Fundamentals of Color and Appearance

Module 4

Color Perception and Communication

Color Science Educational Series

Module 4:

Color Perception and Communication

If you were asked to describe different shades of red, you might use names like: Cherry red, Ruby red, Or fire engine red.

These descriptions may convey general impressions, but they're inherently subjective.

Module 4:

Color Perception and Communication

Now imagine needing one red to precisely match another. How would you communicate the difference? Should it be: Darker? More saturated? Or shift slightly in hue?

Module 4:

Color Perception and Communication

Terms like darker, or more vibrant, are open to interpretation, and lack measurable precision, making consistent color communication difficult across people, teams, and locations.

Fundamentals of Color and Appearance

Module 4:

Color Perception and Communication

Everyone brings their own experiences and associations to color descriptions, and that creates real challenges in communication.

One person's idea of warm red, or bright red, may be completely different from another's.

Module 4:

Color Perception and Communication

Even when using the same terms, interpretations can vary widely.

This lack of precision isn't just a linguistic issue. It can lead to serious miscommunication in quality control, product development, and customer satisfaction.

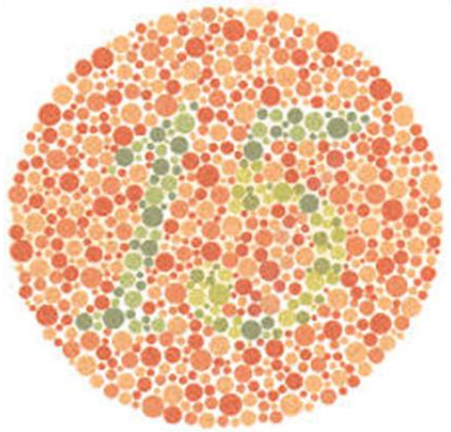
Fundamentals of Color and Appearance

Module 4:

Color Perception and Communication

The world's true measure of color
HunterLab

Even trained observers can perceive color differently based on factors such as lighting conditions, individual visual acuity, and eye fatigue.



These variables can significantly influence how a color appears from one moment, or person, to the next.

Module 4:

Color Perception and Communication

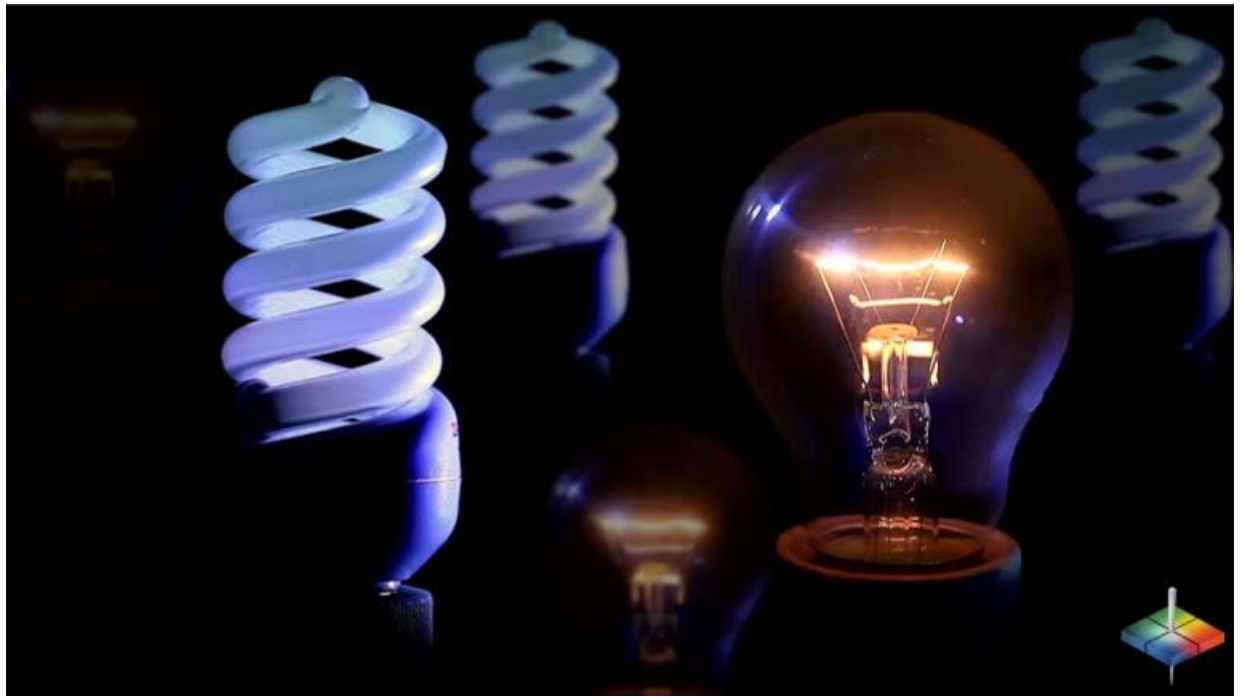
Together, they make visual color evaluations inherently imprecise. In the next section, we will explore these challenges in more detail and explain why objective instrumental measurement is essential for consistent color control.

Module 4:

Color Perception and Communication

Let's start with lighting.

If a light source doesn't contain certain wavelengths, such as blue, then objects that reflect blue light won't appear blue under that light.

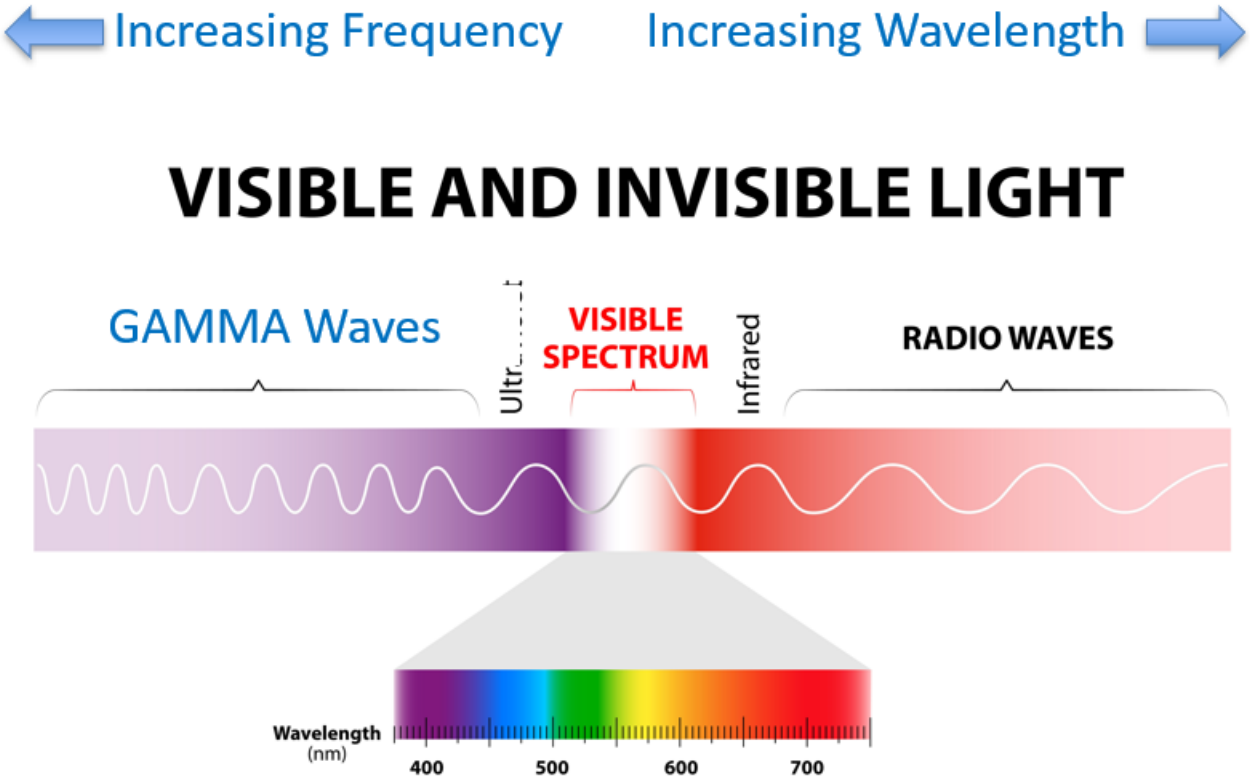


Module 4:

Color Perception and Communication

That's because color is not an inherent property of the object itself, but a result of the wavelengths it reflects from the light that illuminates it.

Without the right light, the true color can’t be seen accurately.



Module 4:

Color Perception and Communication

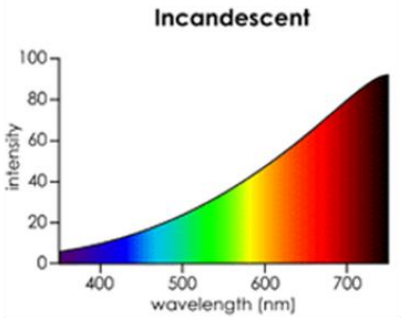
A classic example many people can relate to is the confusion between blue and brown socks.

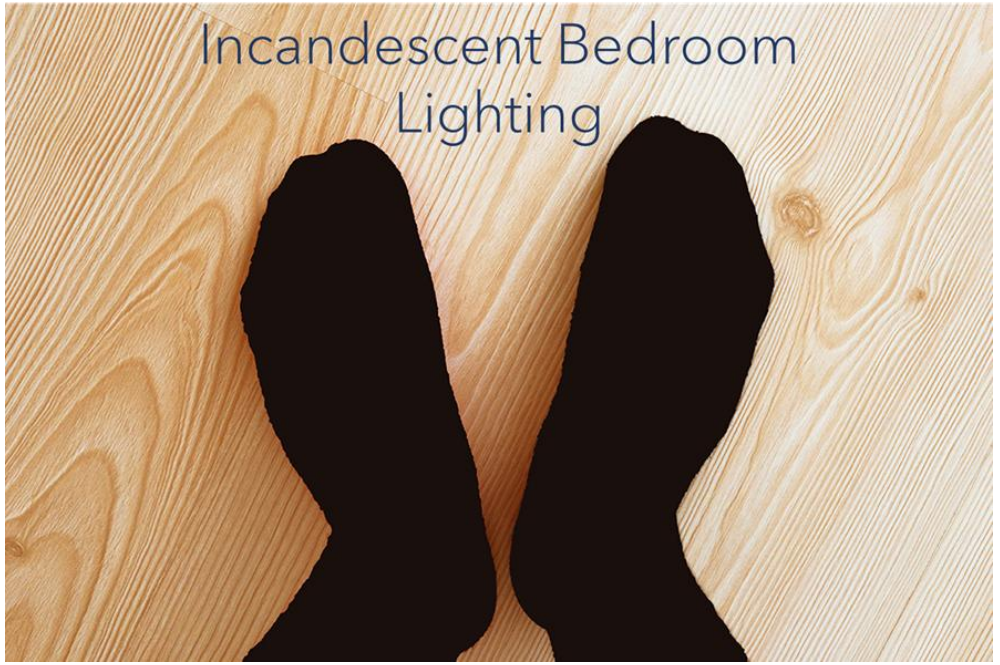
Module 4:

Color Perception and Communication

Under incandescent lighting, a typical bedroom lighting which is weak in blue wavelengths and strong in yellow and red, a blue sock may appear brown.

