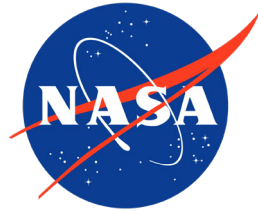
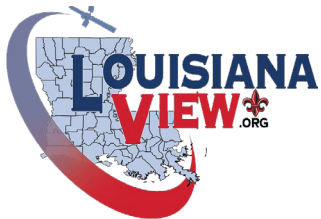




Creating

EARTH AS ART



Session One








THE EARTH AS ART TUTORIAL

Satellites orbiting the Earth capture an incredible variety of views or images of the Earth's surface. Many of these satellite images are simply intriguing to view because of the mesmerizing beauty of river deltas, mountains, and other landscapes within the images. Some images may even remind you of actual famous works of art!

This tutorial is divided into three instructional sessions, each focusing on a stage of the *Earth as Art* development process. Both Art/Color and Image Format are covered within this first session. Topics in the second session include Image Download, Image Manipulation and Image Format – Ready to Print. The third session comprises Guidelines for Printing, Material Sources, Product Development, and Gallery Exhibit Planning.

We hope you enjoy this tutorial. And always be sure to ... ***bring along your imagination***, as we begin bridging the gap between science and the public's perception of science.

Contents of *Session One*

	3		Introduction
Components of Art			4-8
	9-19		Color
Different Image Formats			20-31
	32-39		Principles of Gestalt
Aspect Ratio			40-41
	42-44		Session Wrap-Up

Introduction

In 2011, LouisianaView (www.louisianaview.org), a member of the national AmericaView Earth observation organization (www.americaview.org), began introducing the US Geological Survey's Earth as Art image collection (<https://www.usgs.gov/centers/eros/science/earth-art>) to undergraduate and graduate students in various remote sensing courses. It was readily apparent that the students were captivated by the colors and features contained within the images and they were eager to use their basic photo-interpretation skills to identify and further explore those features. It was from this enthusiastic student response that the idea of a traveling abstract art gallery exhibit based on Earth observation imagery was born.

By 2013 the first art-museum-quality exhibit on canvas was set for display and visitation. It was an engaging success! The exhibit toured across the state of Louisiana, interacting with students, adults, families, and professionals. Since then, more than 60 Earth observation images from USGS, NASA, university students and other AmericaView state programs have been added to the exhibit, depicting areas across the globe. The exhibit has also engaged students and the general public at events in several other states, some of them sponsored by organizations such as PECORA, ASPRS, and URISA. In 2019, it was decided to develop this tutorial to encourage and enable EVERYONE to create their own Earth as Art images and showcase them at their own public location or event.

COMPONENTS OF ART



Let's begin with the selection of a subject!

Subject - something that is being discussed or considered.

A landscape painting, a sculpture of a human, and a photograph of a bird or pineapples could all be known as a subject.



Form

Form - the graphical organization of artwork using line, shape, value, color, and more.

CONTENT

Content - the influence or meaning of the artwork.

Content in a work of art refers to what is being shown and might be helpful in originating a basic meaning. It may appear figurative (realistic) or abstract (distorted).



For creating any artwork you need to

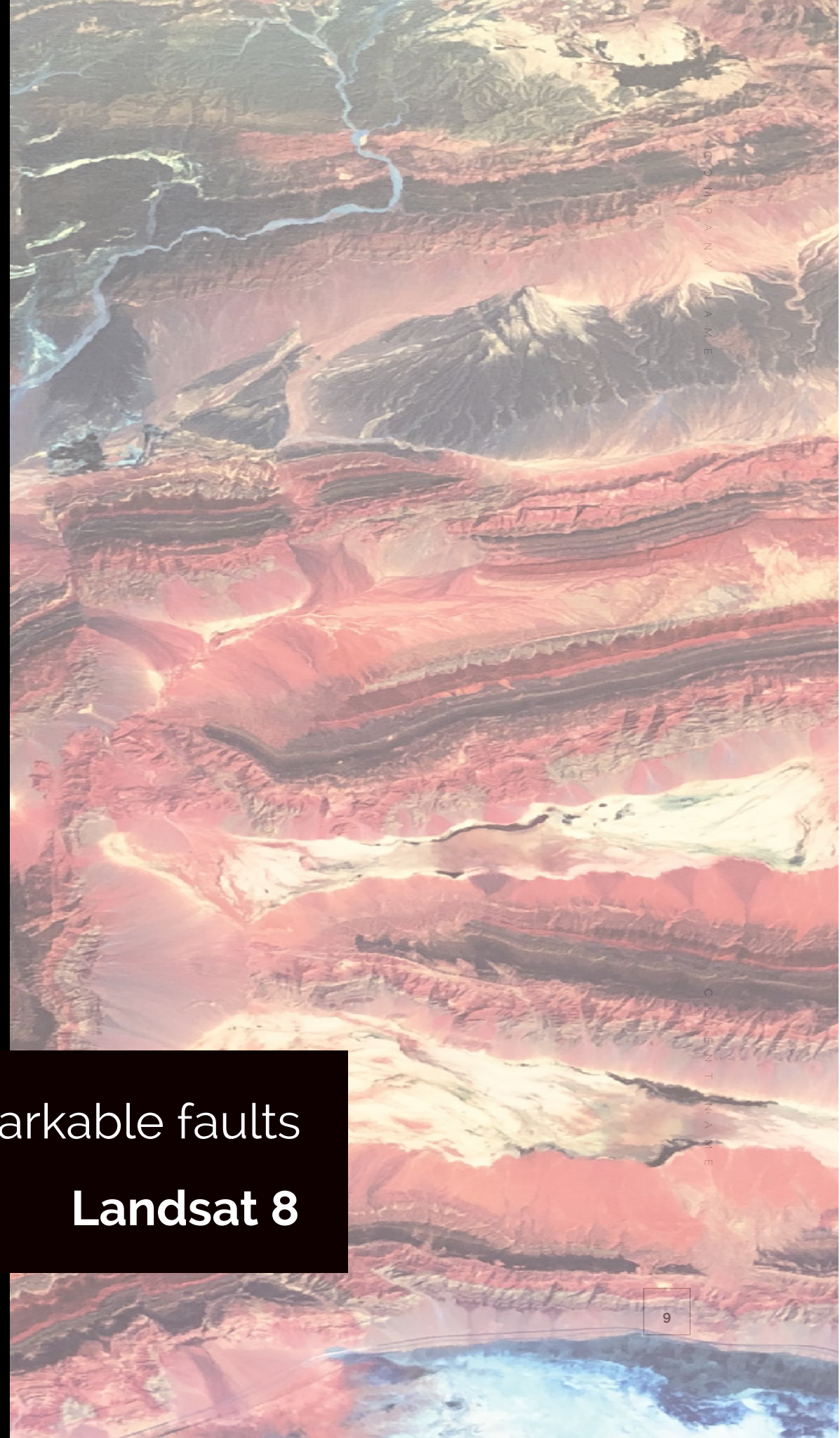
...think about the subject. Is it a photo? an illustration? a painting?

...use the right elements such as color, lines and shapes.

...ensure that it has meaning and communicates an idea to your audience.

