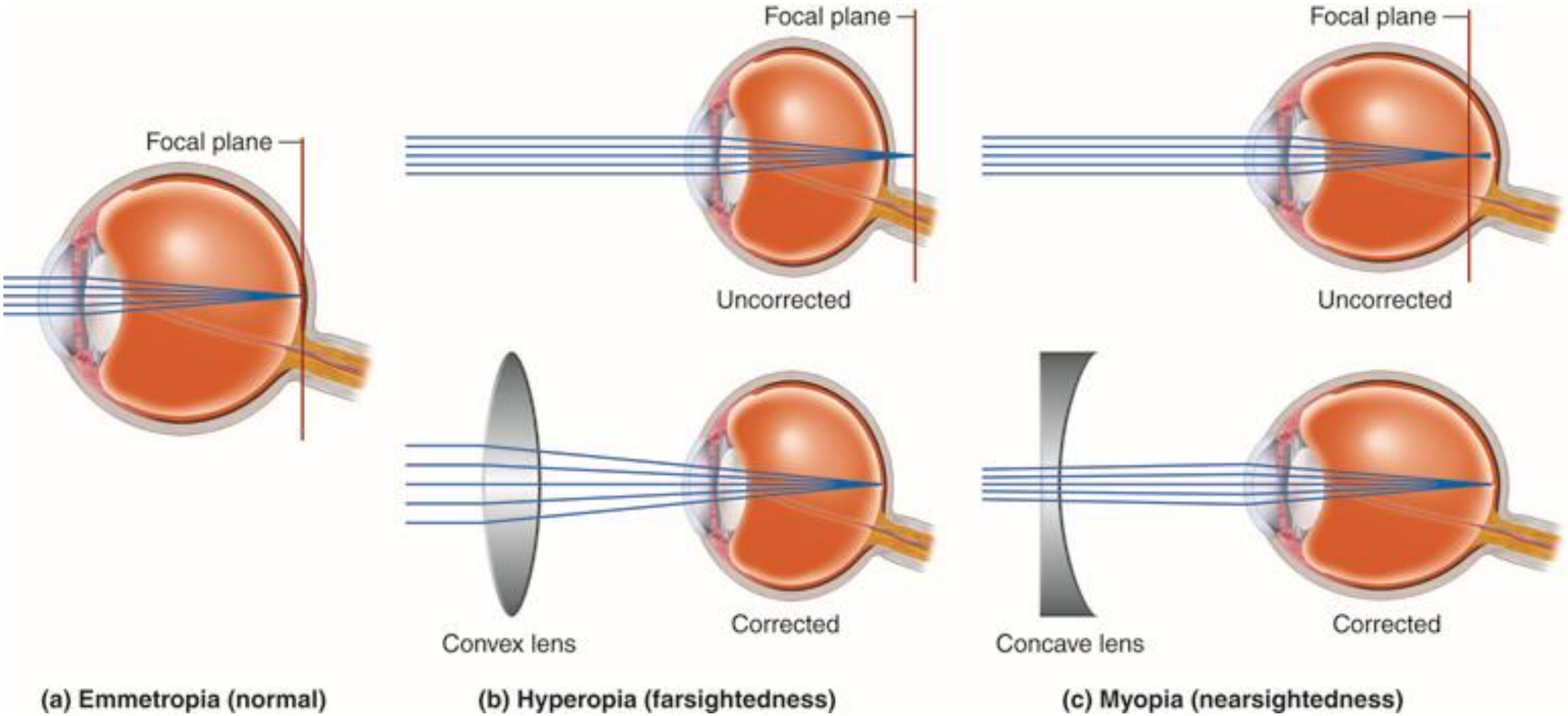
Optic nerve disorders, including glaucoma

Retinal disorders - problems with the nerve layer at the back of the eye

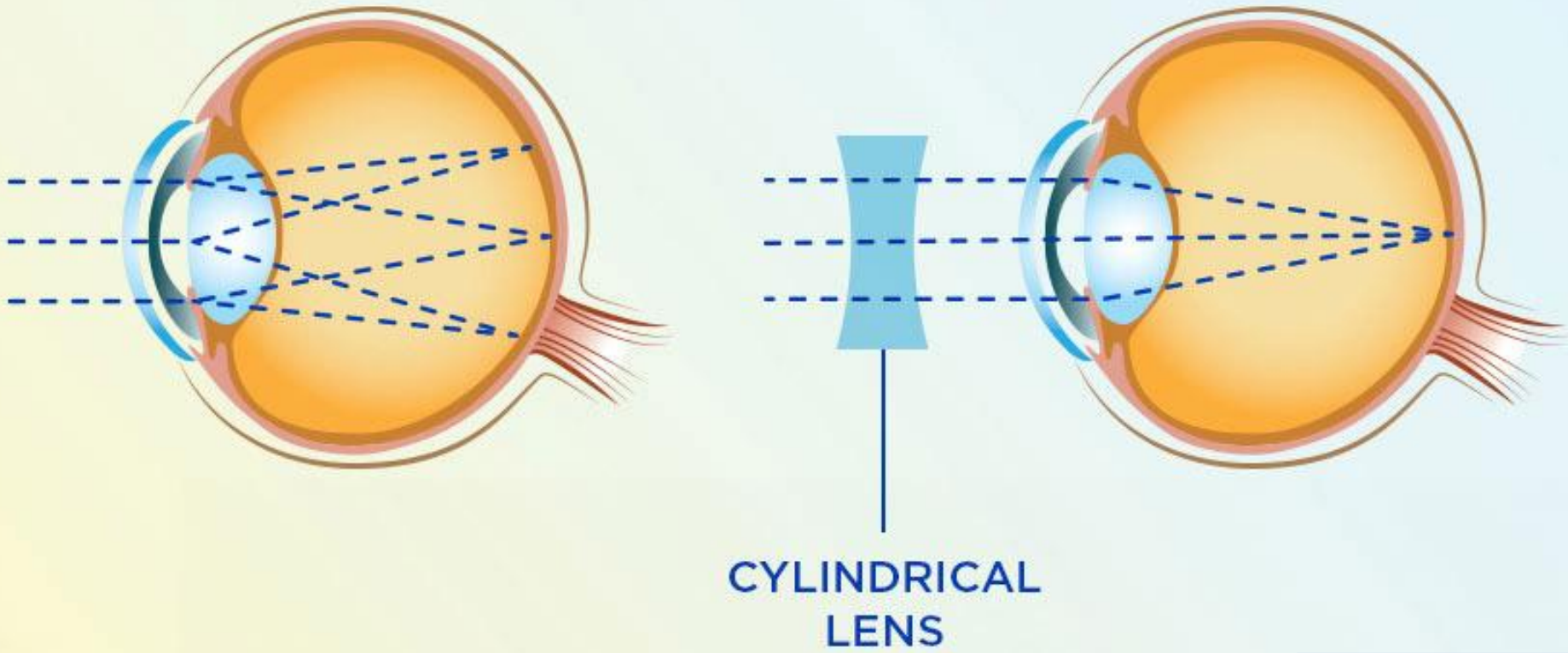
Macular degeneration - a disease that destroys detailed, central vision

Diabetic eye problems

REFRACTIVE ISSUES OF THE EYES



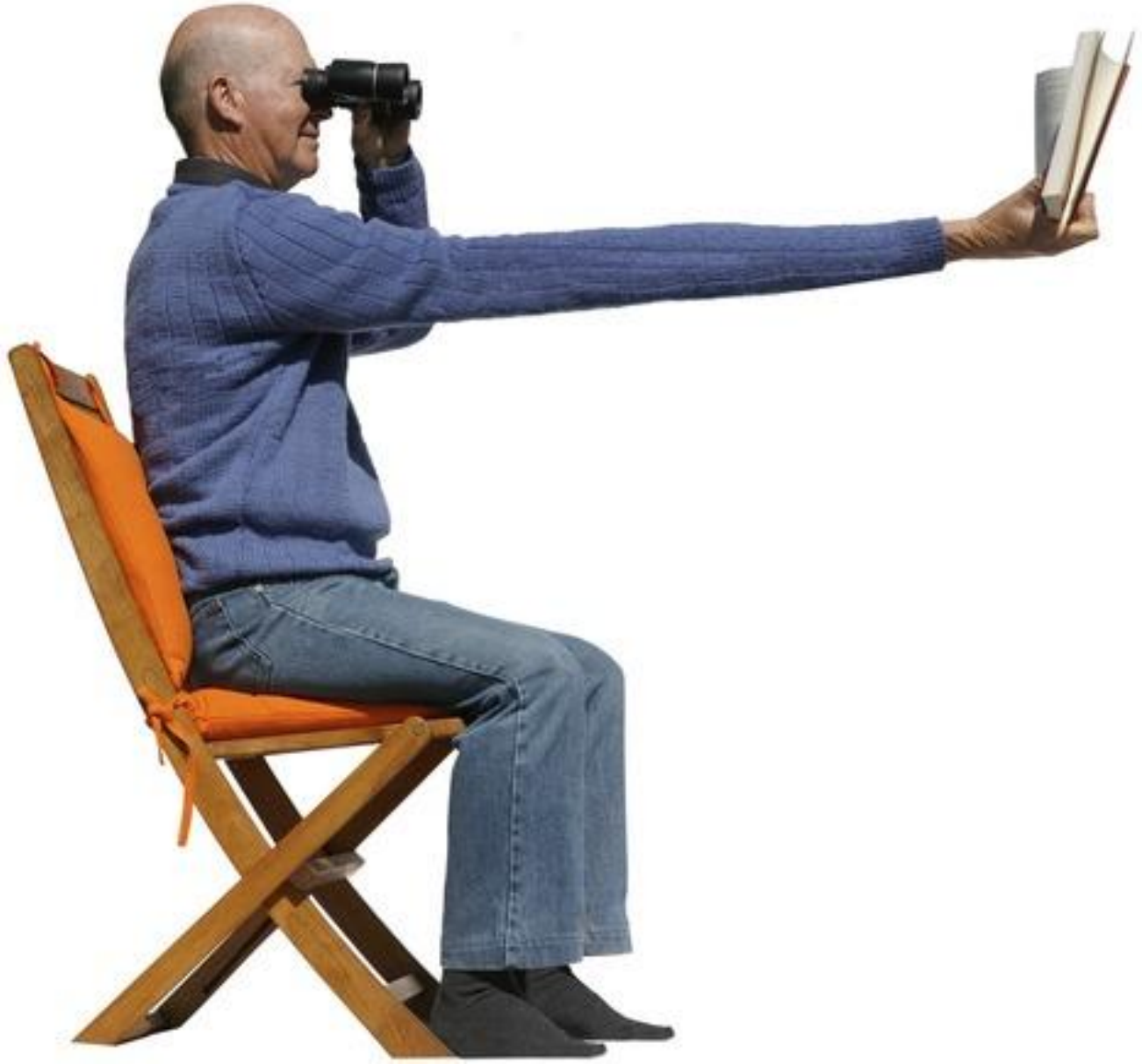
ASTIGMATISM CORRECTIVE GLASSES



PRESBYOPIA

This is when people experience a gradual loss of the eye's ability to focus on close objects as the lens stiffens with age.

It typically begins around age 40, which is why people start holding reading material at arm's length to bring it into focus.



CATARACTS

- Clouding of the lens caused by aging, trauma, diabetes, or heredity
- Reduces vision through glare, lost contrast, and decreased detail
- Affects 25% of adults 65–74
- up to 50% by age 75
- Successfully treated with surgery

No cataract

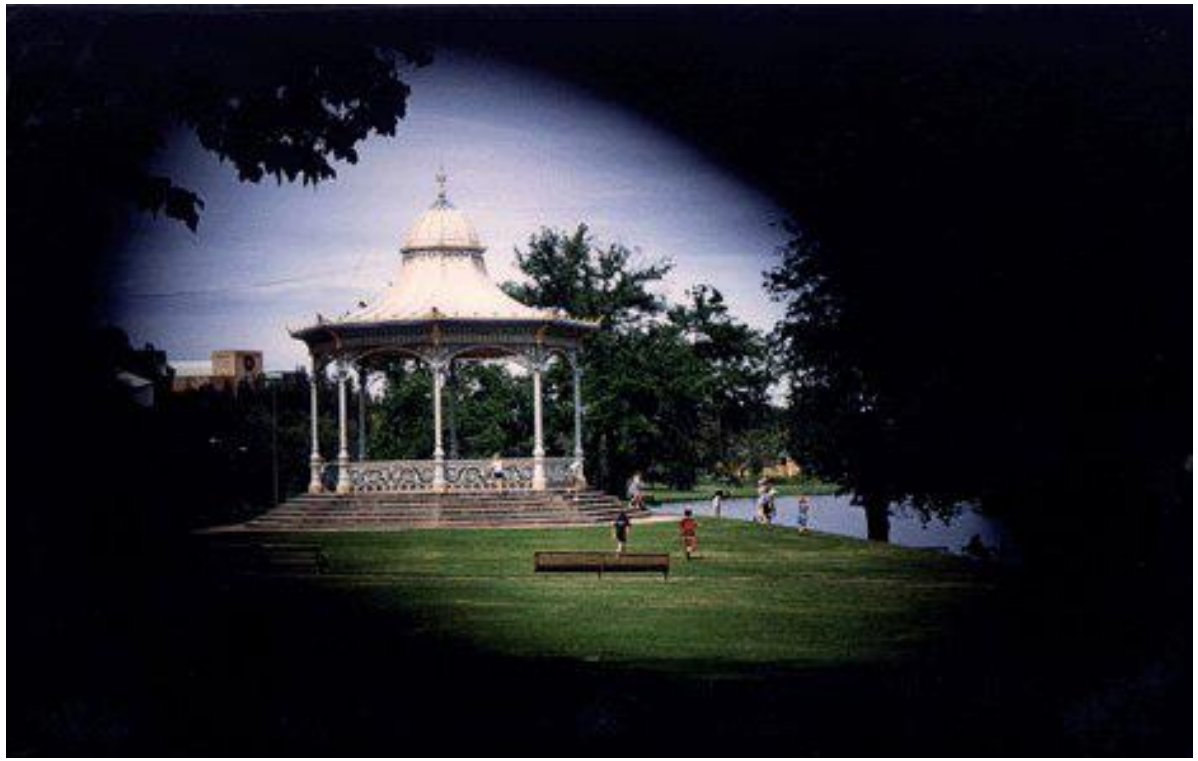
cataract

Normal vision

Vision through a cataract

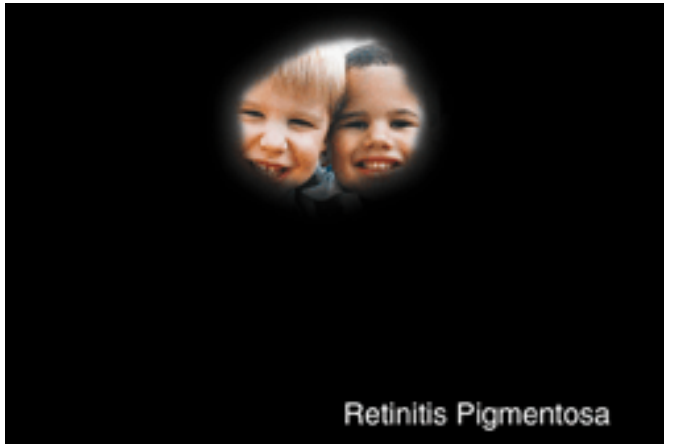
GLAUCOMA

- Increased fluid pressure in the eye — often with no pain
- **2 types**: chronic open-angle (gradual) and acute closed-angle (sudden, painful)
- Destroys peripheral (outer) vision over time
- If untreated: irreversible damage to the optic nerve and visual field



RETINITIS PIGMENTOSA (RP)

- Progressive disease affecting the retina’s pigmentary layer
- Most common cause of inherited blindness
- Symptoms: night blindness, shrinking peripheral vision, glare sensitivity
- 30% of people with RP also experience some hearing loss



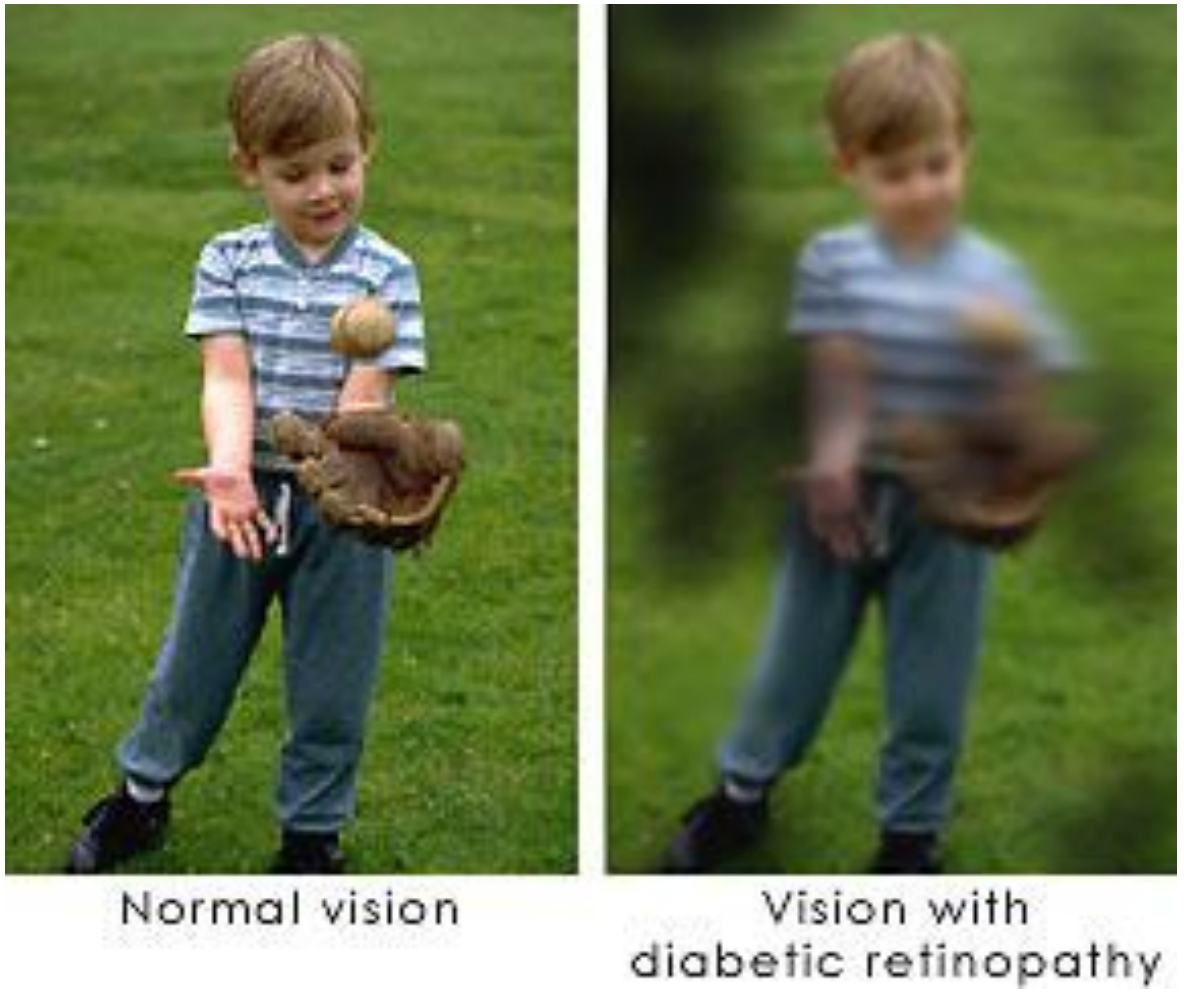
DIABETIC RETINOPATHY

People with diabetes are 25× more likely to go blind than the general population

Affects 40% of people with diabetes

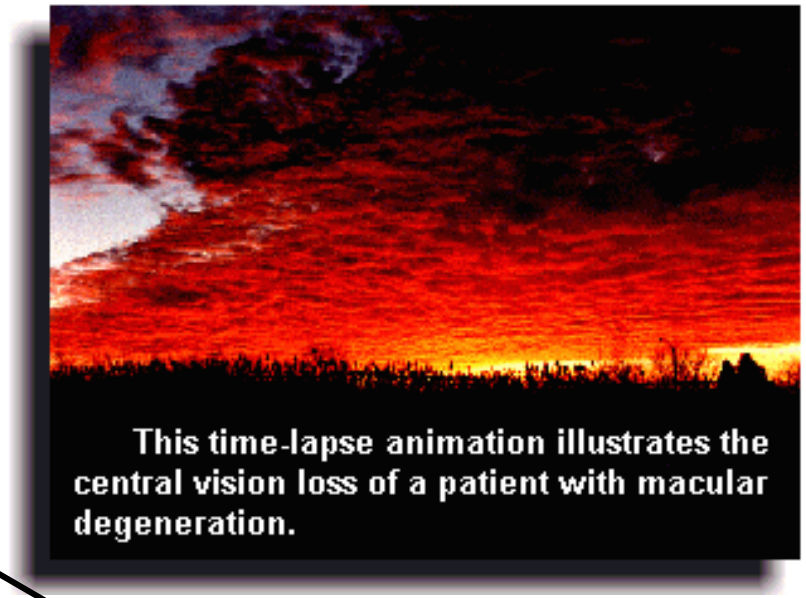
Causes 5,000 new cases of blindness per year in the US

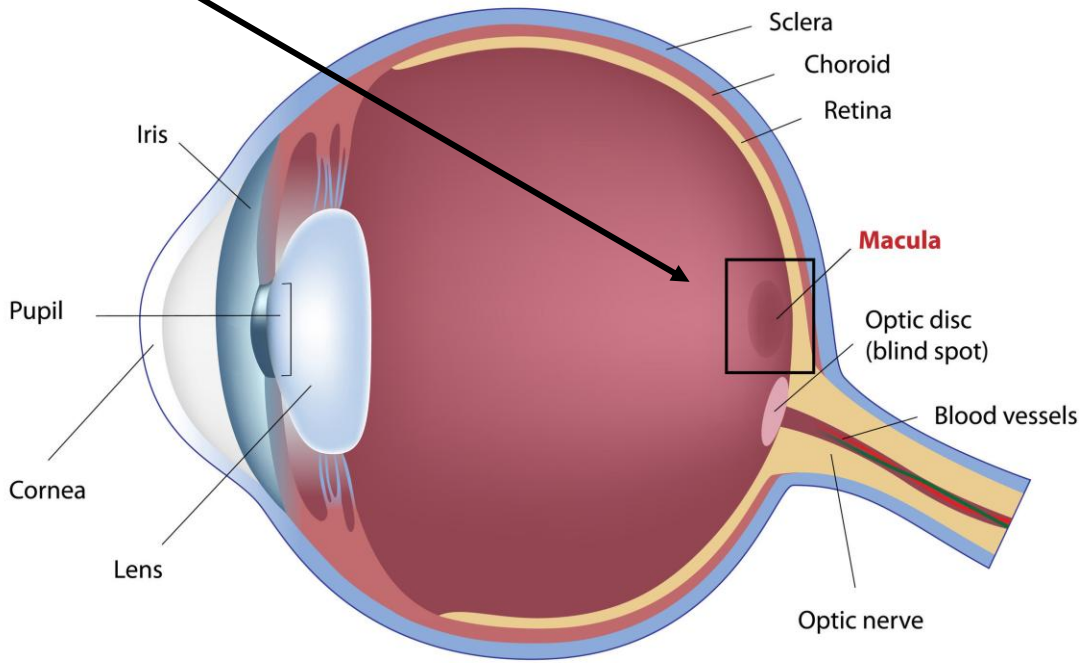
Symptoms: fluctuating vision, glare, reduced contrast, visual field loss



MACULAR DEGENERATION

- **Degenerative changes to the macula cause loss of central vision which is where all detailed vision happens.**
- **Symptoms:** distortion, reduced acuity, color and contrast loss, scotoma.
- Reading becomes increasingly difficult; driving may need to stop.





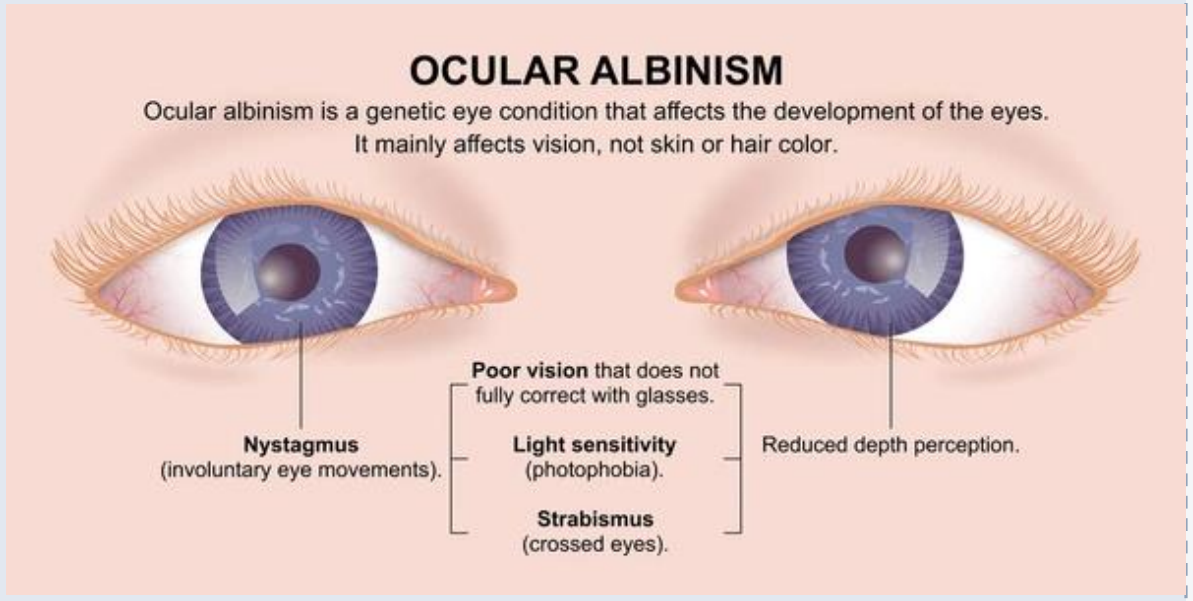
ALBINISM — WHAT IT IS

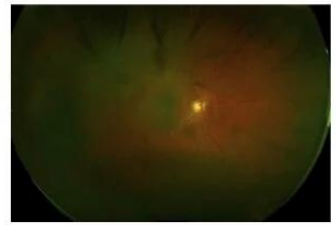
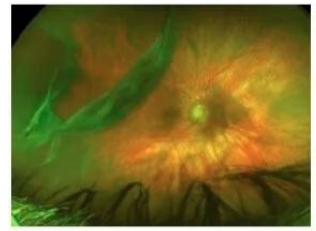
- It is a genetic condition causing reduced or absent melanin (dark pigment) in the eyes, skin, and/or hair.
- Ocular albinism: eyes only — Oculo-cutaneous: eyes, skin, and hair.
- Affects ~1 in 17,000–20,000 people — equally across all ethnicities.
- Melanin is essential to normal retinal development — its absence causes structural eye changes.
- **Eye color is usually pale blue or gray (not red).**
- **A congenital condition, not a disease.**

ALBINISM — HOW IT AFFECTS VISION

KEY EFFECTS INCLUDE:

- Reduced visual acuity
- Involuntary eye movements (nystagmus)
- Extreme light sensitivity (photophobia)
- Poor depth perception due to eye misalignment and abnormal optic nerve connections to the brain.



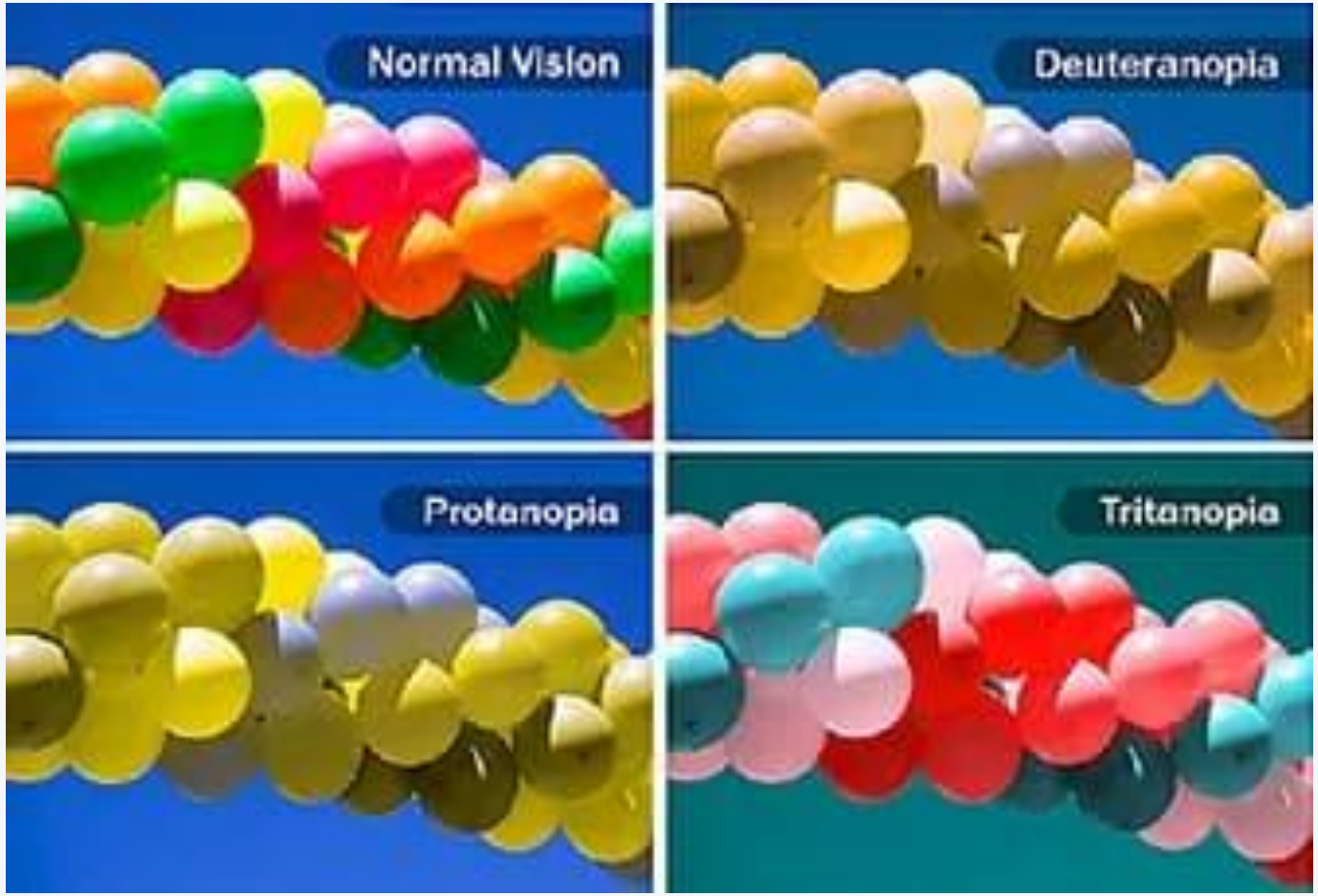
Disease	Outward Appearance	Back of the Eye Photo	What They See
NORMAL			
CATARACTS			
GLAUCOMA			
MACULAR DEGENERATION			
RETINAL DETACHMENT			

Do yuo fnid tihs
smilpe to raed?
Bceuase of the
phaonmneal pweor
of the hmuan mnid,
msot plepoe do.


