Understanding Images on the Web

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Science and Lore

A balance of lore and science

We could just derive everything

Hex code designation is an invention, derived from those first principles

How this Section Looks

How to choose a file format

Beginning with what the relevant formats are

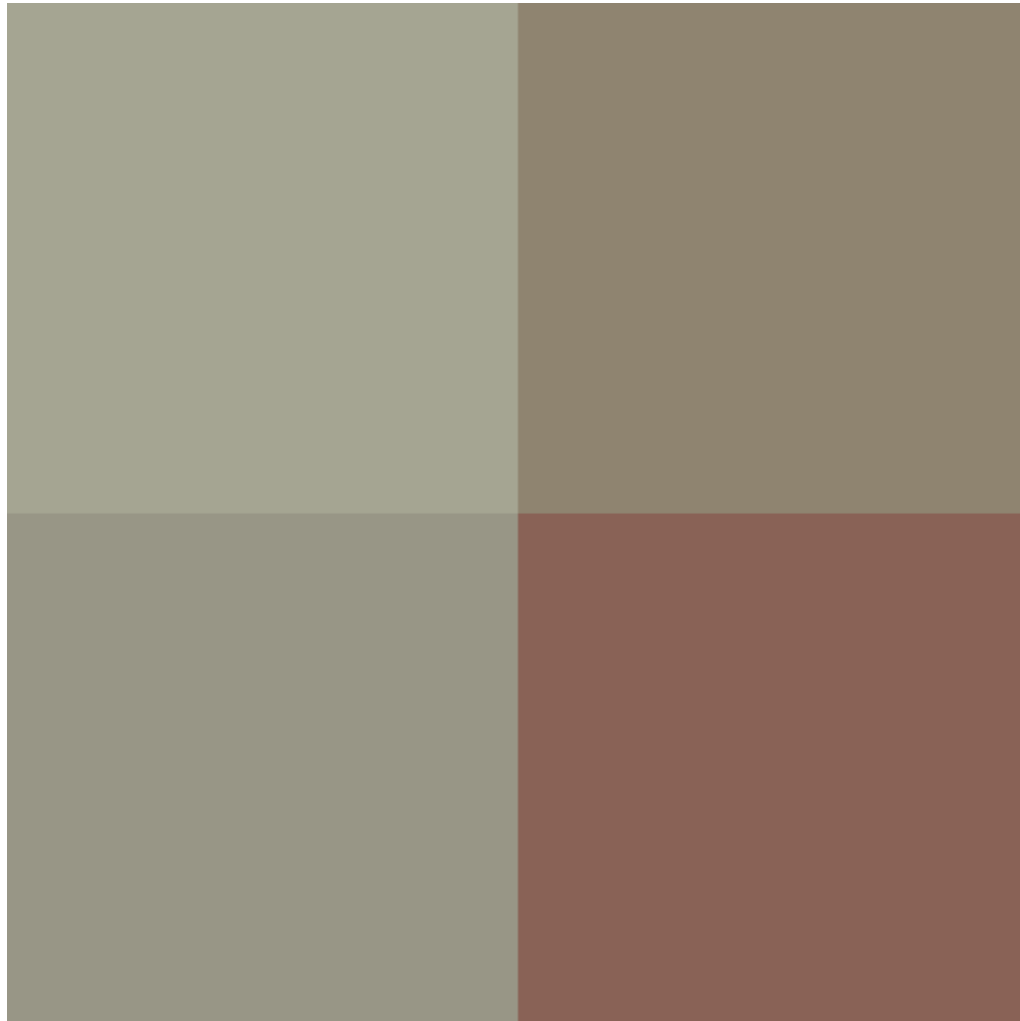**A history of how image formats evolved**

What Is an Image?

An image is a two-dimensional array of colors.

There is no third dimension.

Two-dimensional Color Arrays

Two-dimensional Color Arrays

A Fuzzy Image

The Image Comes into View

An increase of 25x

The Image Comes into View

Sight and Digital Images

As we increase the height and width of the array...

Our brain gets enough data to pattern-match

This mismatch between optical and digital resolution..

Is resolved as the resolution increases

How Many Pixels?