Western China, remarkable faults

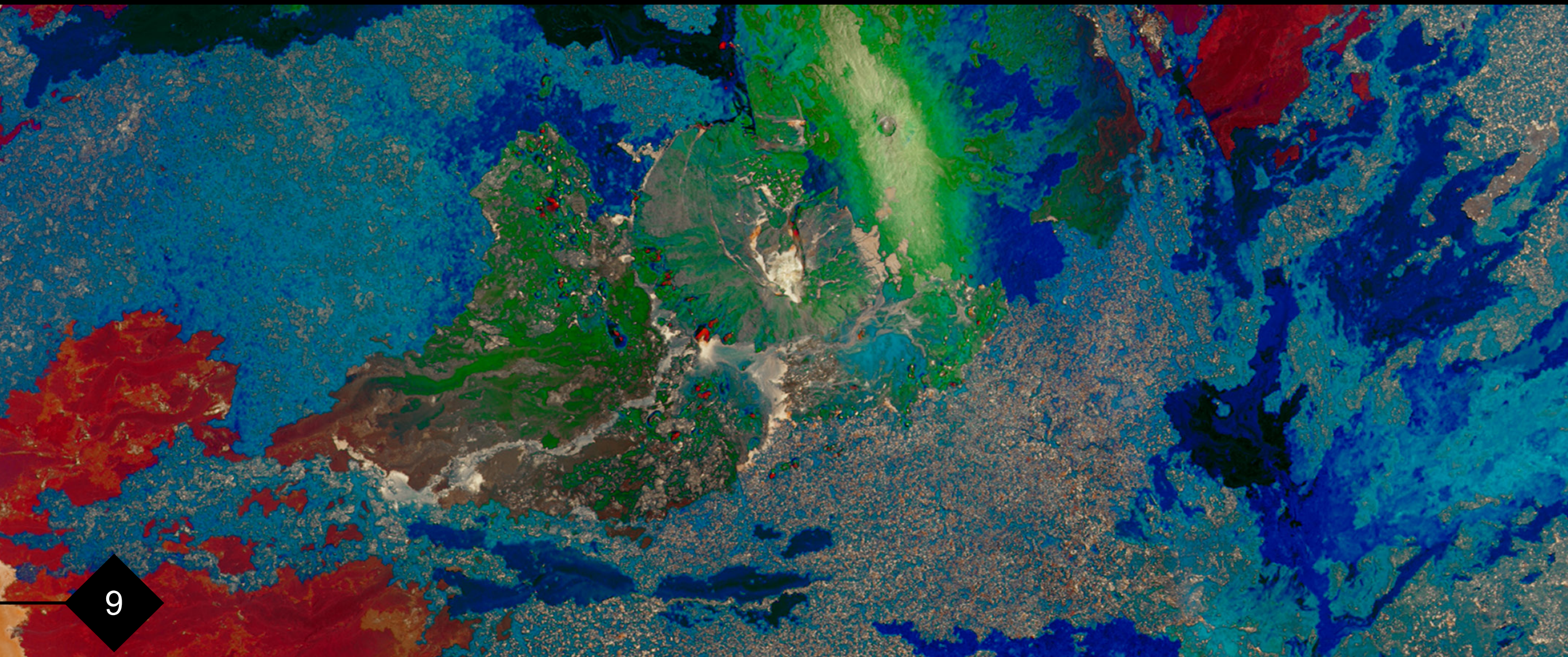
Landsat 8



Next we need an understanding of... **Color**

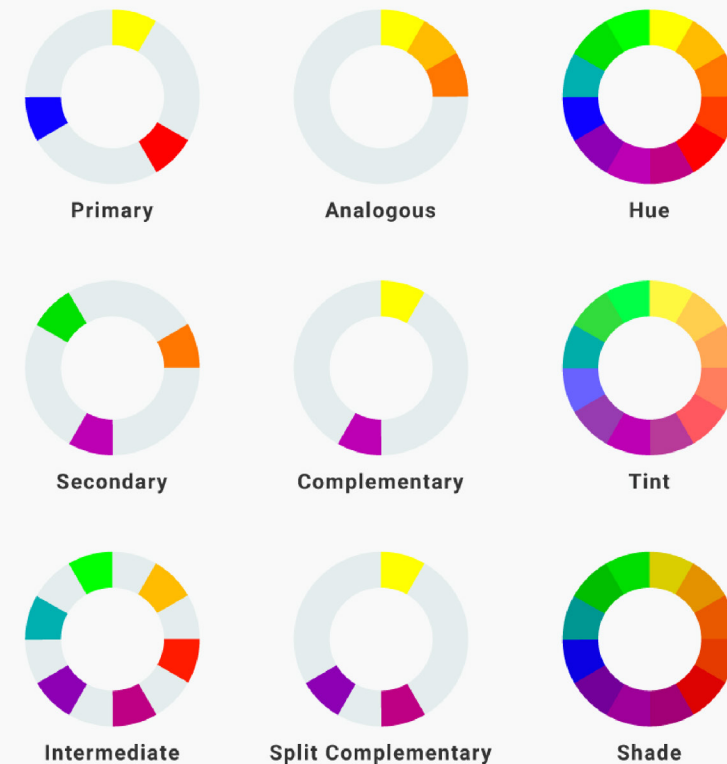
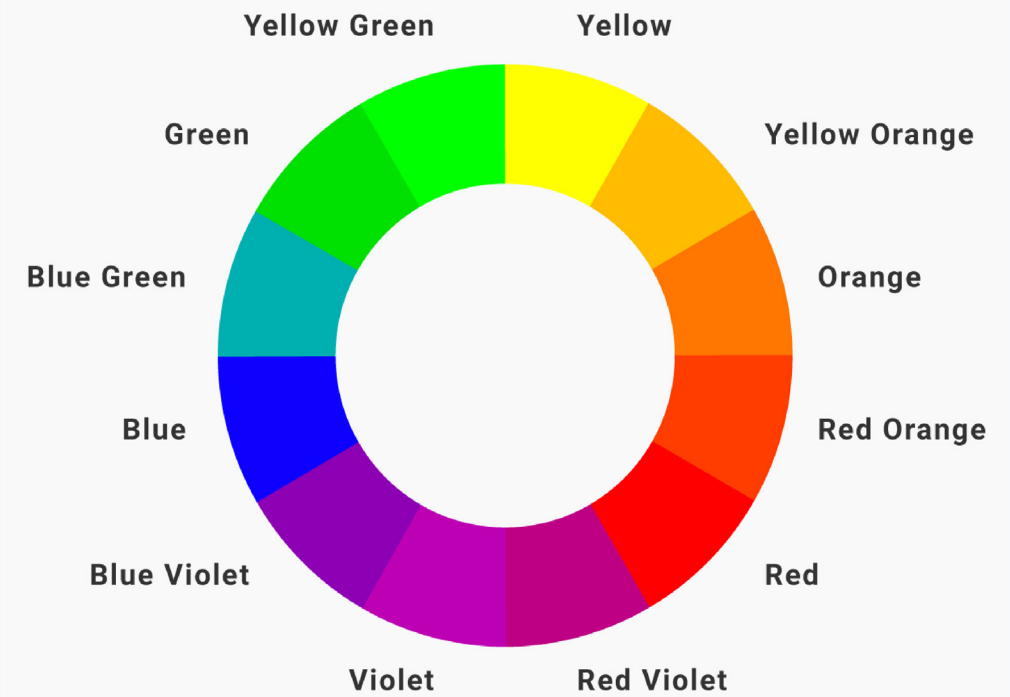
Northeastern Ethiopia

Landsat 8



The Color Wheel

A color wheel is a visual representation of colors arranged according to their chromatic relationship.





The Land of Terror, Tanezrouft Basin in Algeria

Landsat 8

Primary Colors: Blue, Red, Yellow

Secondary Colors: Orange, Green, Violet

Tertiary Colors or Intermediary Colors: Blue-Violet, Yellow-Orange, Yellow -Green

Complementary Colors: Violet and Yellow, Green and Red (opposite colors on the color wheel)

Hue, Saturation, and Value

Hue - another word for color.

Value - the lightness or darkness of a color.

Saturation - the brilliance and intensity of a color.

When a pigment hue is "toned," both white and black (grey) are added to the color to reduce the color's saturation.

A satellite image of Greenland's western coast, showing a complex pattern of ice and water. The ice appears in various shades of blue and white, with some darker patches indicating open water or thin ice. The coastline is visible on the right side, with a dark, rocky shore. The overall scene is a mix of light and dark tones, illustrating the concept of value in color.

Along Greenland's western coast

Landsat 7

What Are the Four Process Colors?

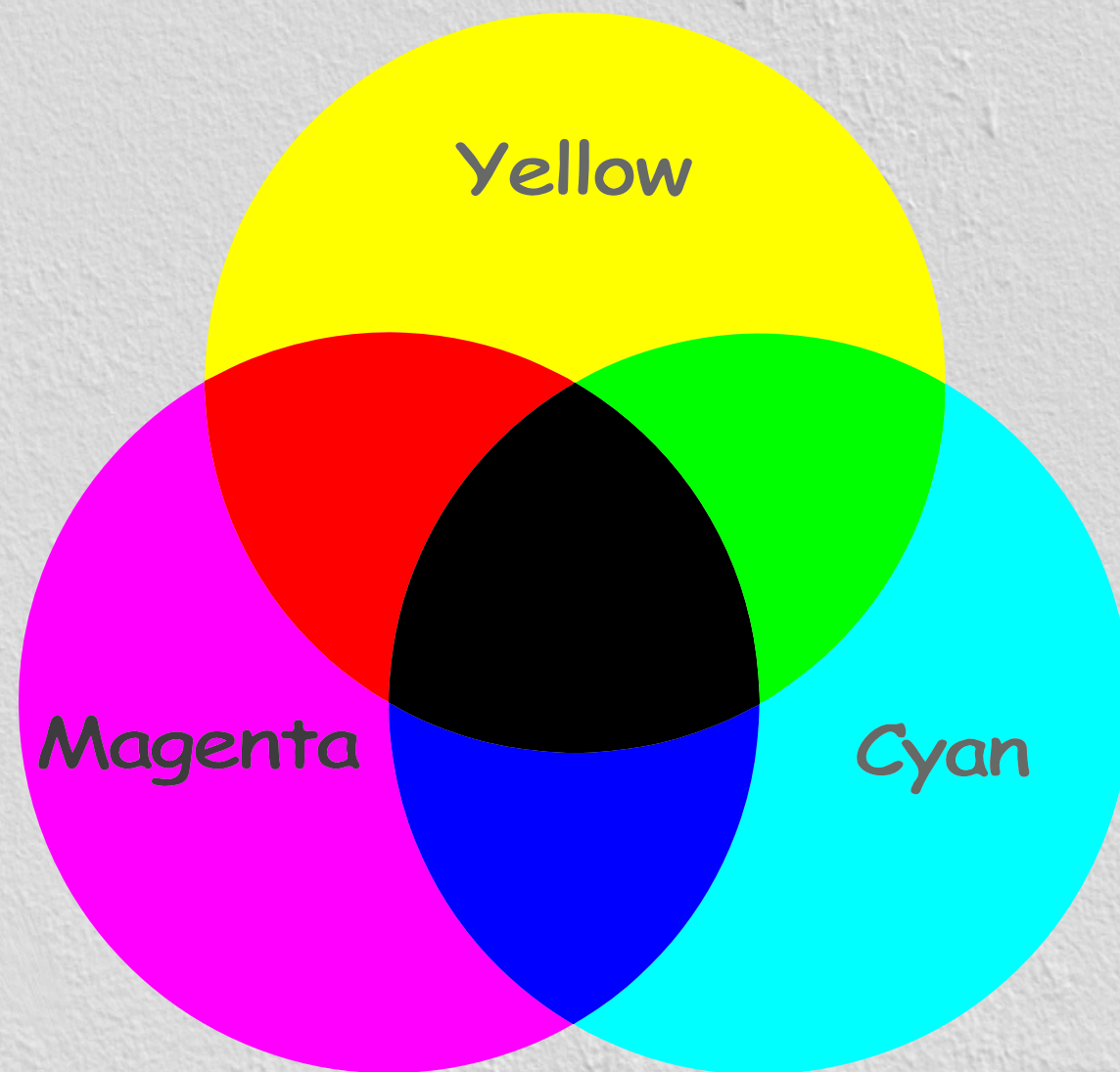
CMYK (also referred to as full color, process color, or 4 color) uses 4 different colors of ink (Cyan, Magenta, Yellow and Black) to achieve the full color spectrum when overlapped.

To print ANY multicolor image these 4 colors of ink are used. The press runs 4 times to apply each ink individually.



How CMYK pallets create new colors

It is the overlapping or mixing of these colors that enables the creation of the full color spectrum.



What is the RGB color model?

RGB is the abbreviation for Red, Green, Blue. It is these three hues of light that can be mixed with each other to generate different colors on devices such as computer monitors and smartphone screens. The amount of red, green and blue light at each pixel location on the screen determines the resulting color. When 0 represents no color and 255 represents maximum color, a pixel with a value of 0 for red, 0 for green, and 255 for blue (RGB = **0,0,255**) will appear on the screen as blue.