This happens because the light source doesn't provide enough blue light for the blue pigments in the sock to reflect, making it appear darker and more muted, closer to brown than blue.



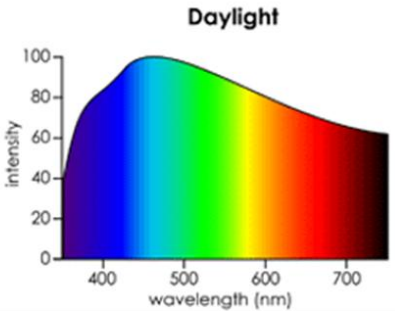


Module 4:

Color Perception and Communication

But under daylight, which contains a balanced distribution of wavelengths across the entire visible spectrum, the same sock appears clearly blue.

This contrast highlights how the perceived color of an object depends not just on the object itself, but also on the spectral quality of the light illuminating it.

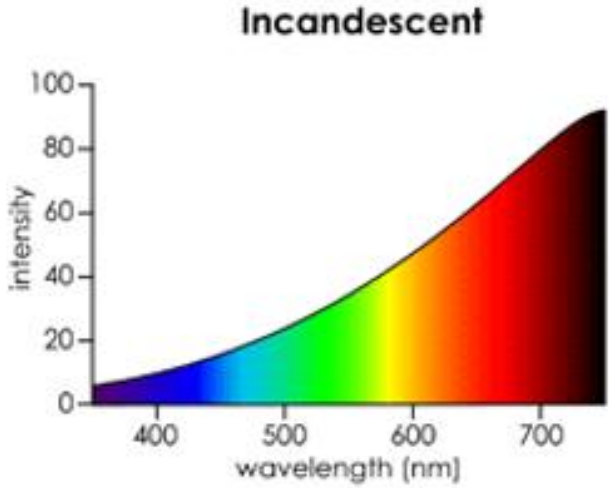


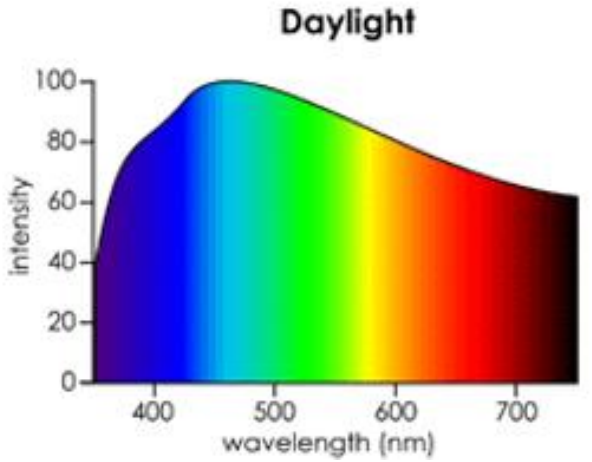
Module 4:

Color Perception and Communication

Metamerism is a phenomenon where the color of two objects appear the same under one light source but different under another light source.

When a different kind of light source is used, the color difference between them is revealed.





Module 4:

Color Perception and Communication

Another major challenge in visual assessment is individual color acuity.

Module 4:

Color Perception and Communication

Estimated 350 million people in the world with red-green color blindness (4% of the total population)

- About 1 in 12 men (8%),
- About 1 in 200 women (.5%)

Less precise statistics are known about blue-yellow color deficiency

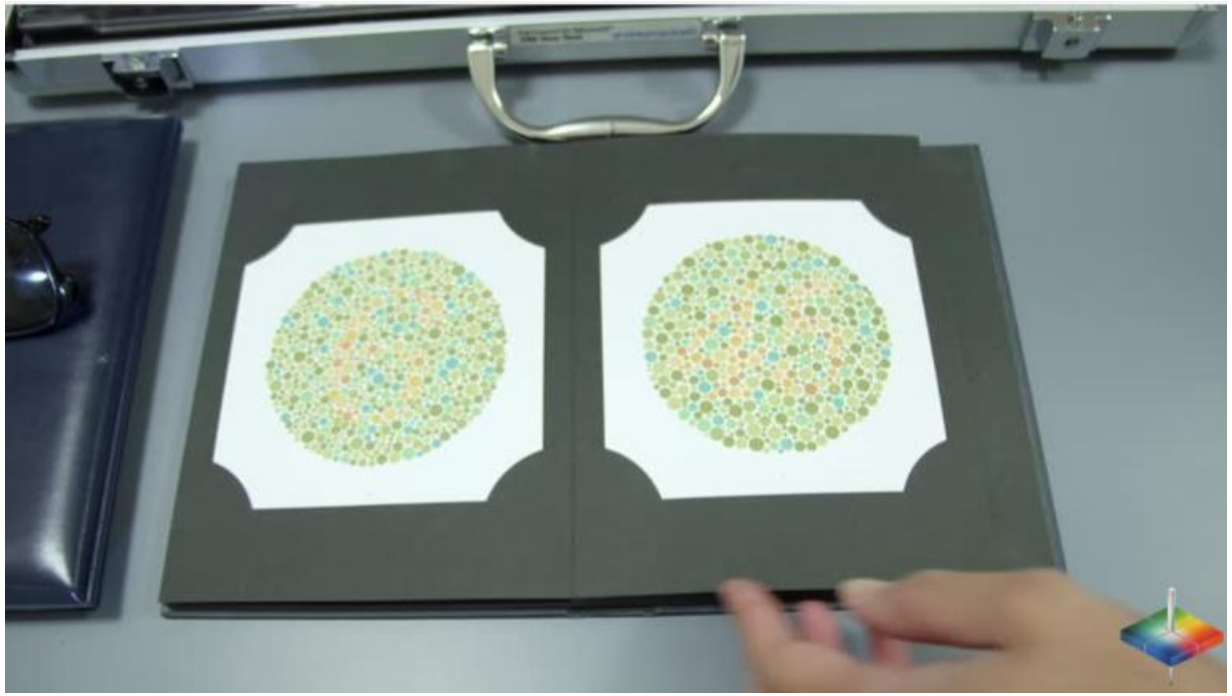
About 1 in 2000 people have more rare forms of color blindness

Module 4:

Color Perception and Communication

There are several standardized tests used to evaluate different aspects of color vision, helping to determine both the type and severity of color blindness in an individual.

One such test is the Ishihara Color Blindness Test.



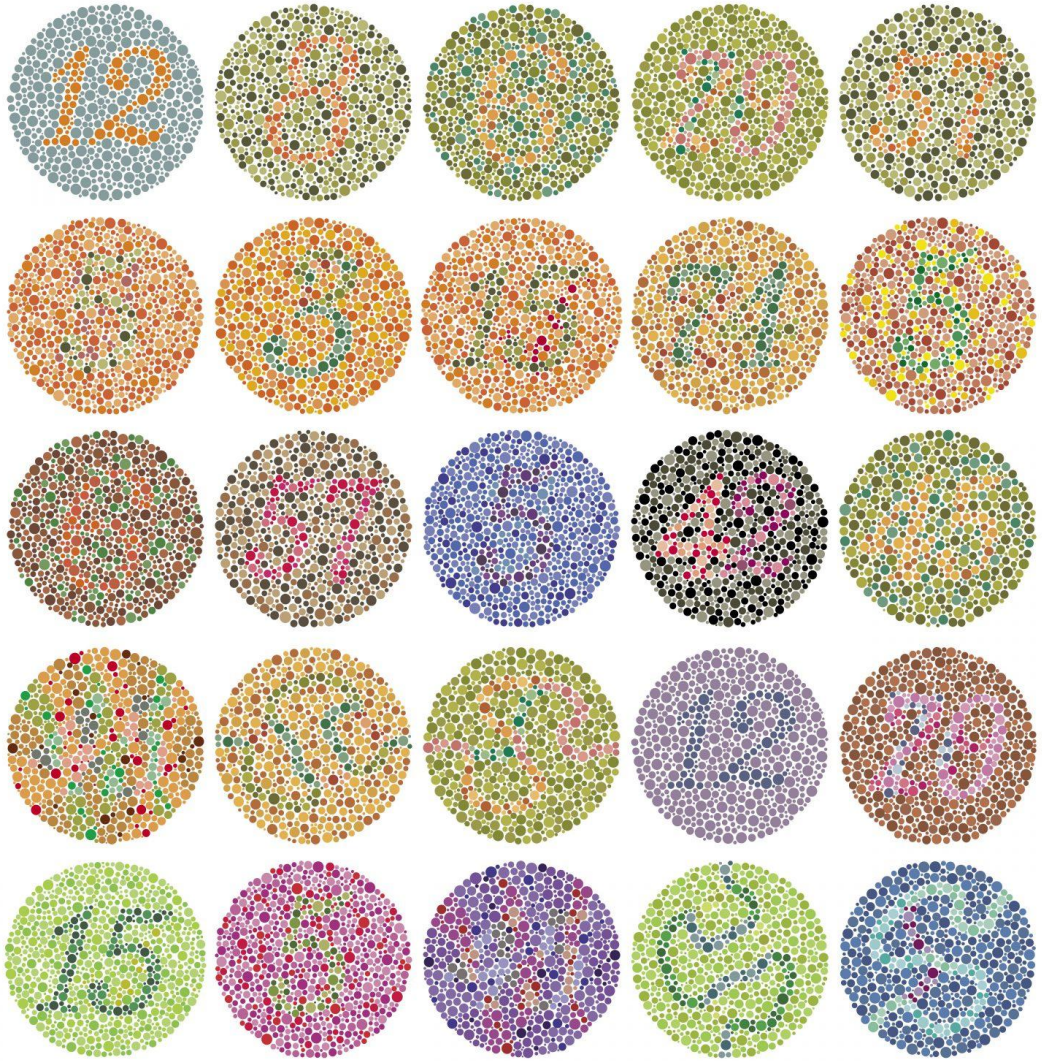
Module 4:

Color Perception and Communication

The world's true measure of color
HunterLab

The Ishihara test is a color vision test for detection of red-green color deficiencies. It is named after its designer, Shinobu Ishihara, a professor at the University of Tokyo, who first published his tests in 1917.