COLOR BLINDNESS

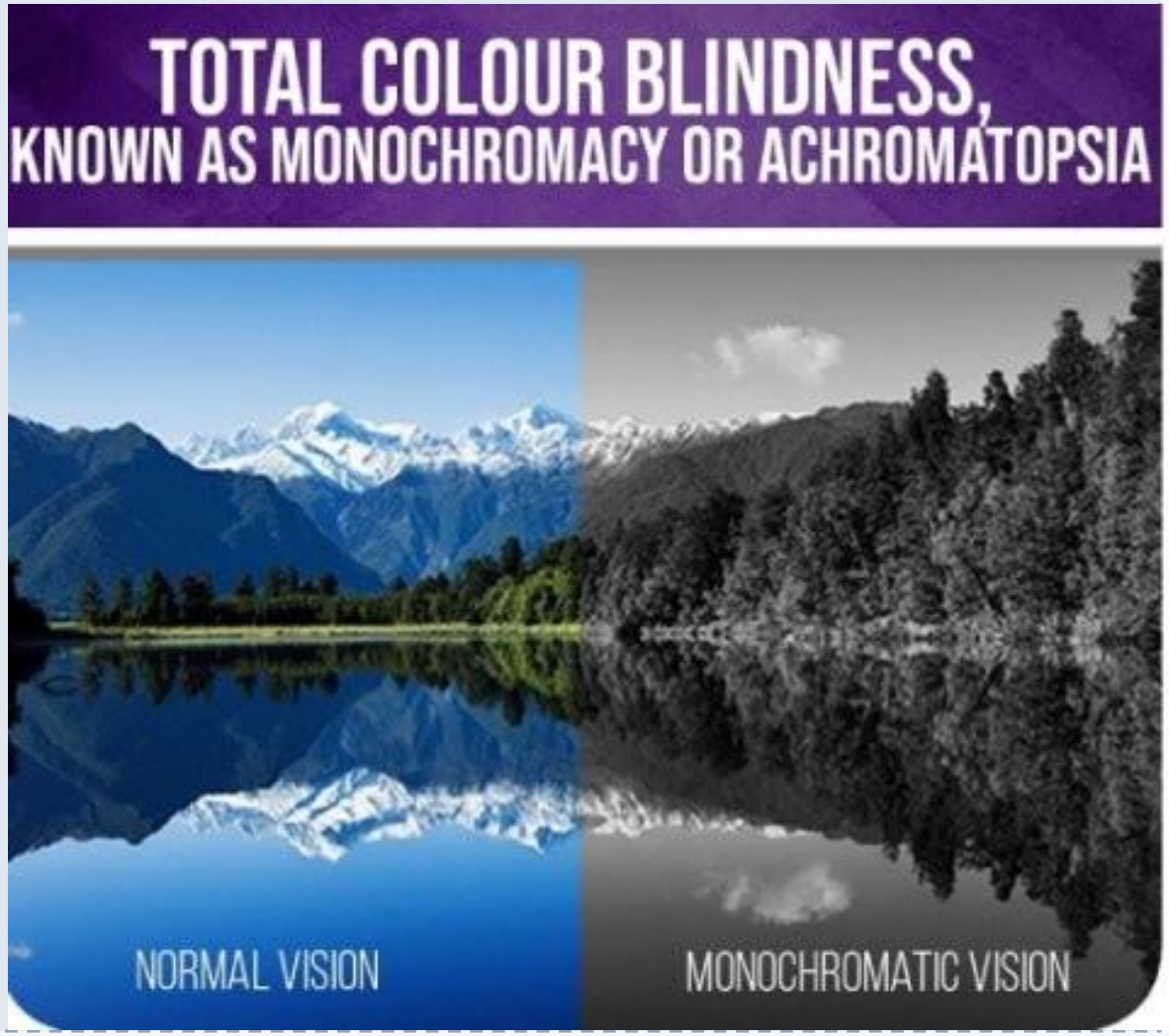
SEEING THROUGH COLOR-BLIND EYES

- **Protanopia**: Sees mostly blues and golds; reds are often confused with black"
- **Deuteranopia**: reds and greens merge to brownish tones
- **Tritanopia**: blues and yellows lose their identity
- **Achromatopsia**: complete gray image (shown on next slide)



ACHROMATOPSIA — COMPLETE COLOR BLINDNESS

- All cone function absent — vision entirely in shades of gray
- Extremely rare: ~1 in 30,000 people
- Vision relies entirely on rod cells — which can’t see colors
- Bright light is physically painful
- Visual acuity typically 20/200 or worse
- 'Day blindness' — vision is better in dim conditions



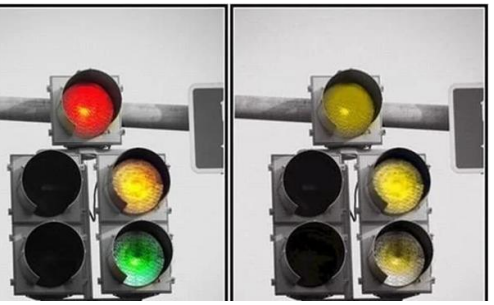
PROTANOPIA AND DEUTERANOPIA ARE BOTH RED-GREEN TYPES

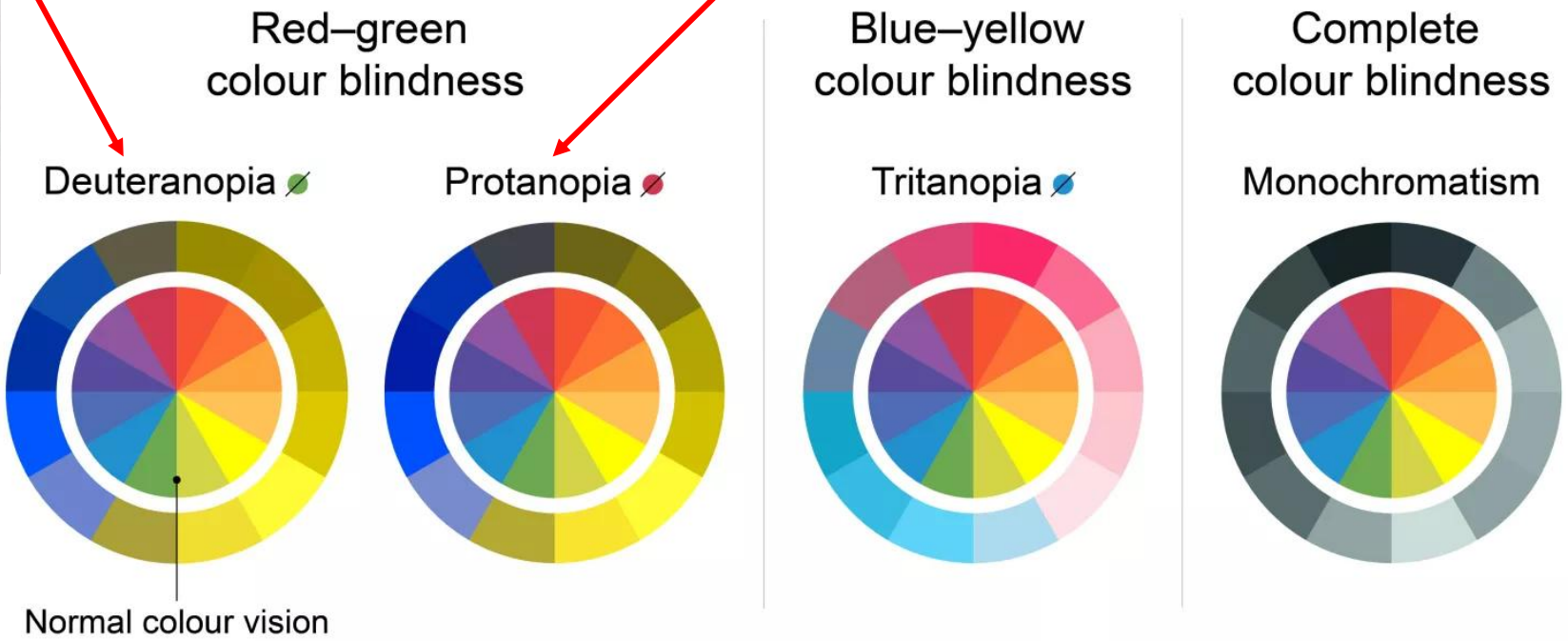
Even though they sound and look different, they both cause confusion about what is red-green blindness — just from different ends:

For Deuteranopia, the green cone is missing **For Protanopia, the red cone is missing**

Both result in an inability to distinguish red from green, which is why they're grouped together as "red-green color blindness.

The experience is similar enough that most people who have one or the other just say "I'm red-green color blind" without knowing which specific type they have.





About 8% of men and 0.5% of women are colorblind.

COLOR VISION VARIATIONS — KEY NUMBERS

8%

Men worldwide

Mostly red-green forms

0.5%

Women affected

X-linked gene provides protection

300M

People globally

Living with color vision difference

1:12

Males in any room

Cannot see full color range

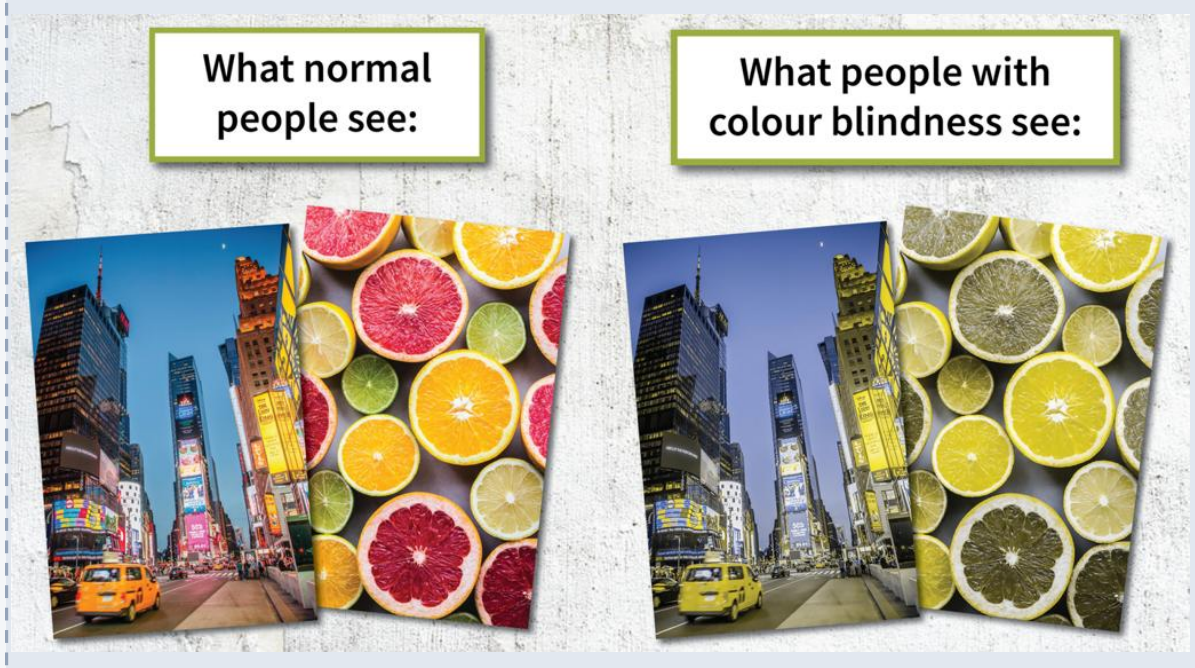
COLOR BLINDNESS — REAL-WORLD IMPACT & DESIGN

Everyday Challenges

- Traffic lights — red vs amber
- Color-coded maps and charts
- Identifying ripe produce
- Matching clothing
- Some careers restricted

Accessible Design

- Use shape AND color — never color alone
- Blue/orange palettes over red/green
- Label lines directly, not just in legend
- Sufficient brightness contrast

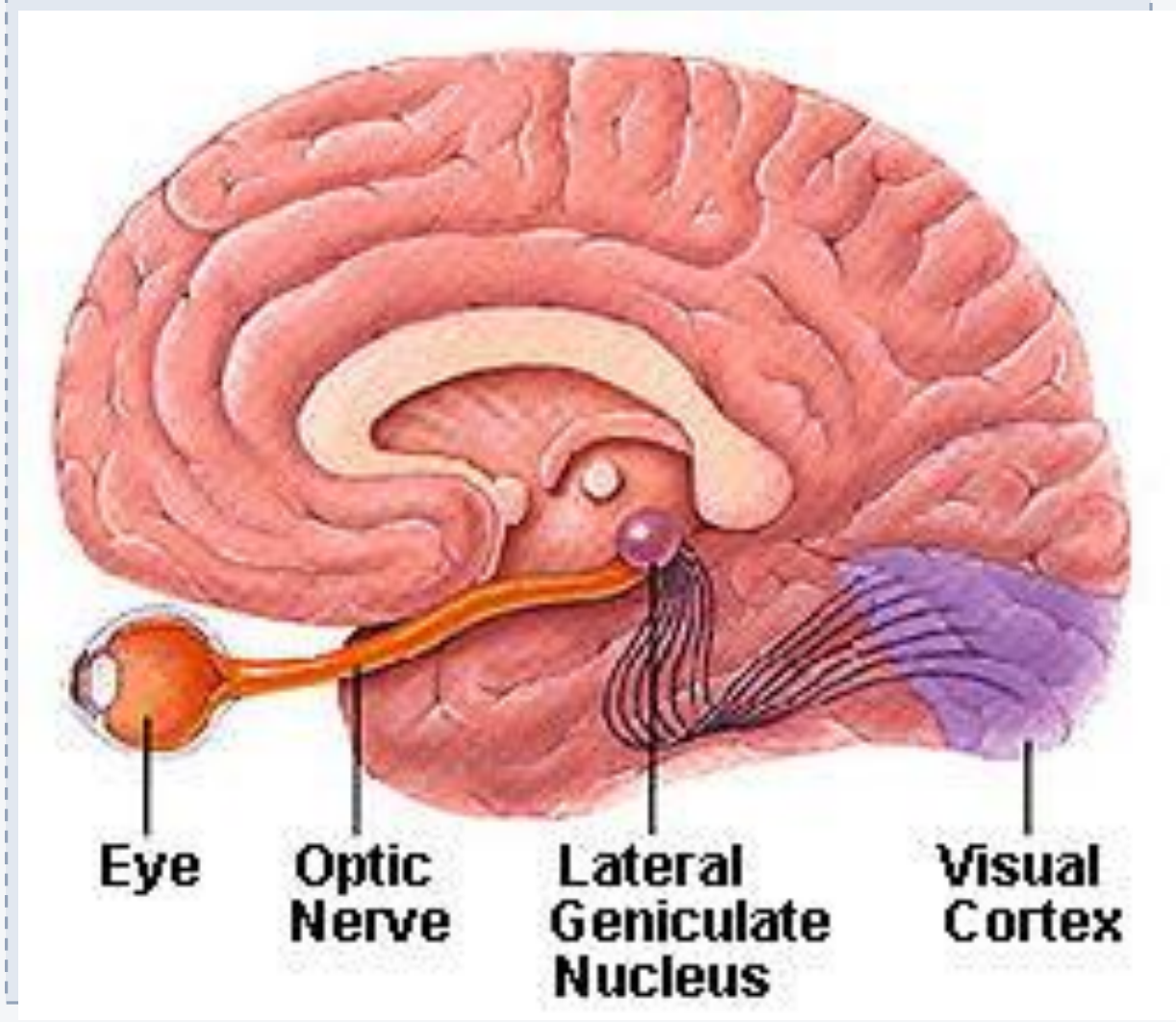


Brain-Vision Conditions

When the eyes are fine — but the brain changes what we see

THE EYE VS. THE BRAIN

- The eye is a camera — captures light and converts it to electrical signals
- The brain does the actual 'seeing' — interpreting, recognizing, and imagining
- Over 30% of the cerebral cortex is involved in visual processing
- Brain-vision conditions arise despite normal eyes and clear signals



THE MENTAL IMAGERY SPECTRUM

The experiences about what we're about to see are not flaws — they are just variations in how each of us sees.

Each one reveals something profound about how the brain constructs the reality we think we all share.

By the end of the presentation, you may never look at the world quite the same way again !

THE MENTAL IMAGERY SPECTRUM

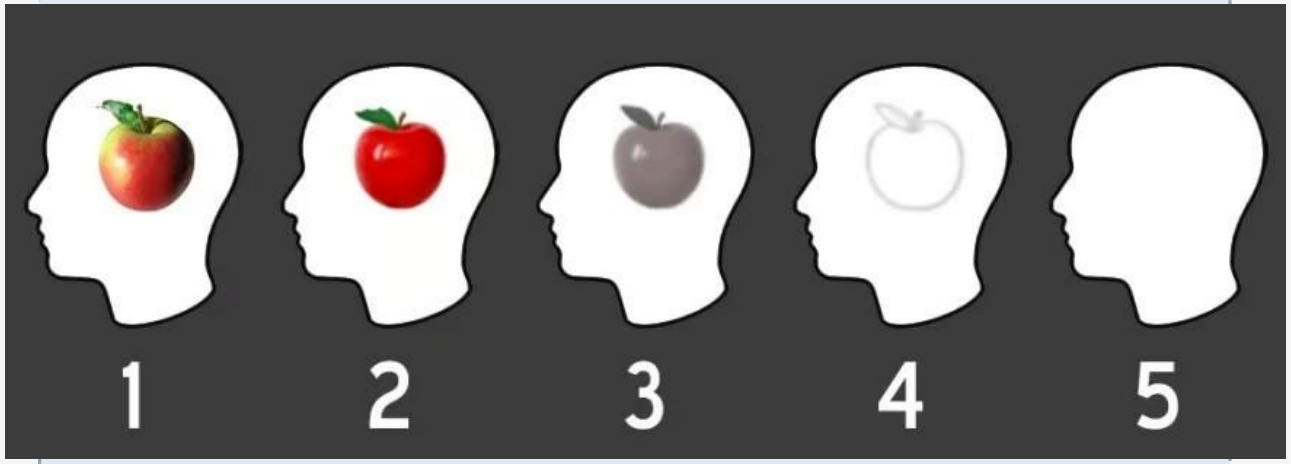
How Vivid Is Your Mind's Eye?

The vividness of mental imagery varies from person to person, from hyperphantasia (left) to aphantasia (far right). Tests such as the Vividness of Visual Imagery Questionnaire can help determine where you fall on the spectrum.

1. **HYPERPHANTASIA**
   Perfectly realistic, as vivid as really seeing
2. Realistic and reasonably vivid
3. Moderately realistic and vivid
4. Dim and vague
5. **APHANTASIA**
   No image, but still thinking of the object

APHANTASIA — NO MENTAL IMAGERY

- The term was coined 2015 by neurologist Adam Zeman - 1–3% of people experience it.
- **Full Aphantasia** - the 'mind's eye' is completely blank — no images generated on request
- **Object aphantasia** - can't imagine items
- **Spatial aphantasia** - can't image layouts
- Persons with full Aphantasia, may still see images in their dreams !!
- Linked to reduced face recognition and reduced auto-biographical memory vividness.



PICTURE THE IMAGE OF A RED APPLE IN YOUR MIND

Did I ever consider that the person sitting next to me, experiences mental imagery completely differently — or possibly not at all ?

HOW DID THE IMAGE OF THE APPLE LOOK IN YOUR MIND ?

(THERE ARE NO WRONG ANSWERS !)

1	2	3	4	5
ABSENT	**VAGUE**	**MODERATE**	**VIVID**	**HYPER-PHANTASIC**
Aphantasia	Hypophantasia	Typical	Above Average	Hyperphantasia
No image at all — complete blank	**Barely a sense of something**	**Recognisable but not sharp**	**Fairly detailed and stable**	**Photo-realistic — like actually seeing it**
✋ Raise your hand	✋ Raise your hand	✋ Raise your hand	✋ Raise your hand	✋ Raise your hand

Based on the VVIQ — Vividness of Visual Imagery Questionnaire

APHANTASIA VS. HYPERPHANTASIA

Aphantasia

- No voluntary mental images
- Linked to face recognition difficulty
- Reduced autobiographical memory
- Associated with autism traits
- Over-represented in the STEM (Science, Technology, Engineering, and Mathematics fields

Hyperphantasia

- Photo-realistic, intrusive imagery
- Strongly linked to synesthesia
- Enhanced autobiographical memory
- Higher creative aptitude
- Over-represented in the arts fields

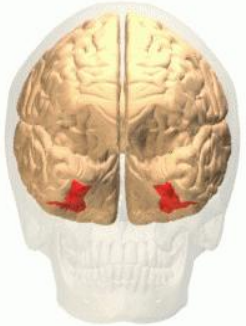
PROSOPAGNOSIA — FACE BLINDNESS

- Cannot recognize familiar faces — including family or own reflection in severe cases
- Developmental: present from birth, 2–2.5% of population — no brain damage
- Acquired: caused by stroke, brain injury, or tumor to the face area.
- Brad Pitt has publicly discussed his prosopagnosia.

- People rely on voice, gait, hairstyle, or context instead of facial features.
- Often co-occurs with topo-graphagnosia (not knowing places or place-map blindness) and aphantasia.

People with prosopagnosia can see faces but have a hard time recognising their identities.

The fusiform gyrus (red in the figure on the right) is a brain structure often implicated in prosopagnosia



VISUAL AGNOSIA — CAN'T RECOGNIZE BY SIGHT

- Very rare – under 1% of people
- Visual agnosia — the eyes work perfectly, but the brain cannot interpret what it sees.
- Can see clearly but cannot recognize or name objects using vision alone.
- **Apperceptive**: cannot form a coherent shape percept — may be unable to copy a drawing.
- **Associative**: shape perceived but cannot link to stored knowledge.
- Can identify same object by touch, sound, or smell.

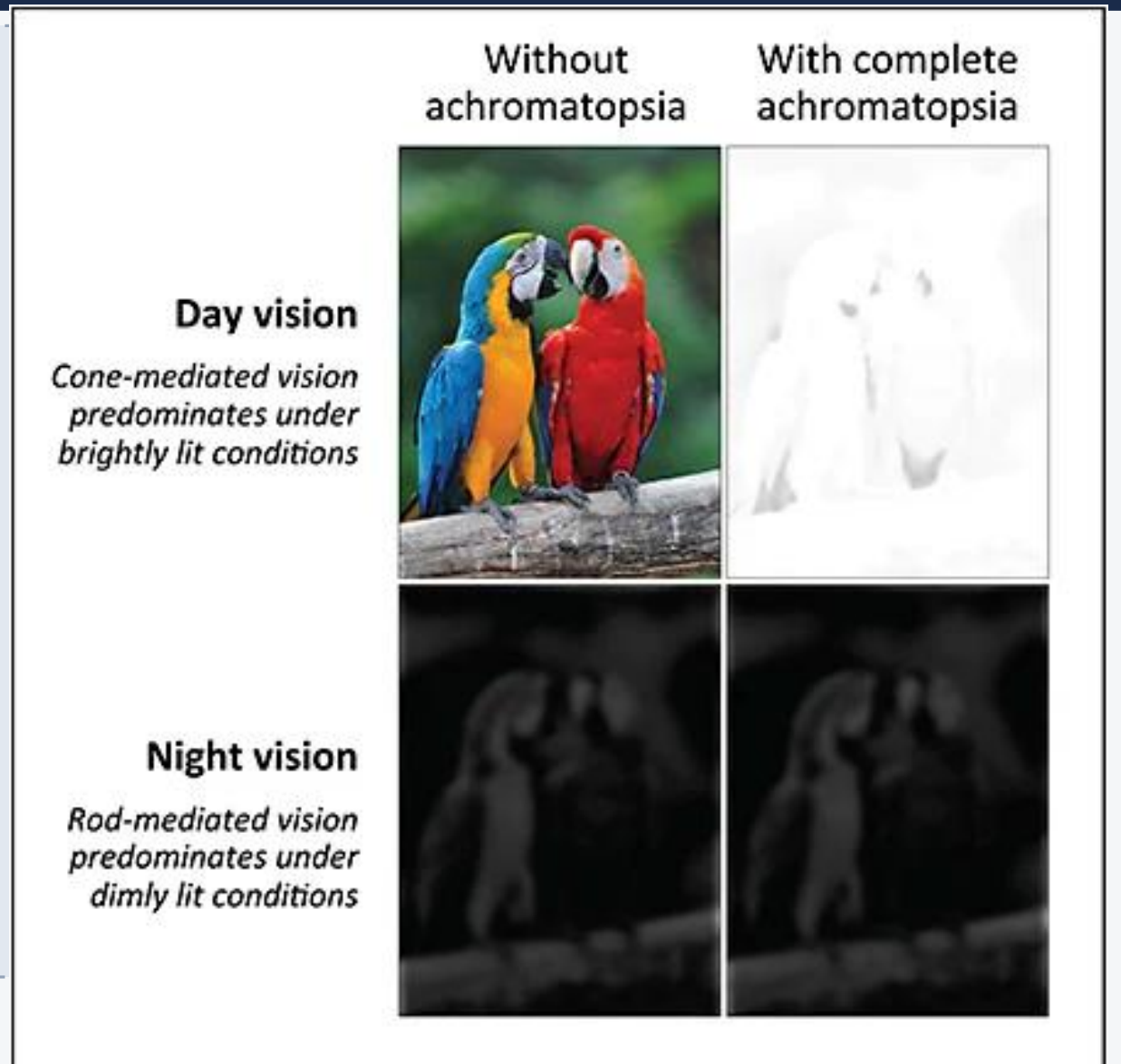
VISUAL AGNOSIA -

TOPOGRAPHAGNOSIA — PLACE BLINDNESS

- Cannot recognize familiar places — streets lived on for years appear unknown
- They know intellectually where they are — just cannot 'recognize' it visually
- Navigate by counting blocks, turn sequences, or following companions
- Developmental form (DTD) exists — present from childhood without injury

CEREBRAL ACHROMATOPSIA — BRAIN-BASED COLOR LOSS

- Complete color loss caused by brain damage — eyes and cones are entirely normal
- World described as 'washed out,' 'dirty,' or like an old black-and-white film
- Usually caused by a stroke to the posterior cerebral artery (back of the brain)
- Often part of a tetrad: color loss + face blindness + place blindness + visual field loss



HEMIANOPIA — LOSS OF HALF THE VISUAL FIELD

- Blindness in the same half of the visual field in BOTH eyes simultaneously
- Most commonly caused by stroke, TBI, or tumor affecting the visual cortex
- Homonymous hemianopia: right half or left half gone in both eyes
- Brain often 'fills in' the missing area — patient may be unaware initially
- Reading severely impaired when right visual field is affected

► *Unlike glaucoma (peripheral ring loss), hemianopia cuts vertically down the midline*

AKINETOPSIA — MOTION BLINDNESS

- Cannot perceive visual motion — world appears as a series of frozen still frames
- Damage to the brain's motion processing region
- Pouring liquid: appears frozen, then cup is suddenly overflowing
- Crossing a street: cars appear stationary, then are suddenly very close
- Faces in conversation: frozen between expressions — transitions invisible

VISUAL SNOW SYNDROME

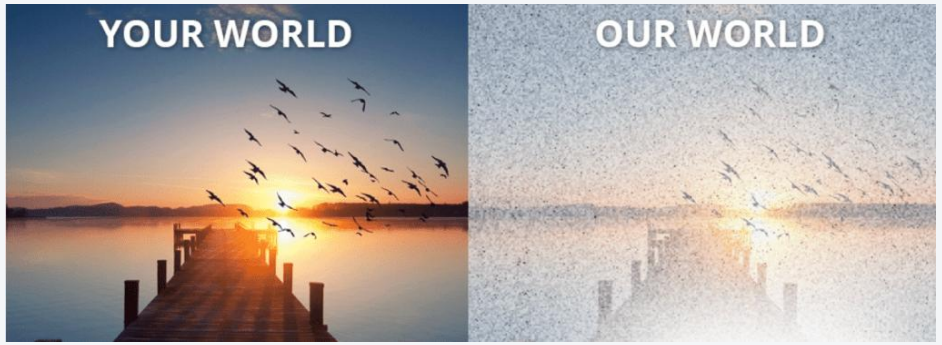
- **It is a nerve syndrome that 2-3 % of people have.**

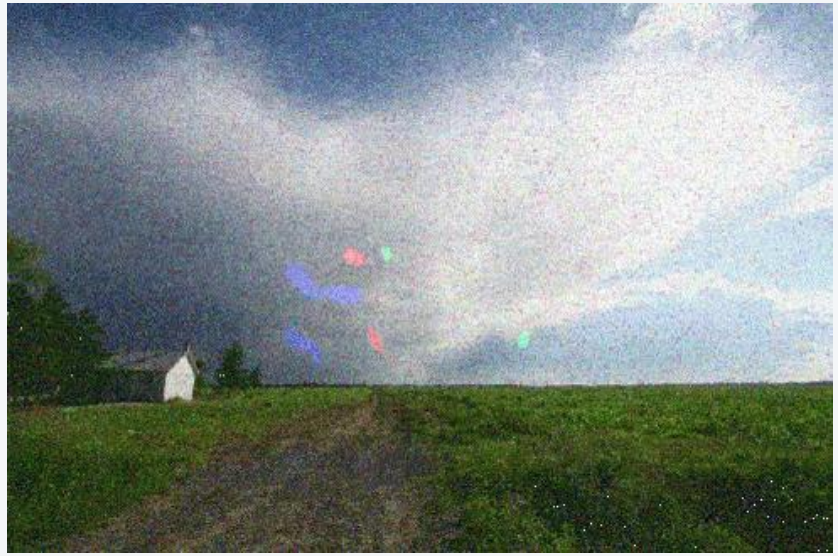
- **They occasionally experience mild visual static, and only a small fraction meet the full clinical criteria for VSS.**

- Persistent static across the entire visual field — like an older TV with no signal.