Square pixels is the obvious model
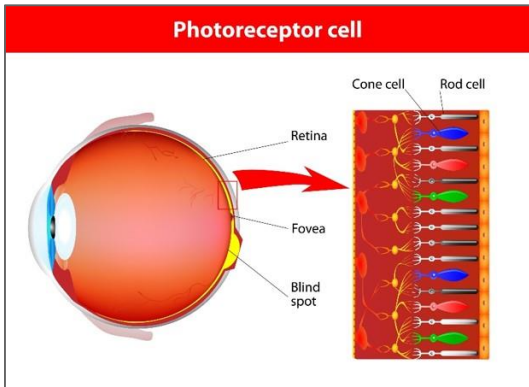
"How many pixels?"

Phosphor dots illuminated by an electron gun
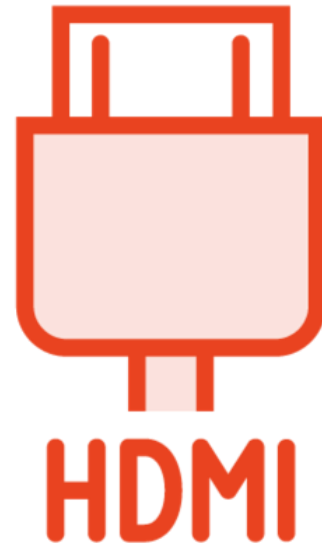
Microscopic crystals of an irregular shape

Is Gone With the Wind 4K?

So, Are Cones Pixels or Not?

The density of the cones varies across the retina

Only the center of focus of your vision is HD

Cones are NOT pixels

With enough pixels, the difference doesn't matter

Working with Different Image Formats

Every pixel needs to be able to express **16,777,216**

True color – 24 bit / 16.8 million colors

Instead, we can make an indexed color palette

http://allRGB.com
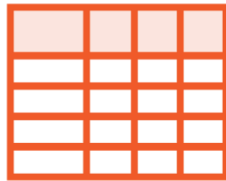
Since 16.7 million colors doesn't usually happen in an image

A Map of the Image Bits

Human color perception is in the 2 to 8 million range, depending on who you talk to

If you limit the color domain you can greatly reduce the bit depth, and therefore the size of your file

A map of the bits – a bitmap

TIFF – tagged image file

Eventually, you need to digitally transfer the files

So, you zip them up

And send them over

- Phone lines

- The Internet

- Sneakernet (physical media)

GIF and LZW

Then, you take a closer look at the nature of your images

Illustrations, for example, can have a very low color space

As opposed to photographs

Combine that with LZW compression, and you have GIF

Lossless and Lossy Compression

When you zip up a file, you don't worry about losing information

Zip compression is *lossless*

Meaning that the decompressed target = the original

Great for precise digital information

Less effective when the data series is fuzzy and imprecise

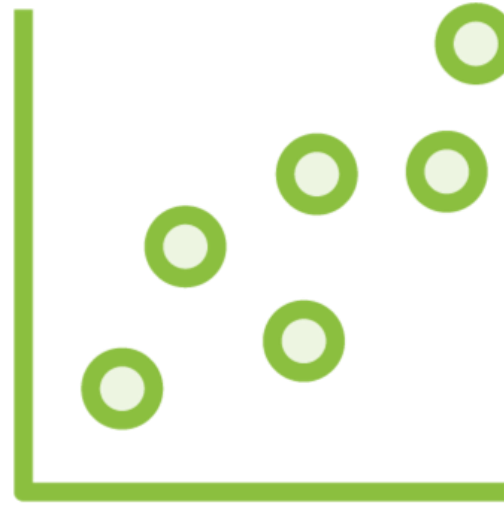In short, natural data doesn't compress well because of the large domain
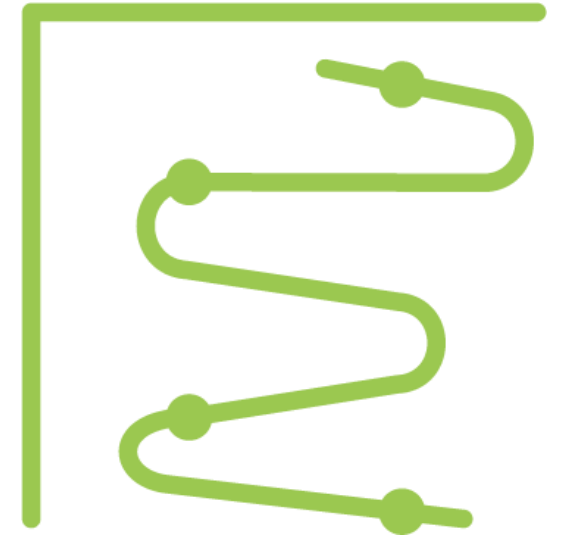
Discrete Cosine Transform

All of data, especially audio

Dr. Nasir Ahmed
Credit: Jogfalls1947

ANY data series

DCT can approximate and compress

The Joint Photographic Experts Group

Apply DCT to images...