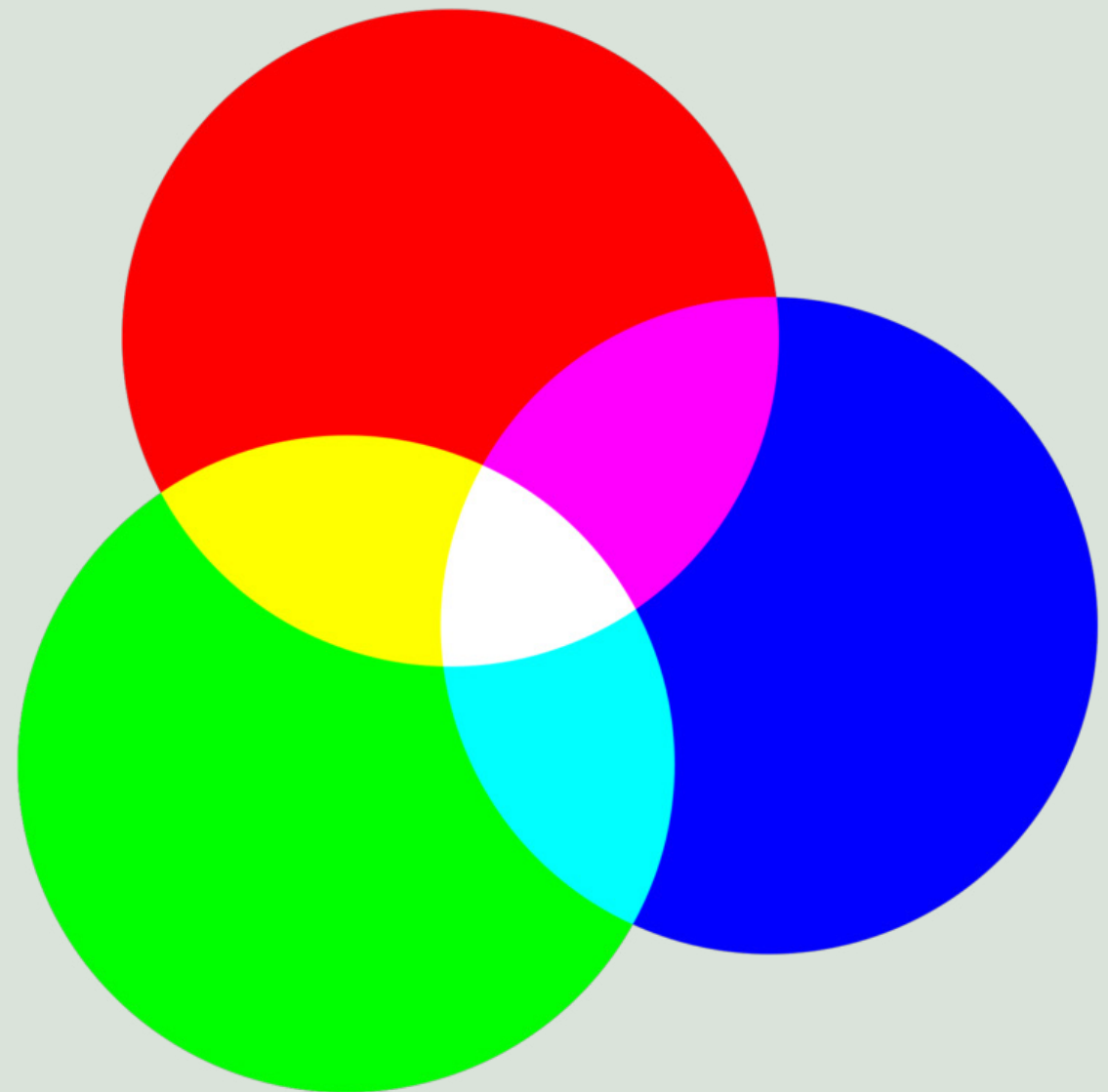
Likewise, (RGB = **0,255,0**) and (RGB = **255,0,0**) will result in a green and red pixel, respectively.

A pixel with RGB values of 0,0,0 results in black while values of 255,255,255 results in white.



How RGB pallets create new colors

The amount of red, green and blue light at each pixel location on the screen determines the resulting color.



Solid / Spot Color Process

In simple terms, spot (or solid) inks are premixed inks and are applied only to the area assigned for each color. To print a black, brown, and red image, black, brown and red pre-mixed inks are used. In this instance the printing press runs only three times, thus reducing printing costs.



What is the Right Color Combination?

Color combinations are important for conveying your subject matter to the audience. The right colors will enhance an image and provide a more engaging experience to the viewer. Have you ever looked at someone's slide presentation and become disinterested just because the text and graphics did not read well? With art and imagery, it works the same. We want to captivate our audience.



Rock folding in northwestern Africa, Morocco

Landsat 8

It is not the color's fault!

Most of the time the contrast between colors is more important than the colors themselves

Hello

Hello

Different Image Formats

The image is a satellite photograph of a mountainous region in northern Argentina. The terrain is highly varied, with a central mountain range (Sierra de Velasco) showing a mix of green, brown, and grey. To the left, there are large, irregular patches of red and orange, likely representing agricultural land or specific vegetation. The surrounding areas are predominantly blue and cyan, indicating water bodies or wetlands. The overall appearance is a mosaic of different colors and textures, typical of a satellite image used for land cover analysis.

Sierra de Velasco Mountains of northern Argentina
Landsat 5



Now on to the Image Formats!

Choosing the File Format for Saving our Image Data

Various image file types are available for different purposes. The first important step in producing digital or printable art is defining which file type best suits the image needs.

There are not only several commonly used image formats, but also many formats that are native to specific applications. It is essential to understand that there is a difference between native file types and image file types.

.jpg

File type does matter!

PNG

PNG, or “Portable Graphics Format,” is a raster-based format with lossless compression, meaning there is no loss in quality each time it is opened and saved again. PNG also handles detailed, high-contrast images well. One of the best features of PNG is its support of transparency.



PROS AND CONS OF PNG FORMAT

Pros

Lossless
compression

Transparency
support

Great for text and
screenshots

Cons

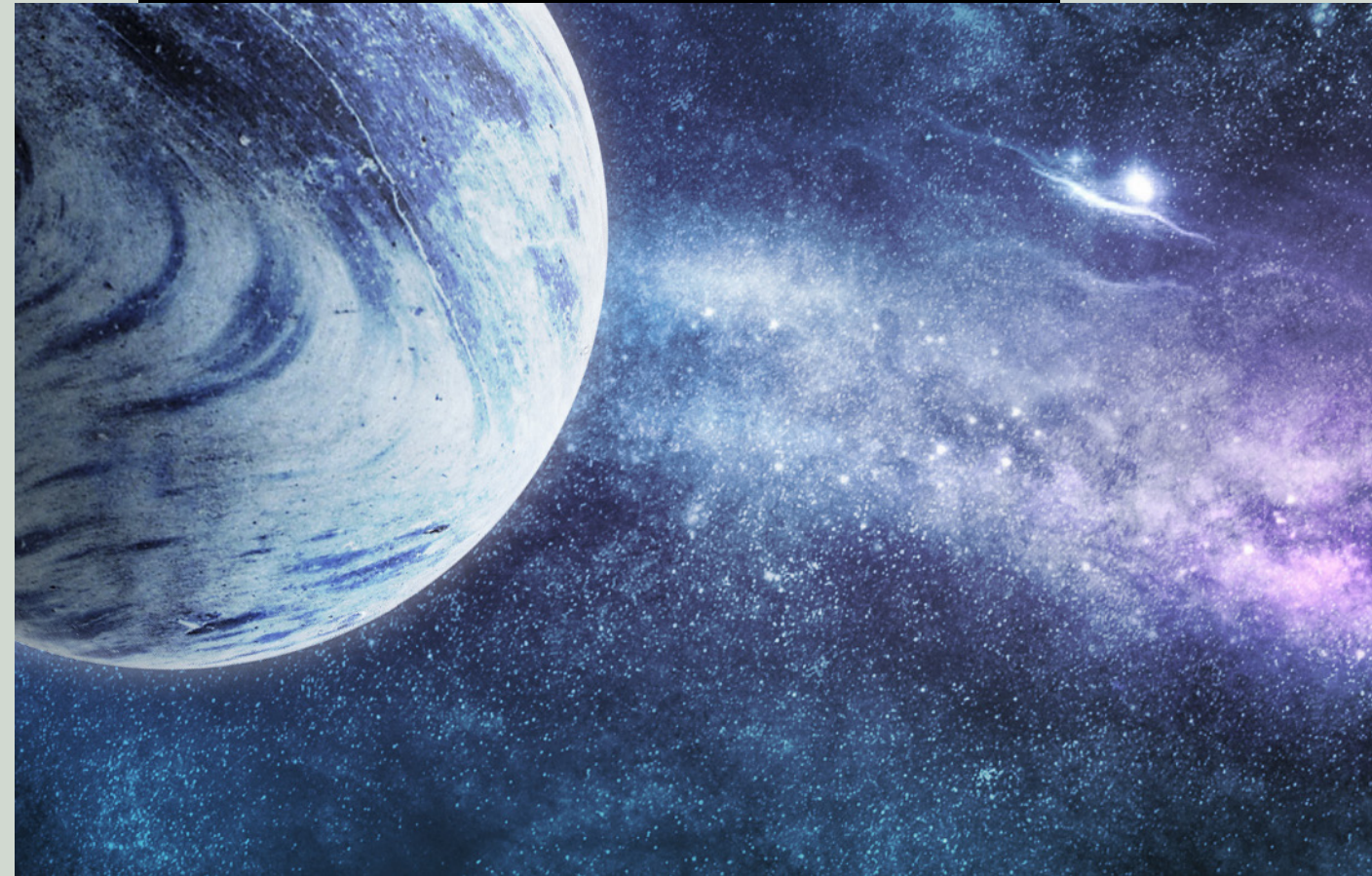
Large file

No native EXIF
support
(Exchangeable image file format)