- Additional features: lingering after-images, light flashes, poor night vision.

- Often accompanied by tinnitus, brain fog, and light/sound sensitivity.





BRAIN-VISION CONDITIONS — SUMMARY

1–3%

Aphantasia

No voluntary mental imagery

2.5%

Prosopagnosia

Developmental face blindness

2–3%

Visual Snow Syndrome

Persistent static overlay

>30%

Issues with the cerebral cortex

Dedicated to visual processing

Assistive Technology for Low Vision

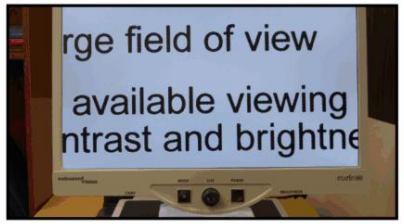
- Screen magnification software enlarges text and images on any device.
- Text-to-speech converts written content to audio.
- High-contrast display modes improve legibility.
- The smartphone, for many with low vision, has become the most powerful accessibility tool ever created.

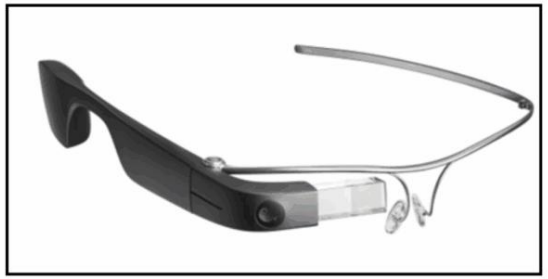
ARTIFICIAL INTELLIGENCE

Around 16% of the global population — 1.3 billion people — have a significant disability.

For the visually impaired, there are hundreds of AI powered Apps & Devices available that provide real-time scene description, text reading, face recognition, and navigation assistance, such as:

- Microsoft's Seeing AI
- Be My AI
- OrCam MyEye wearable
- Envision Glasses
- Dot Lumen glasses.





BE MY EYES

Blind and low-vision users can request live video support through the Be My Eyes smart phone app.

Volunteers provide real-time assistance, helping with tasks like reading labels, identifying objects, or navigating unfamiliar environments.

BE MY AI™

The new **free** app now features an AI assistant called Be My AI™.

It uses GPT4, from the **Open AI company** to enhance its performance.

When logged in as a blind or low-vision user, you can send images via the app to Be My AI™.

It will answer questions about the image and provide conversational AI-generated visual descriptions in 36 languages.

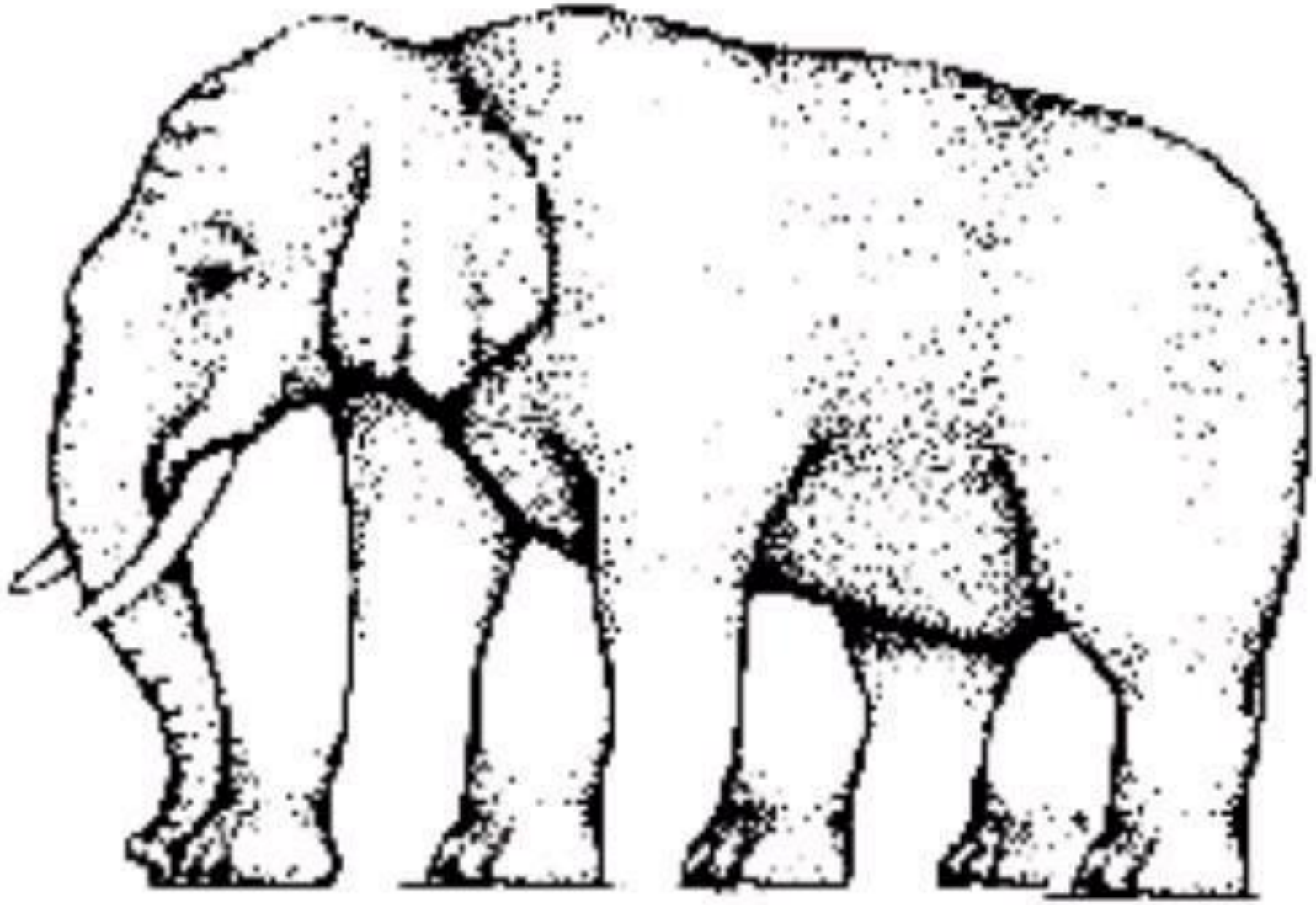
A video of a man who is blind, with the app "Be My AI" that uses GPT 4 installed in his cell phone, on vacation in England and asking it about Buckingham Palace and more.

https://www.youtube.com/watch?v=KwNUJ69RbwY 1.1 min

PART 7

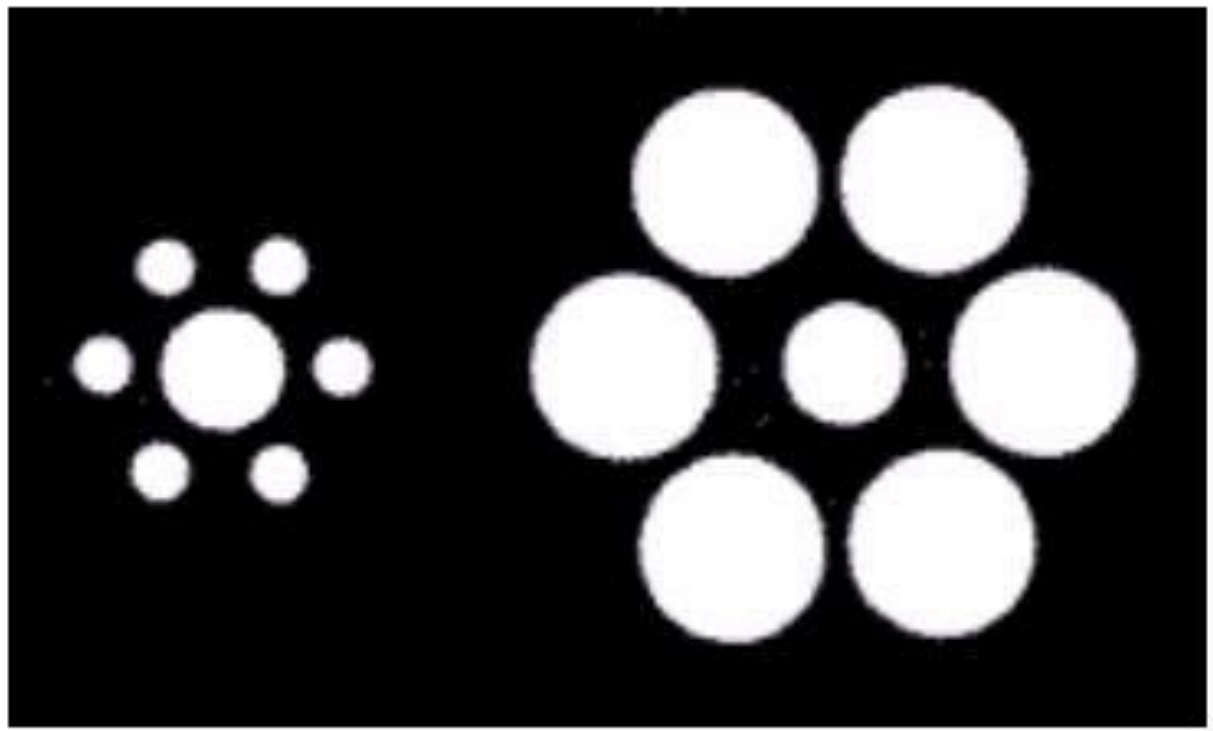
Optical Illusions Showcase


Illusions



How many legs does this elephant have?

Is the left center circle bigger?

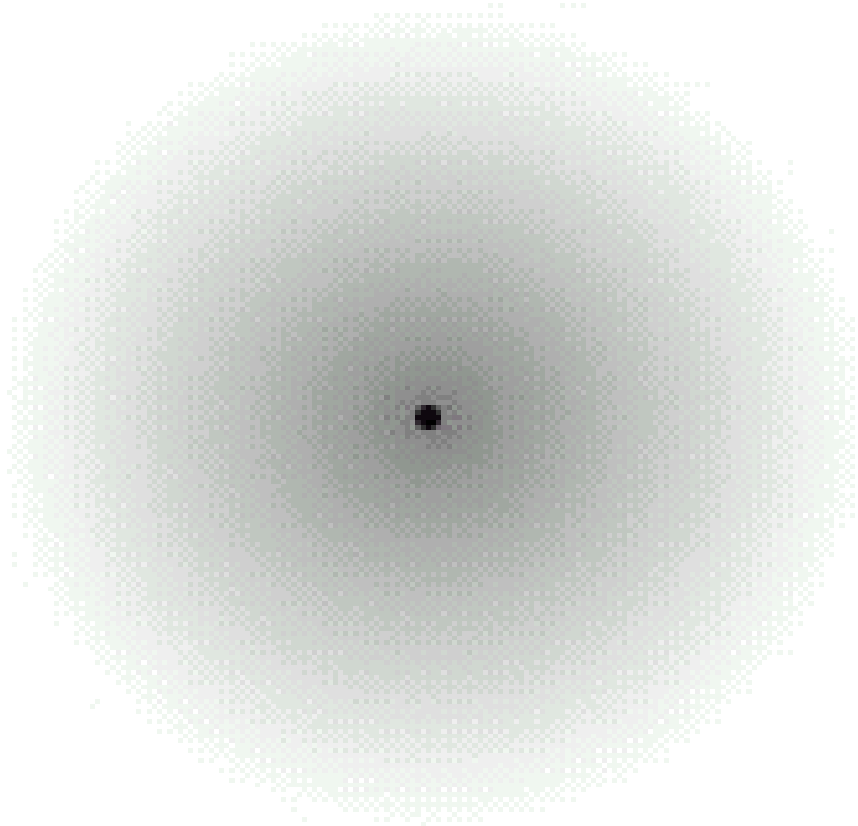


Look at the chart and say the COLOUR not the word

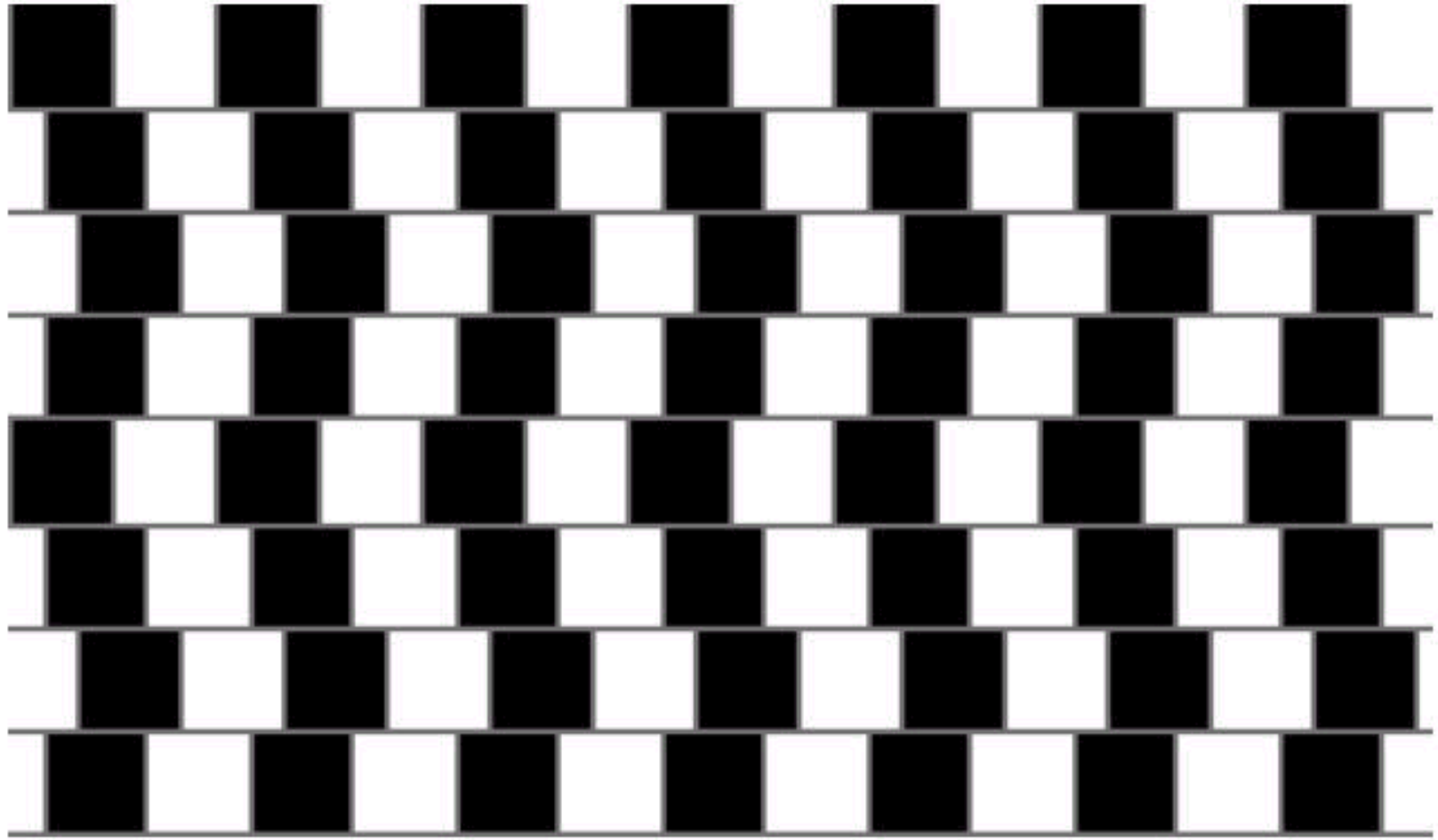
YELLOW BLUE ORANGE
BLACK RED GREEN
PURPLE YELLOW RED
ORANGE GREEN BLACK
BLUE RED PURPLE
GREEN BLUE ORANGE

Left – Right Conflict

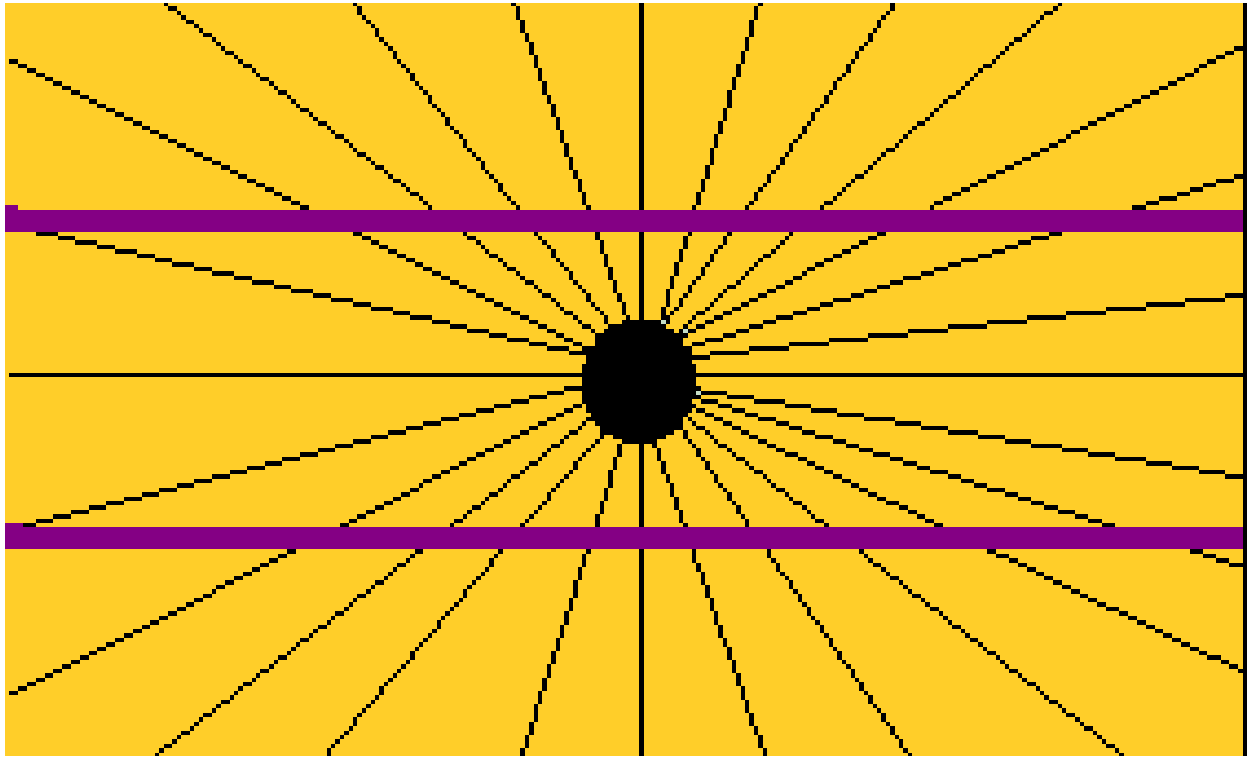
Your right brain tries to say the colour but your left brain insists on reading the word.



If you stare at the black dot, after awhile the haze around it should start to dissipate.

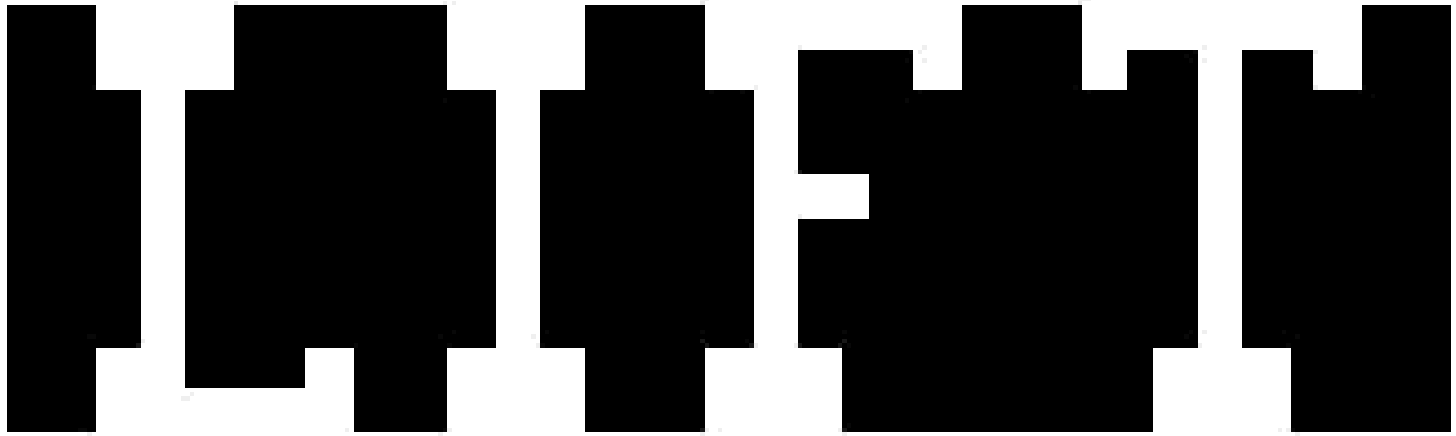


Are the horizontal lines parallel or do they slope?

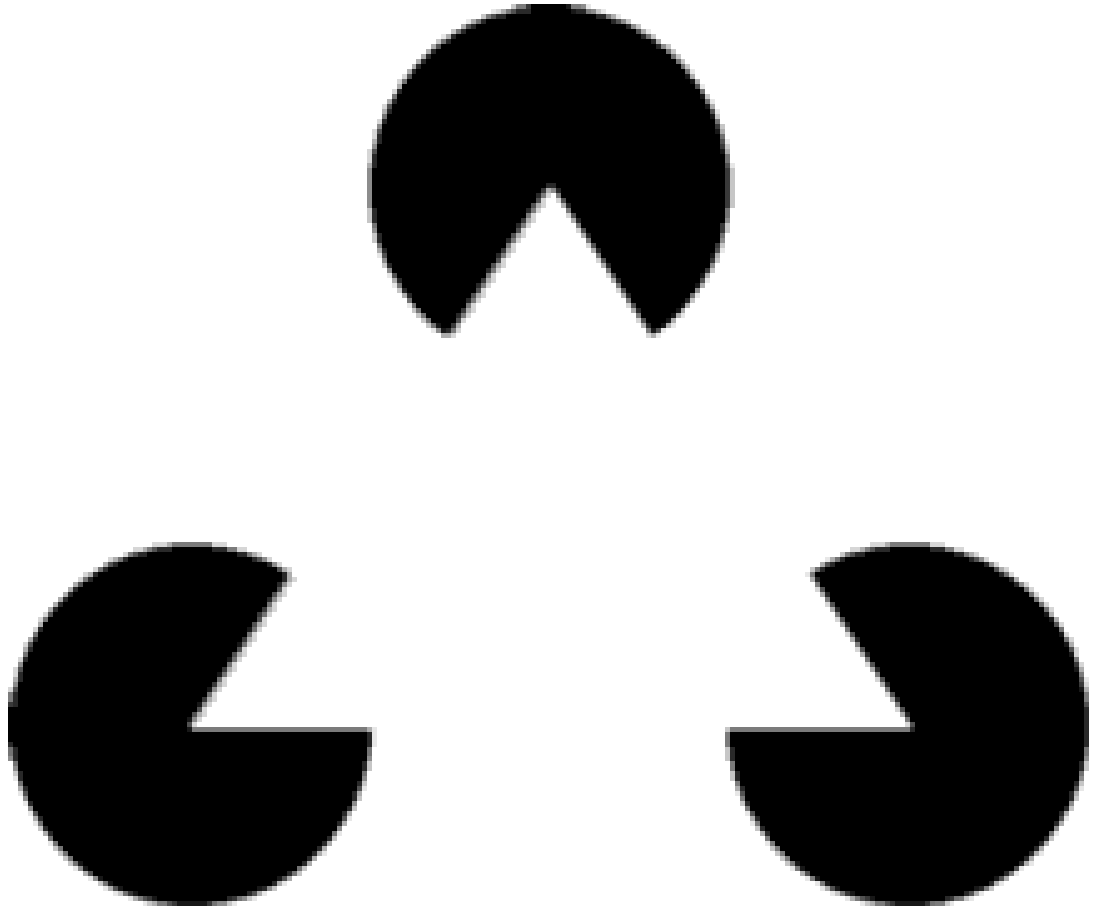


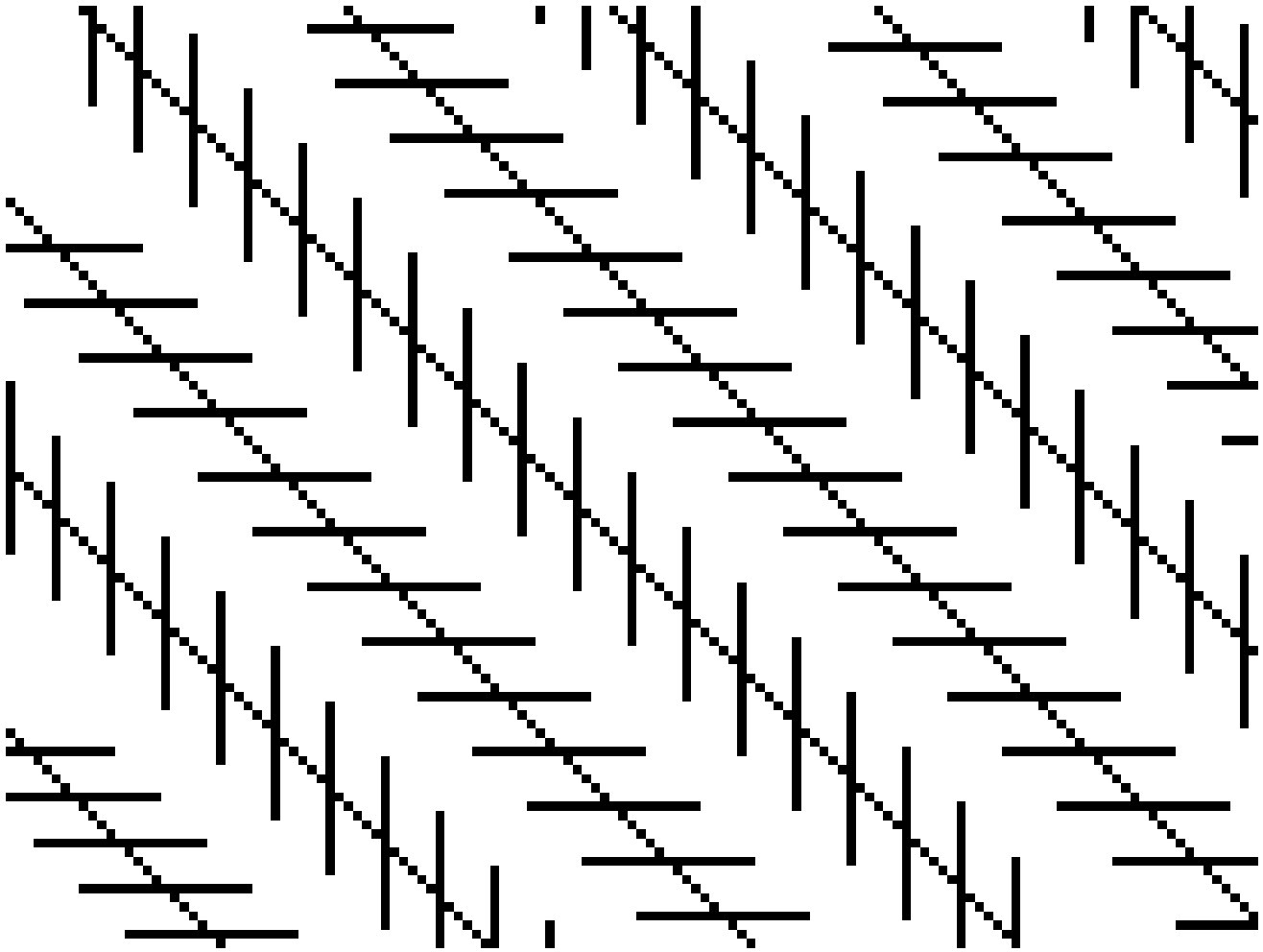
ARE THE 2 HORIZONTAL LINES PARALLEL?

LOOK AT THE IMAGE AND THEN TURN YOUR HEAD TO THE RIGHT AND LOOK AT IT AGAIN !