And you get JPEG

JPEGs have *lossy* compression

But with good compression choices, the difference can be imperceptible

Choosing an Image Format

- ~~Bitmap~~

- ~~TIFF~~

- ~~Compressed TIFF~~

- GIF

- JPEG

Portable Network Graphics

The next format

PiNG

GIF compression (LZW) was patented

RFC 2083

What is PiNG?

GIF 2.0

Lossless compression

Meaning that you can save it over and over again without losing information

Animated GIFs

PNGs don't do animation

Animated GIFs are horrible

Don't use animated GIFs (except maybe for sharing memes)

Transparency

GIF and PNG can do transparency, JPEG cannot

Transparency allows the color of the parent layer to shine through

When to Use JPEG

PNG in the case of illustrations

A judgment call in the case of photographs

The difference may not matter much in the case of a single image

Key Takeaways

1. Use PNG unless you're sure you need JPEG
2. JPEG Compression is lossy – don't use it for working copies
3. The file size between JPEG and PNG can add up

Demo

Create a brand new page for Bethany's Pie Shop

While keeping it consistent with the existing color scheme

Using a new background image

And working with transparency

The Asterisk to Our Image Formats
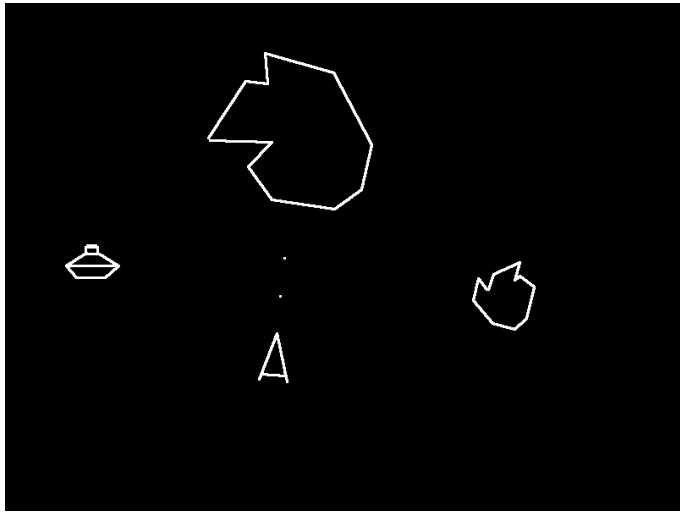

Credit: Steve Sherill

Raster

Rastrum - a rake used to draw musical staff lines

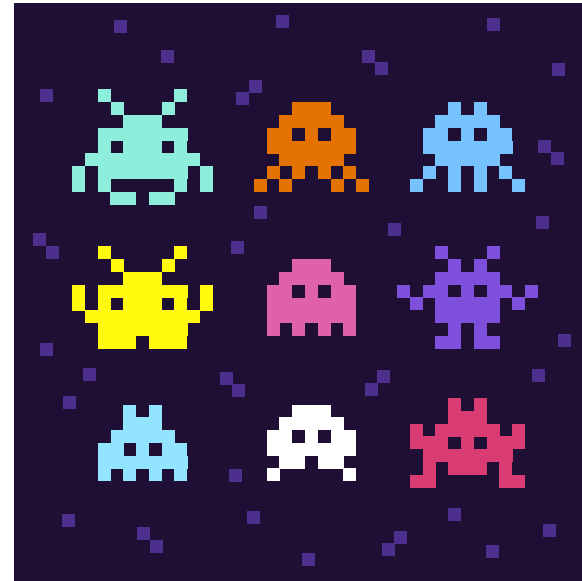**If we zoom in far enough on a raster image...**