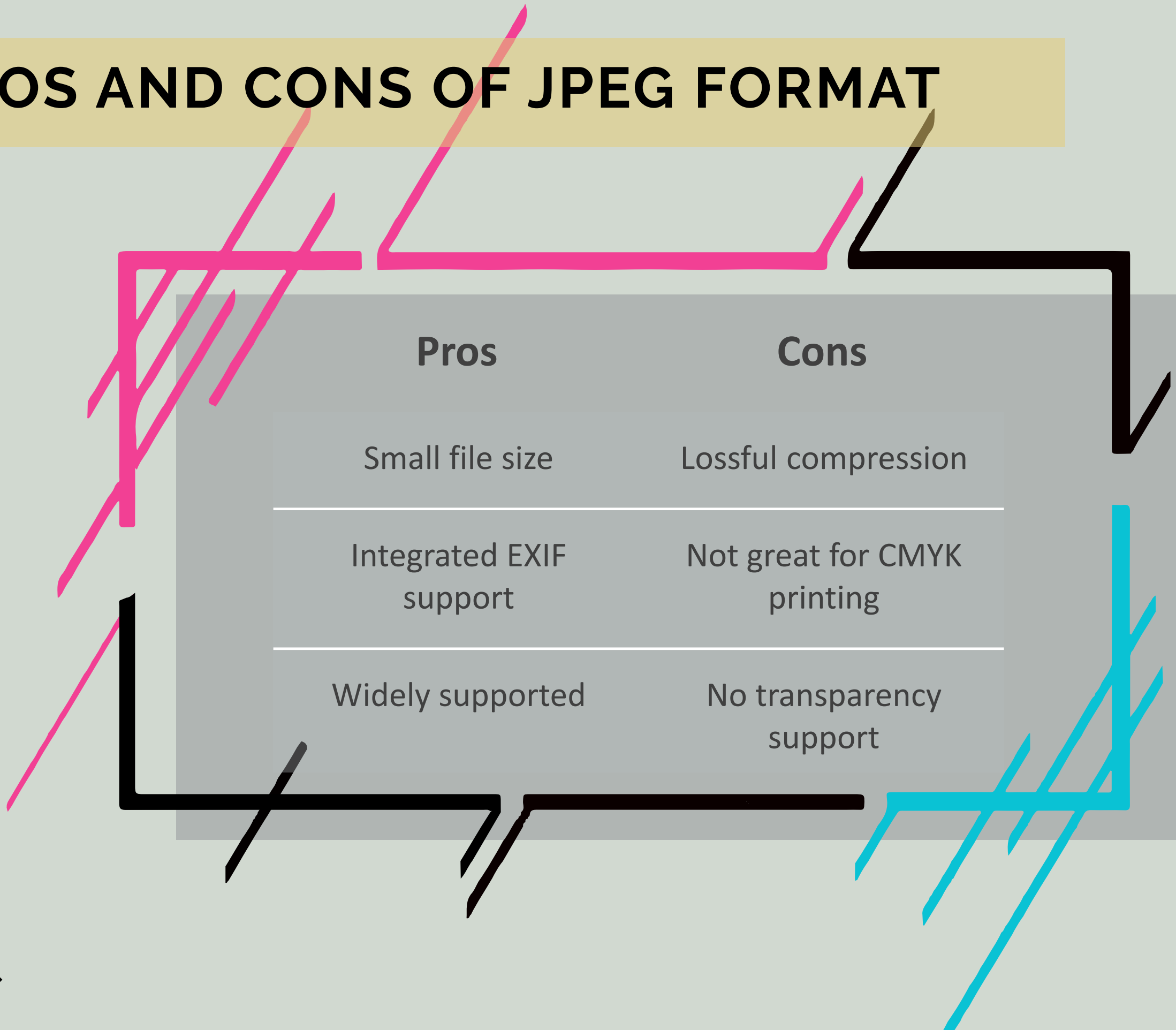
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JPEG

JPEG stands for Joint Photographic Experts Group—the name of the developers of this format. JPEG has become the standard compressed format in digital photography and online image sharing thanks to its careful balance of file size and image quality.



PROS AND CONS OF JPEG FORMAT



TIFF

TIFF stands for “Tag Image File Format.” It is best for any raster graphics images that you want to edit. TIFF files do not compress, so they are large files because they are intended to preserve quality. You can use tags, layers, and transparency and are companionable with photo manipulation programs such as Photoshop. It is not a small file or a web-friendly format, but it works perfectly for editing digital images.



PROS AND CONS OF TIFF FORMAT



Pros

No image data is lost

Good image quality

Good for using in heavily manipulated photo editing program like Photoshop

Cons

Very large file size

Most Web browsers, cannot open TIFF files

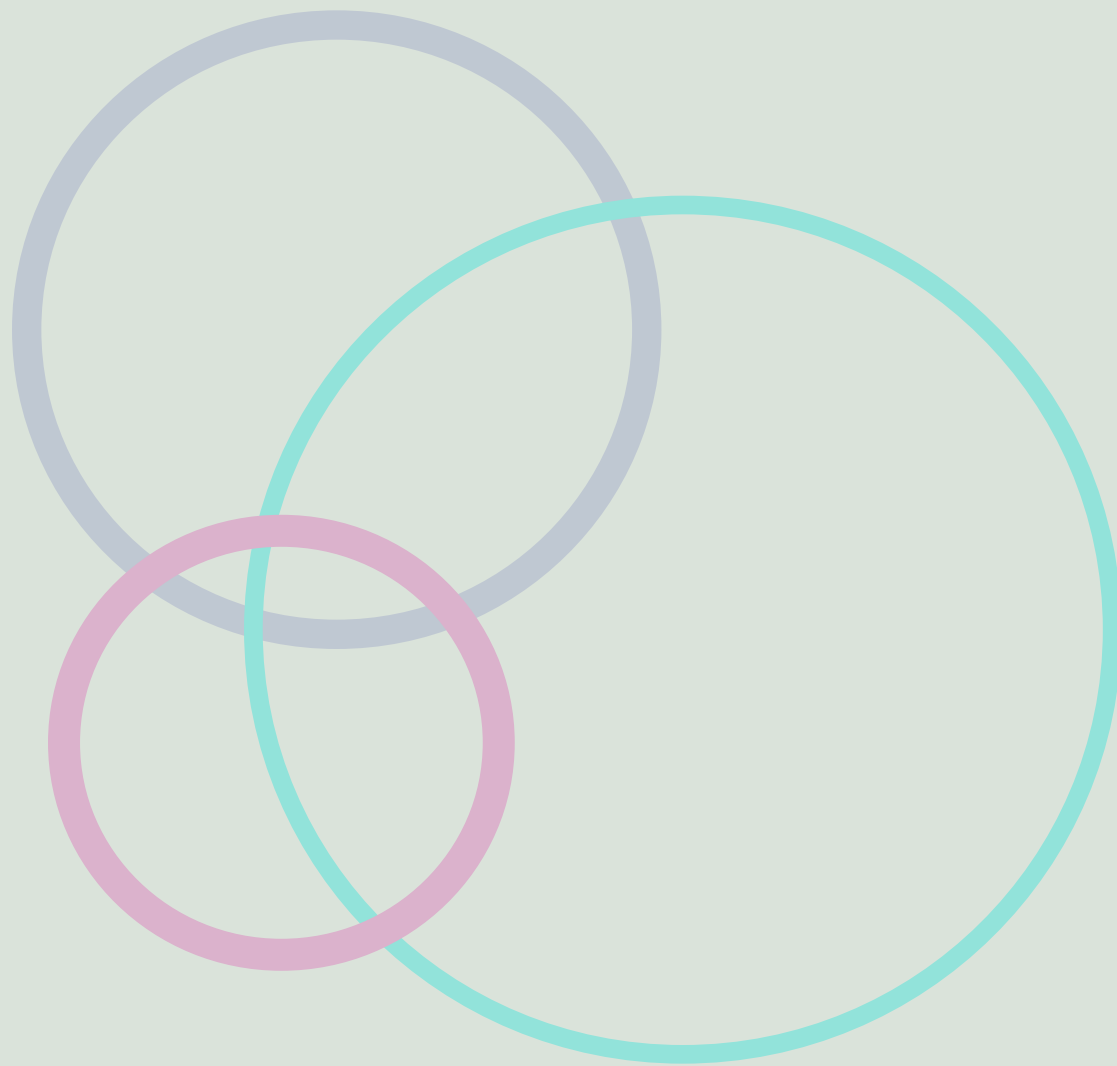
Long time to open or download

GIF

GIF stands for "Graphic Interchange Format." It is a file extension for an often-animated raster graphics file. GIF is the second-most common image format used on the World Wide Web after JPEG.



PROS AND CONS OF GIF FORMAT



Pros

Cons

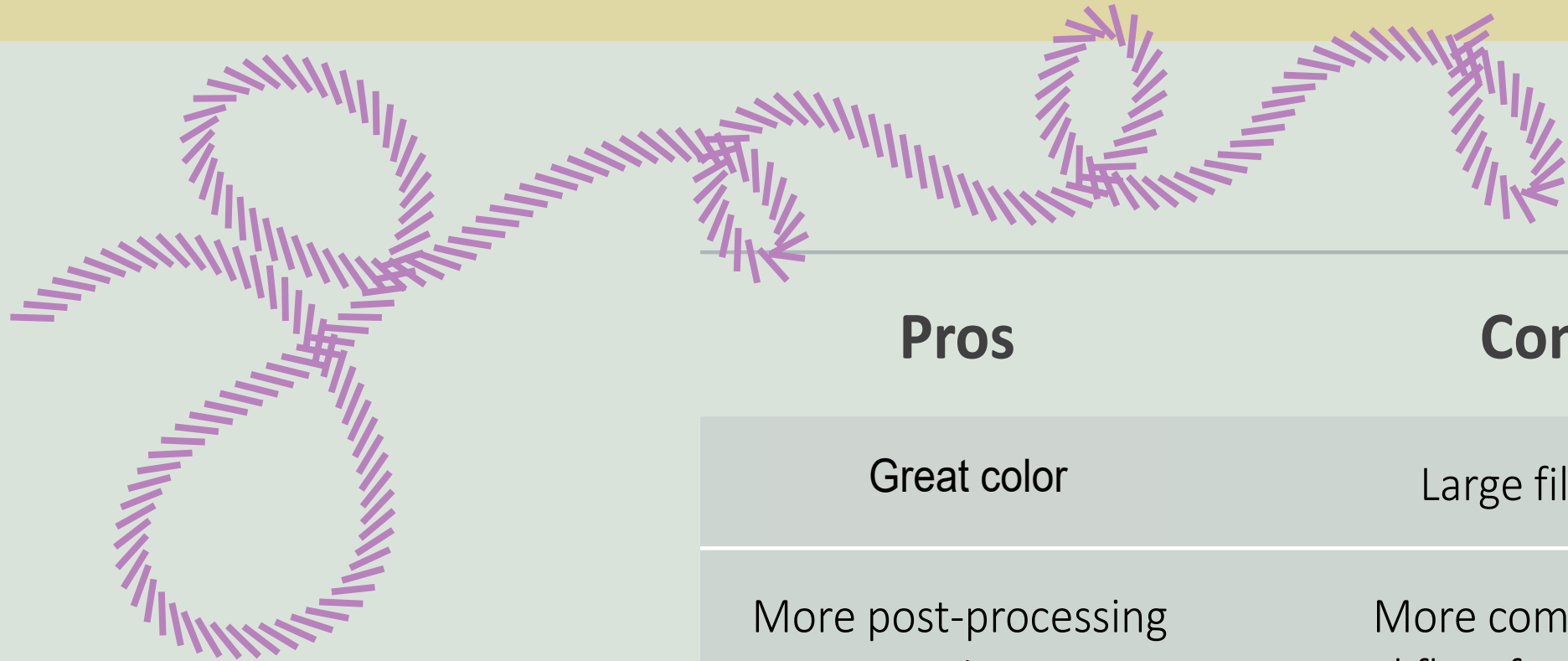
Small file size	Limited color pattern
Professional looking images	Editing is not possible
Show movements and emotions	Internet connection matters

RAW

A raw file is a group of unprocessed data, containing 0 and 1 values. The file has not been altered, compressed, or manipulated. A common type of raw file is "Camera RAW," which is generated by a digital camera and the data is left unprocessed and uncompressed until it is opened with a computer program.