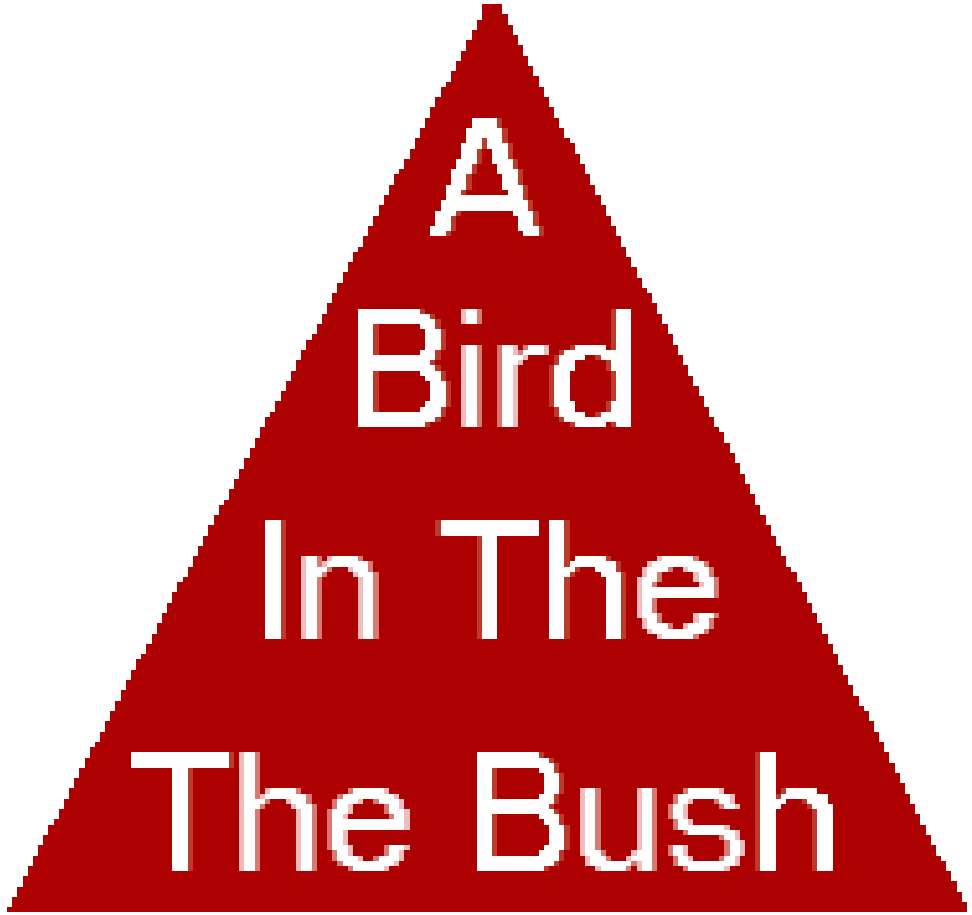


LOOK AT IT FOR A LITTLE WHILE AND SEE IF IT CHANGES !

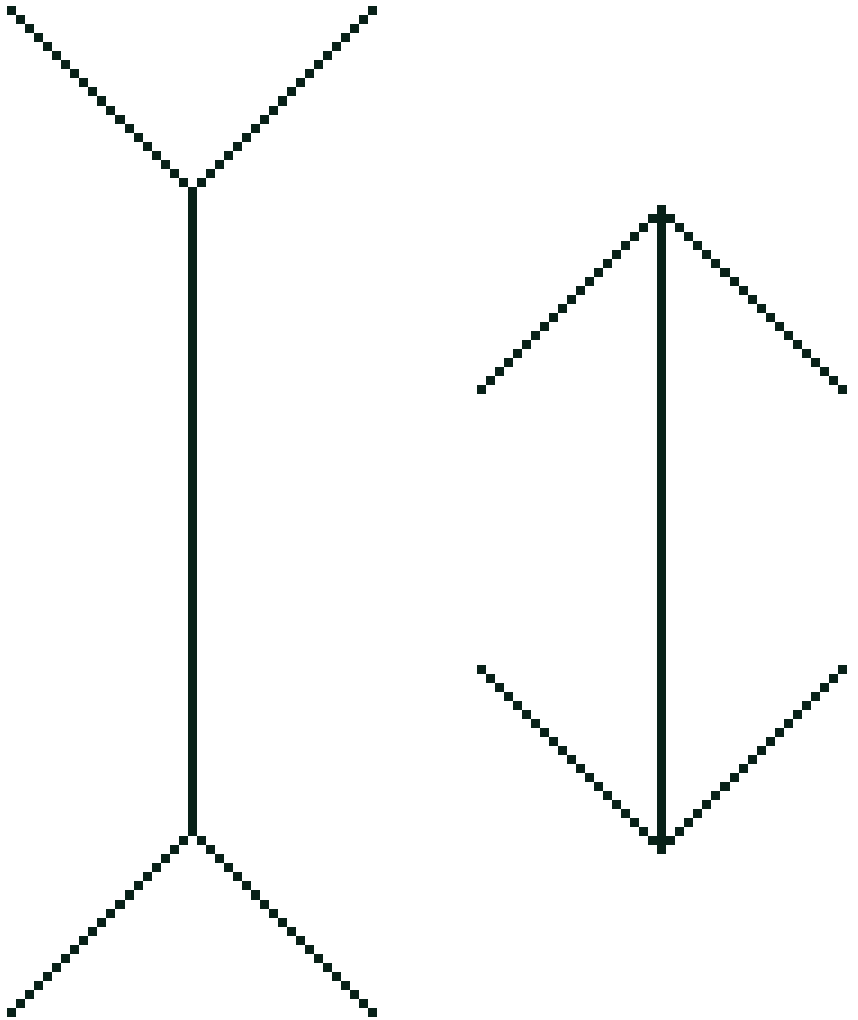




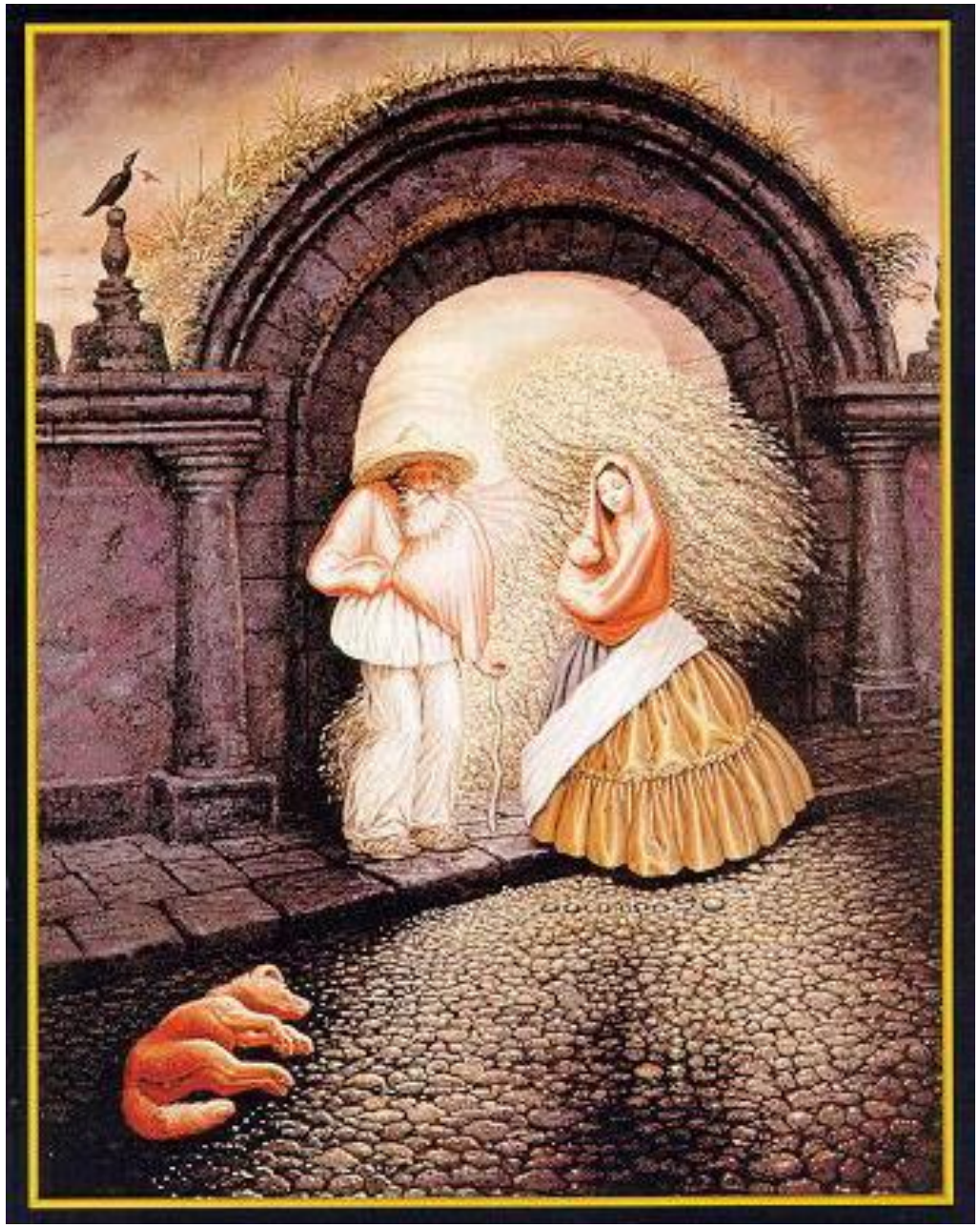
ARE THE LONG LINES PARALEL TO EACH OTHER ?