The image becomes deresolved
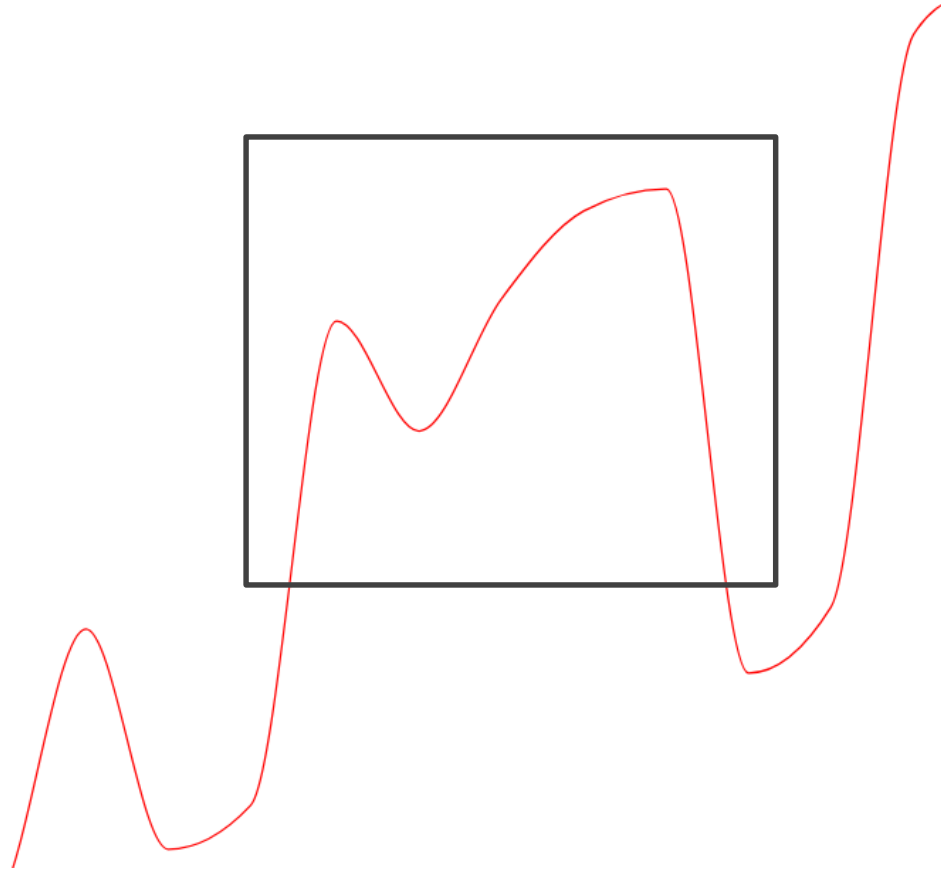
Vector Formats