PROS AND CONS OF RAW FORMAT



Pros

Great color

More post-processing options

Cons

Large file size

More complicated workflow for processing

PRINCIPLES OF GESTALT

The word Gestalt is used in modern German to mean the way a thing has been “placed,” or “put together.” There is no exact equivalent in English. “Form” and “shape” are the usual translations; in psychology the word is often interpreted as “pattern” or “configuration.”

Gestalt psychology is a school of thought that looks at the human mind and behavior as a whole. When trying to make sense of the world around us, Gestalt psychology suggests that we do not simply focus on every small component. Instead, our minds tend to perceive objects as part of a greater whole and as elements of more complex systems.

Gestalt elements include:

Similarity

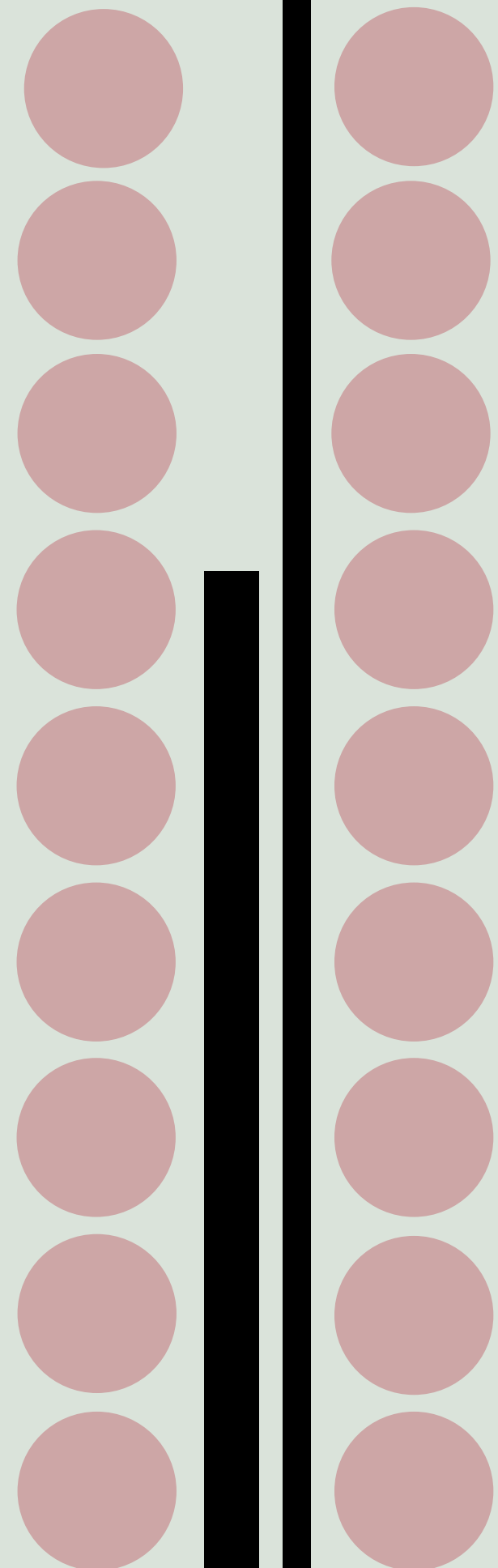
Continuation

Closure

Proximity

Figure and ground

Symmetry

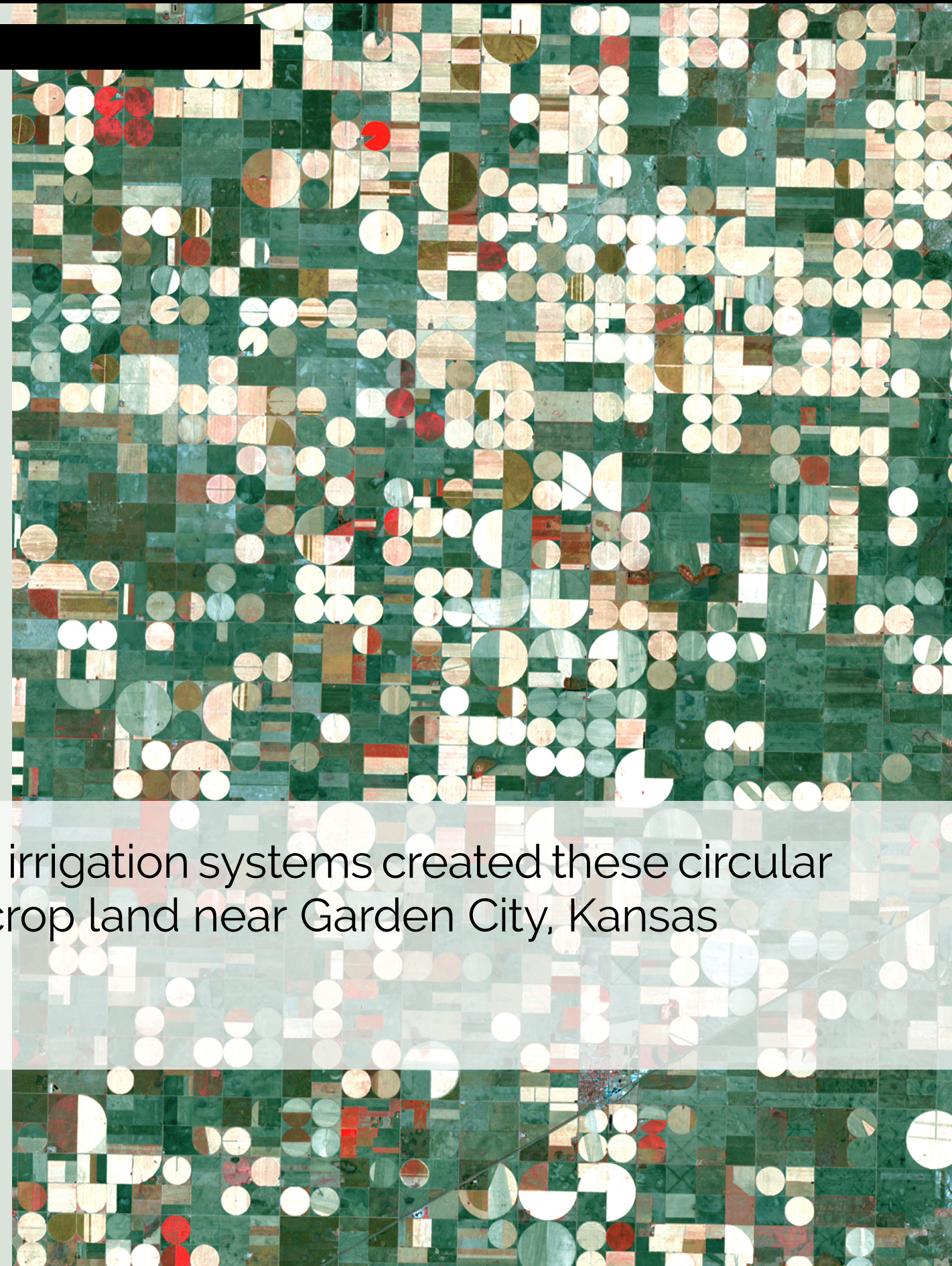


SIMILARITY

Similarity involves objects that look similar to one another. People often perceive them as a group or pattern.

Center pivot irrigation systems created these circular patterns in crop land near Garden City, Kansas