The test consists of several Ishihara plates, which are a type of pseudoisochromatic plate.



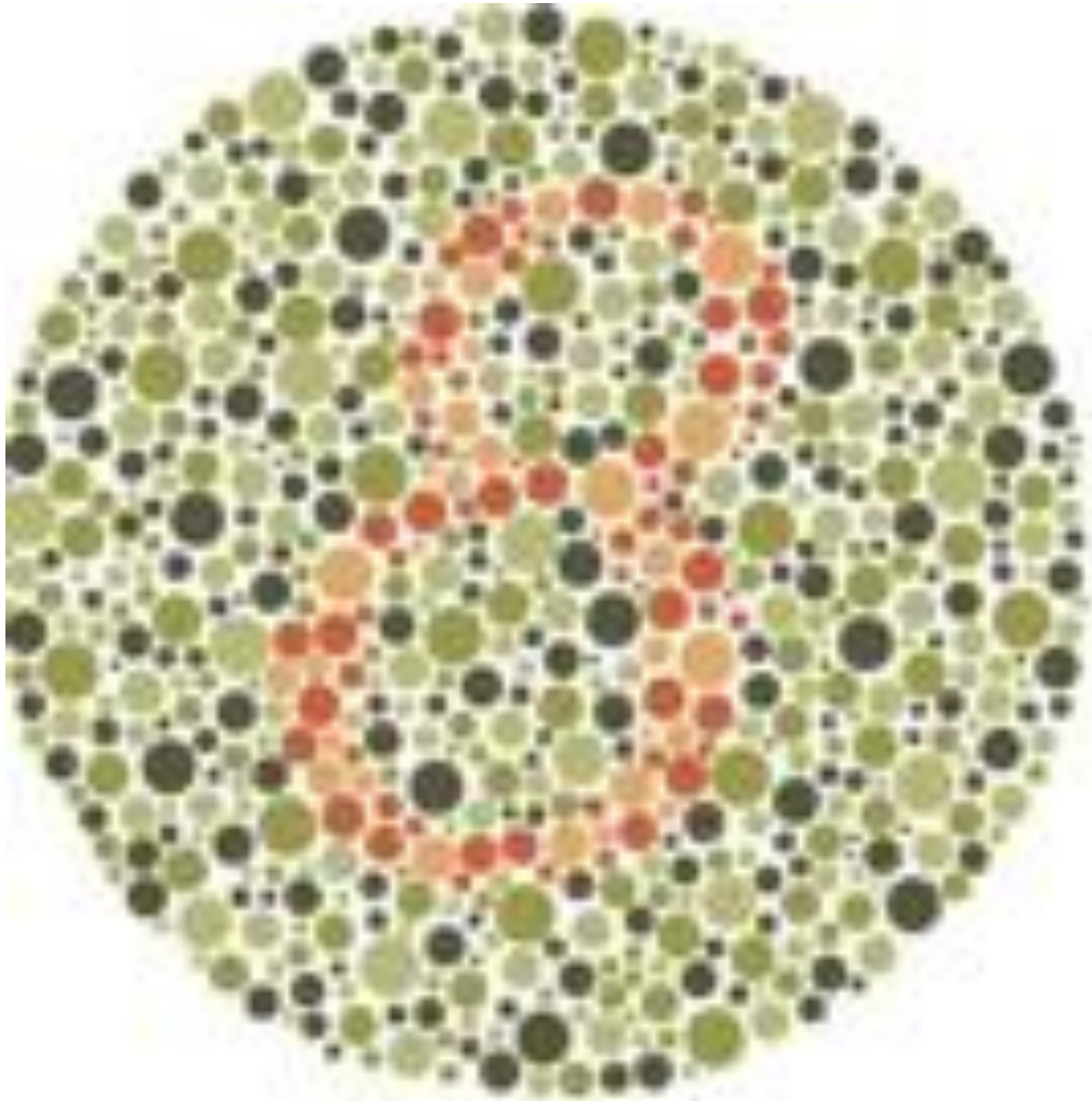
Module 4:

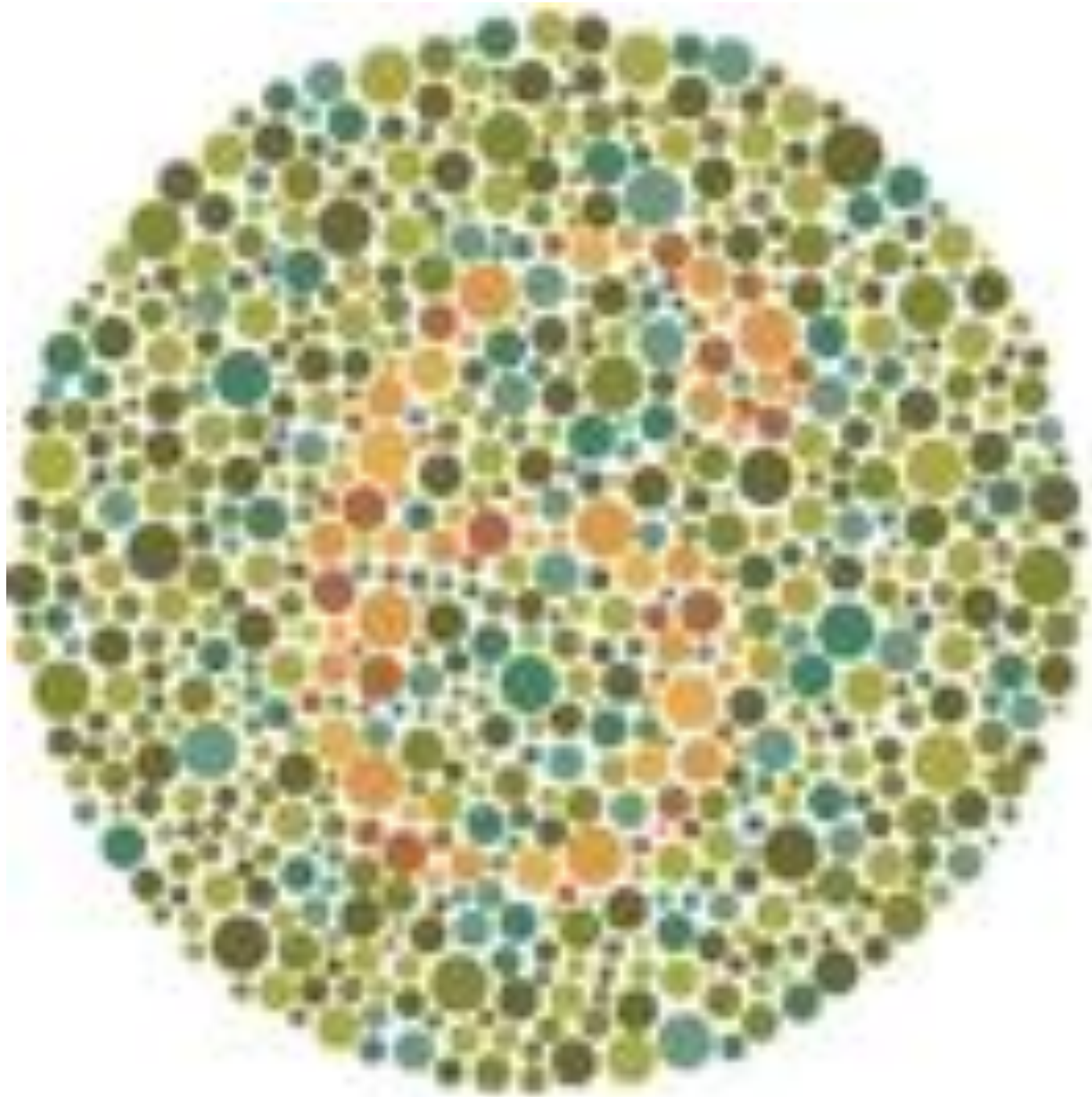
Color Perception and Communication

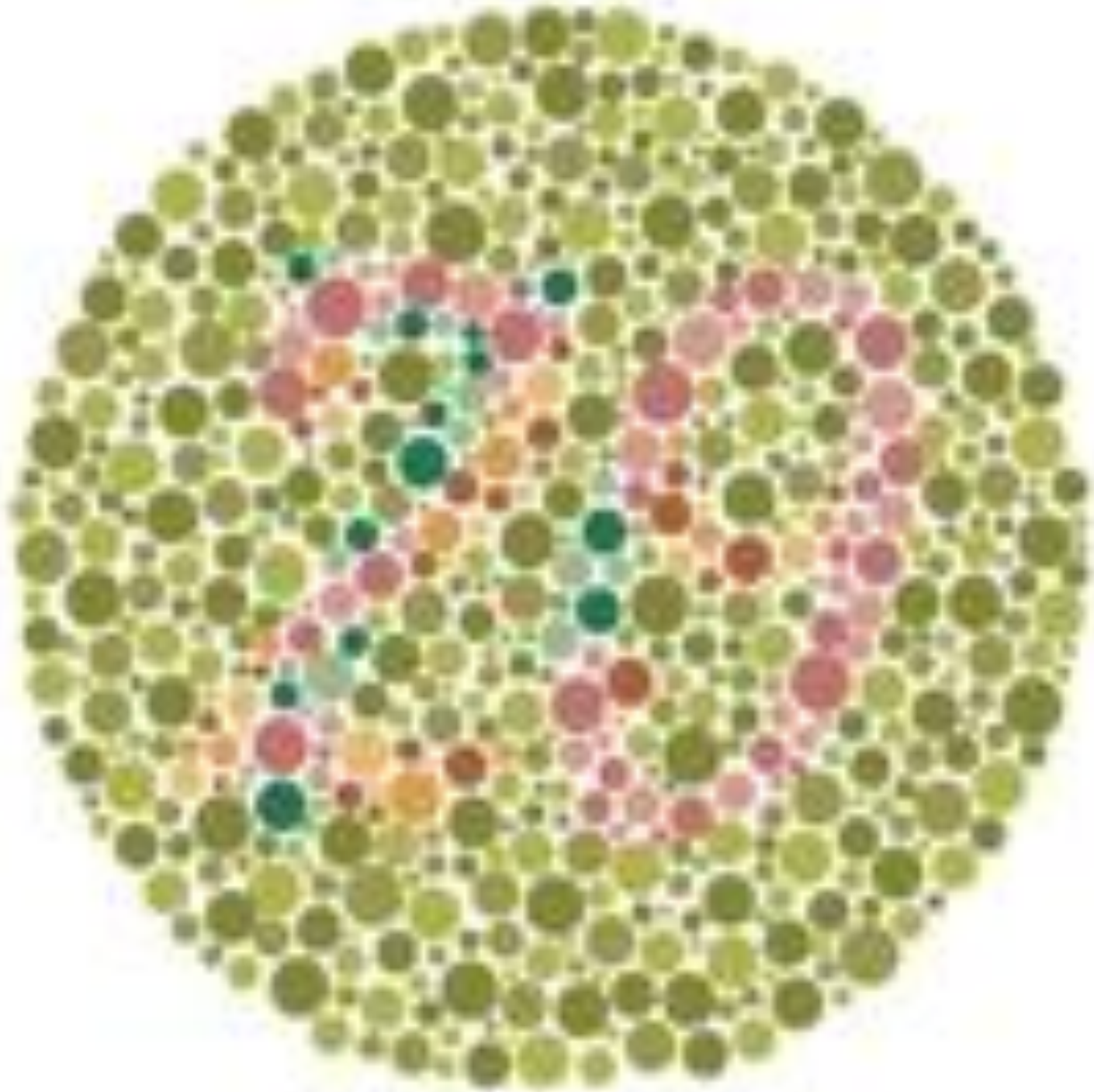
The world's true measure of color
HunterLab