A scene rendered with vector instructions

A raster graphic
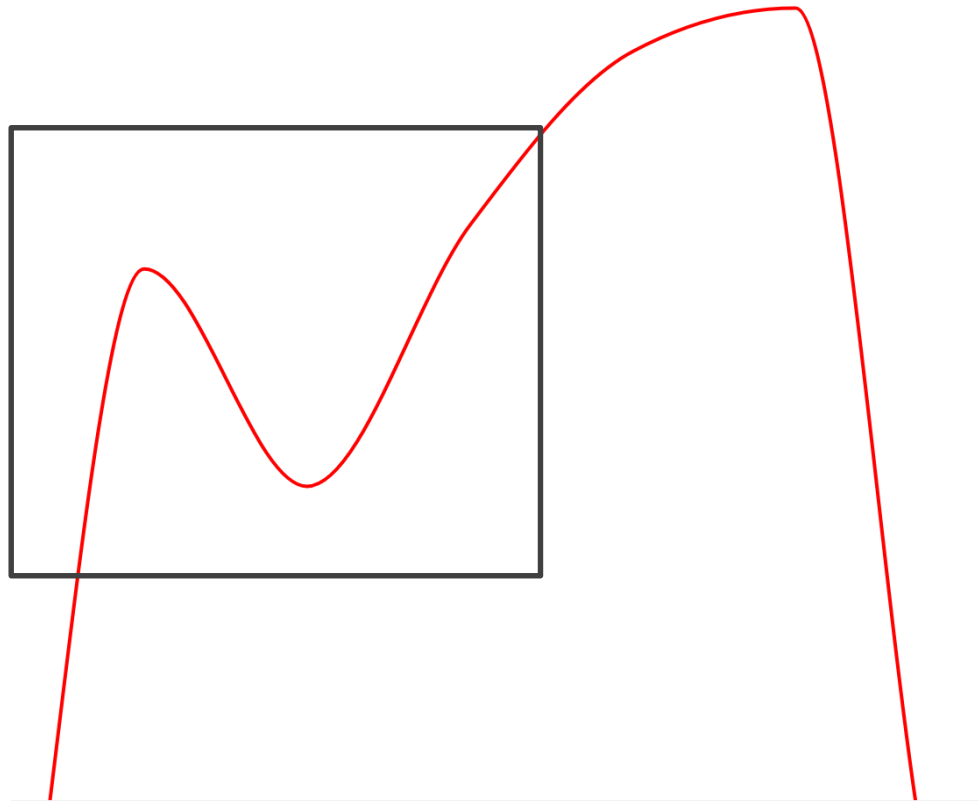
Vector

Vector - Zoomed

Vector – Zoomed Again
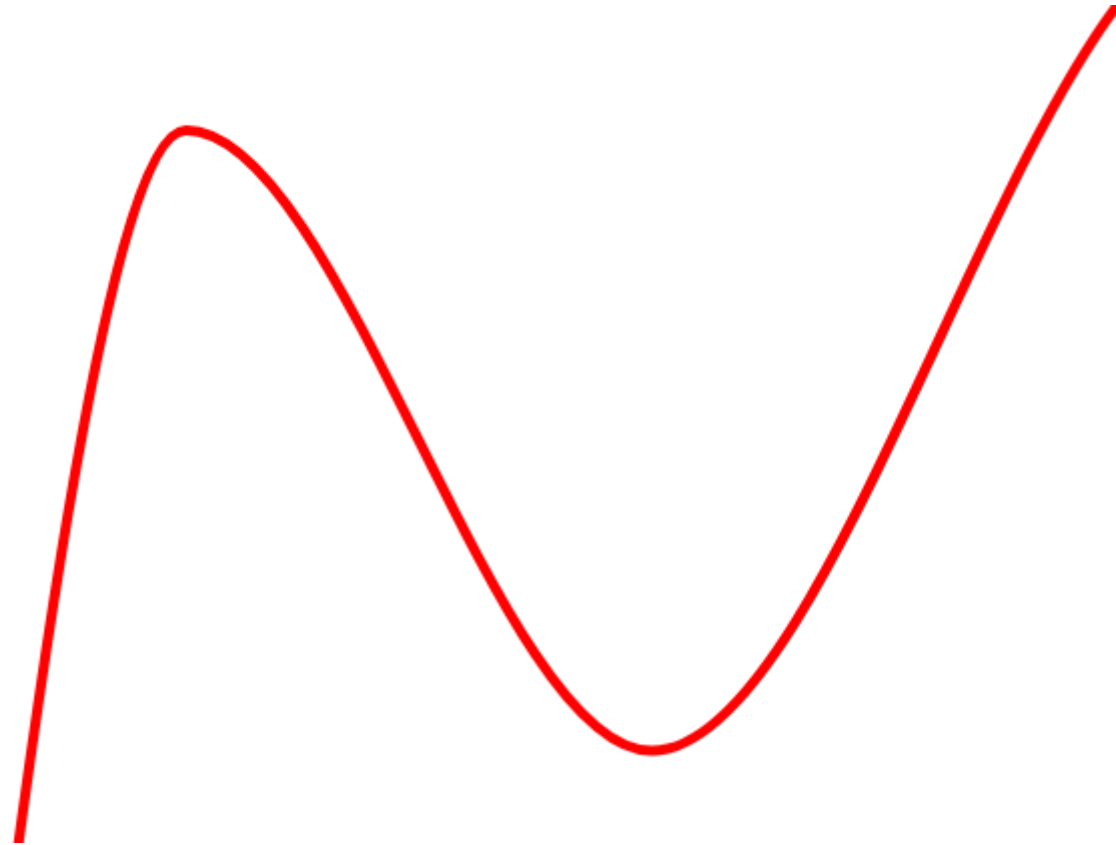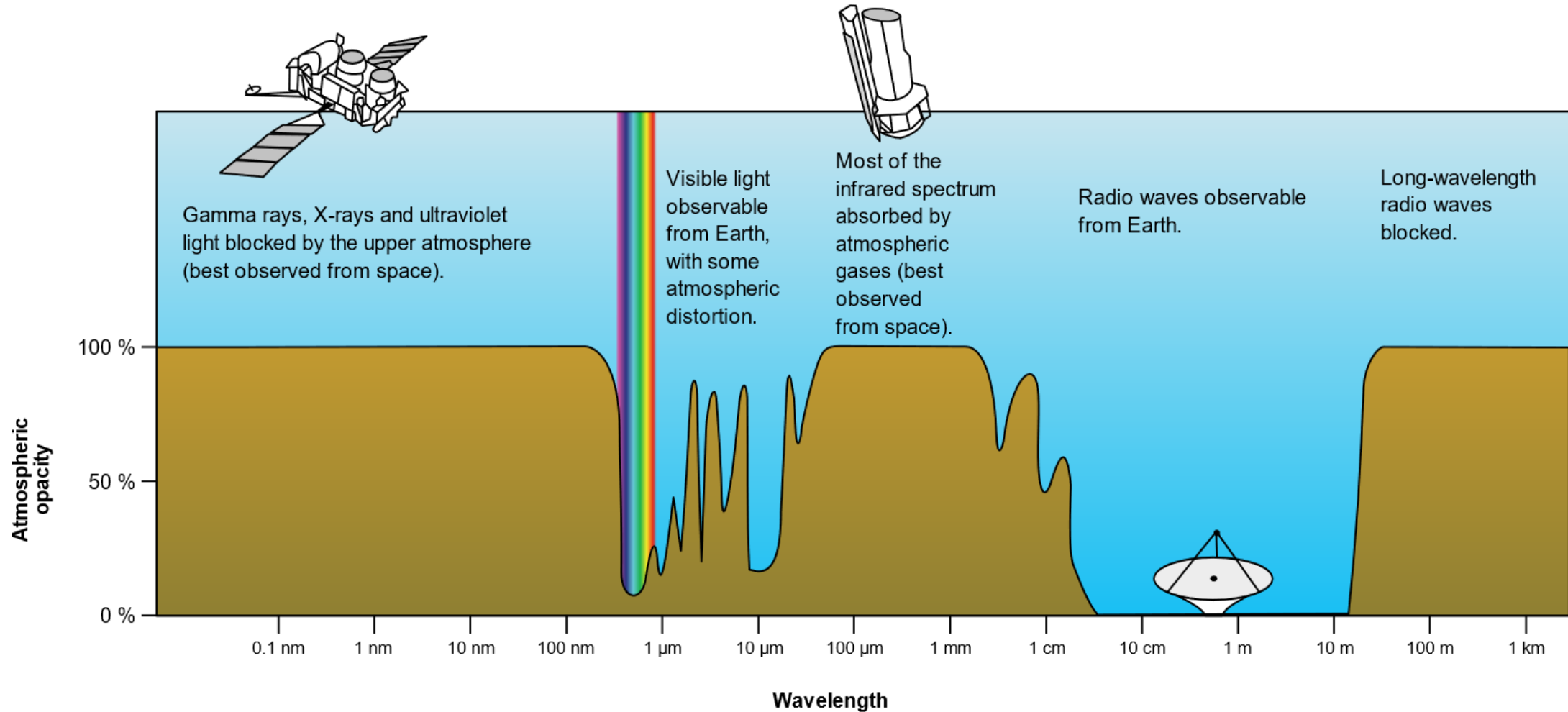
Scalable Vector Graphics

Credit: Nick84

The SVG File

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?><!-- Created with Inkscape
(http://www.inkscape.org/) -->
<svg>
<defs id="defs1903">
<linearGradient
        id="linearGradient3549">
    <stop
        st
        offset="0"
        id="stop3551" />
    <stop
        style="stop-color:#18bff3;stop-opacity:1;"
        offset="1"
        id="stop3553" />
</linearGradient>
```

https://app.pluralsight.com/library/courses/d3-getting-started

Summary

Deepened our understanding of color

An exploration of the nature of images

Explored some useful image formats
- BMP
  TIFF
- GIF
- JPEG
- PNG

Put this knowledge into practice

Created a brand new image-driven page

An understanding of SVG