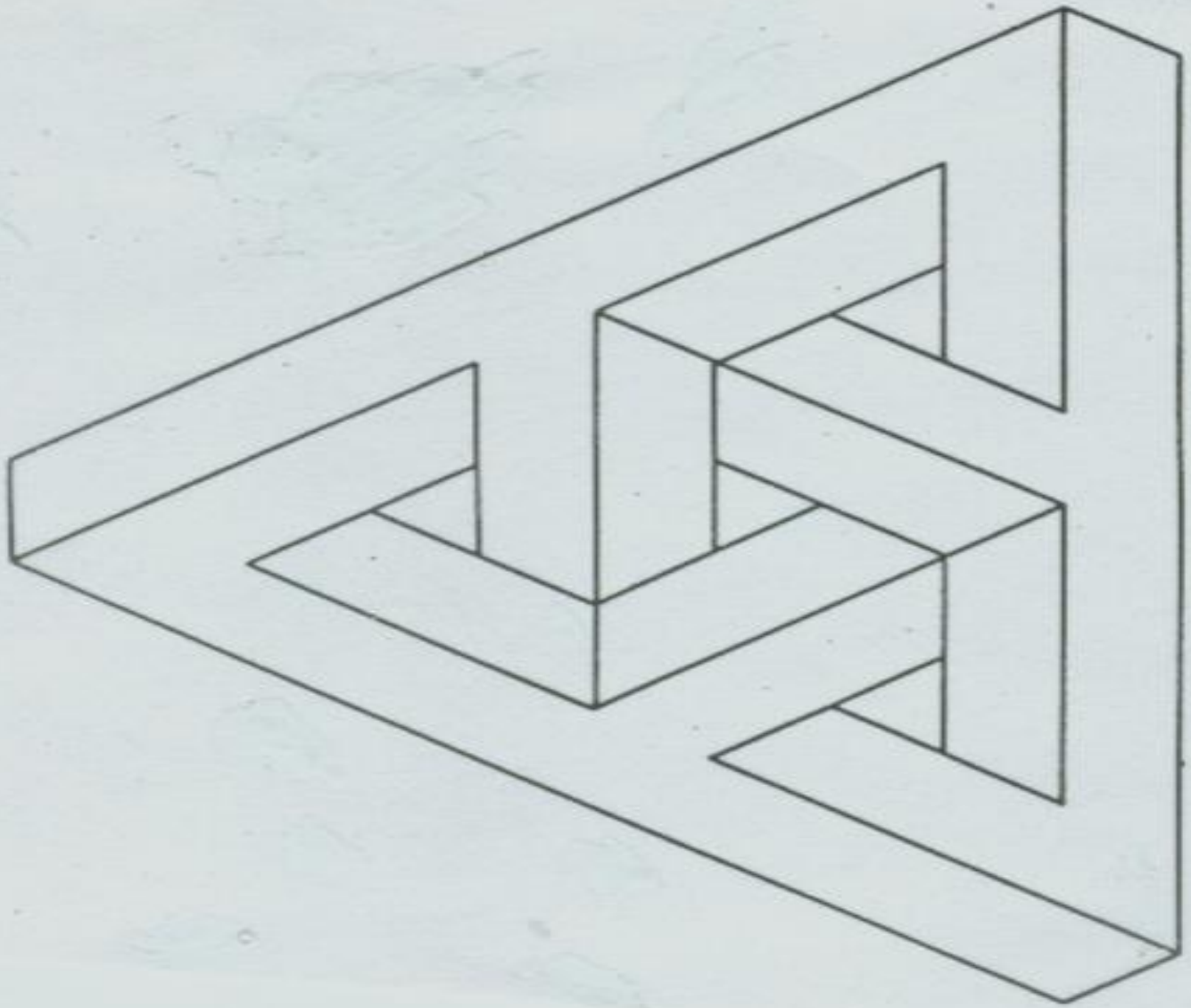


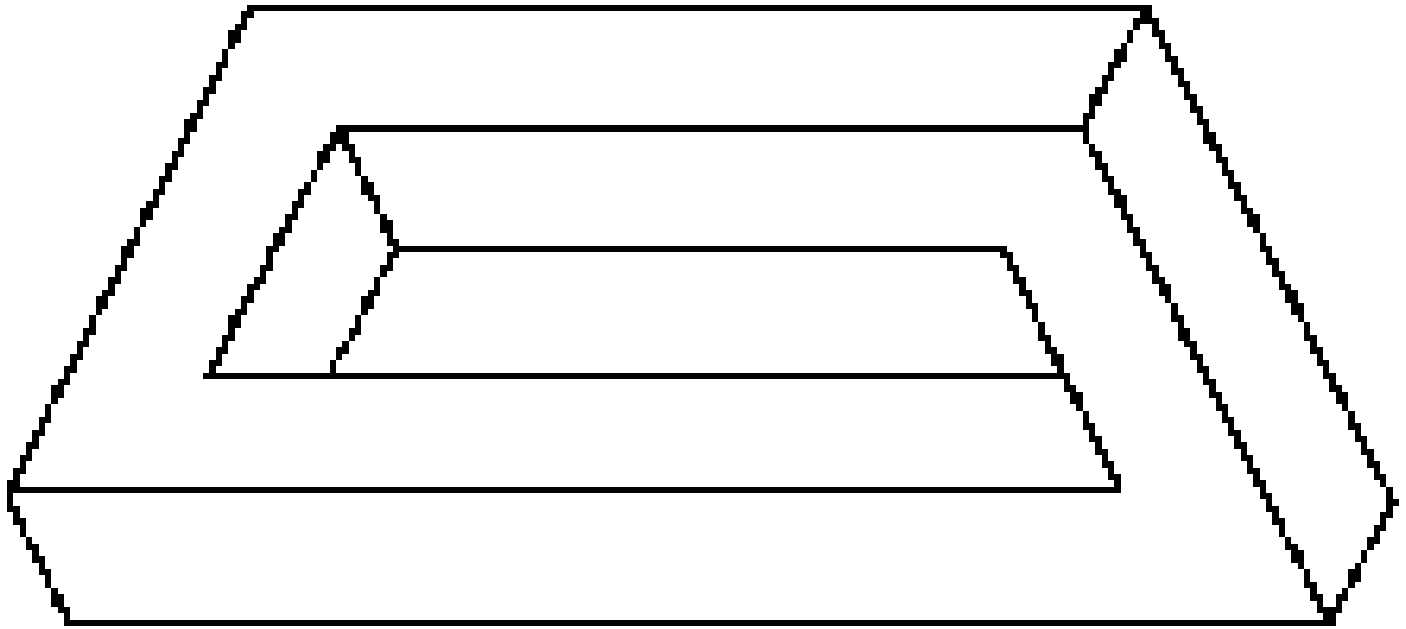
READ IT TWICE TO SEE WHAT WE MISS

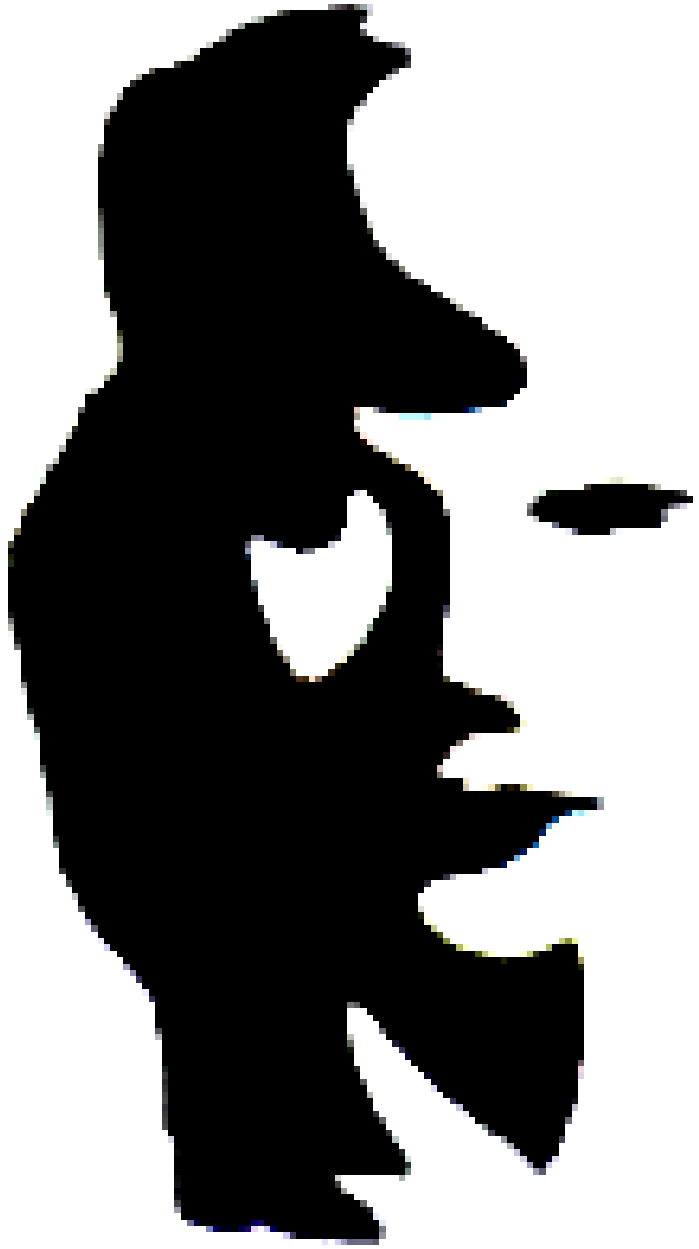


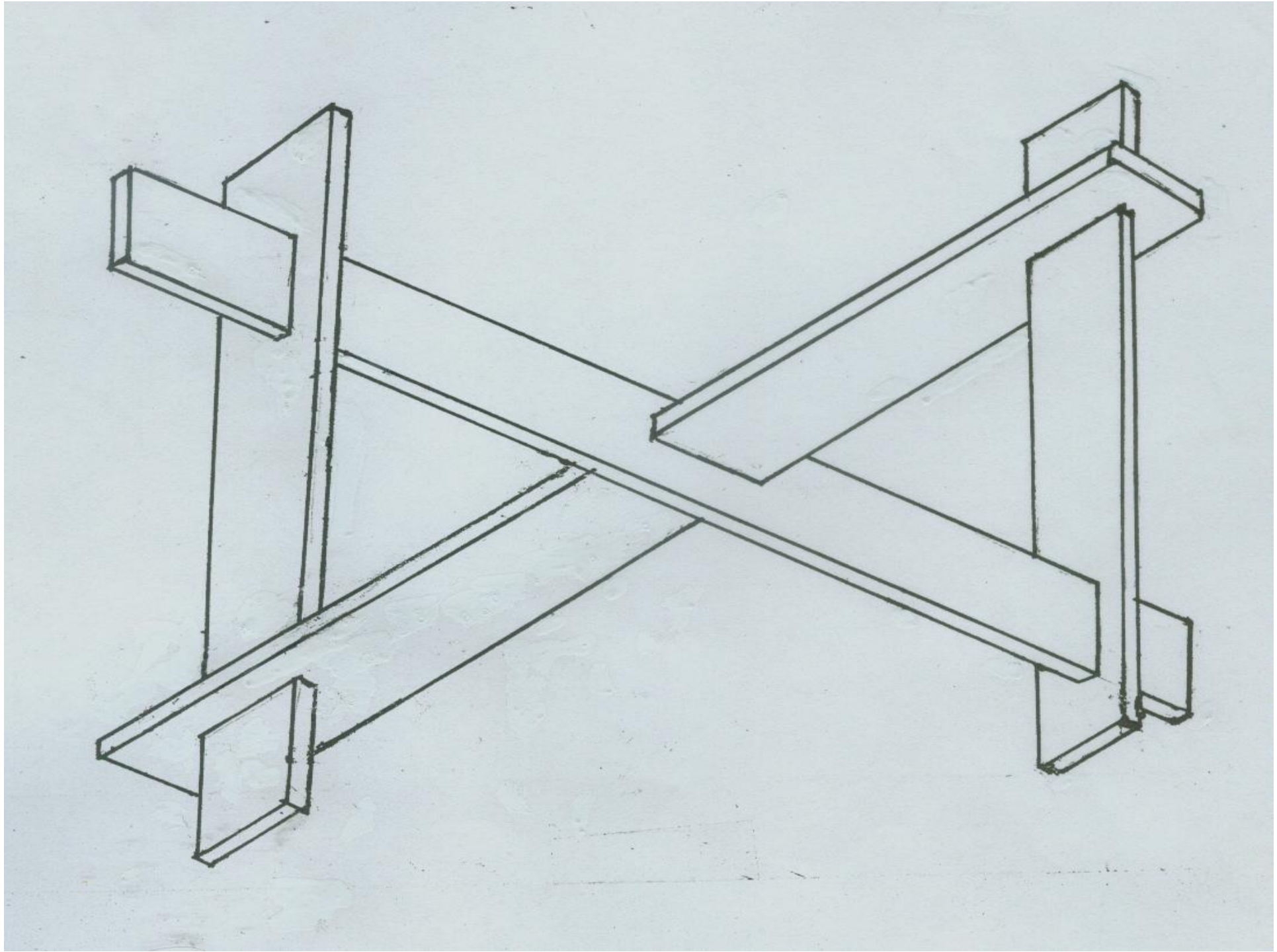
THE VERTICAL LINES ARE THE SAME LENGTH

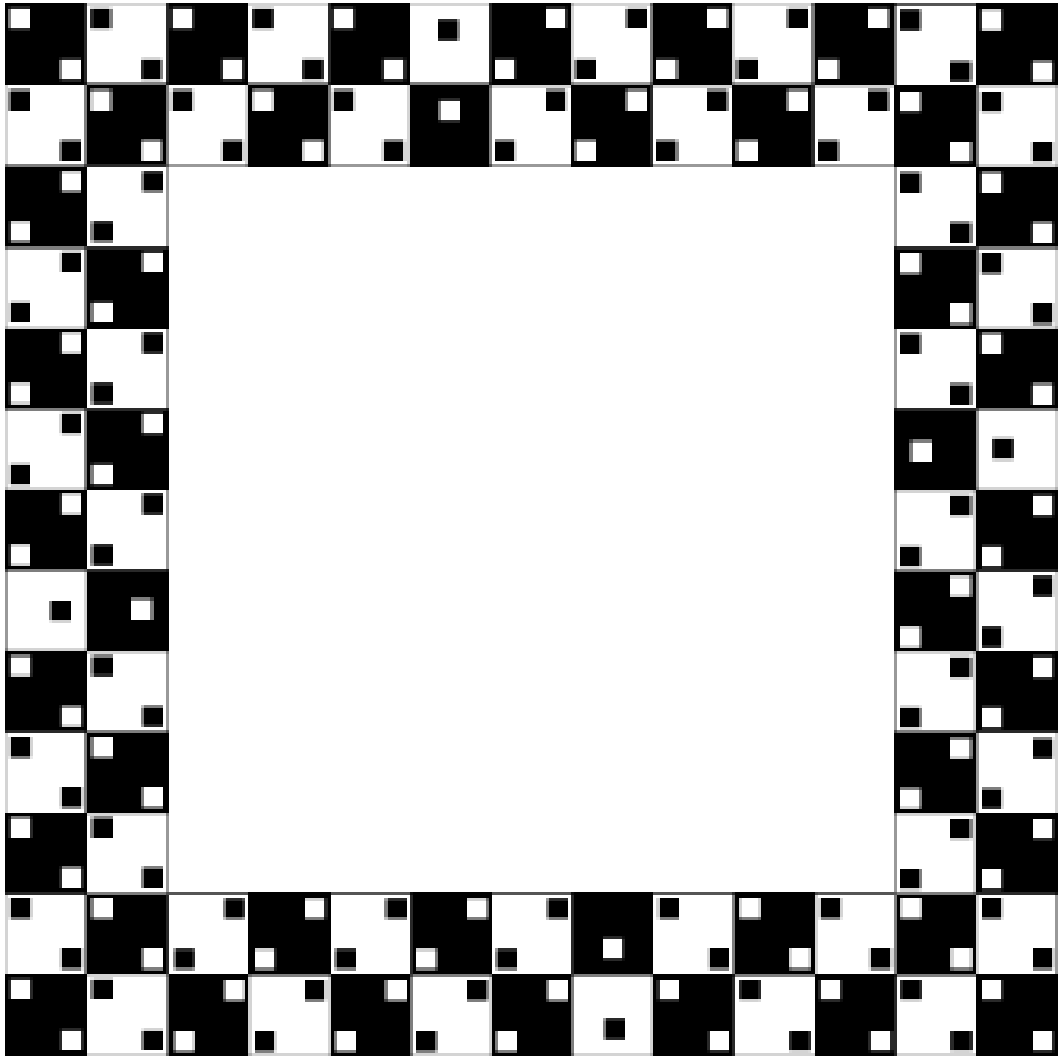




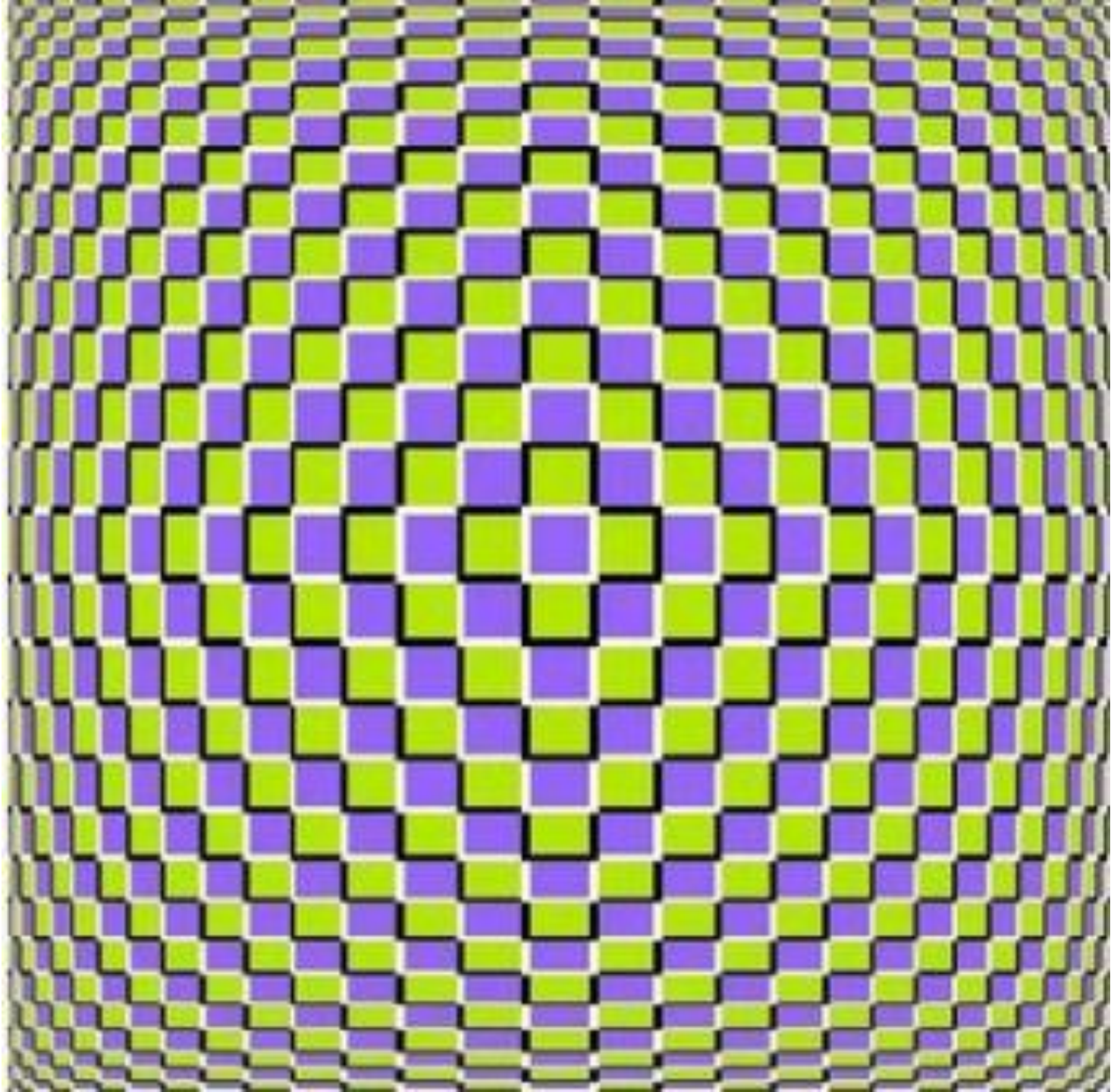


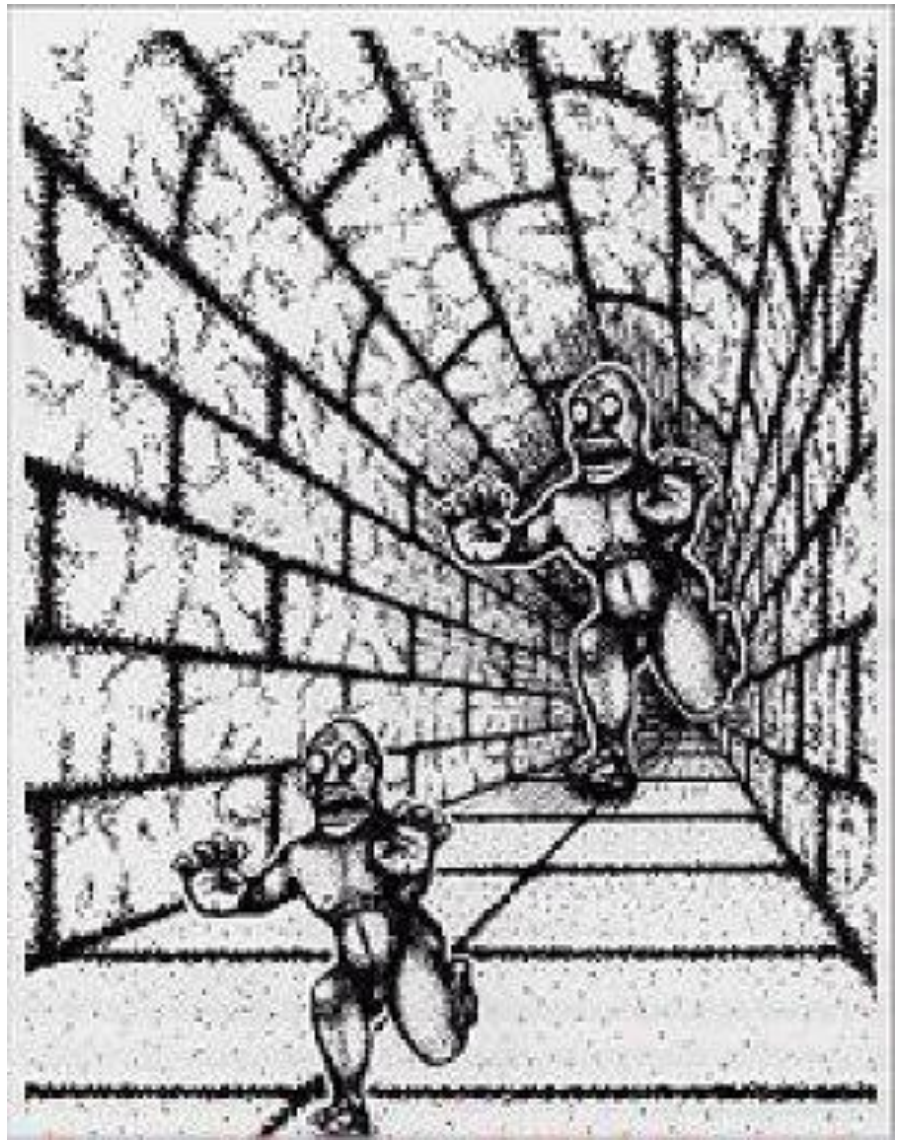




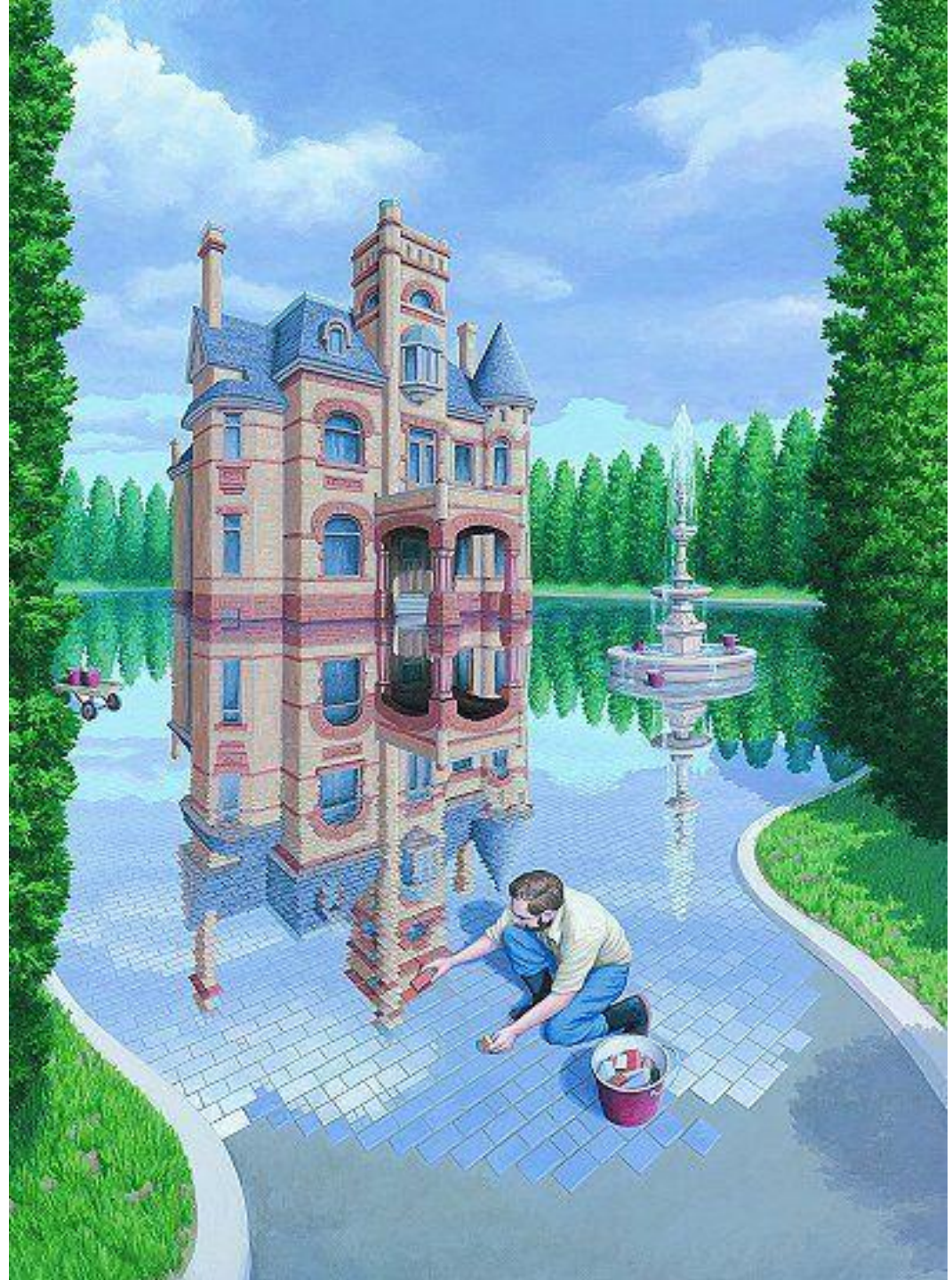


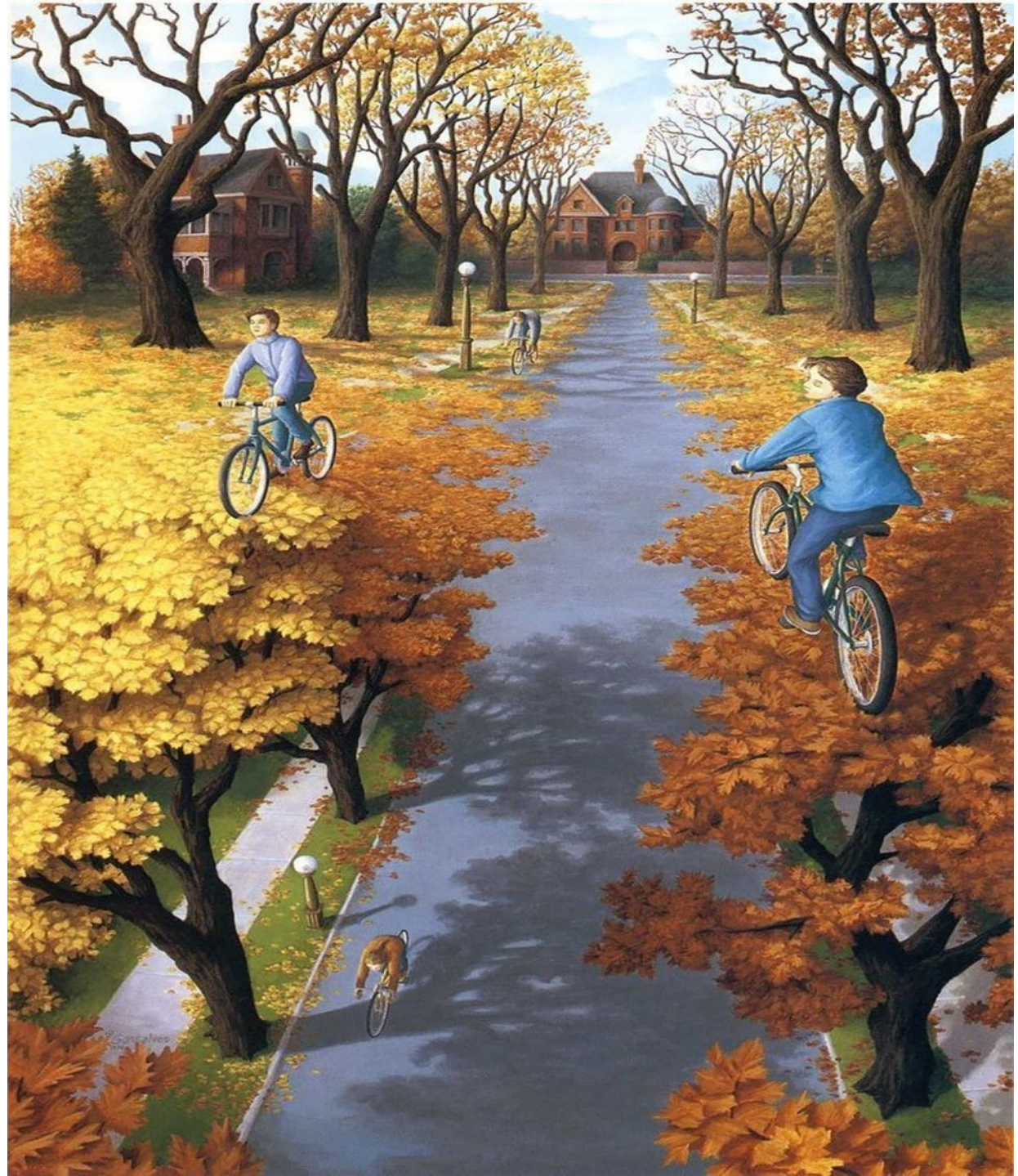
ARE THE INNER AND OUTER LINES STRAIGHT ?

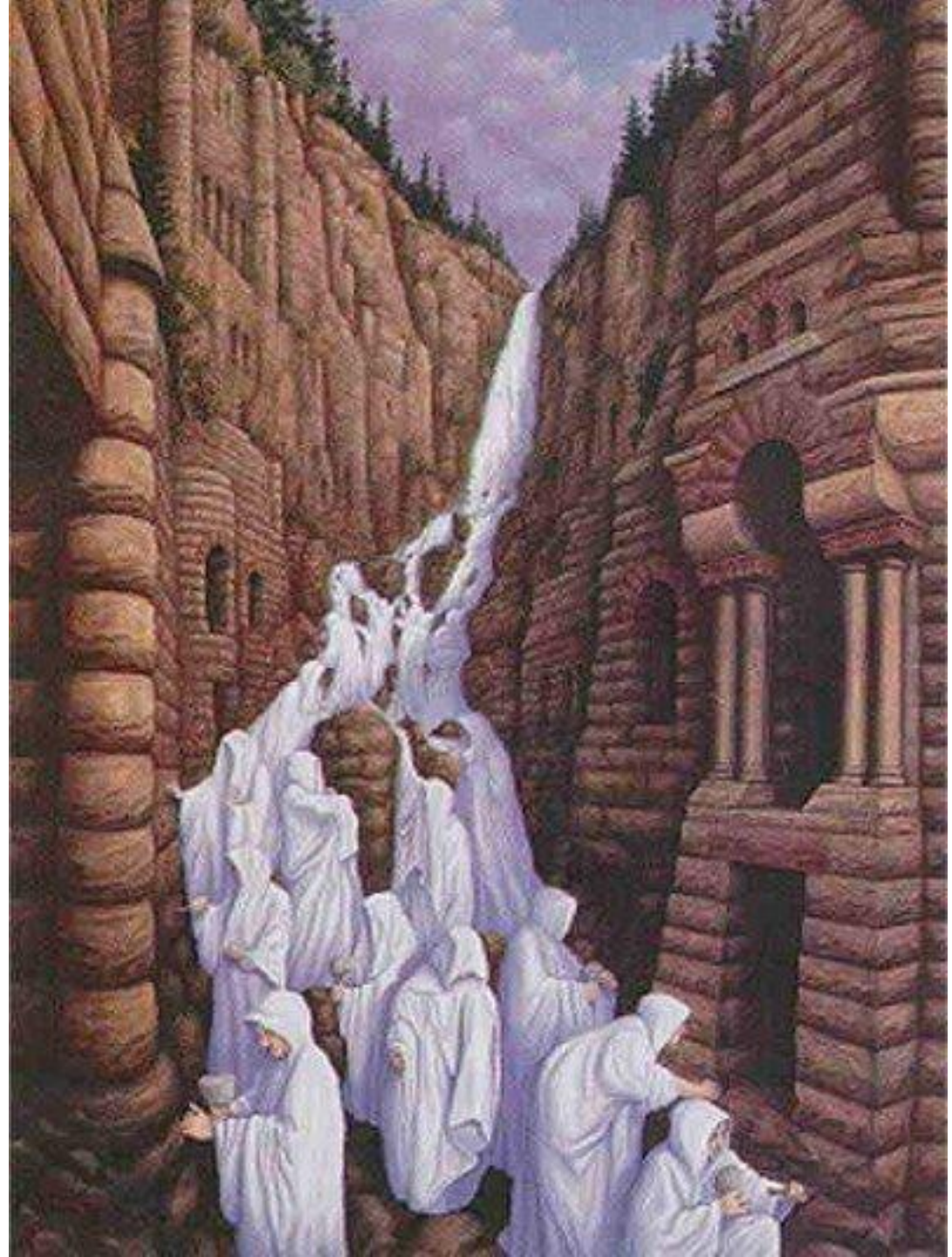


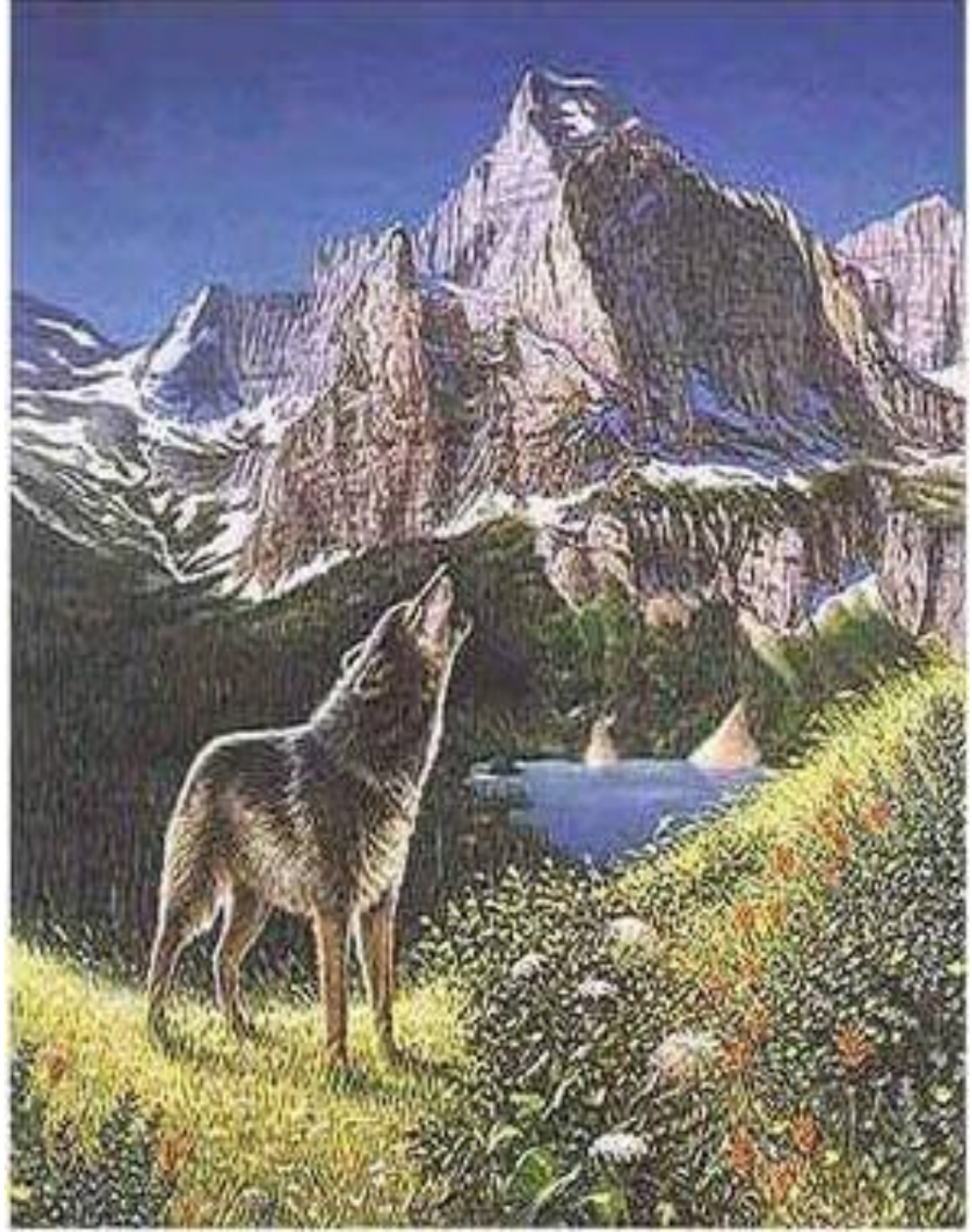


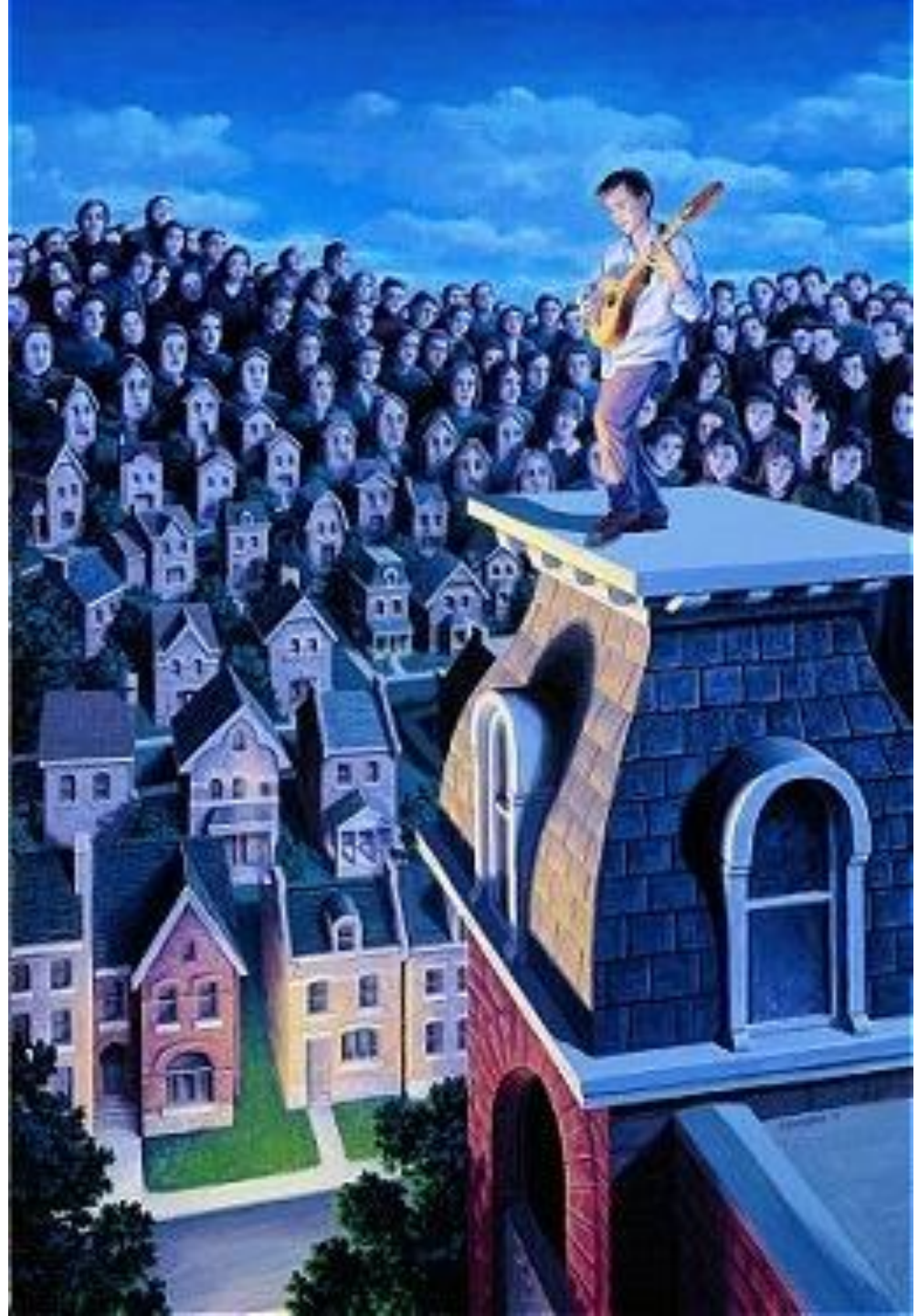
THE 2 MEN ARE THE SAME SIZE !