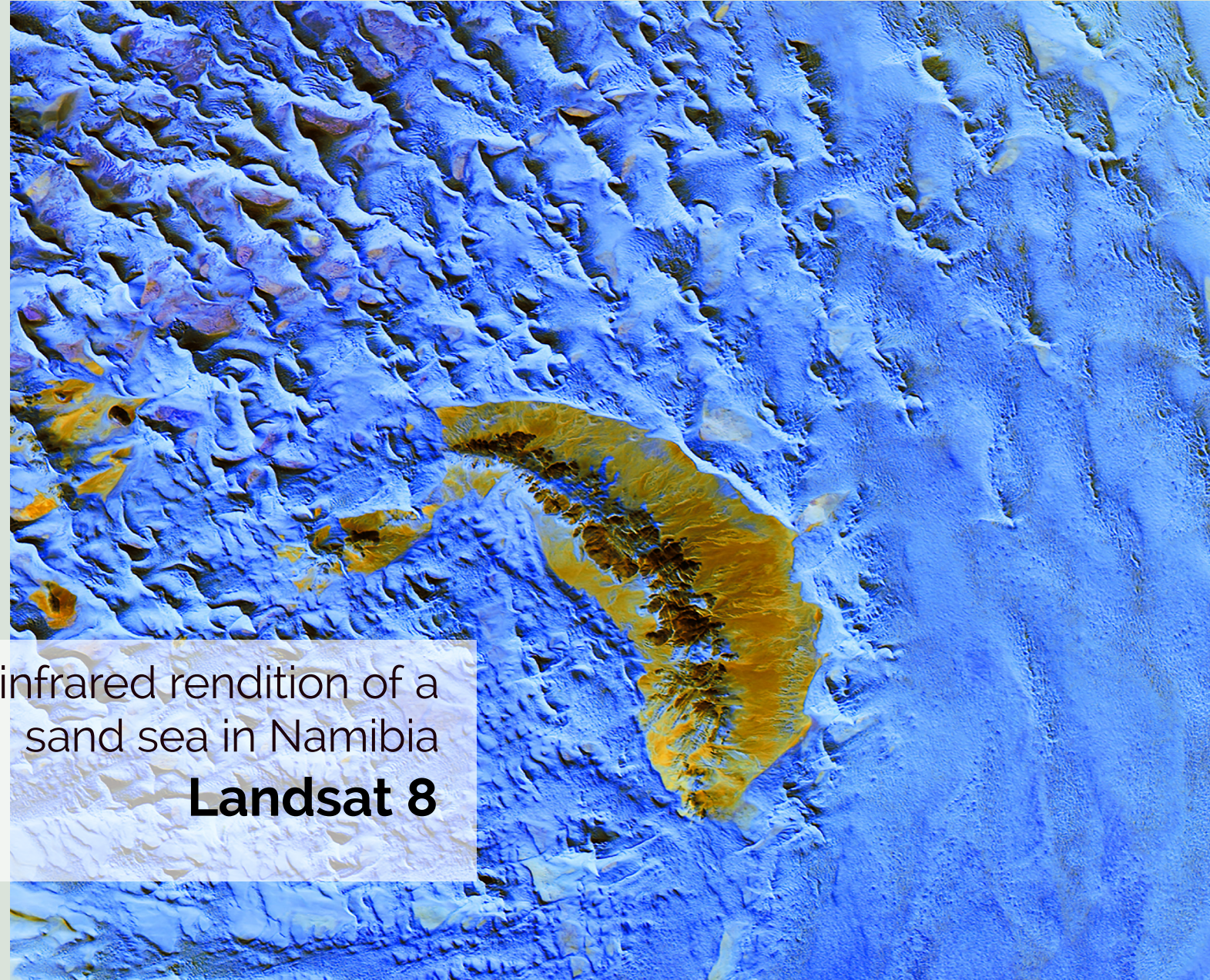
Landsat 7



SIMILARITY WITH ANOMALY

When similarity occurs, an object can be emphasized if it is dissimilar to the others.

This image is an infrared rendition of a sand sea in Namibia
Landsat 8

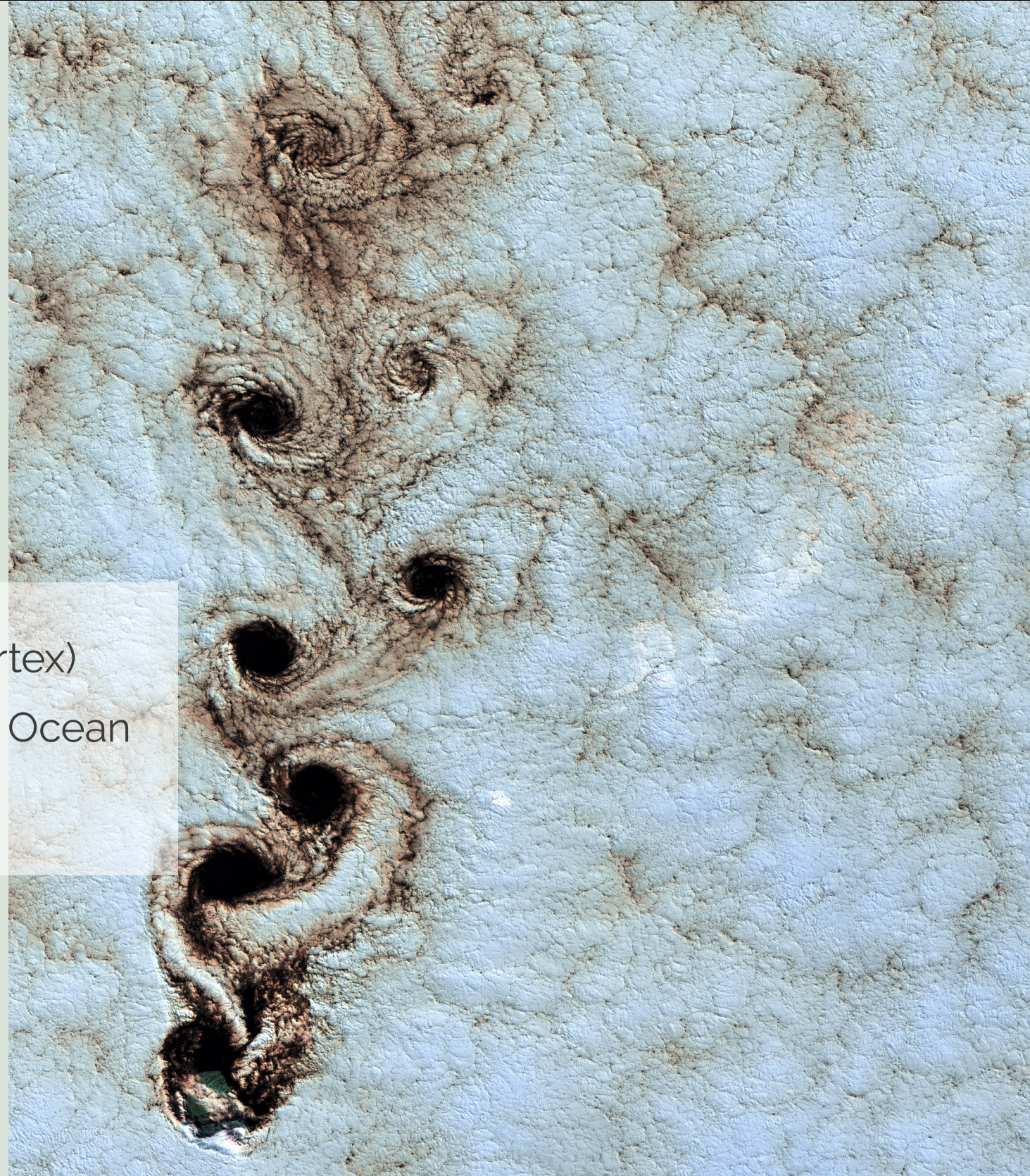


CONTINUATION

Continuation happens when the eye is compelled to move through one object and continue to another object.

Meteorological phenomenon (Karman vortex)
Alexander Selkirk Island, Southern Pacific Ocean

Landsat 7



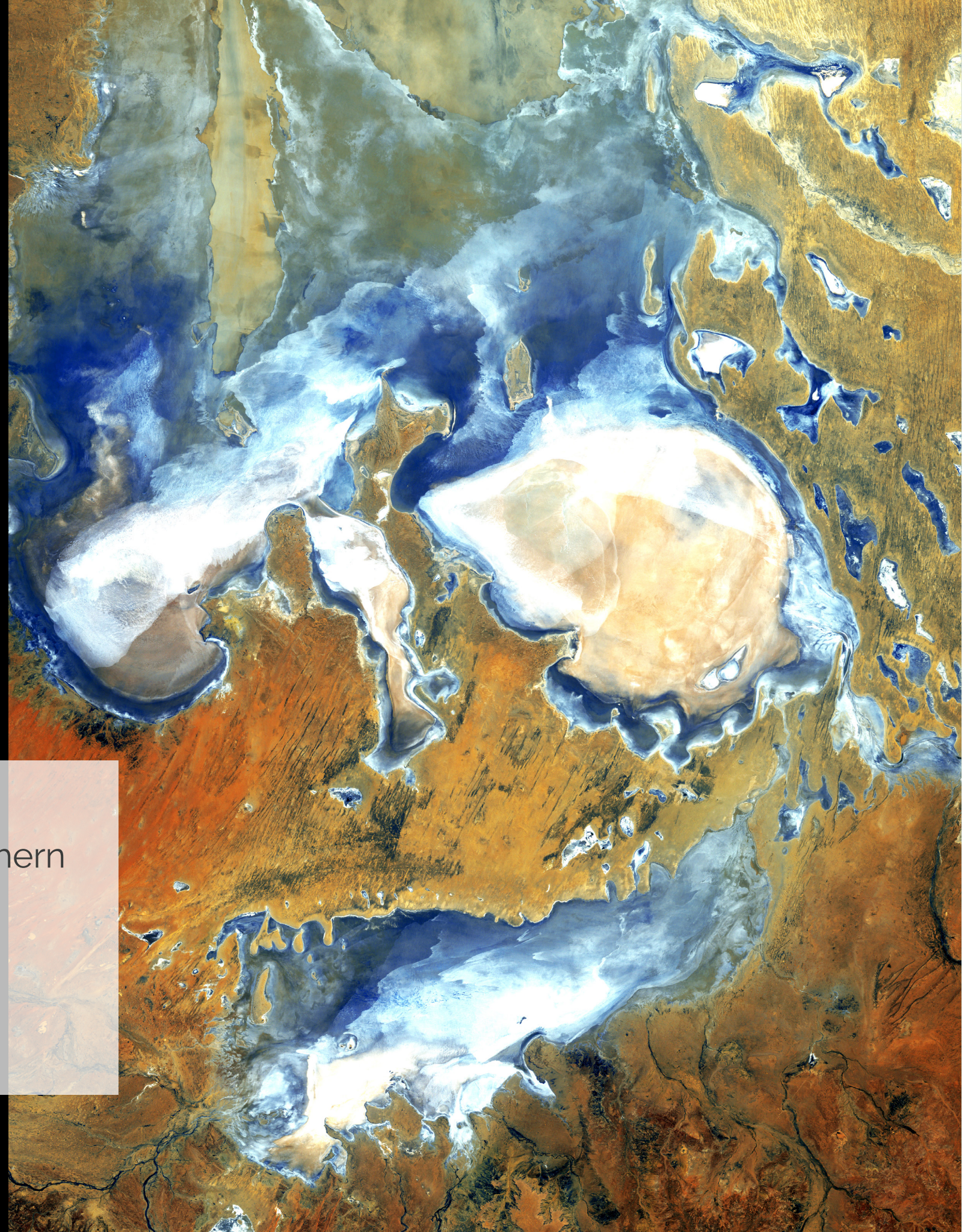
CLOSURE

Closure occurs when an object is incomplete but, if enough of the shape is indicated, people observe the whole by filling in the missing information.

Deep in the desert country of northern South Australia, Lake Eyre

What do you see?

Landsat 5



PROXIMITY

Proximity happens when elements that are placed close together tend to be perceived as a group.