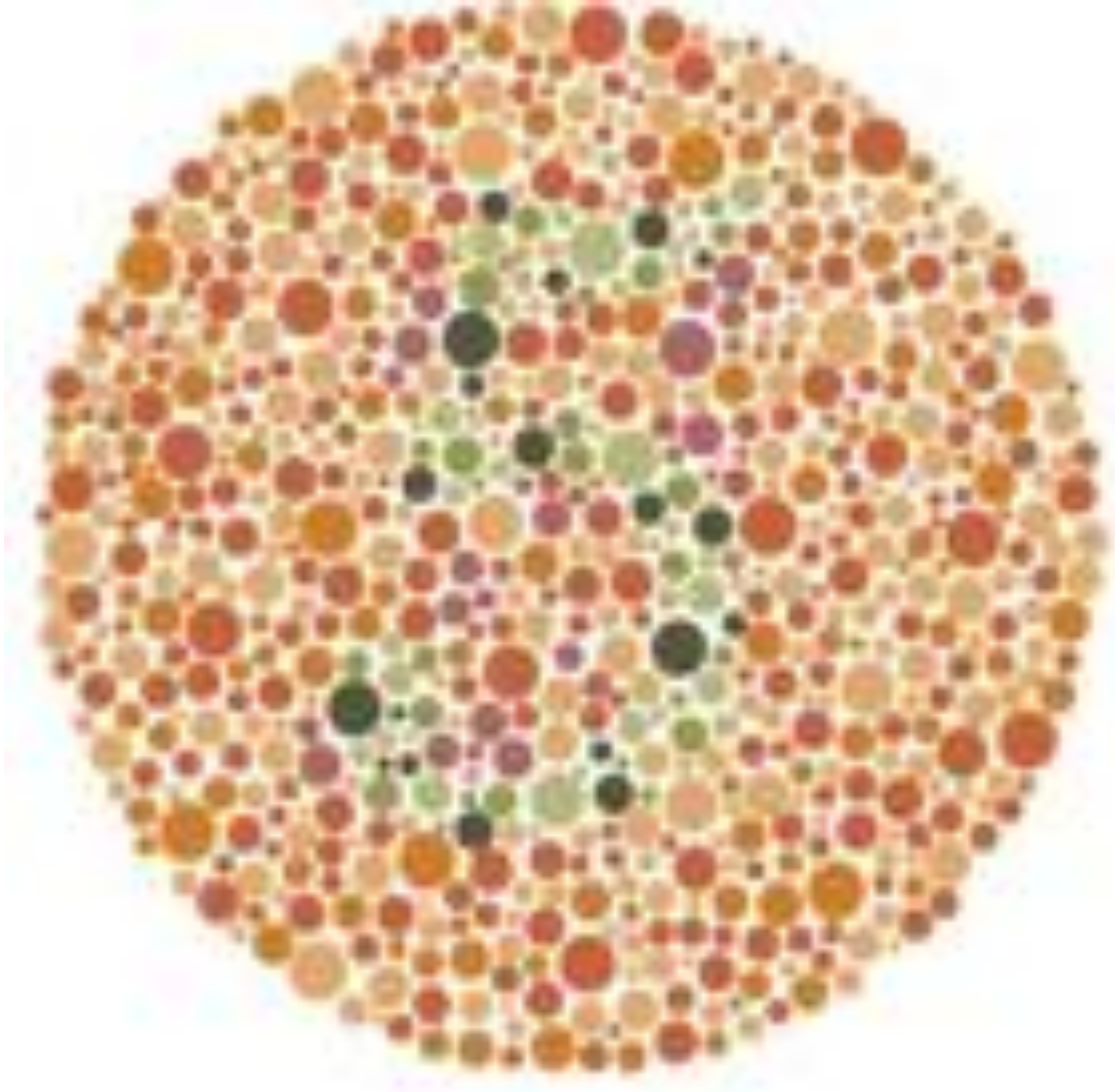
In the next several images, look closely at each image and see if you can determine the number hidden within.

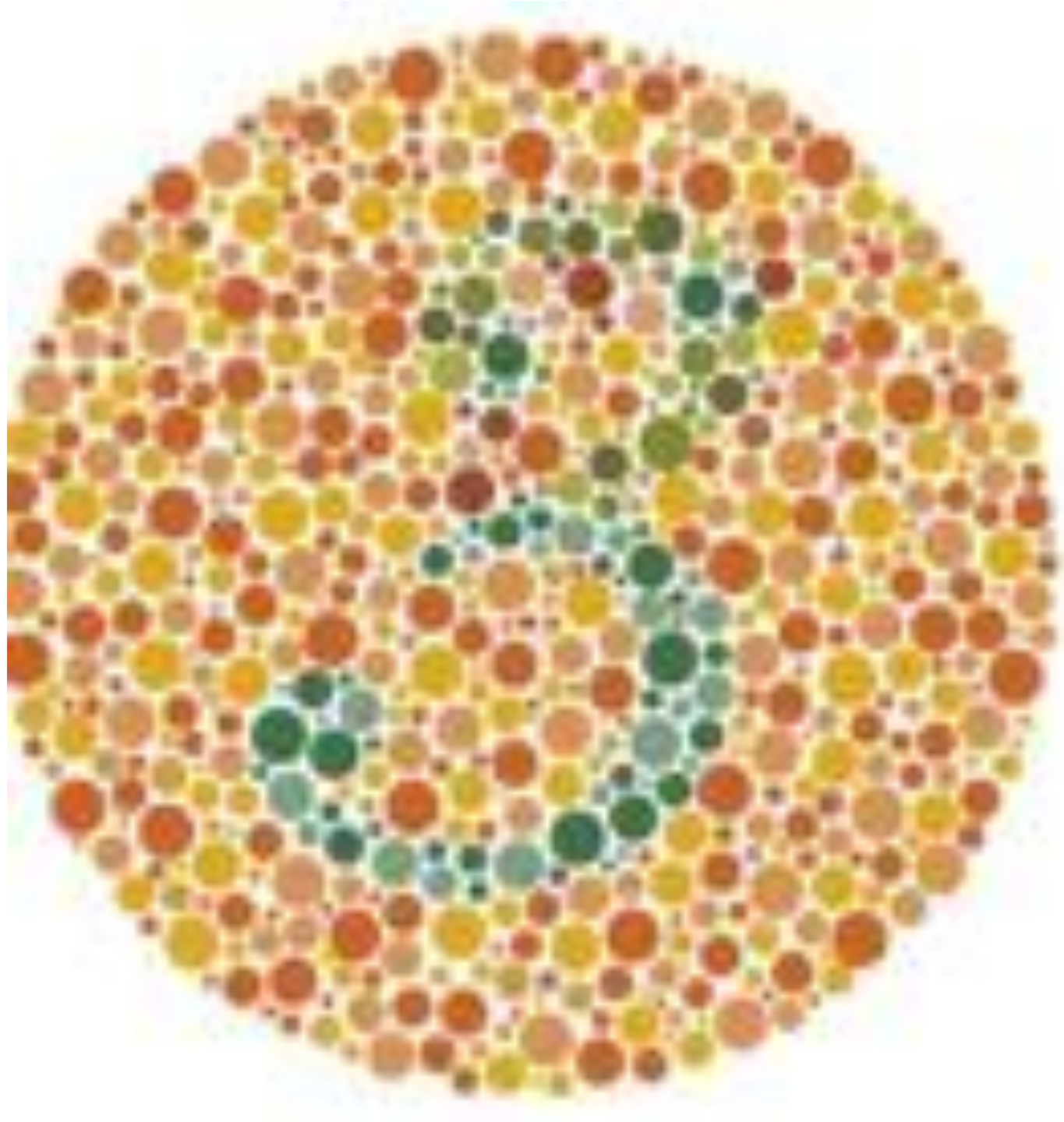
Write down what you see and compare to the answers at the end of this test.