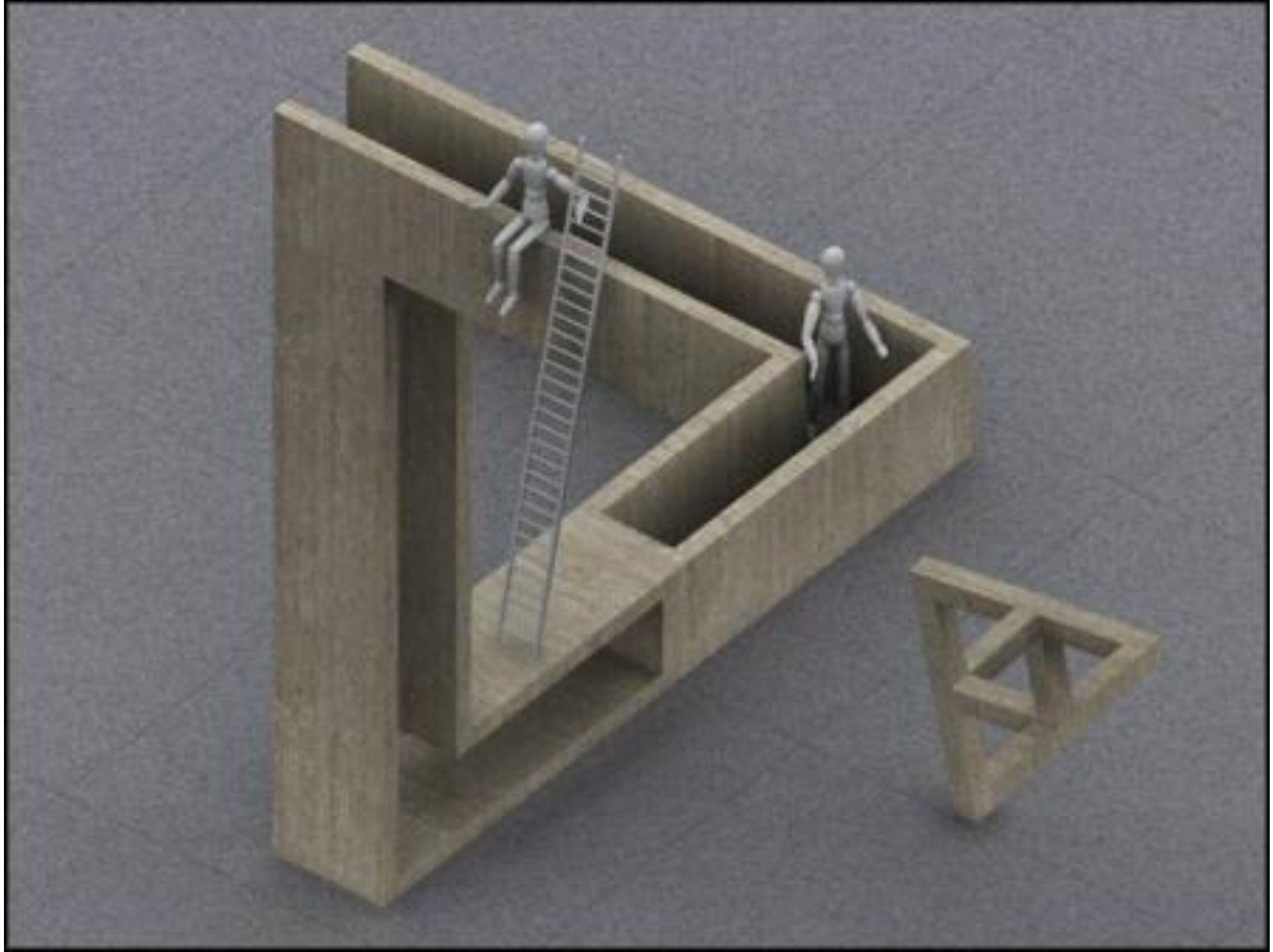


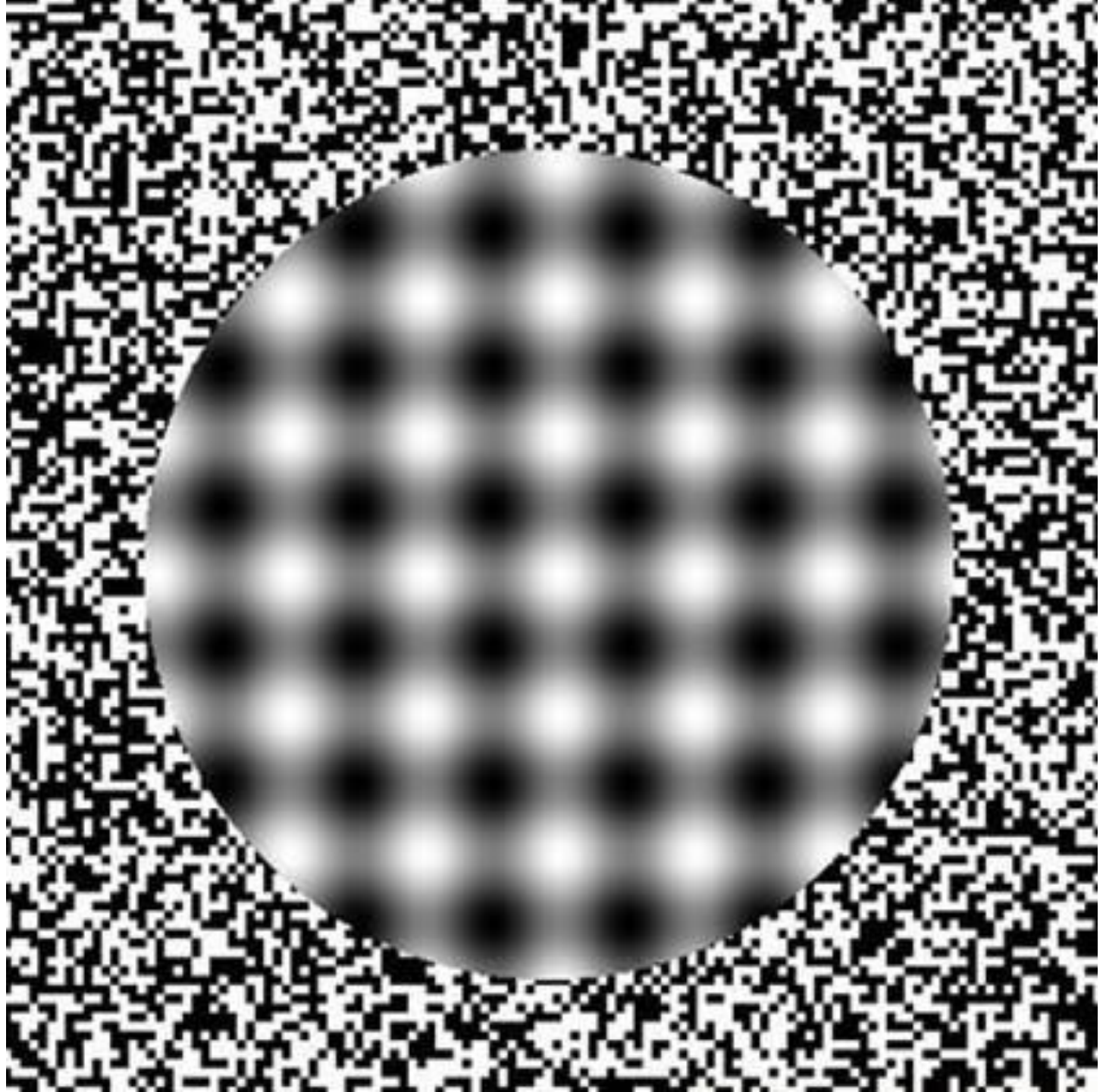


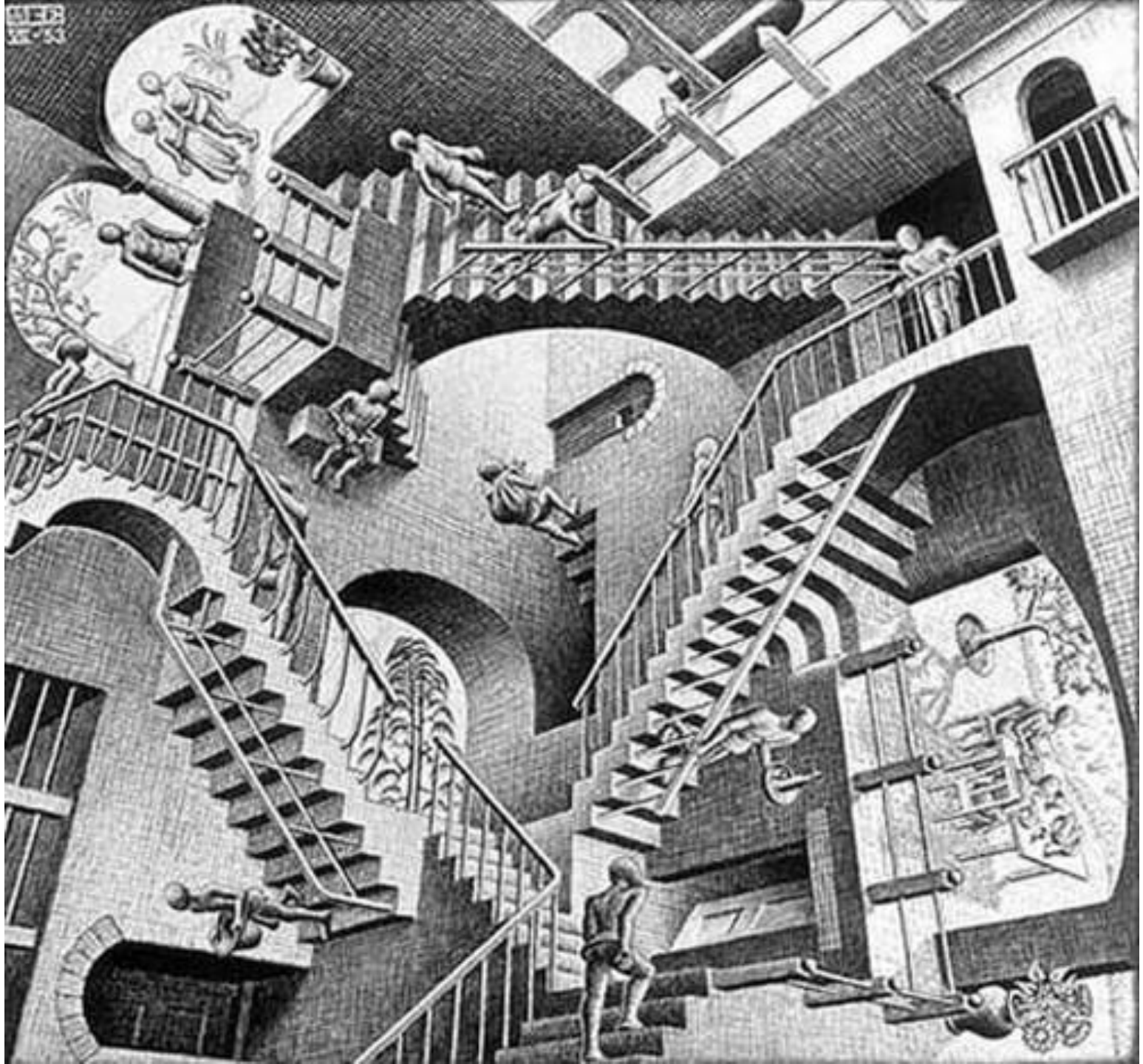


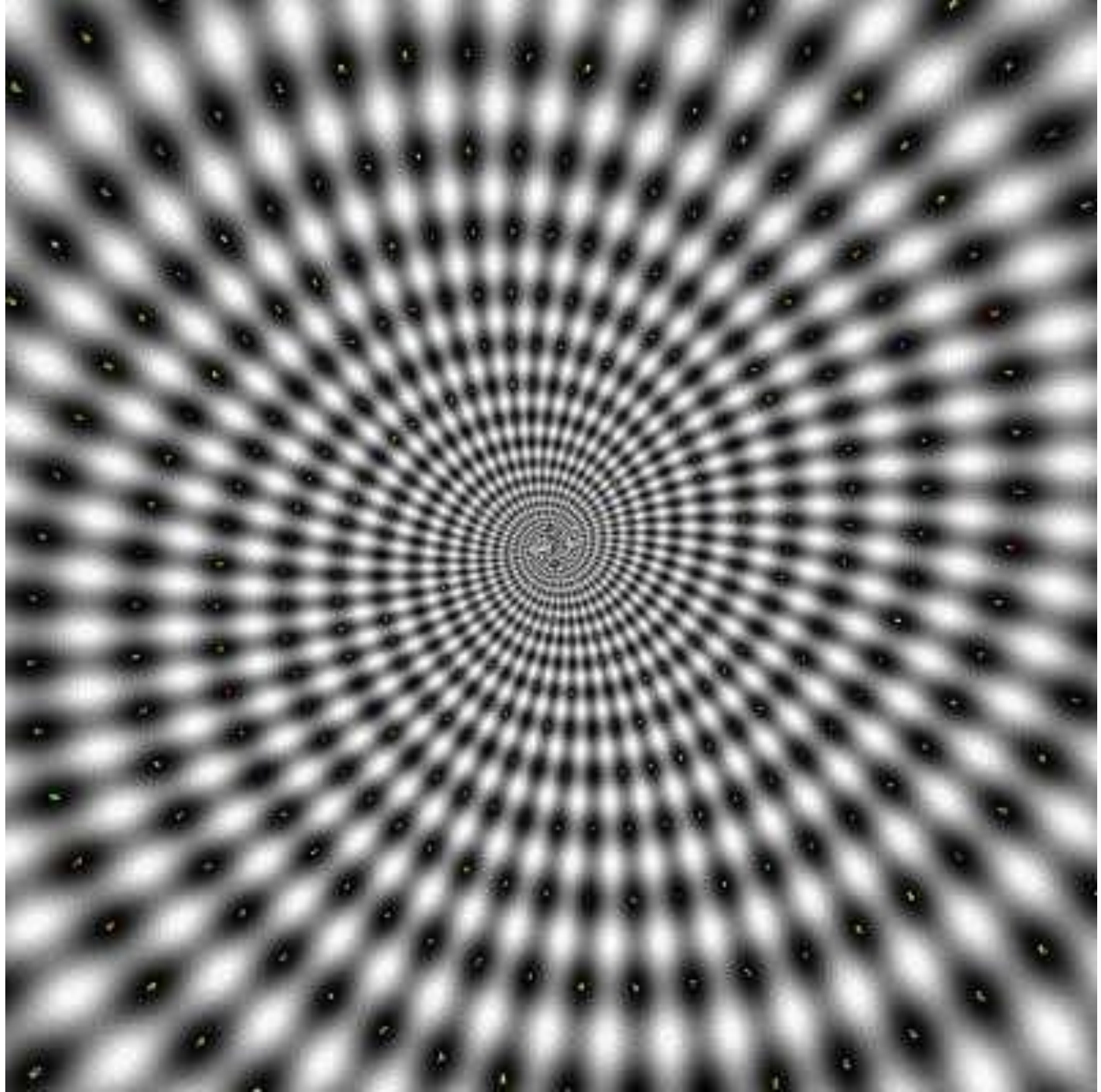


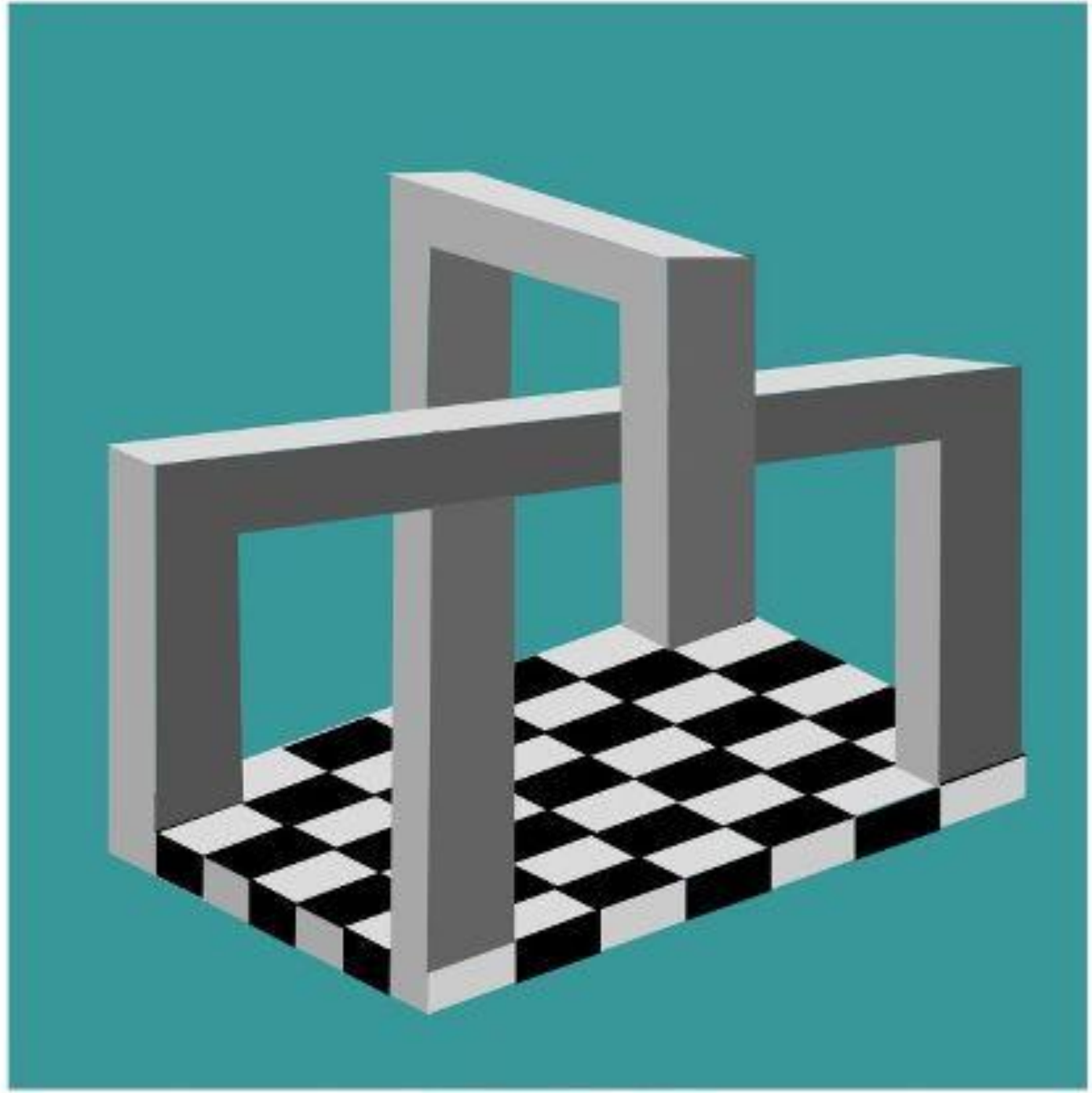
LOOK AT IT FOR A FEW SECONDS TO SEE IT CHANGE

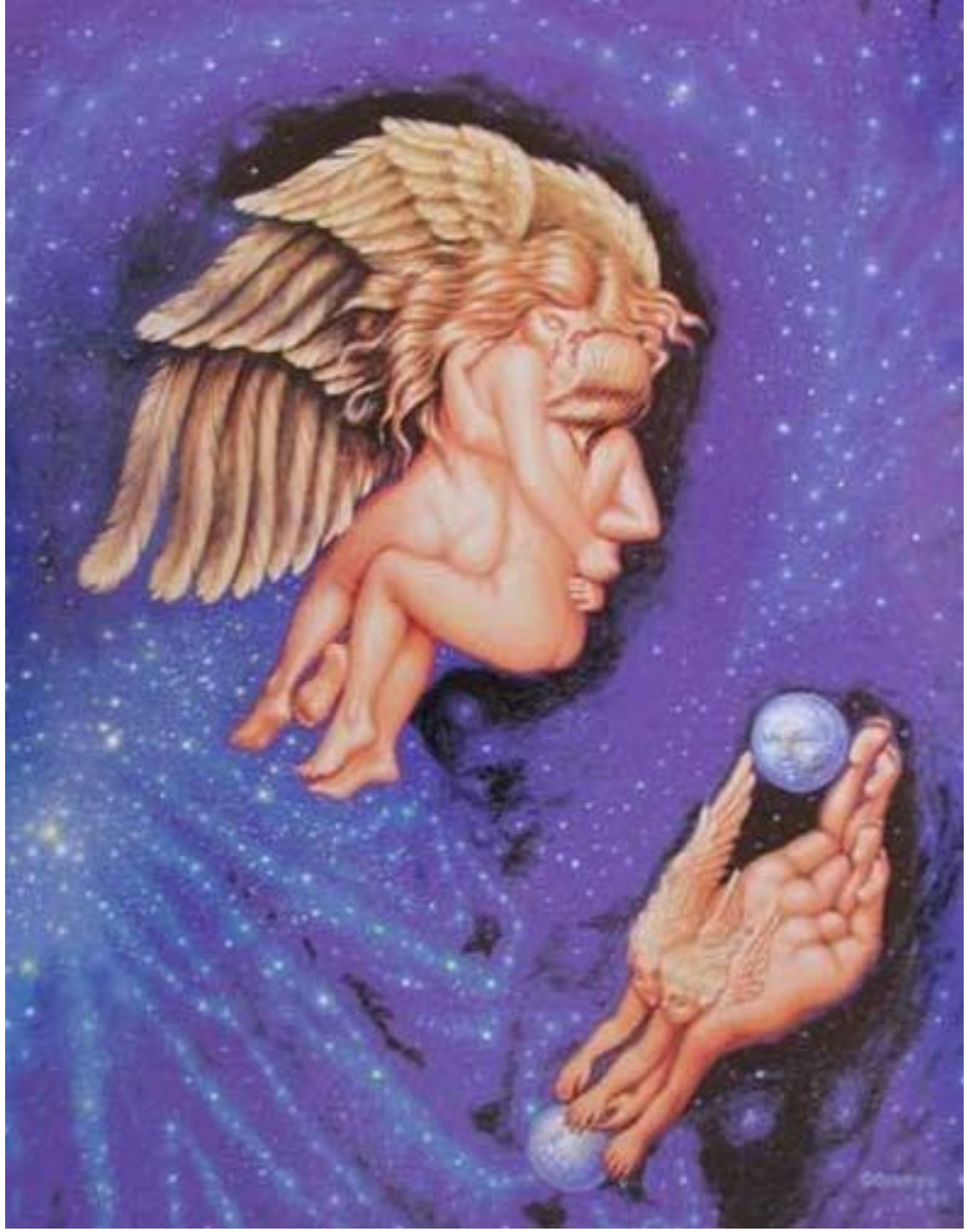


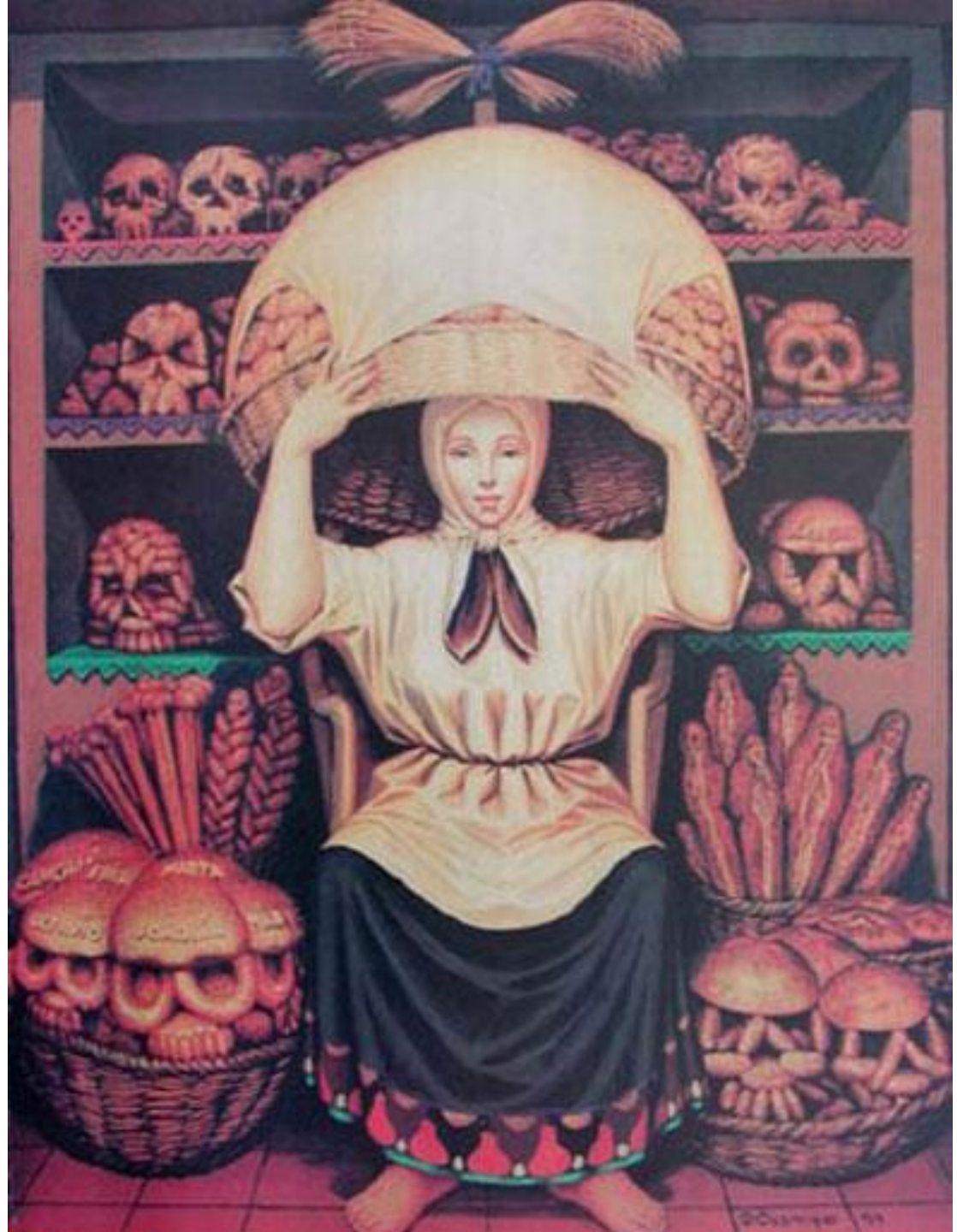


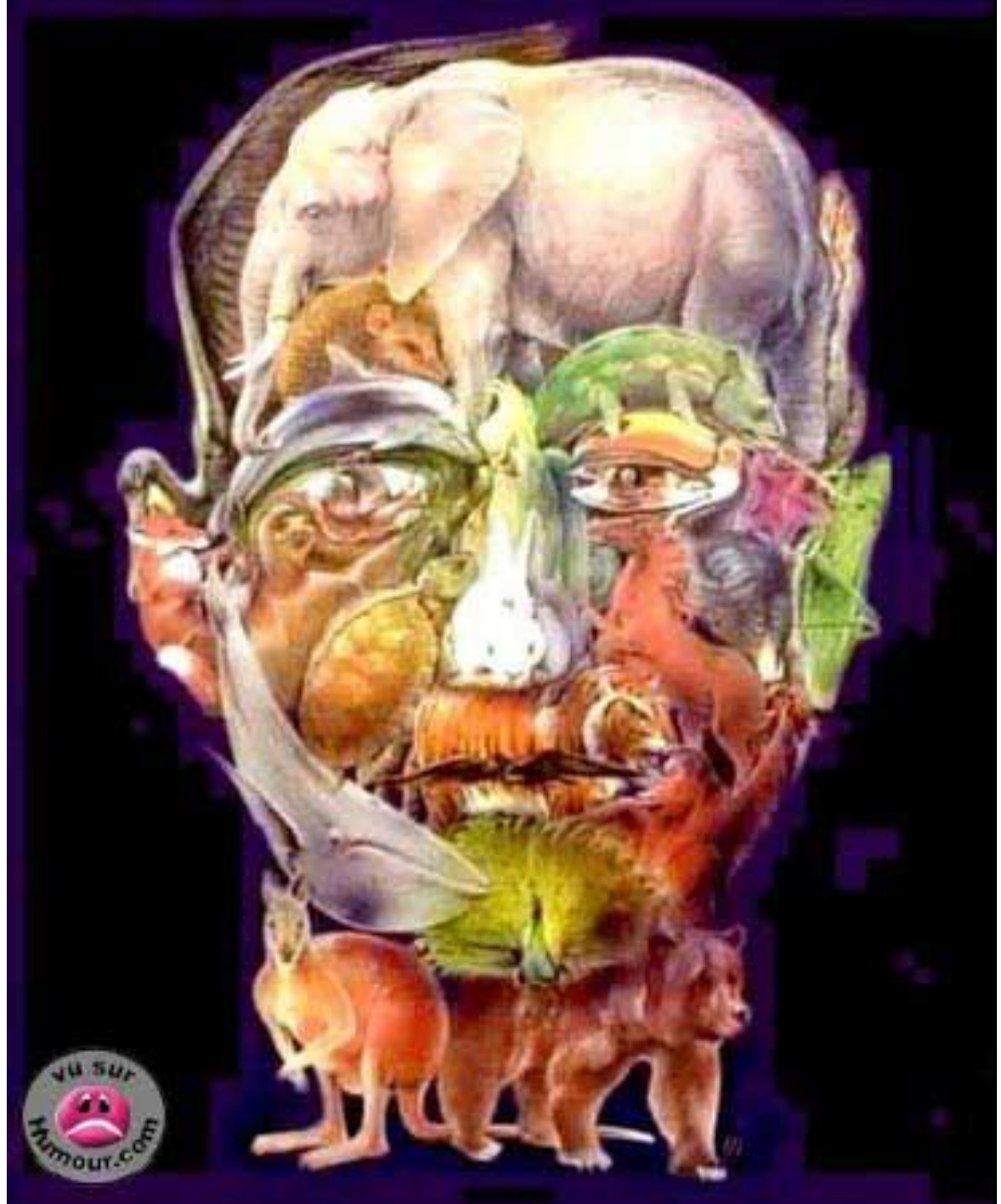








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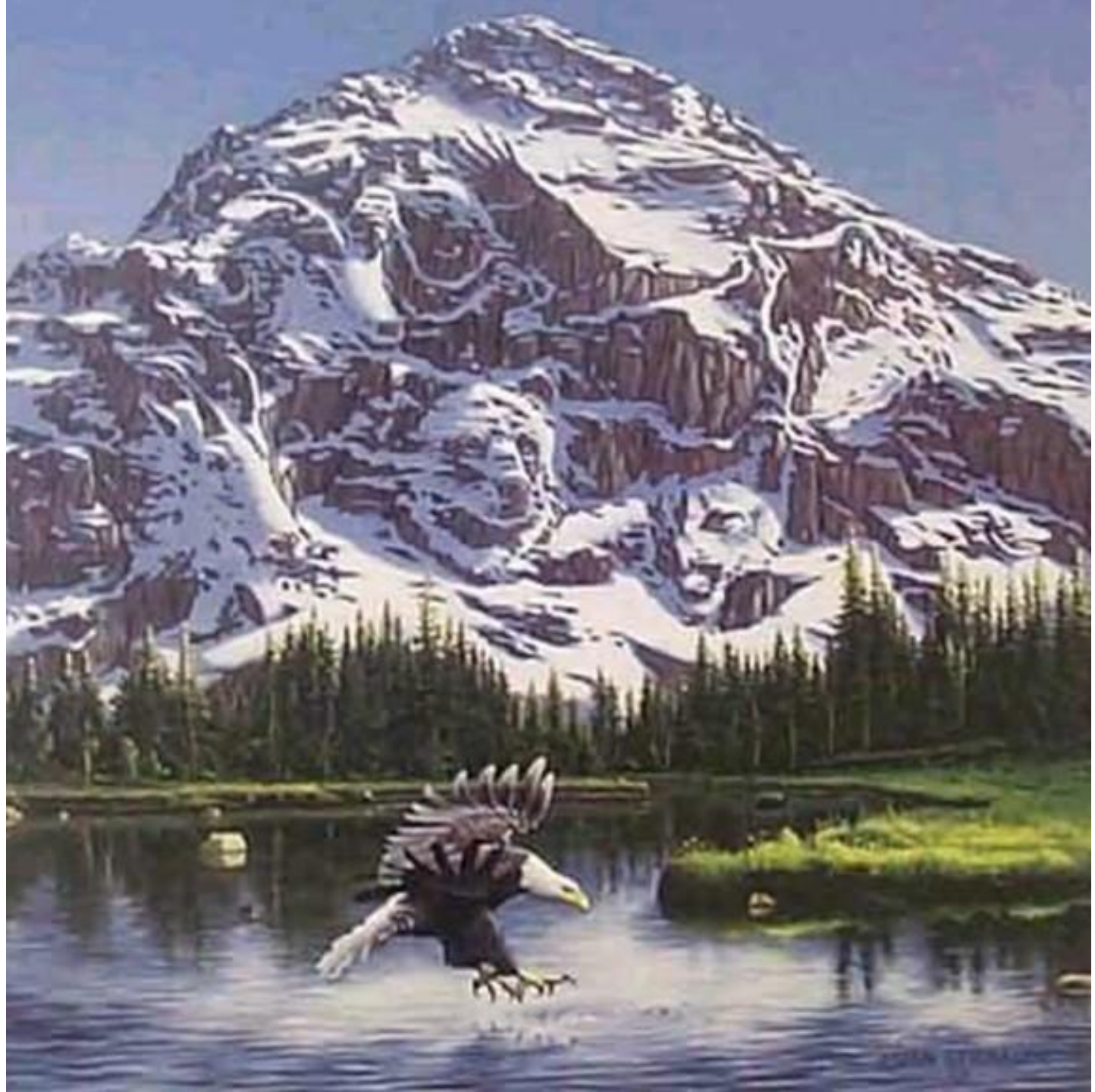