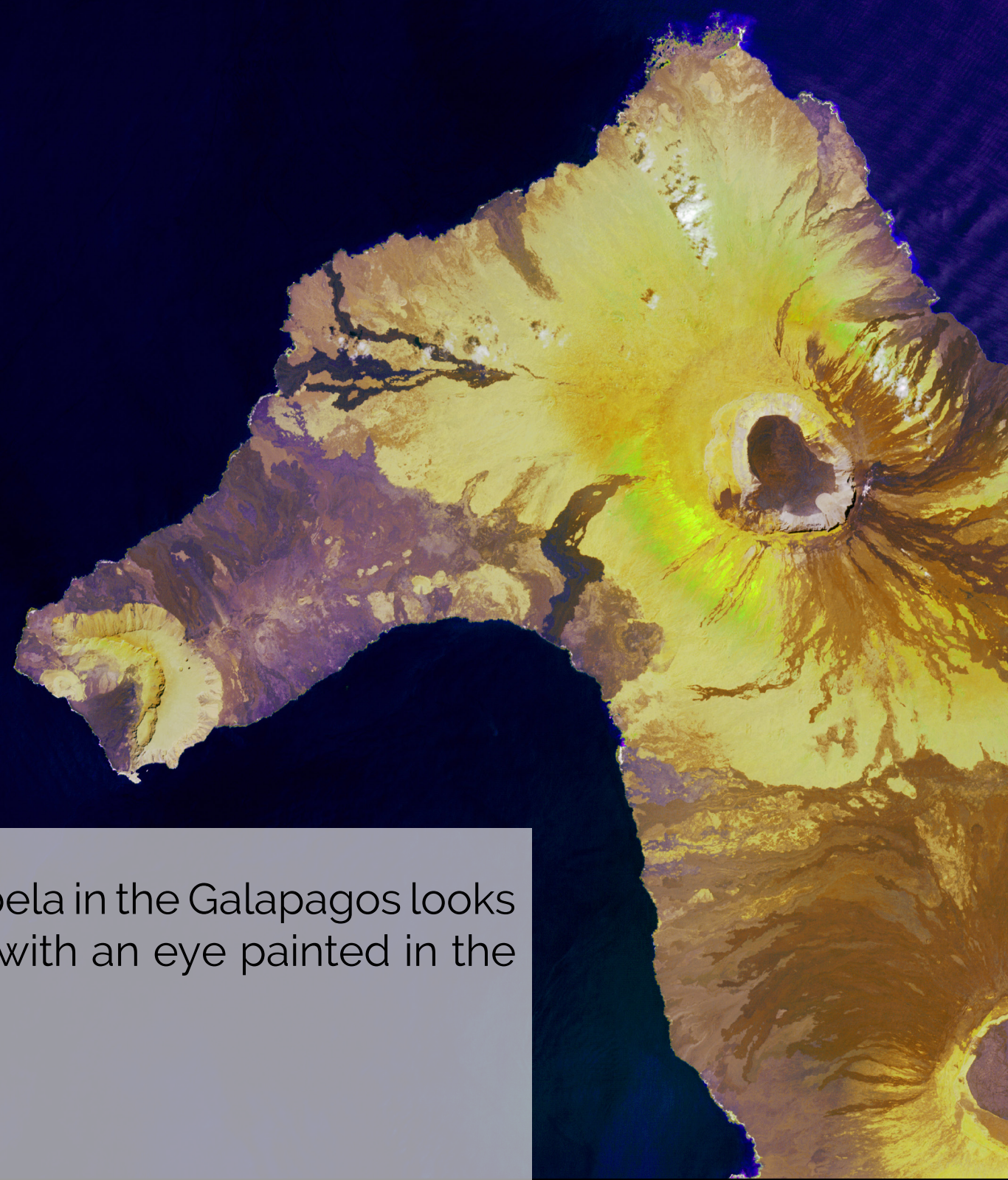
Geometric shapes lie across
the emptiness of the Sahara
Desert in southern Egypt

Landsat 8

FIGURE AND GROUND

The figure and ground relationship shapes visual perception. A figure (form) is always seen in relation to what surrounds it (ground, or background).

The northern end of Isla Isabela in the Galapagos looks like a seahorse with warts—with an eye painted in the ancient Egyptian style.



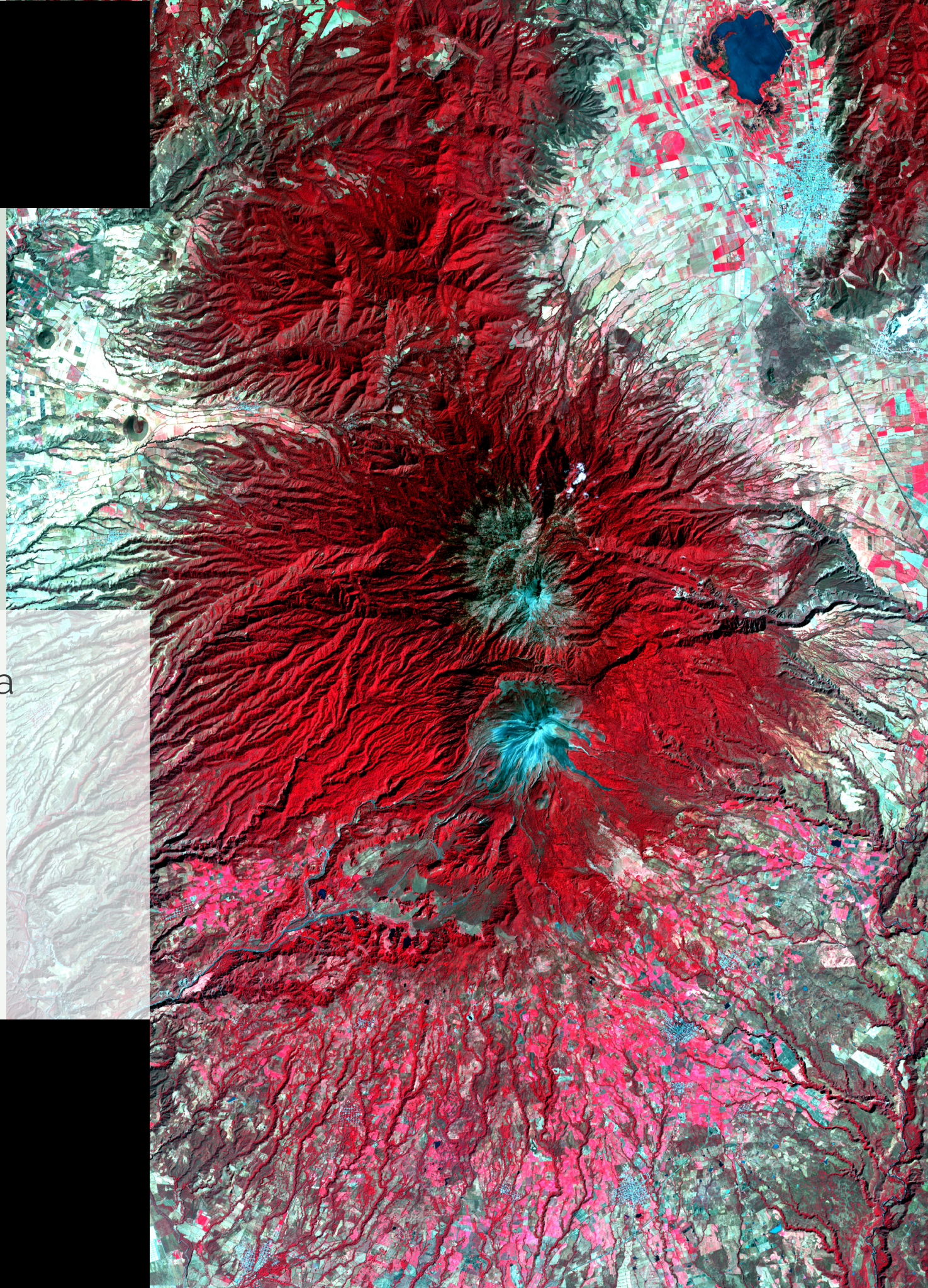
SYMMETRY

Elements that are symmetrical to each other tend to be observed as a unified group.