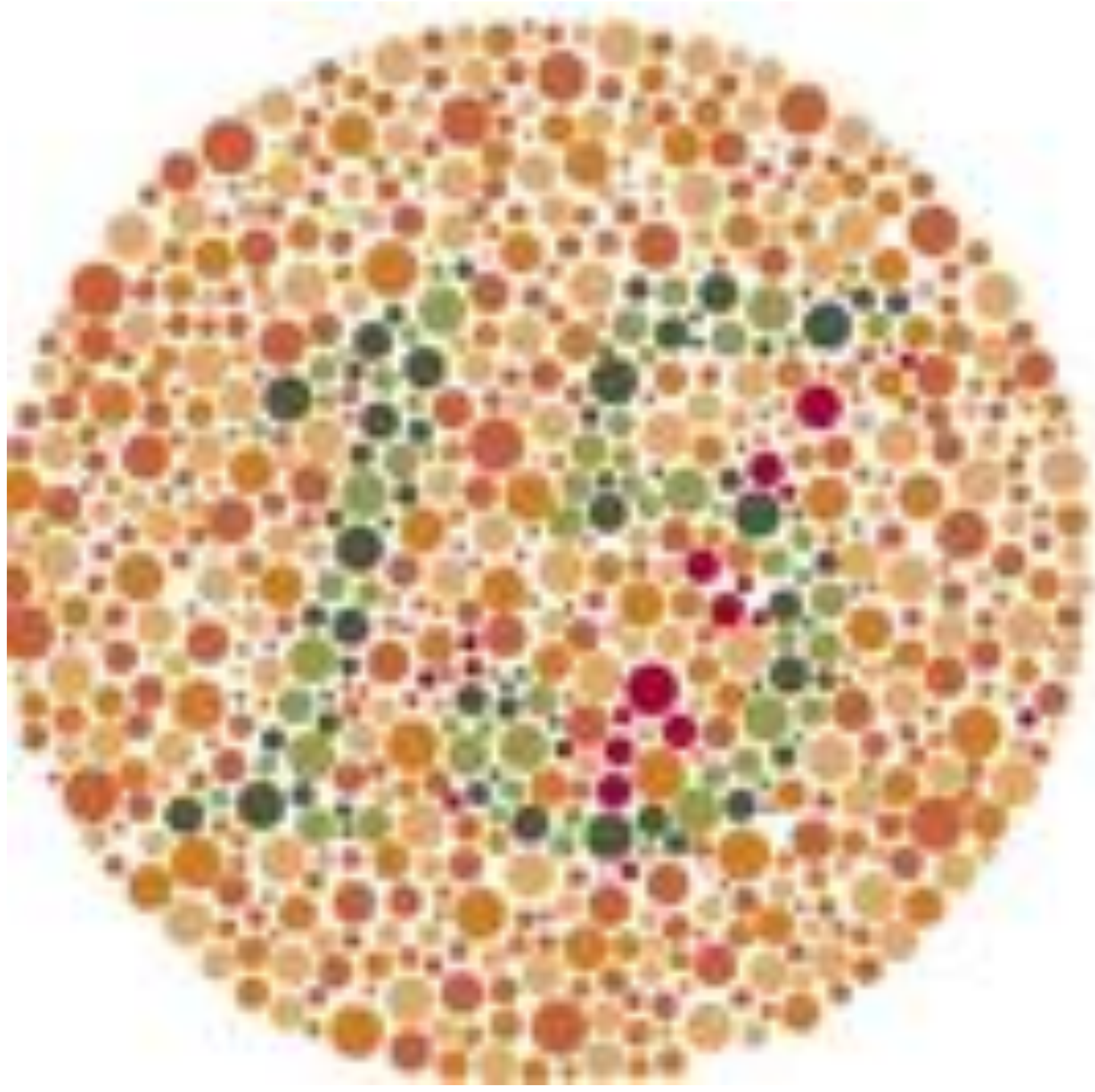


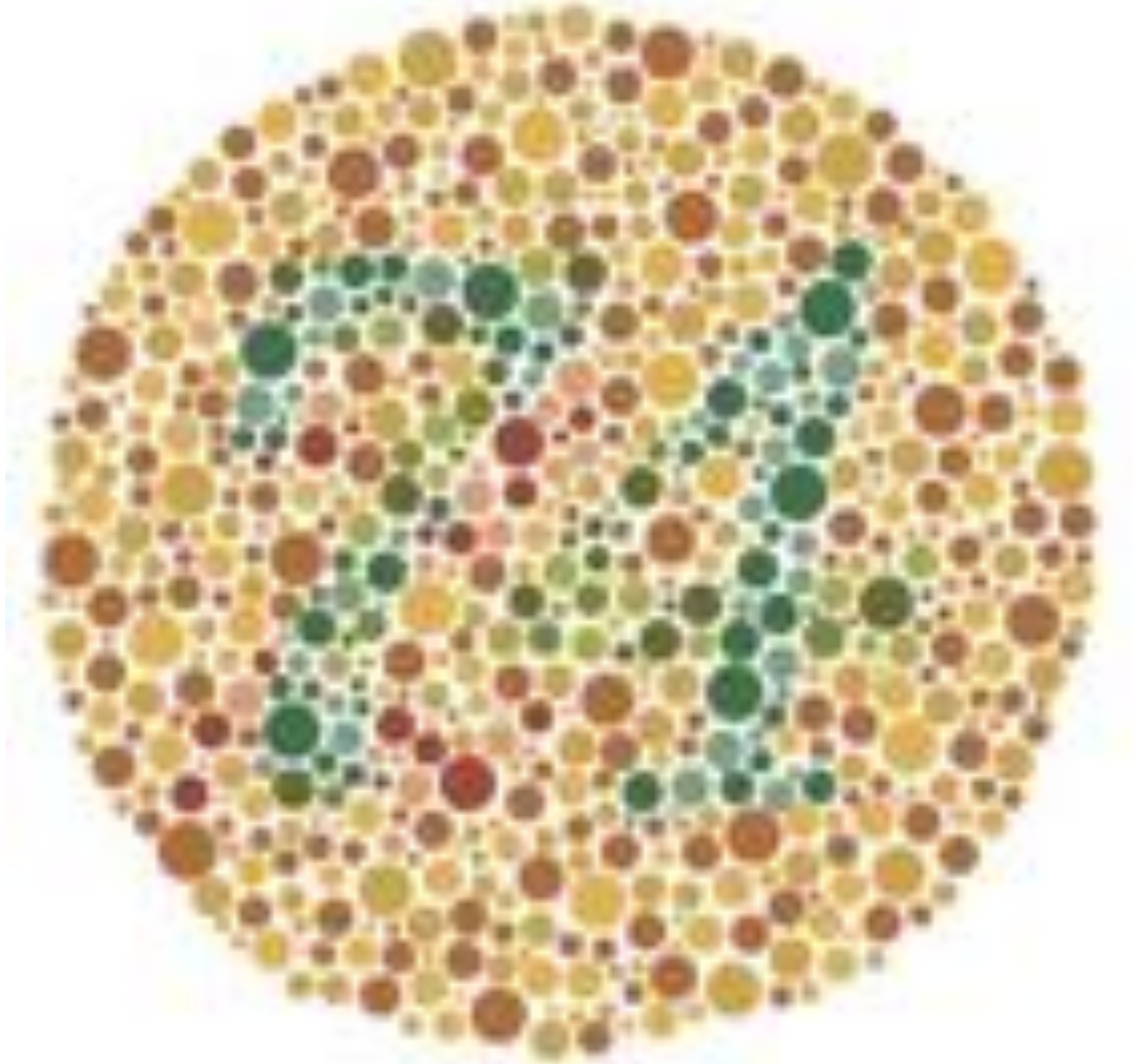


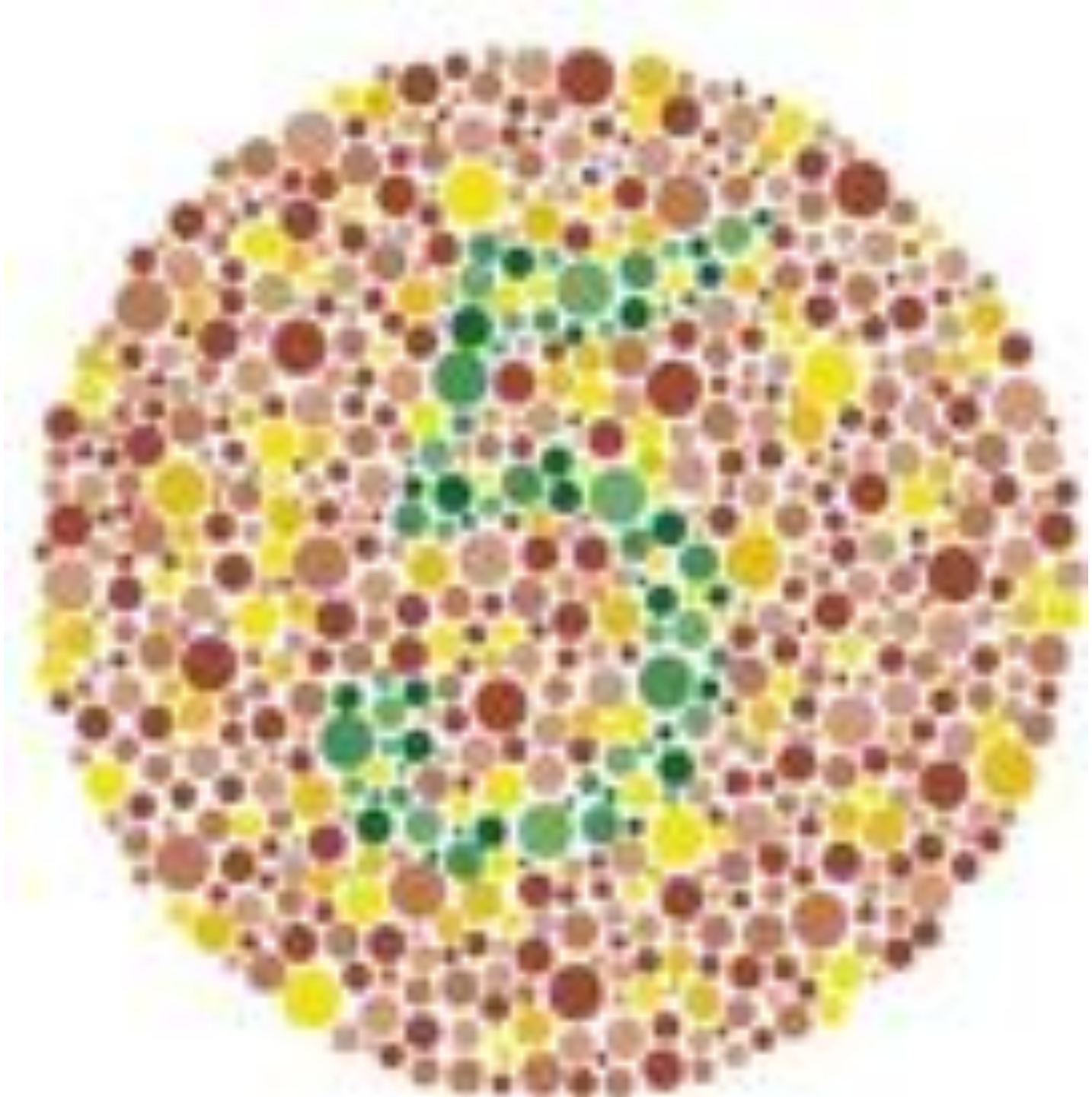


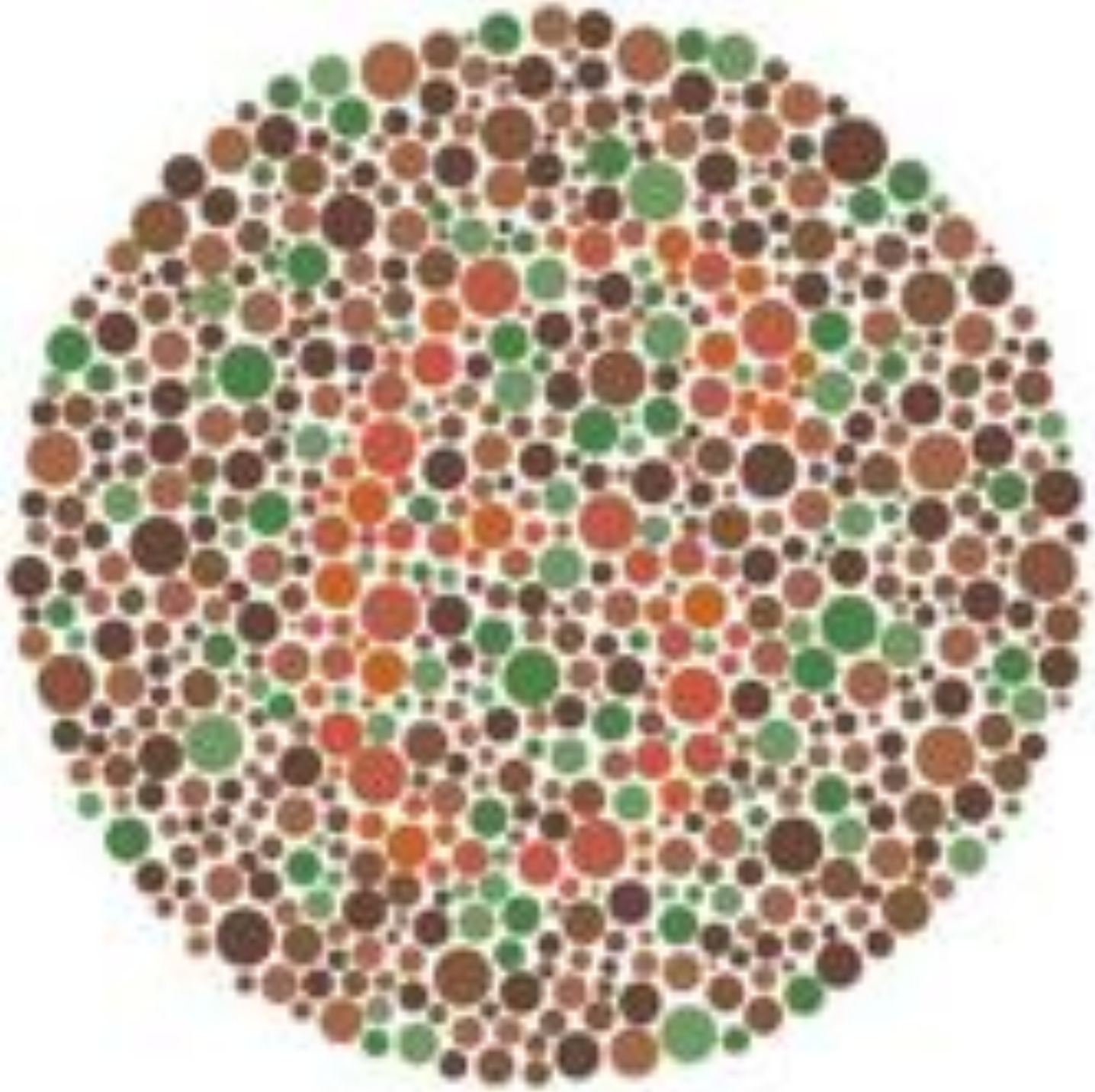


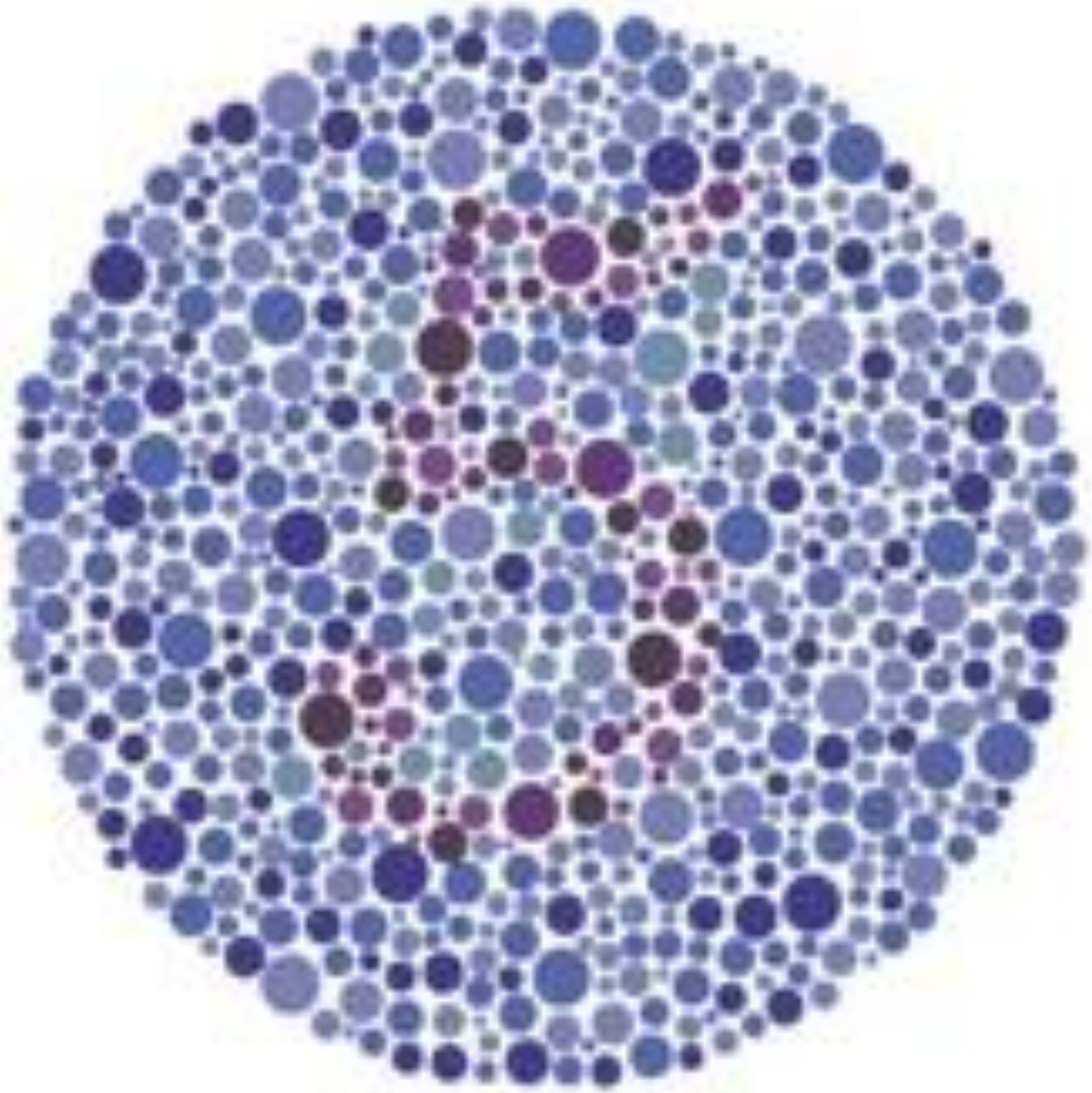


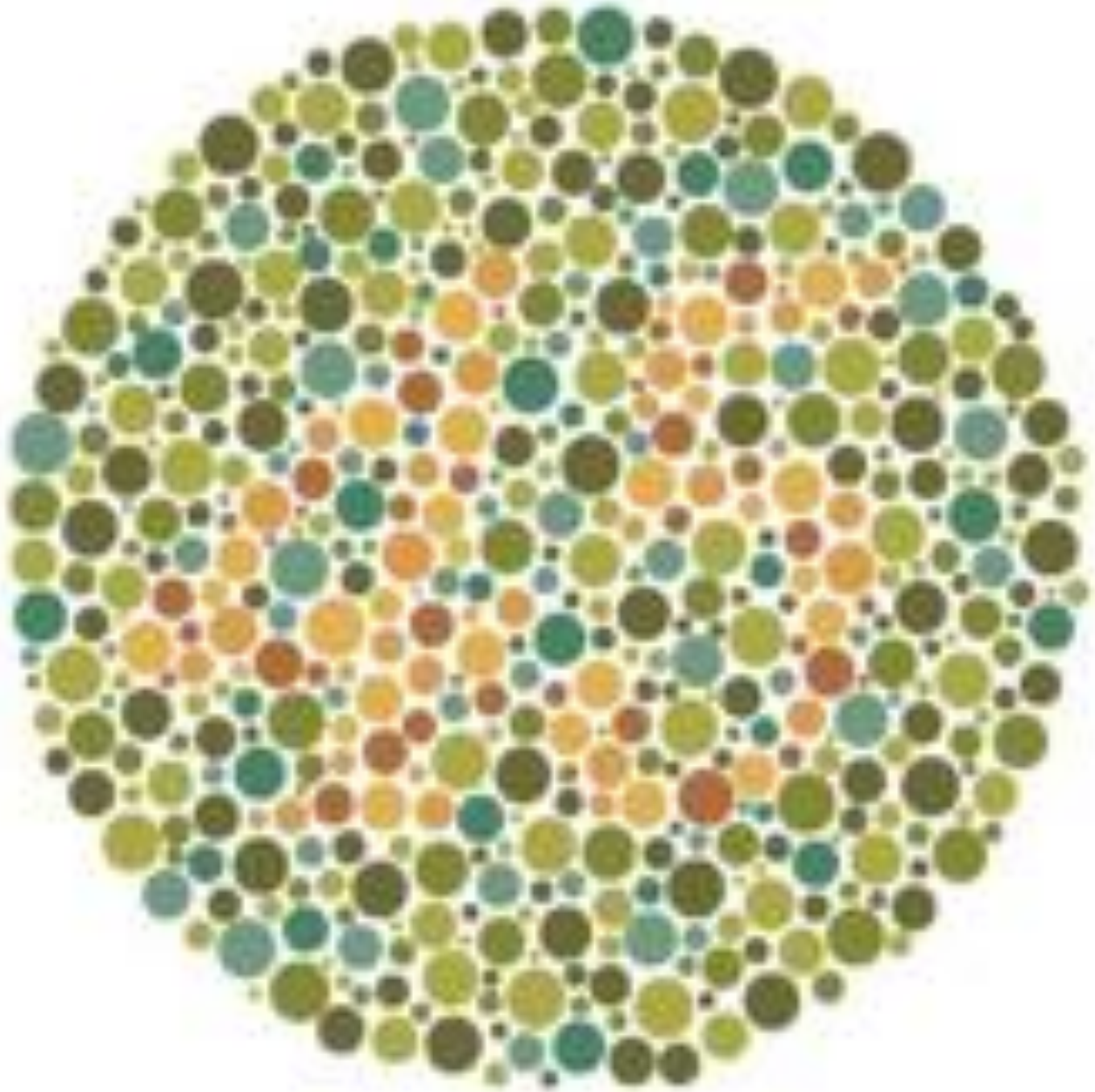


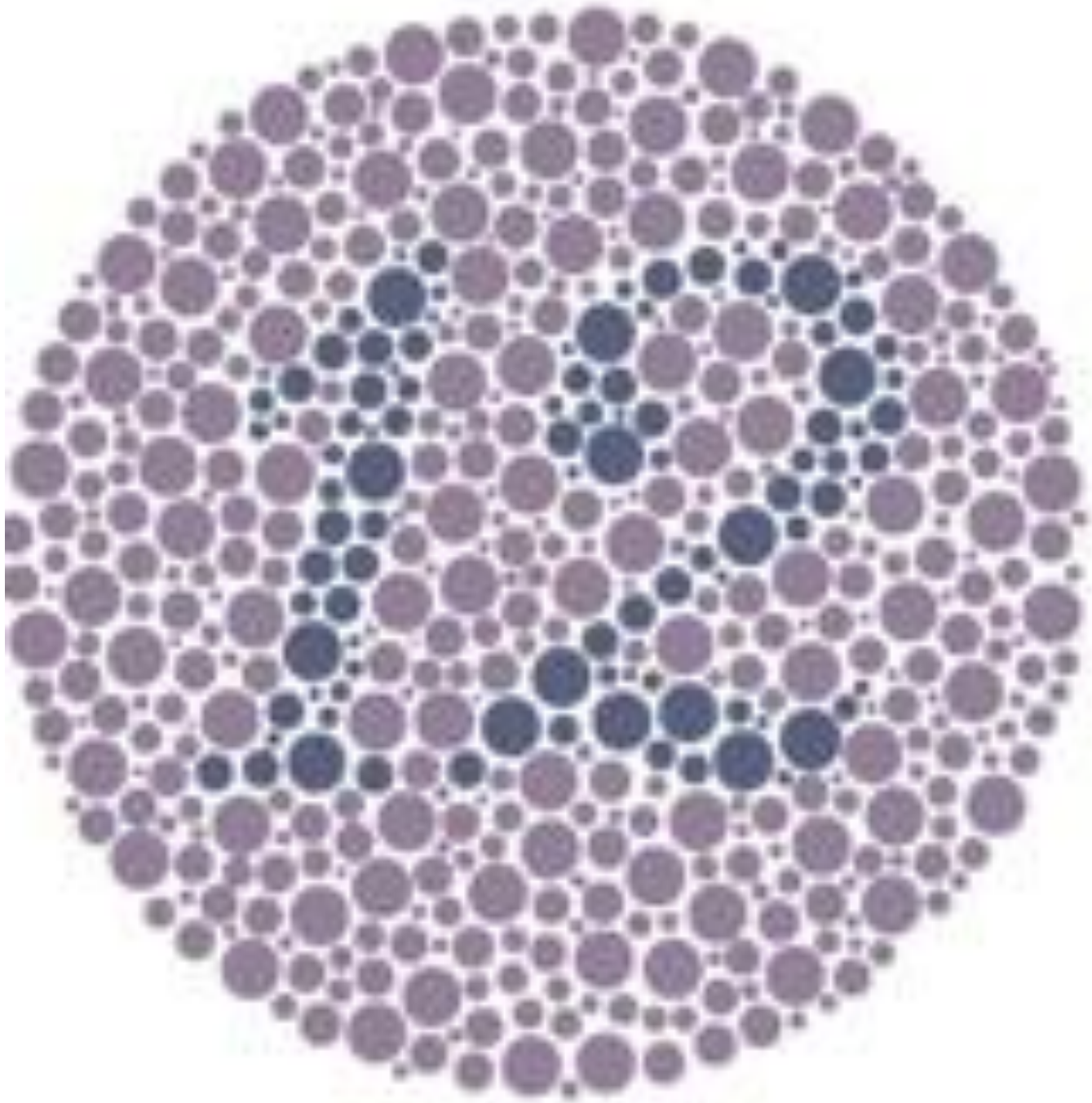


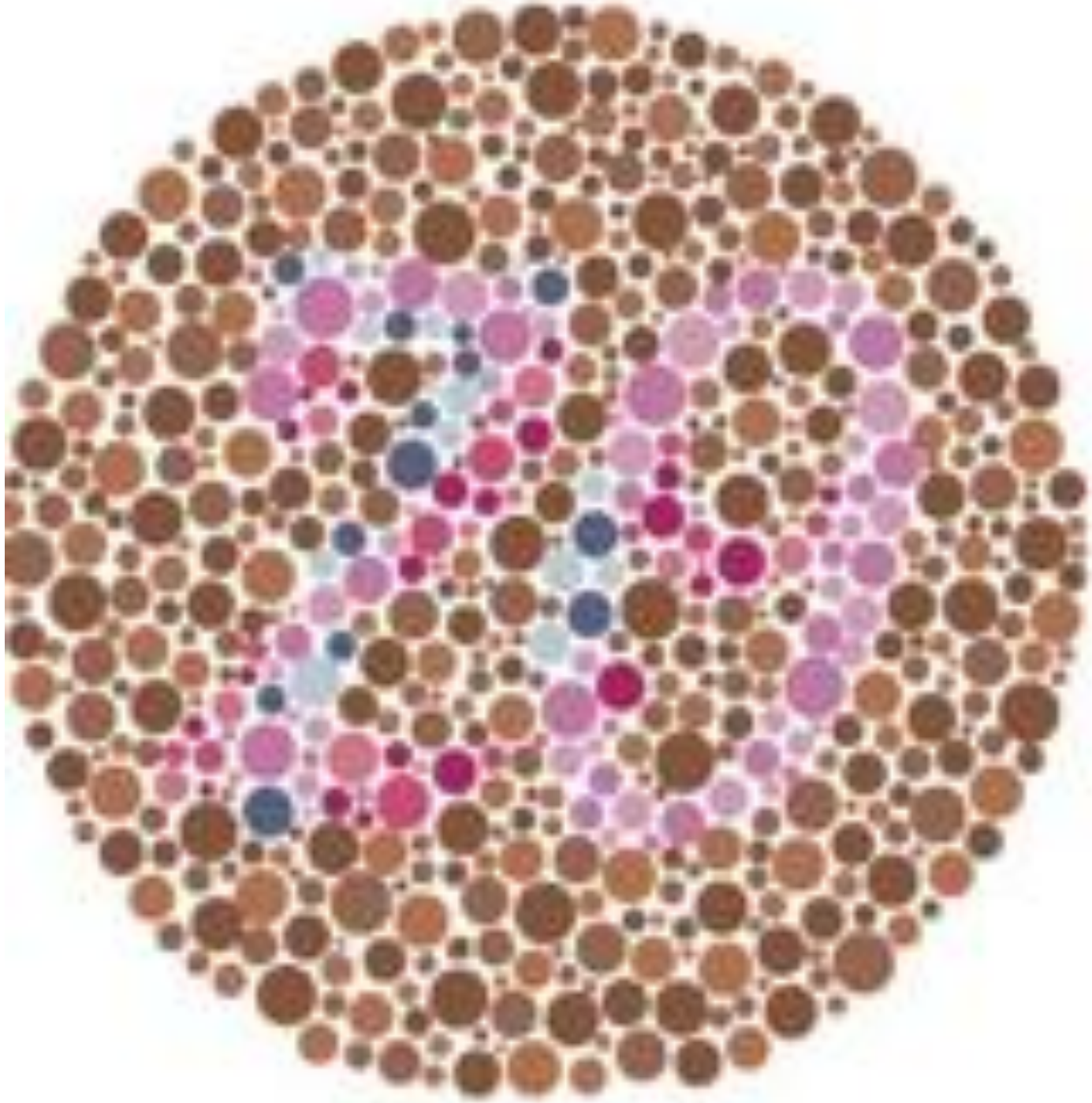


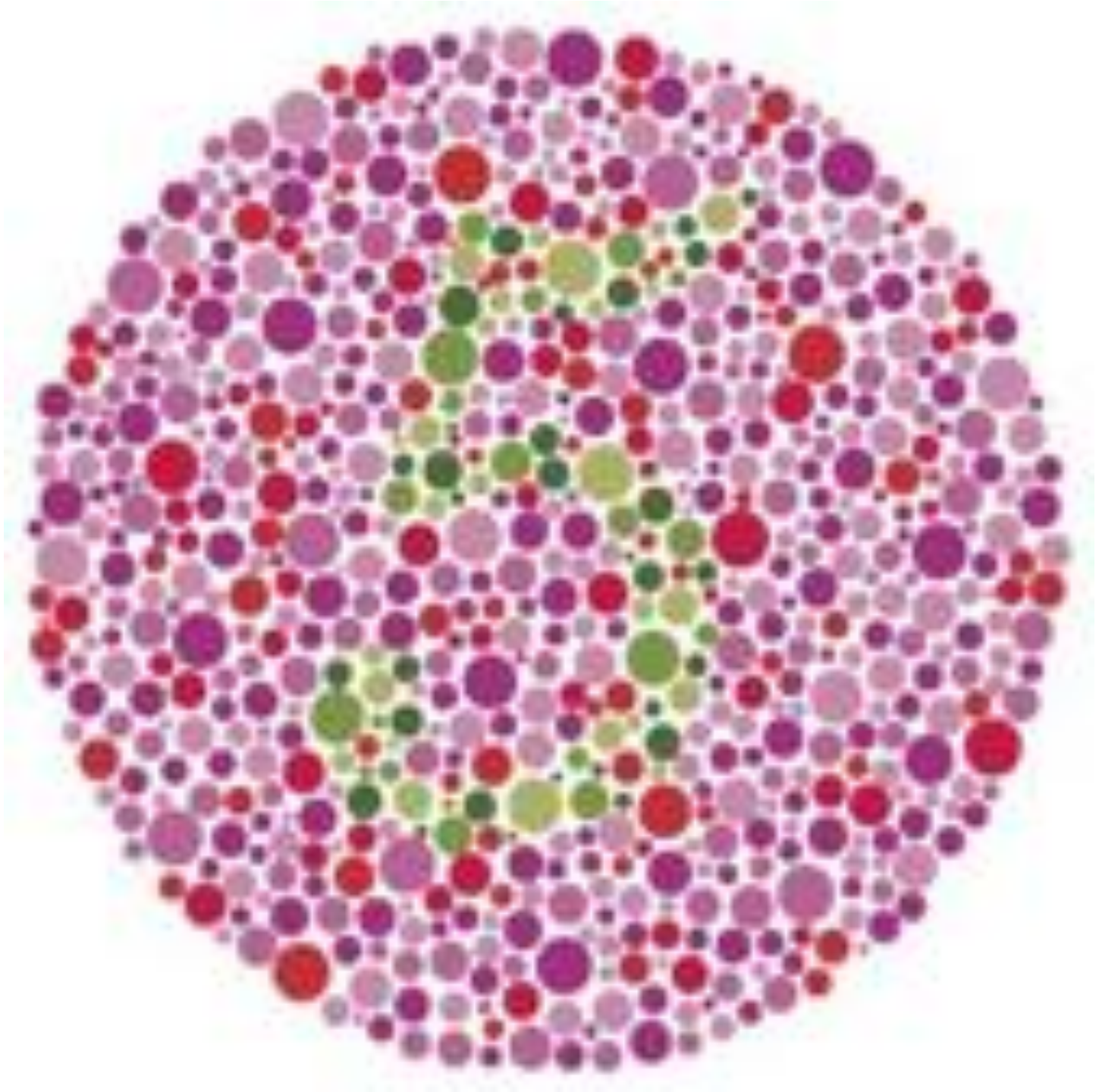












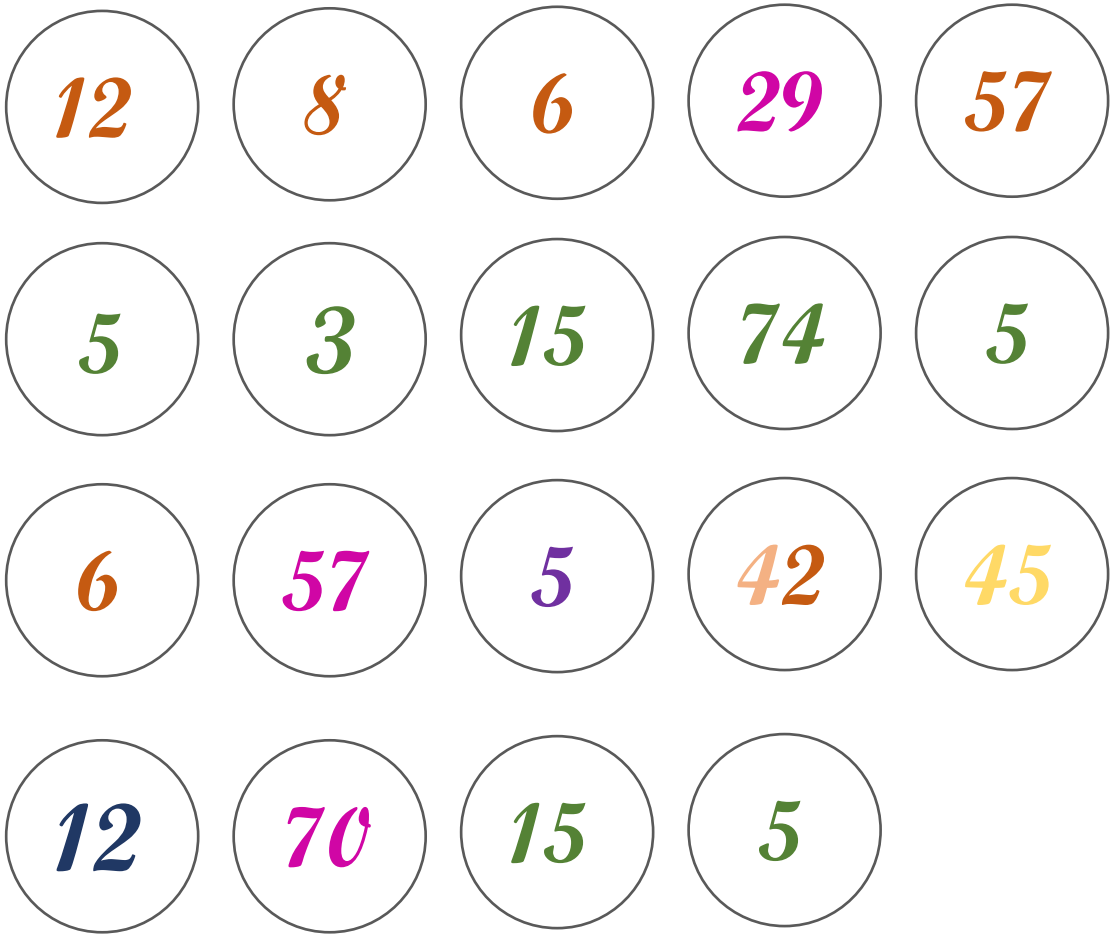
Module 4:

Color Perception and Communication

The world's true measure of color
HunterLab

How did you do?

Did your results surprise you?

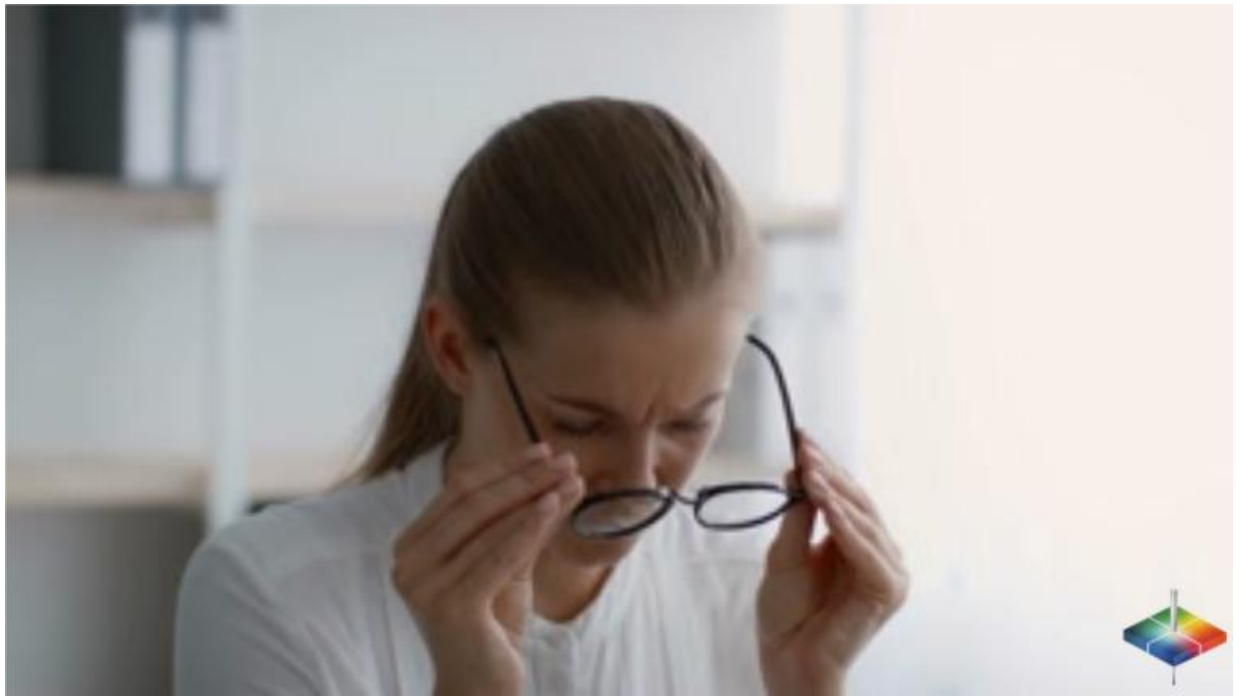


Module 4:

Color Perception and Communication

Now, let's talk about the effects of fatigue on visual color assessment.

After extended periods of reviewing samples, or staring at computer screens, the human eye becomes fatigued, reducing its sensitivity to subtle color differences.



Module 4:

Color Perception and Communication

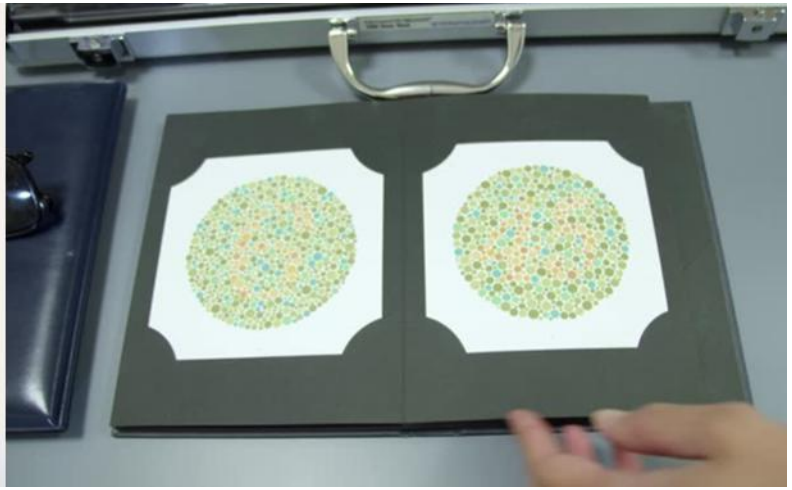
This effect is especially pronounced under poor lighting, or after repetitive visual tasks, increasing the likelihood of misjudgments.

Fundamentals of Color and Appearance

Module 4:

Color Perception and Communication

Given all these influencing factors, from lighting conditions, to individual color acuity, and eye fatigue, visual color evaluation is inherently subjective and imprecise.



Module 4:

Color Perception and Communication

That's why we rely on instrumental color measurement. Color measurement instruments are designed to replicate human color perception using standardized lighting and geometric conditions.

This ensures consistency, not just for one individual, but across teams, shifts, and global facilities.

Fundamentals of Color and Appearance

Module 4:

Color Perception and Communication

Instruments like those from HunterLab deliver objective, repeatable, and precise measurements, providing a universal language for color that eliminates the guesswork and variability of visual assessment.

Fundamentals of Color and Appearance

Module 4:

Color Perception and Communication

Thank you for joining us in this exploration of color science.

Be sure to watch Module 5, **Instrumental Color Measurement**, where we'll explore just how color can be measured and communicated with precision, accuracy, and consistency, using modern spectrophotometric instrumentation and color scales.

And be sure to visit **hunterlab.com** to learn more about how our solutions can help you achieve color confidence, every time, or to schedule a consultation with one of our color experts.