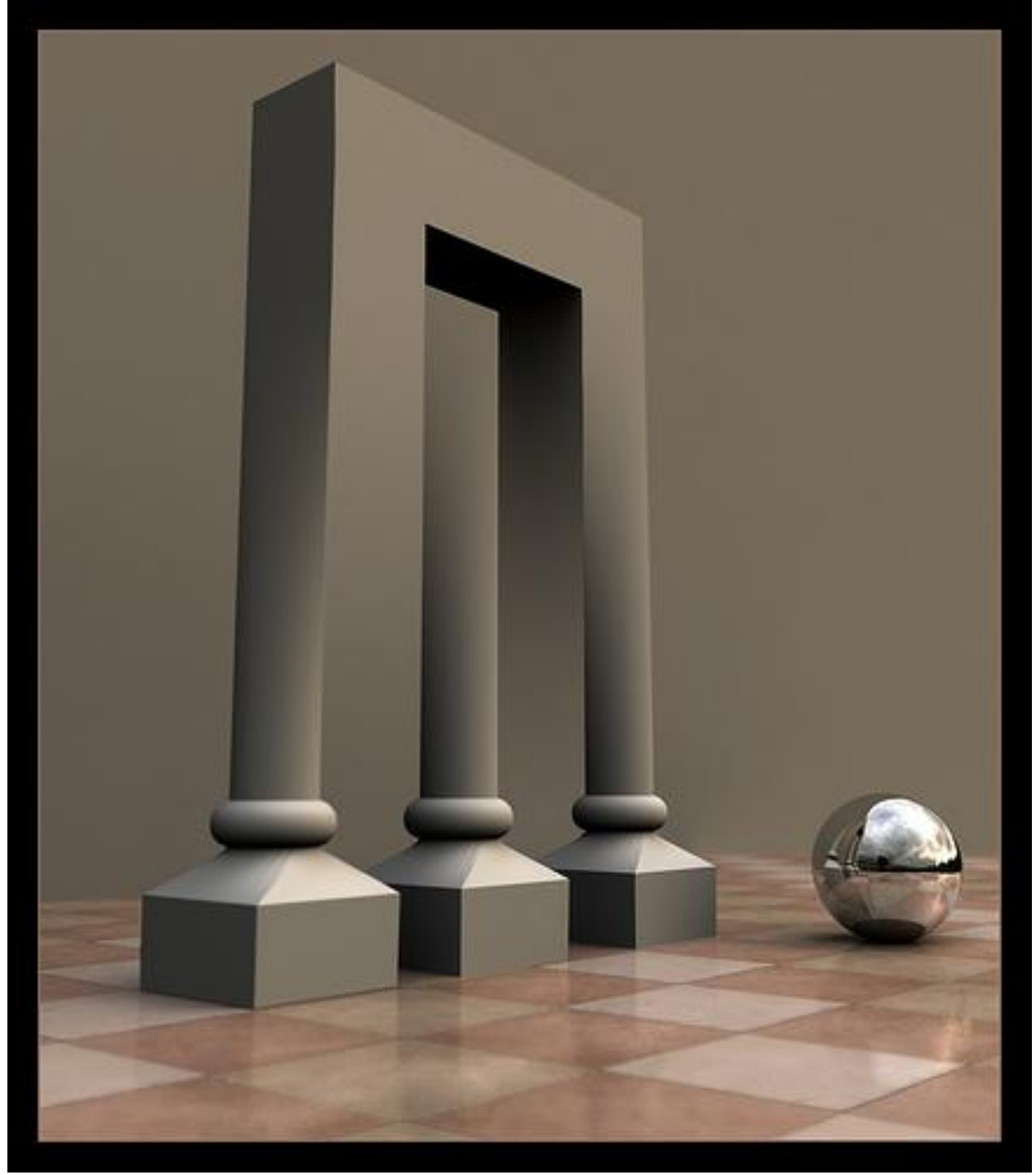

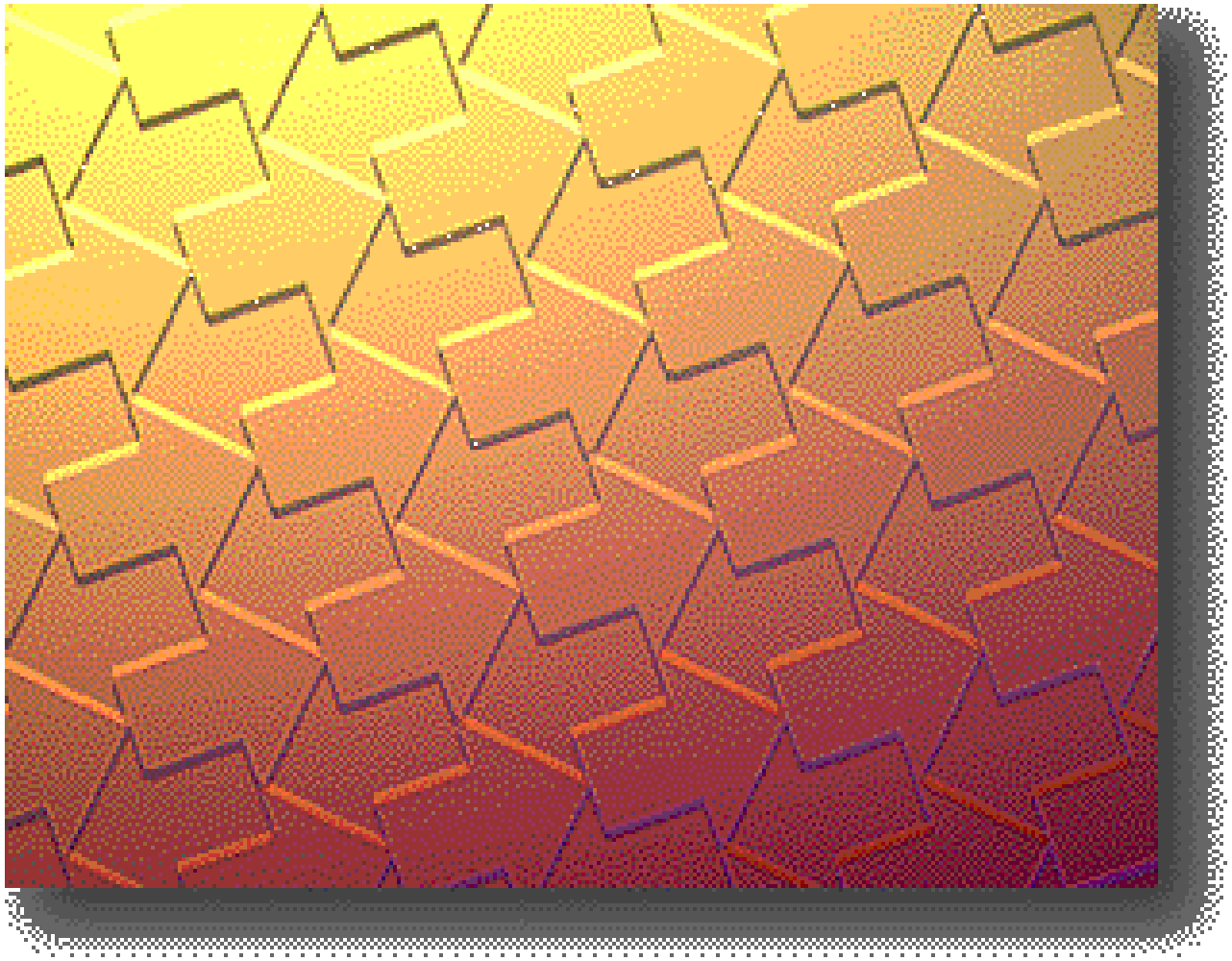

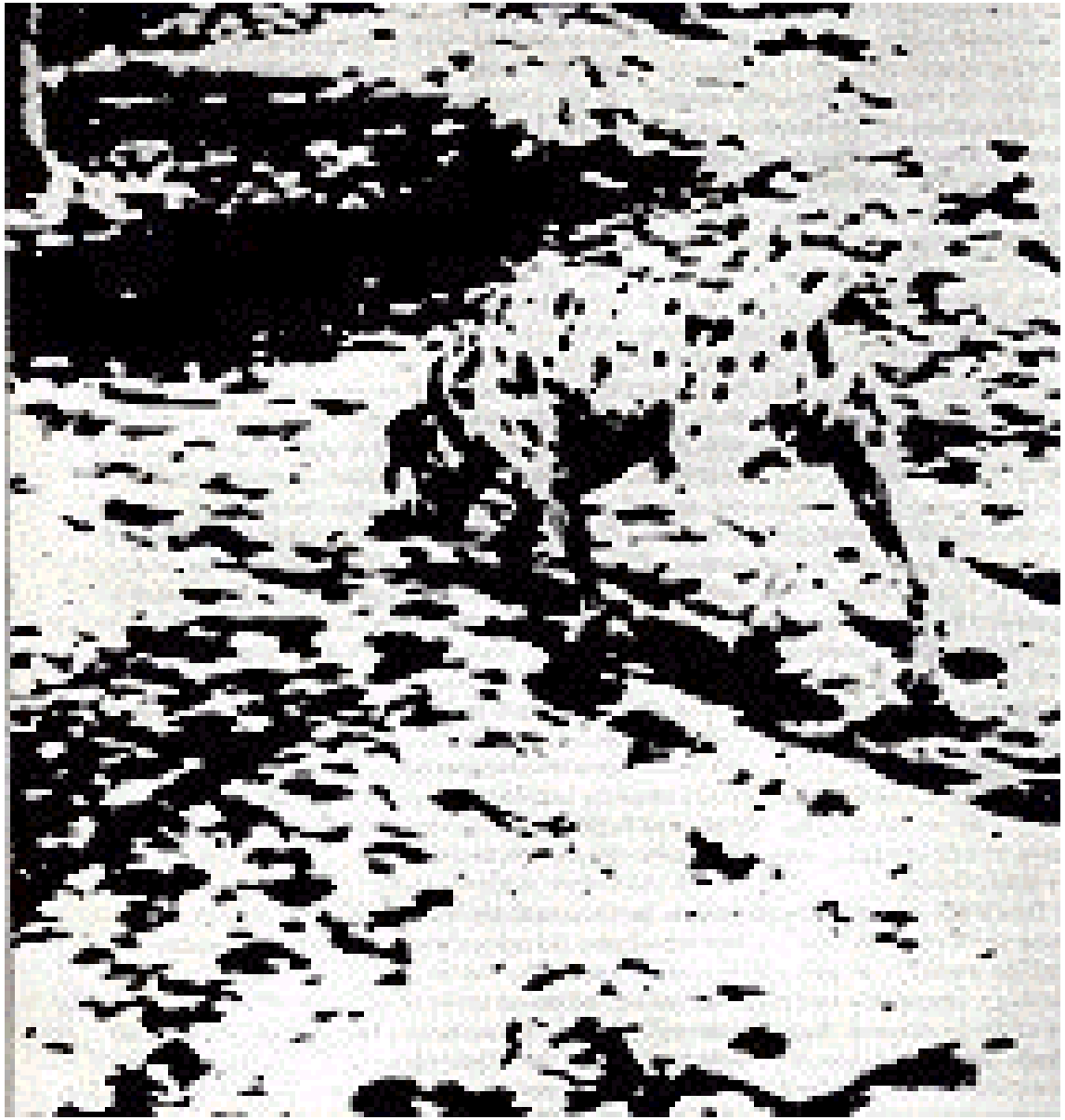

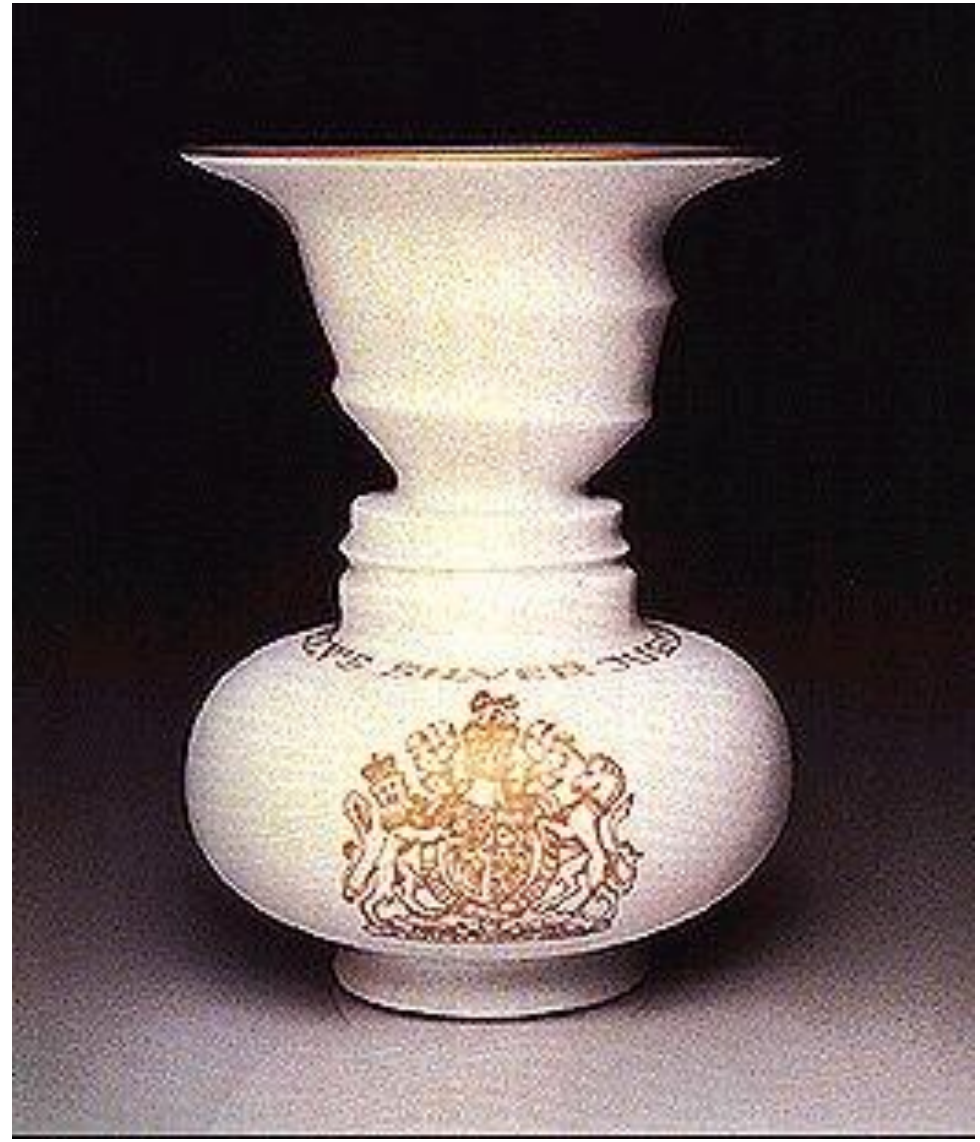

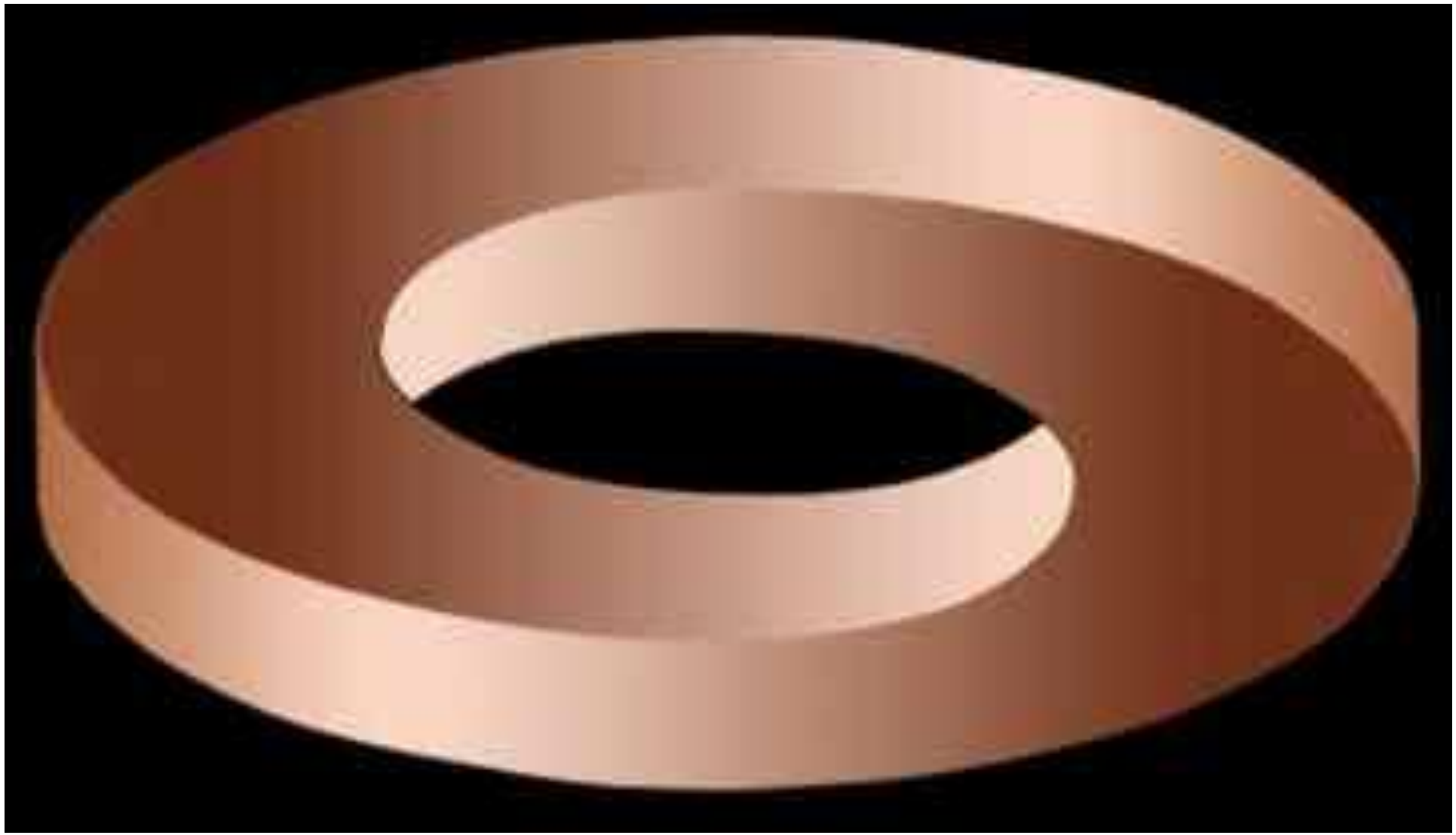

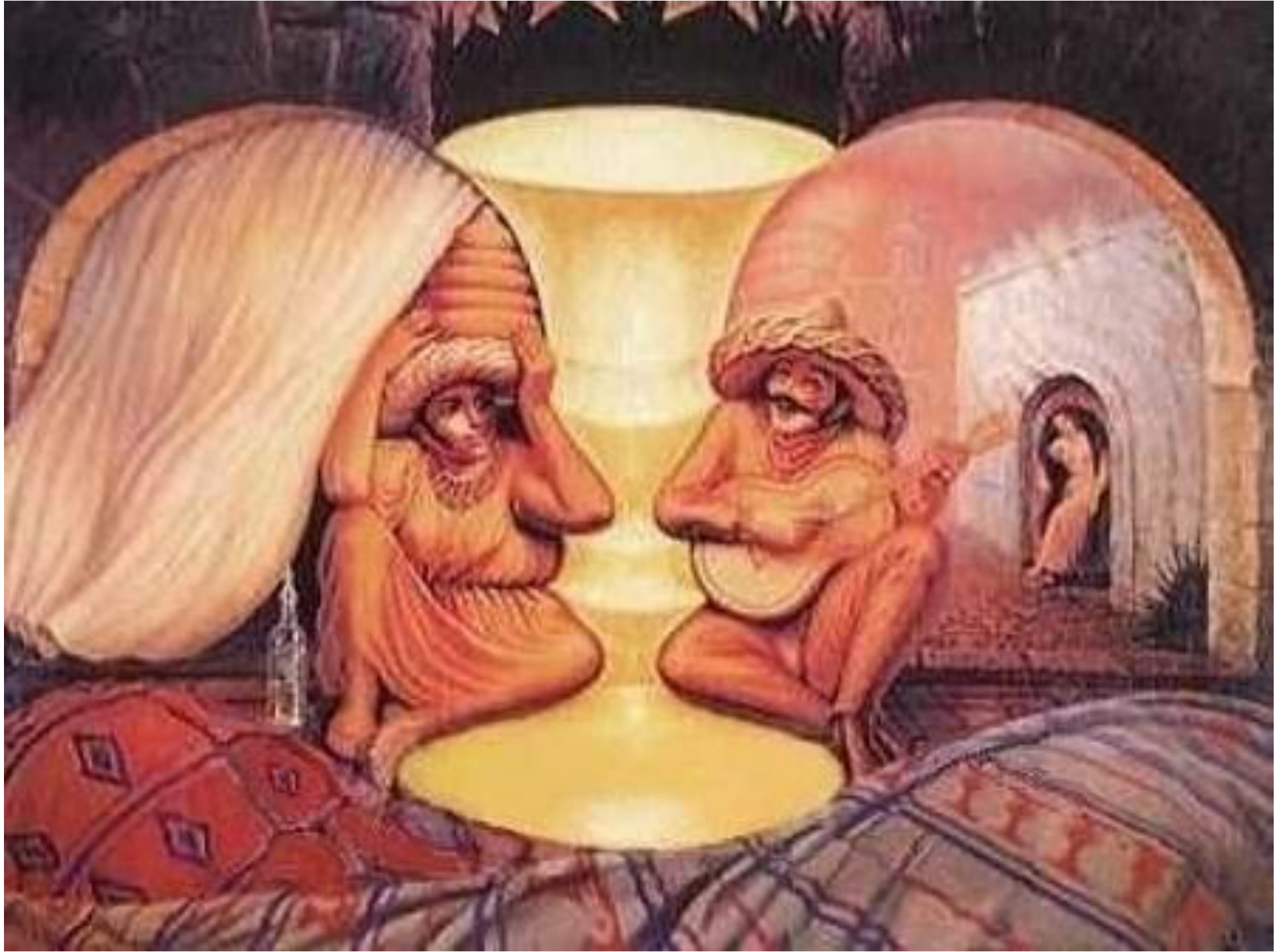

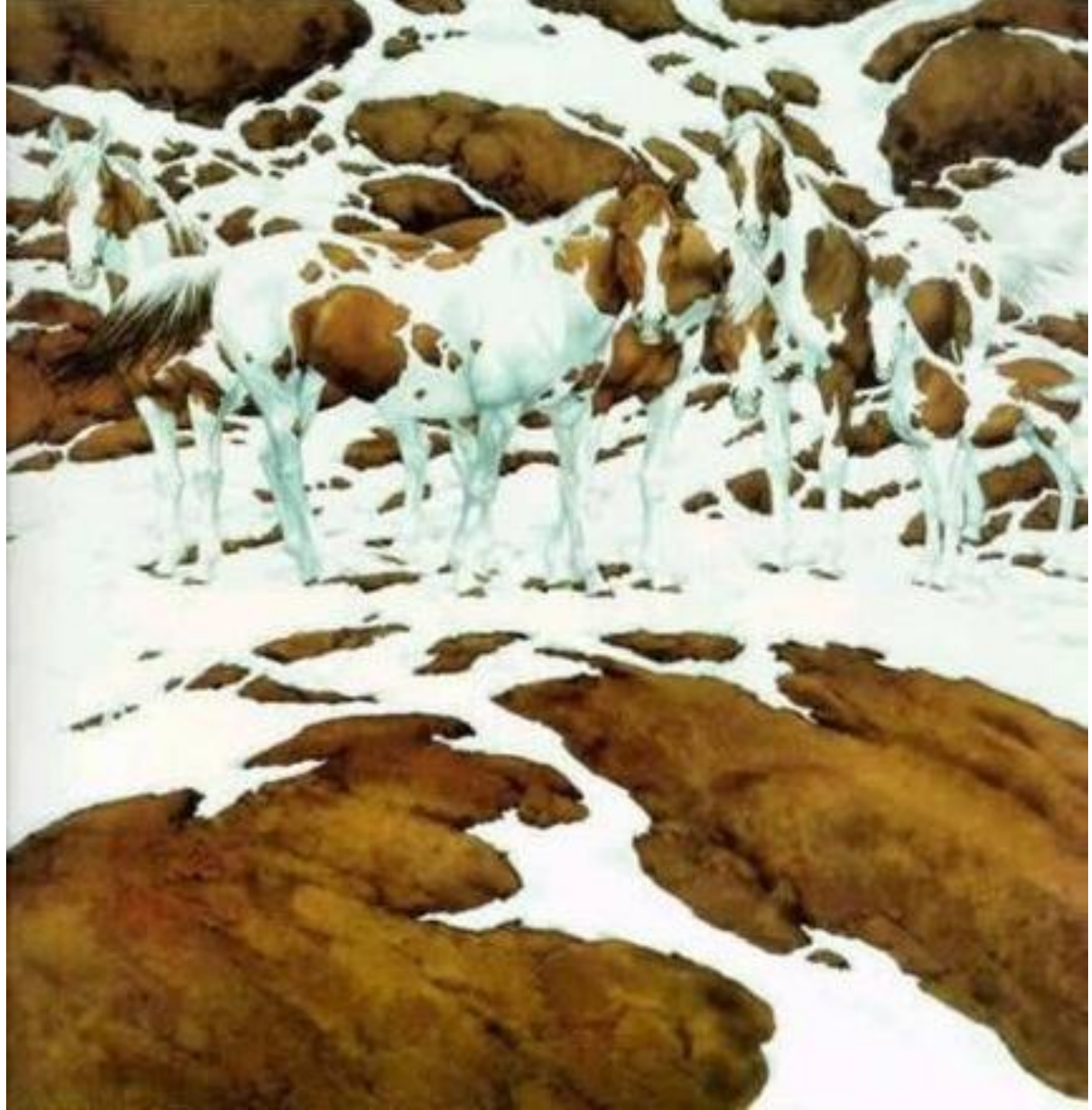


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Aujourd'hui rose, demain....
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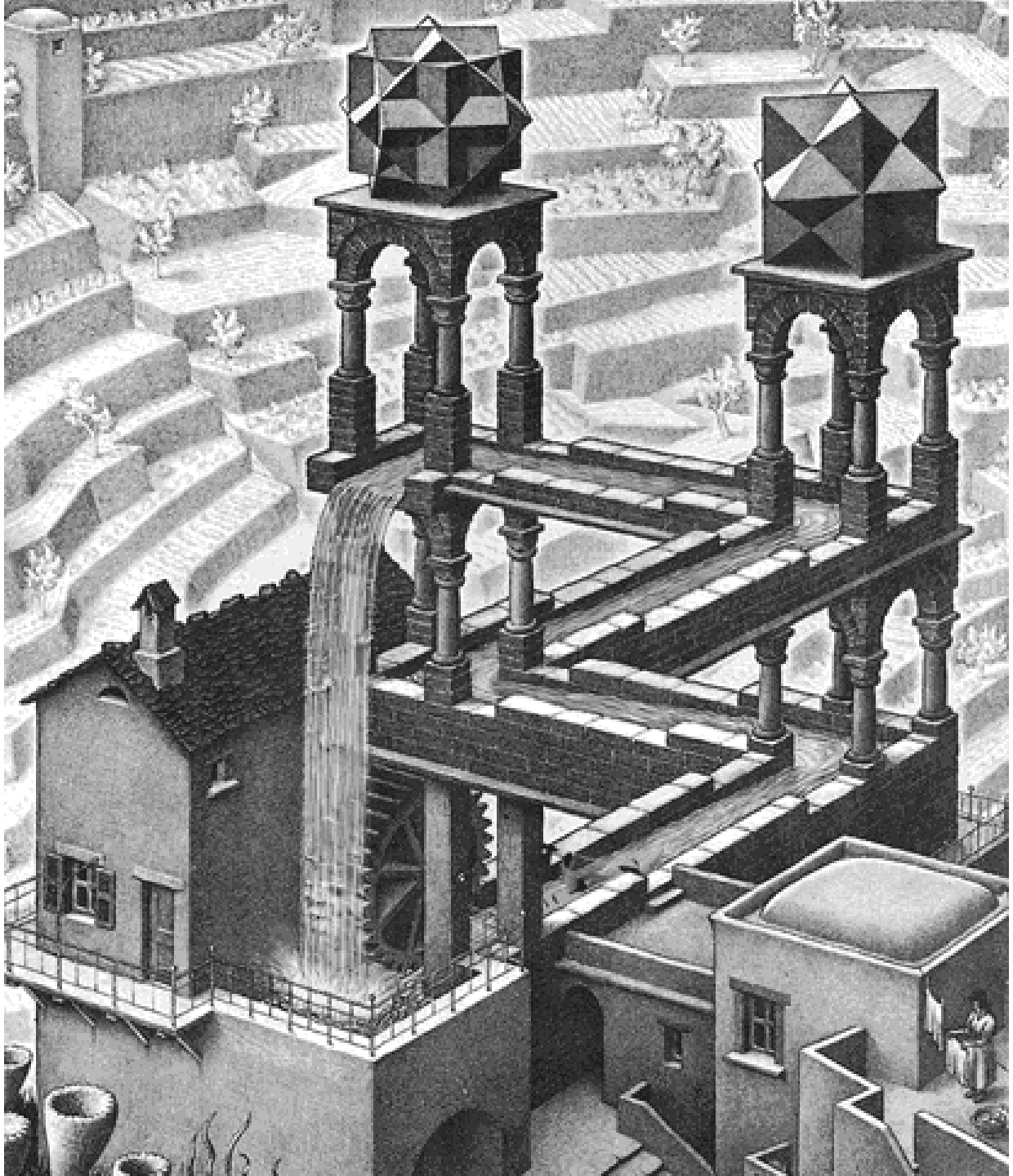