Snow-capped Colima
Volcano

Jalisco Mexico

ASTER

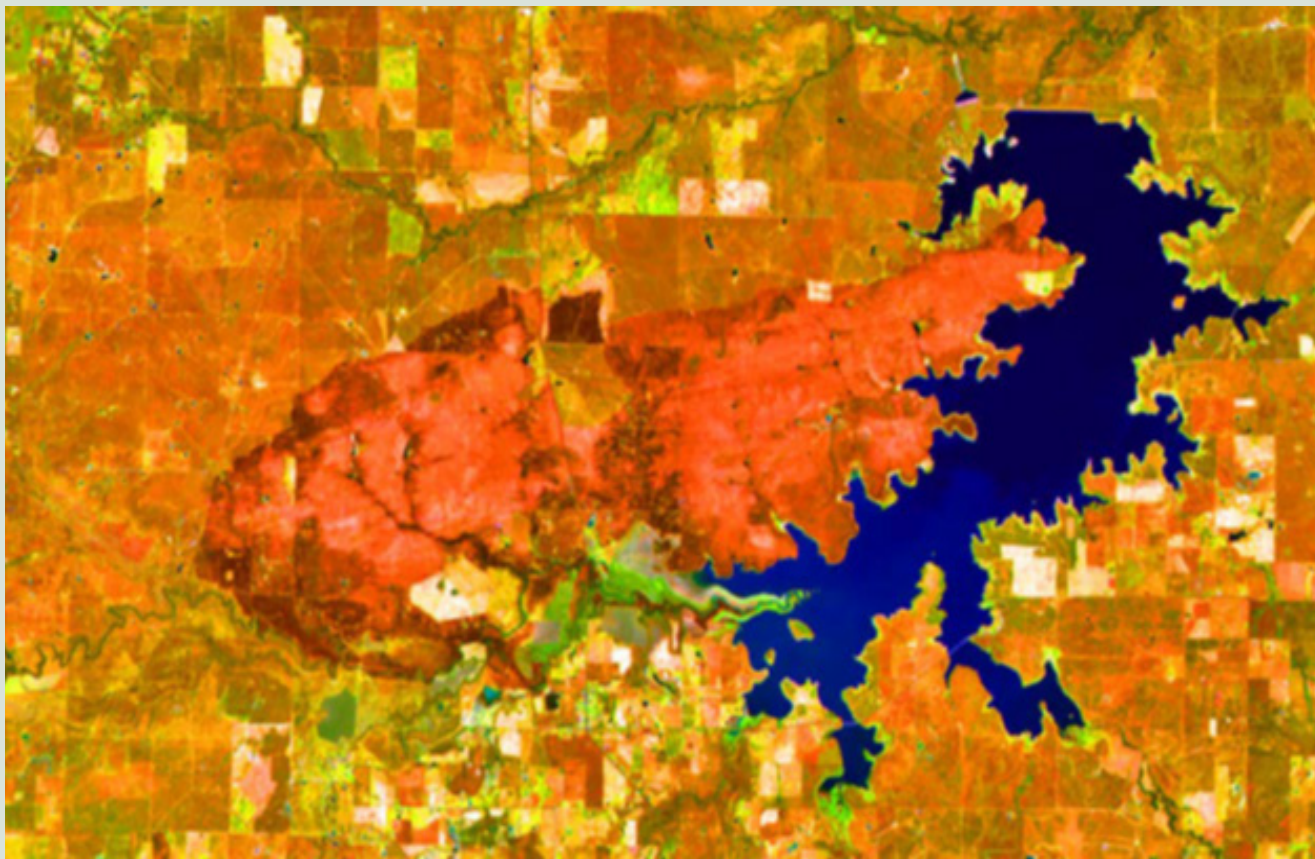


Identifying the Focal Part of the Image

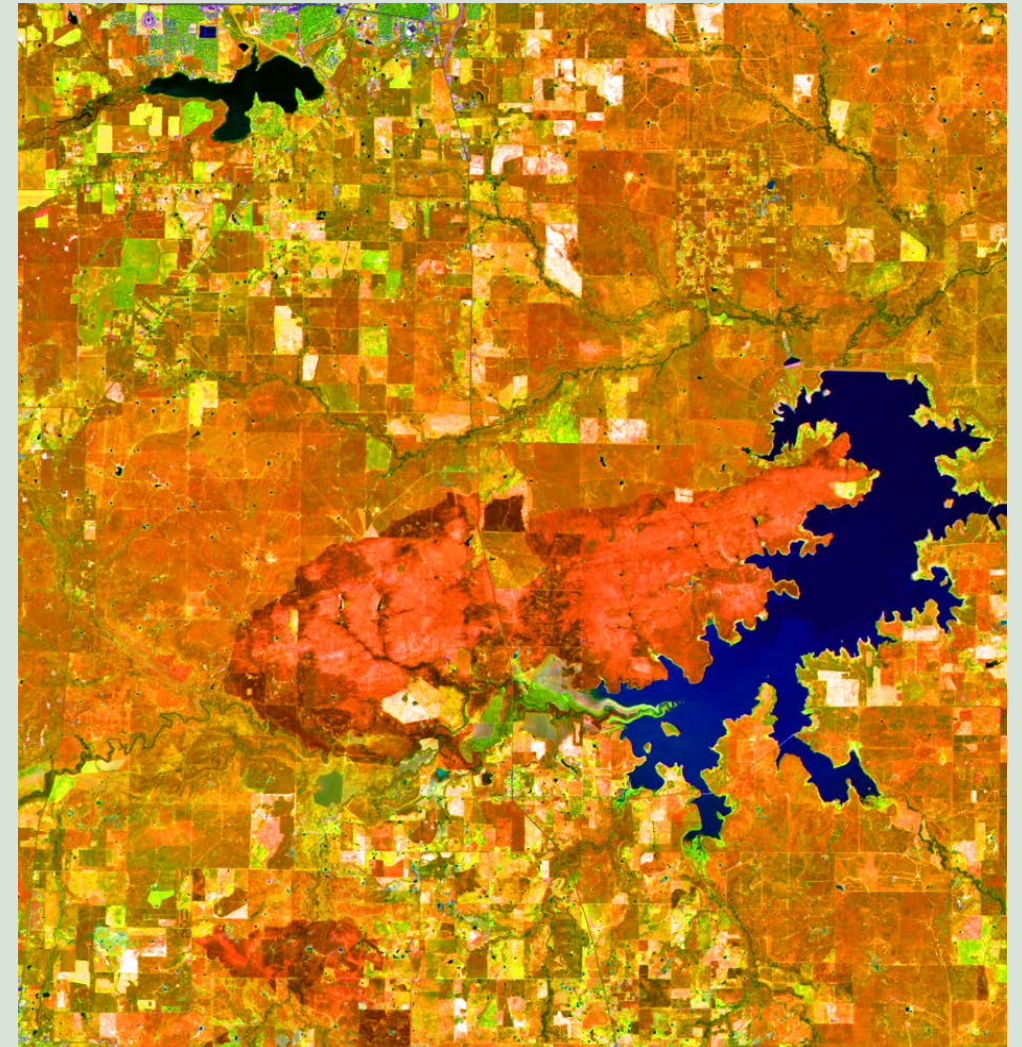
Lake Arrowhead, Texas
Landsat 7

ASPECT RATIO

The aspect ratio of a geometric shape is the ratio of its two dimensions, width and height. For example, a rectangle's aspect ratio is the ratio of its longer side (width) to its shorter side (height).



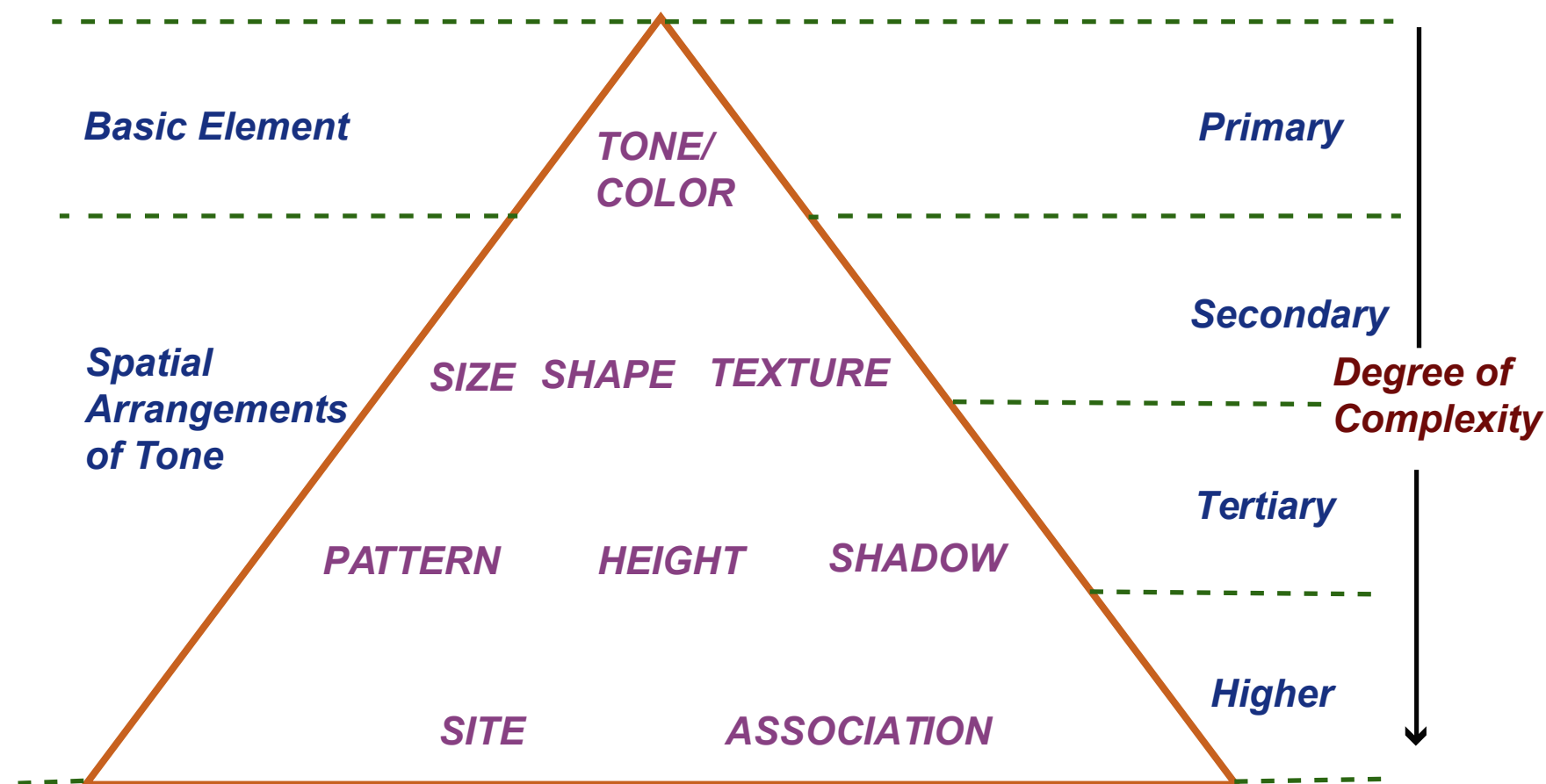
Lake Arrowhead, Texas and 2009 Burn Scar



When editing satellite imagery:

1. Maintain the original pixel aspect ratio (do not distort the image)
2. Do not rotate the image (keep the image reliable to its true north)

PRIMARY ORDERING OF IMAGE ELEMENTS FUNDAMENTAL TO THE ANALYSIS PROCESS



You have now completed ***Session One*** of the 3-session Earth as Art tutorial. The concepts you just studied also comprise many of the base concepts of the science of photo-interpretation.

These components make up:

The Elements of Airphoto/Image Interpretation:

www.rscg.umn.edu

Davis Mountains State Park and 2011 Rock House Burn Scar, Texas

Additional information about photo-interpretation and other aspects of remote sensing can be found on the Remote Sensing Core Curriculum website – rsc.umn.edu. This remote sensing educational website is co-sponsored by AmericaView, a nationwide partnership of remote sensing scientists who support the use of Earth observation data through applied remote sensing research, K-12 and higher STEAM education, workforce development, and technology transfer. For a thorough description of the AmericaView program, see the 2011 Feature Article in *Photogrammetric Engineering and Remote Sensing*, a publication of the American Society of Photogrammetry and Remote Sensing, or visit the AmericaView website at AmericaView.org.

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Session Wrap-Up

*Now, empowered with basic knowledge of Components of Art, the Study of Color and Image File Formats gained from **Session One**, you are ready to advance to **Session Two**. In the second session you will learn how to download, process (using ArcGIS, Multi-Spec and Adobe Photoshop software), and archive an image file that is ready to print. Once learned, these procedures can easily be modified for many other image software platforms.*

Enjoy your journey through this three-session tutorial that will enable you to create your own Earth as Art masterpiece. And remember to always...

Bring along your imagination!

R. Brent Yantis

Nina Zamanialavijeh

Sediment in the Gulf of Mexico
off the Louisiana coast

Landsat 8