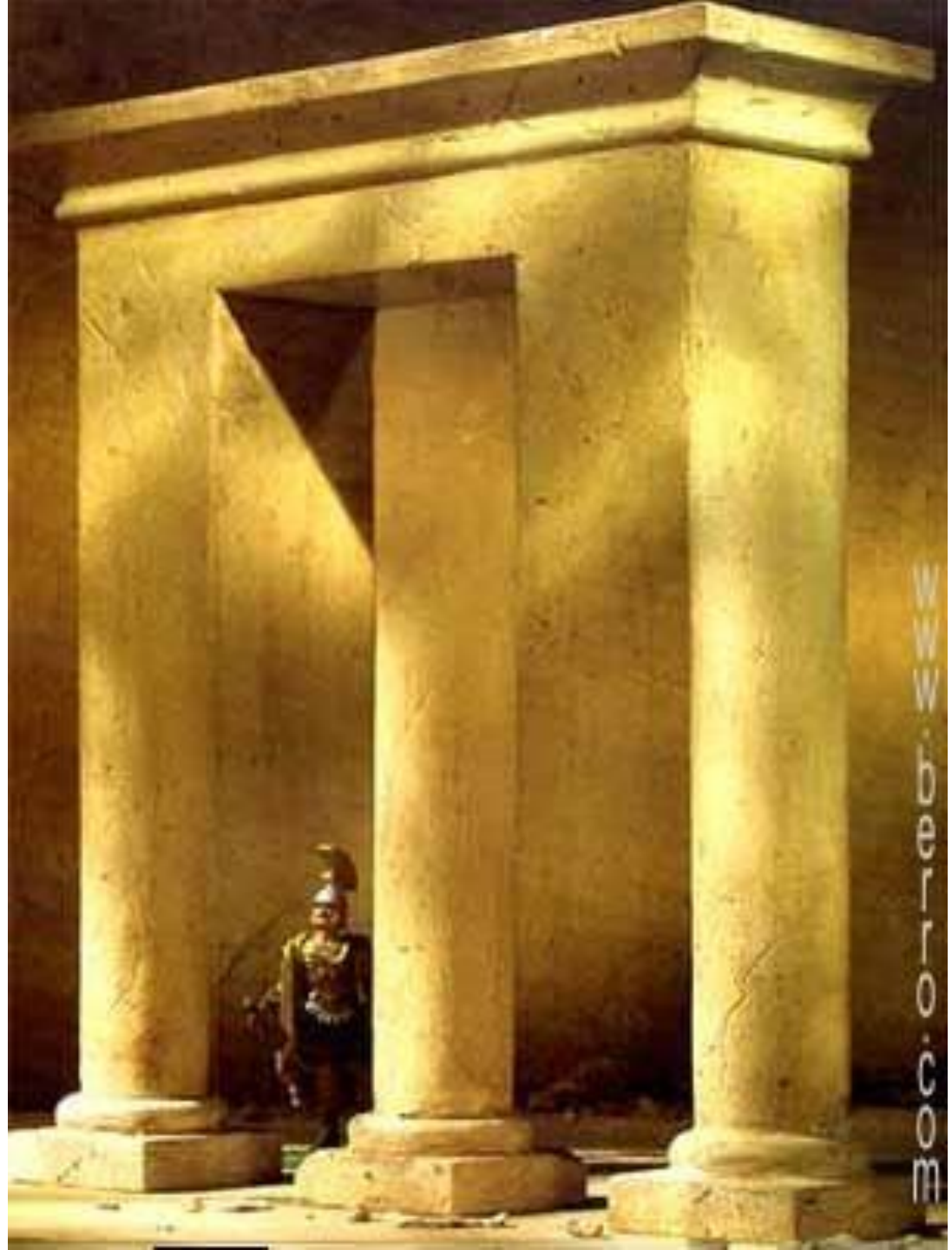
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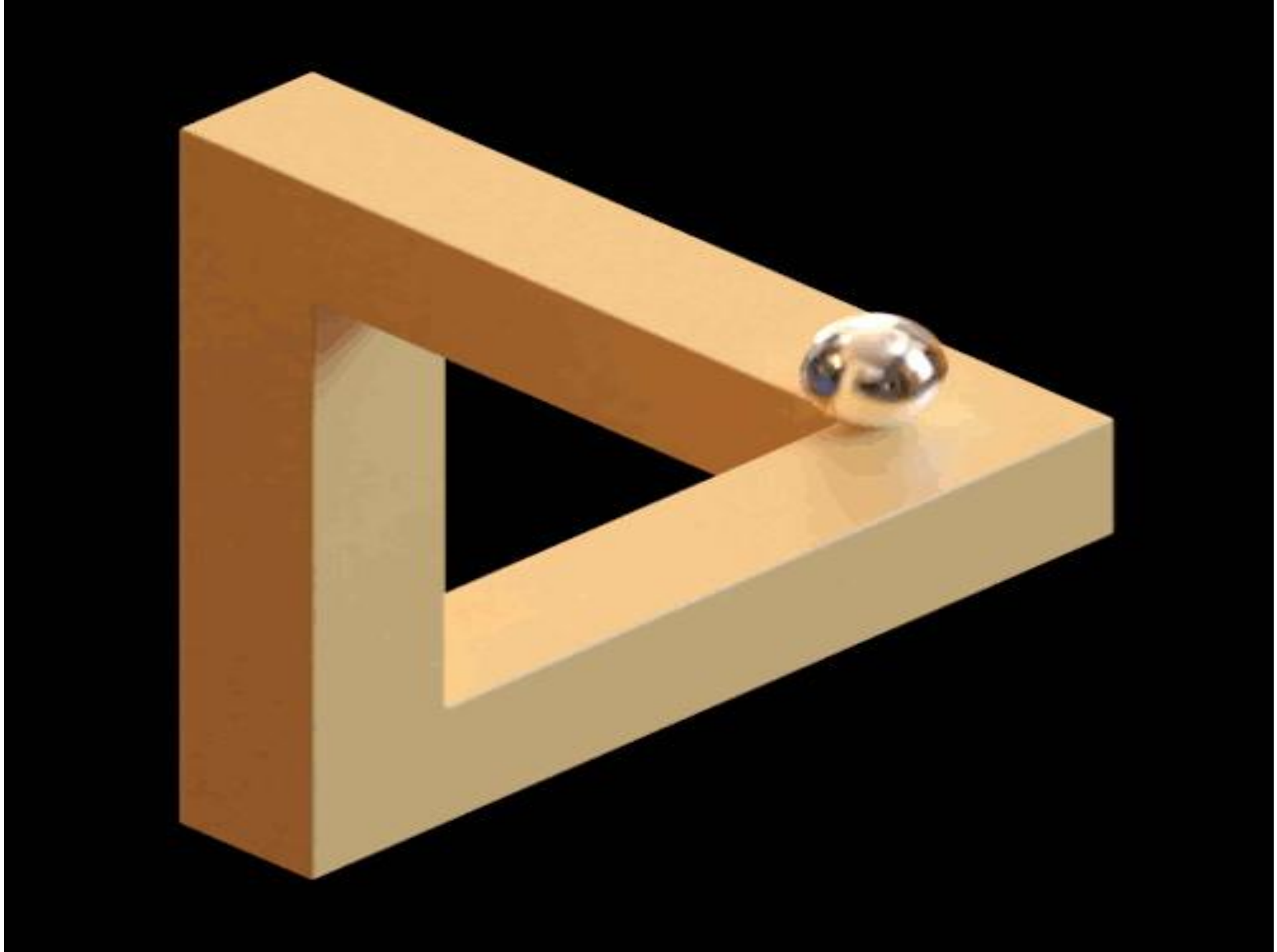
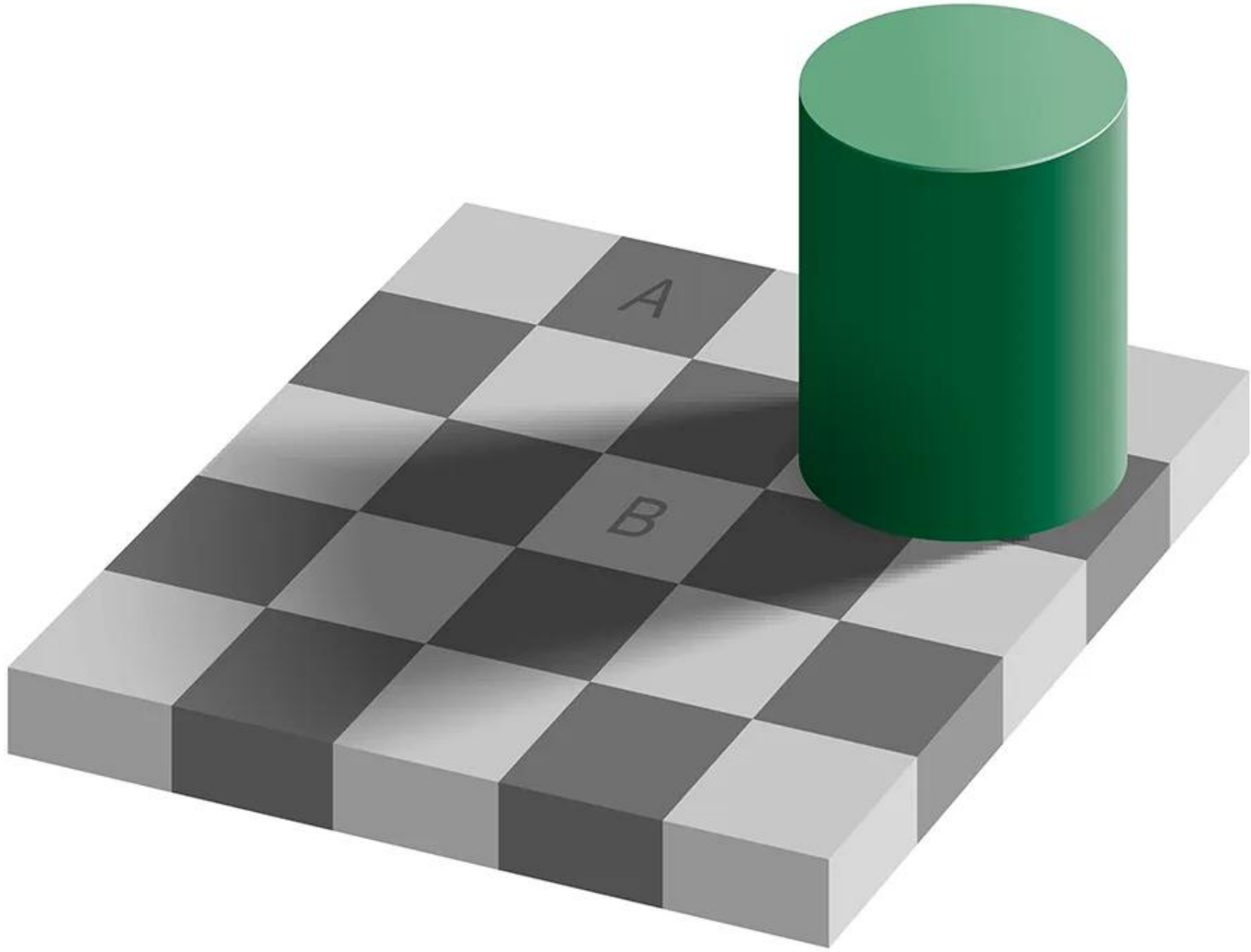
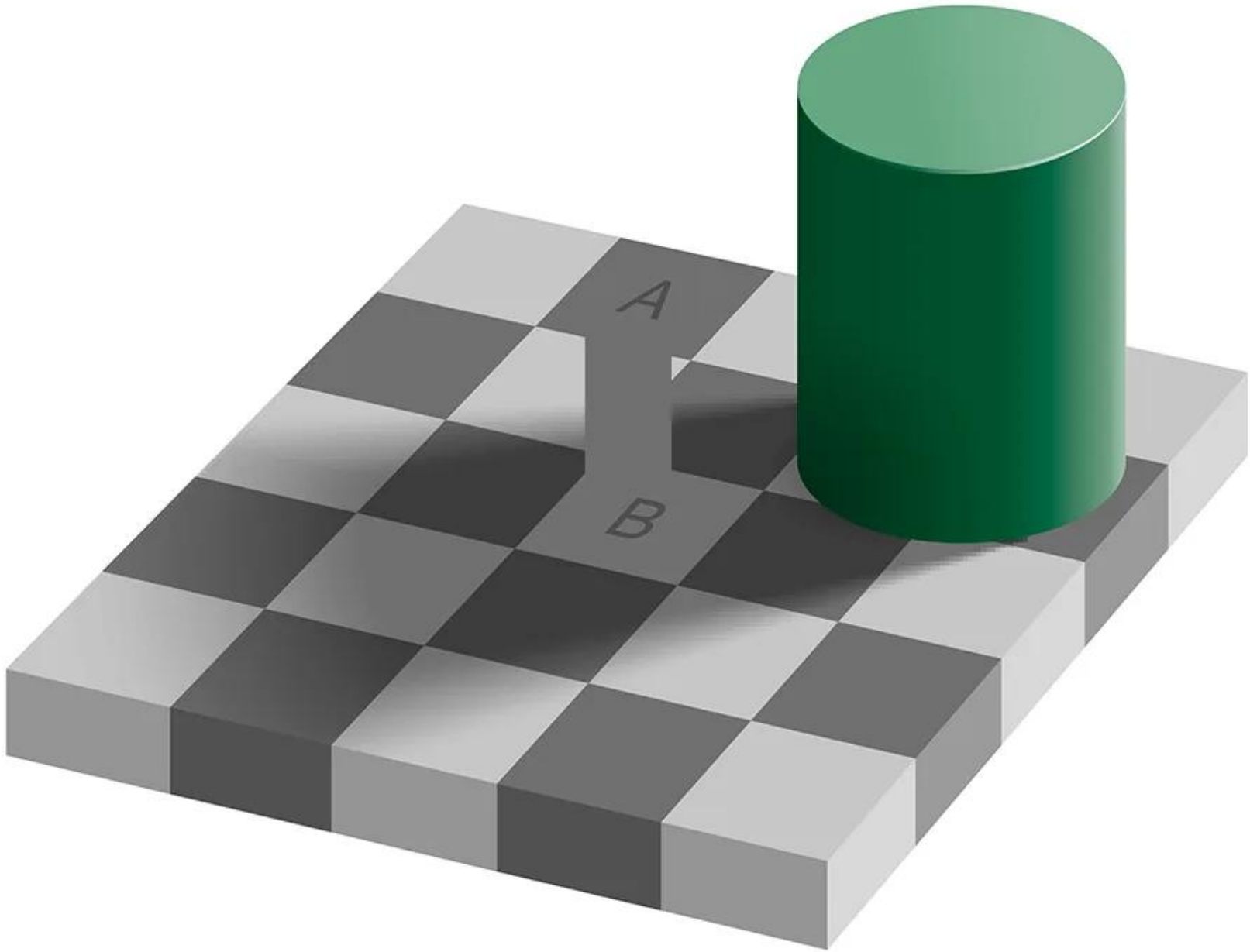
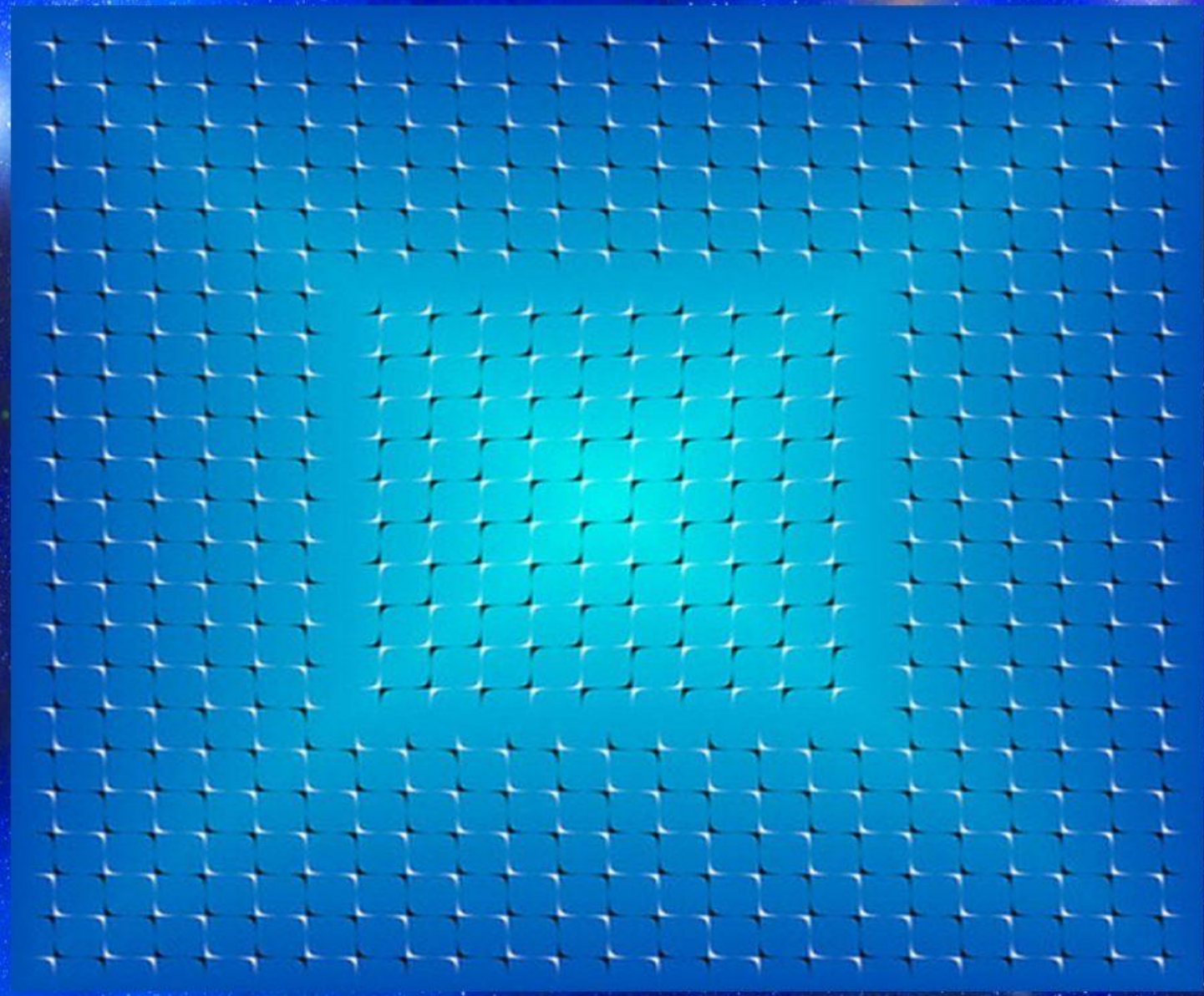
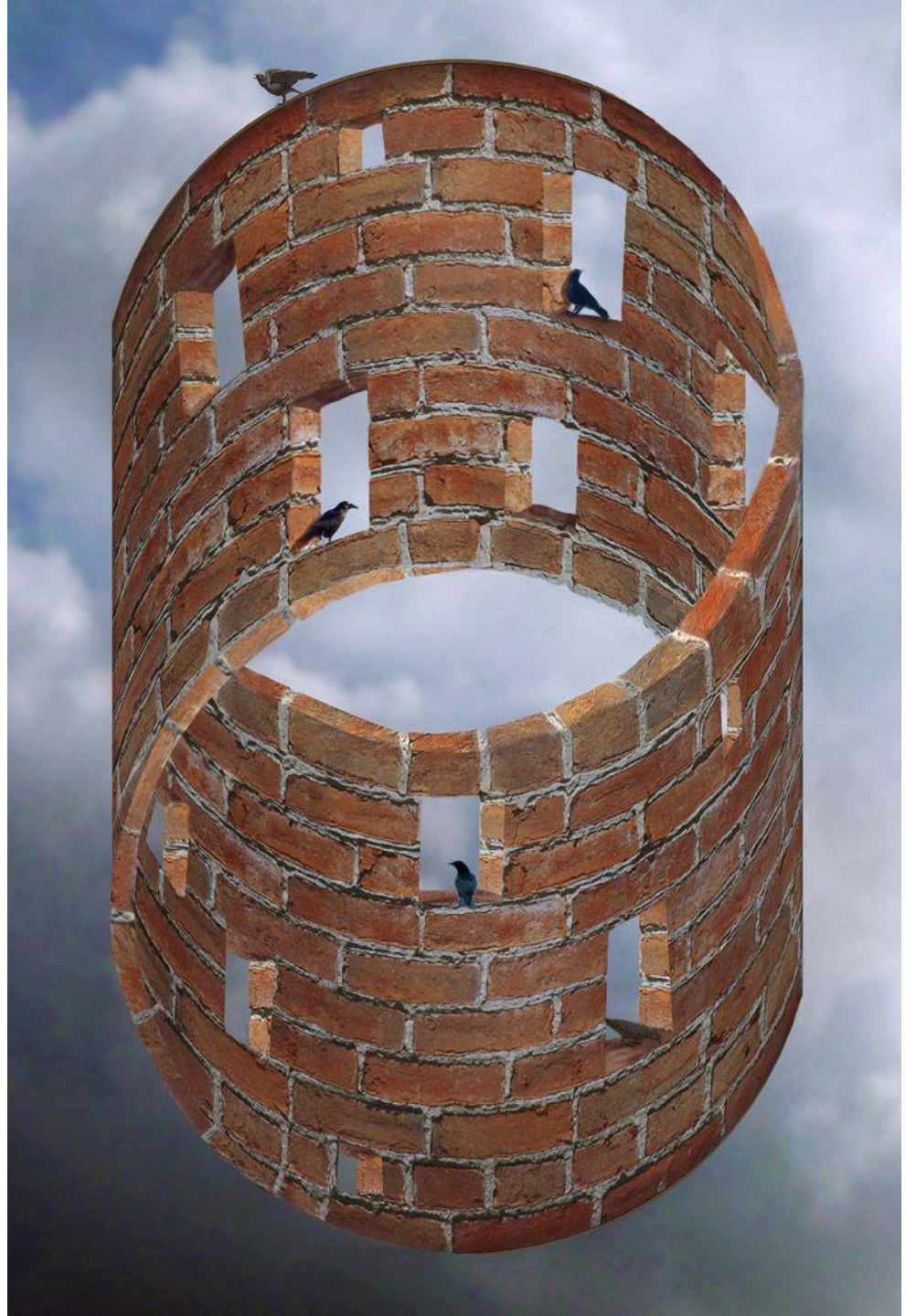


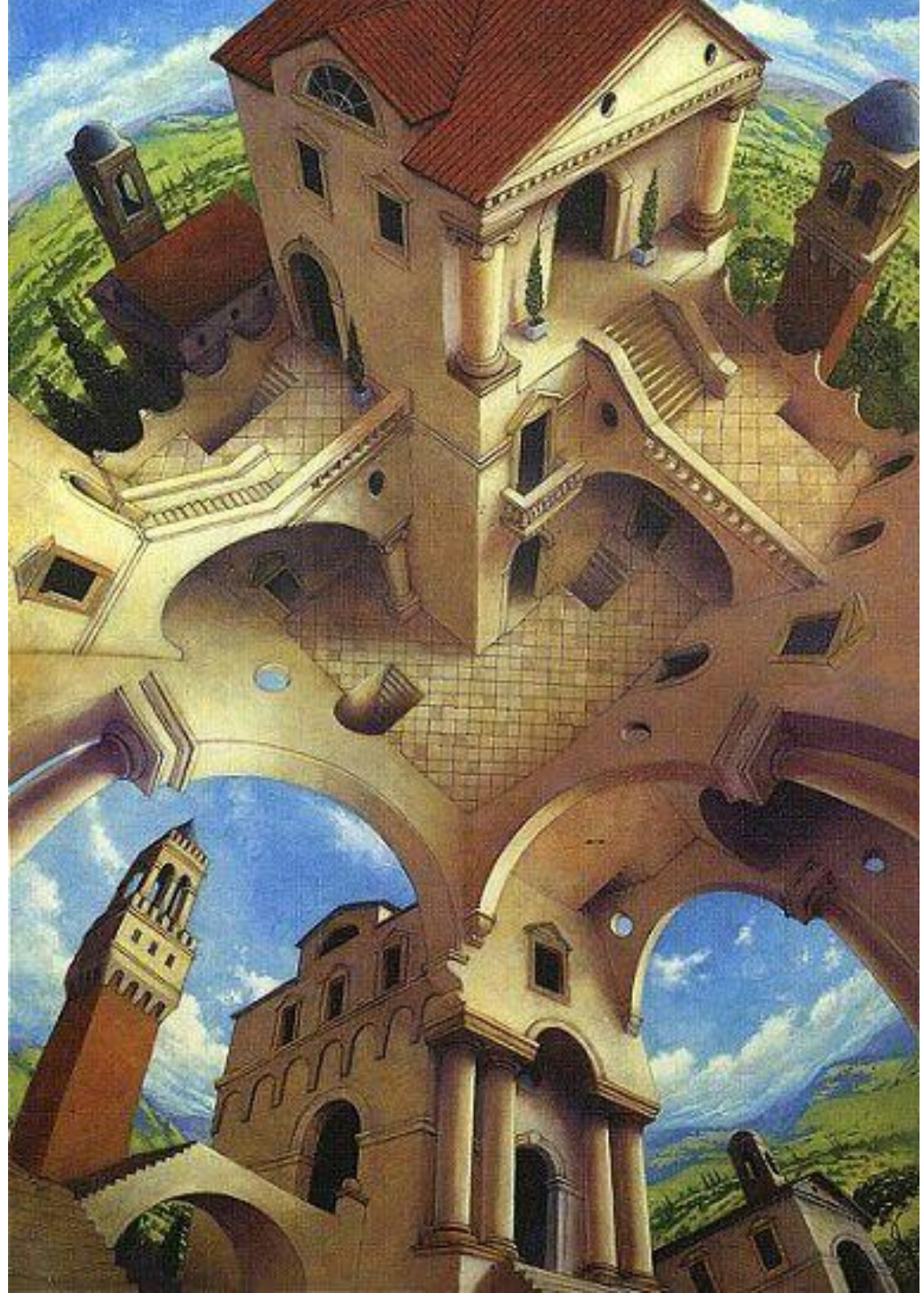

A
B

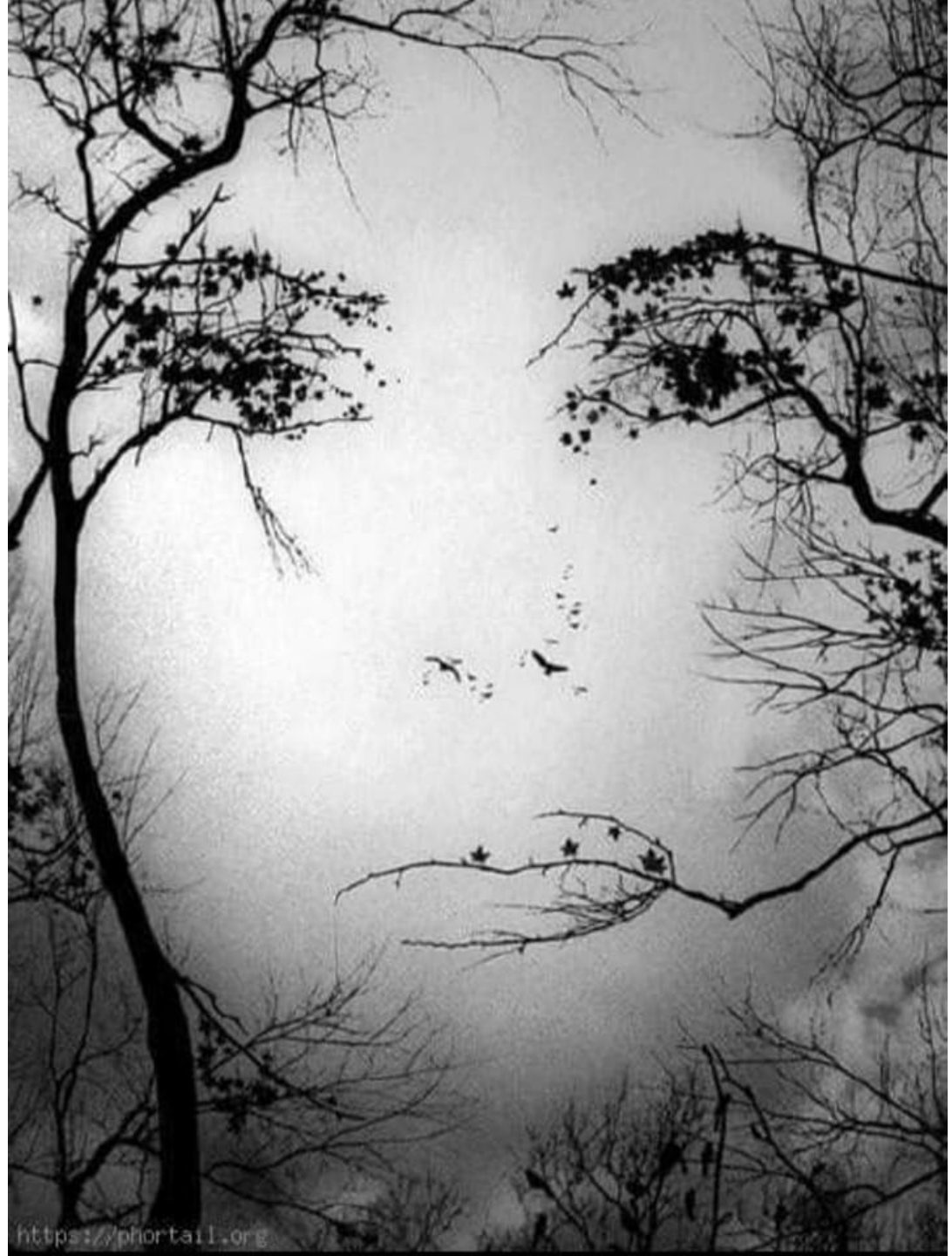

A
B



If you move your head,
the middle square will appear to be bouncing.



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You May Never Look at the Visual World Quite the Same Way Again !

THE MAGIC OF OUR VISION: COLORS, ILLUSIONS, AND HOW WE SEE THE WORLD

Selected Bibliography

COLOR PSYCHOLOGY & PERCEPTION

Schauss, A. G. (1979). Tranquilizing effect of color reduces aggressive behavior and potential violence. Journal of Orthomolecular Psychiatry, 8(4), 218–221.
Primary research on Baker-Miller Pink and its calming effects on inmates at the Naval Correctional Institute, Seattle.

Elliot, A. J., & Maier, M. A. (2014). Color psychology: Effects of perceiving color on psychological functioning in humans. Annual Review of Psychology, 65, 95–120.
Comprehensive review of how color influences mood, cognition, and behavior.

Faber Birren Color Research & Application — various issues. John Wiley & Sons.
Leading peer-reviewed journal covering color science, design, and human response to color.

COLOR VISION DEFICIENCY (COLOR BLINDNESS)

Birch, J. (2012). Worldwide prevalence of red-green color deficiency. Journal of the Optical Society of America A, 29(3), 313–320.
The most widely cited source for global prevalence statistics of color vision deficiency by type and gender.

Colour Blind Awareness Organisation. (2022). Types of colour blindness. Retrieved from https://www.colourblindawareness.org/colour-blindness/types-of-colour-blindness/
Accessible overview of protanopia, deuteranopia, tritanopia, and achromatopsia with prevalence estimates.

Neitz, J., & Neitz, M. (2011). The genetics of normal and defective color vision. Vision Research, 51(7), 633–651.
Explains X-linked inheritance patterns and why color blindness disproportionately affects males.
Media Market US. (2026). Color blindness statistics by vision deficiency. Retrieved from https://media.market.us/color-blindness-statistics/
Current prevalence data: deuteranomaly 2.32%, protanomaly 0.54%, deuteranopia 0.64%, protanopia 0.51%.
Colorblind.io. (2026). Color blindness statistics: Prevalence by gender, type & region. Retrieved from https://colorblind.io/learn/statistics
Red-green color blindness accounts for ~99% of all cases; affects ~8% of males and ~0.5% of females.

VISUAL AGNOSIA & NEUROLOGICAL VISION DISORDERS

Zihl, J., & Kennard, C. (2003). Visual agnosia. In T. E. Feinberg & M. J. Farah (Eds.), Behavioral Neurology and Neuropsychology (2nd ed.). McGraw-Hill.
Estimated prevalence of pure visual agnosia at 1–3% among neurological patients; a foundational clinical reference.
StatPearls. (2023, January). Agnosia. National Center for Biotechnology Information (NCBI) Bookshelf. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK493156/
Less than 1% of all neurological patients have agnosia; visual agnosia is the most common and best-described type.