WEEK 2

Intro to Data Visualization, Digital Art, & Design

DATA VISUALIZATION

Digital storytelling at the confluence of science, art, and technology

Working Group Format & Resources

- Website (working syllabus, compiled resources): https://datavisualization.sites.ucsc.edu/
- Google Group (email listserv for meeting announcements/funding opportunities): https://groups.google.com/u/1/g/data-visualization-collective
- Canvas (modules, assignments, and grading for enrolled & auditing students): https://canvas.ucsc.edu/courses/41815
- Shared Google Drive (workshop slides, files, and data sharing): https://drive.google.com/drive/u/1/folders/0AFCLSgi-duPIUk9PVA

Pre-meeting to do's – any issues?

- Meet with data contributors to discuss data format and next steps.
- Read Chapters 1 & 2 of "Data Visualization" by Claus Wilke
- Watch LinkedIn Learning Design Fundamentals Course (1hr)
- Explore other LinkedIn Learning Art & Design Courses
- Download Microsoft Office 365 (for PowerPoint)
- Download Adobe Creative Cloud (sign in with CruzID):
  Install Photoshop & Illustrator

Agenda for today

Introduction to the three D's:

Data Visualization

Digital Art

Design

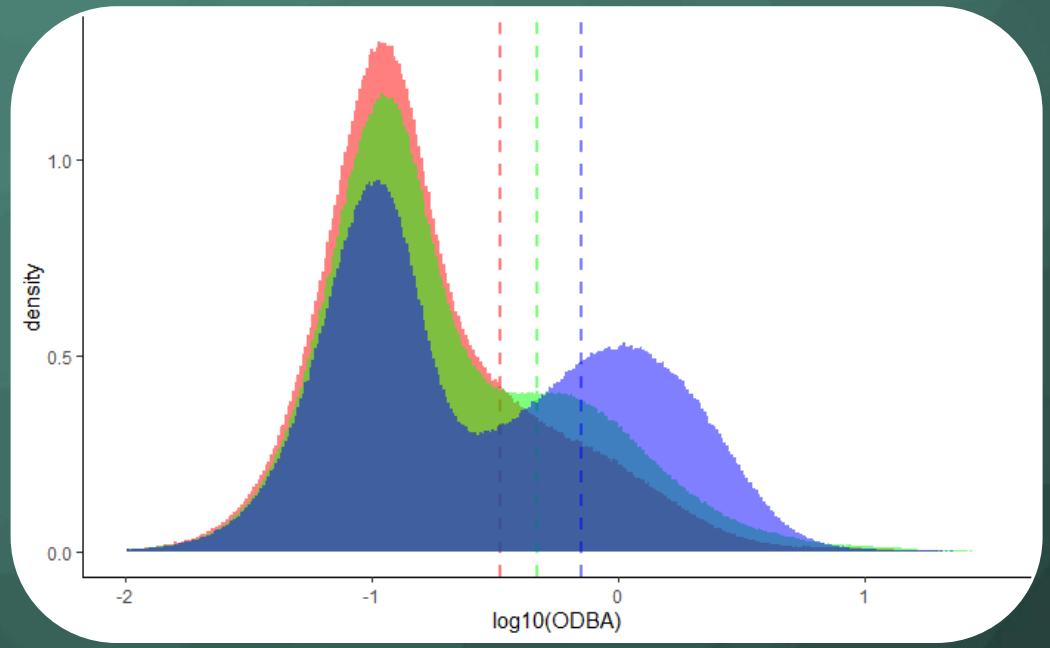
Intro to Data Visualization

Why, how, and using what tools.

WHY VISUALIZE

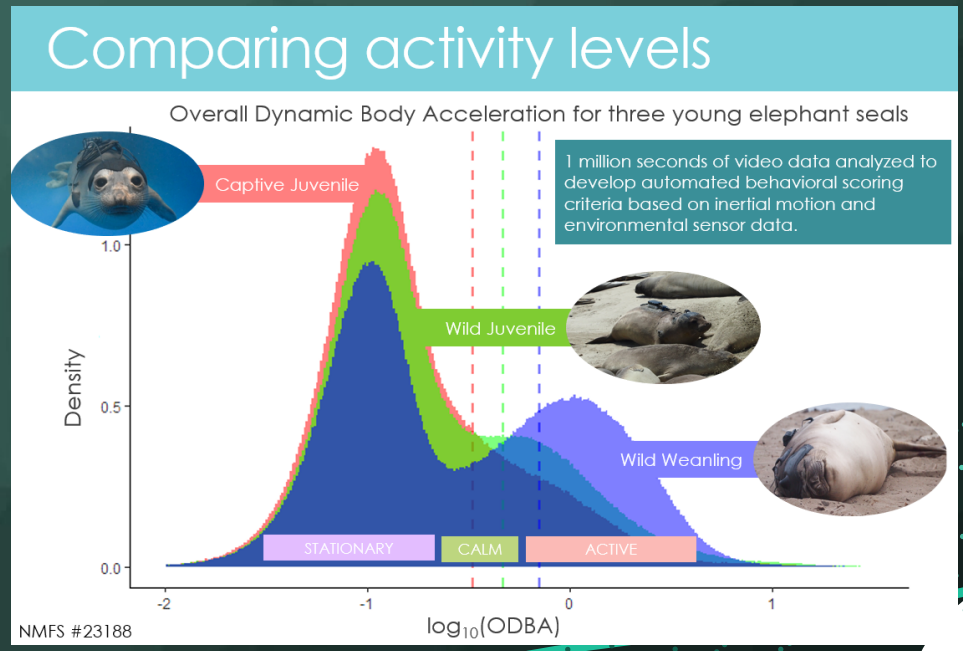
EXPLORATION

Visualizations help find patterns in the data and to guide your analytical approach.



COMMUNICATION

Visualizations help communicate your findings quickly and clearly.



WHY VISUALIZE

EXPLORATION

Visualizations help find patterns in the data and to guide your analytical approach.

AUDIENCE:

- Data scientists and their collaborators
  - PhD student ☺
  - Data analysts
  - Research scientists
  - & so many more

COMMUNICATION

Visualizations help communicate your findings quickly and clearly.

AUDIENCE:

- Public:
  - News & journalism (ex. NY Times)
  - Web tools (ex. fire maps, surfline)
- Internal:
  - Advertising (ex. web stats & reach)
- Academic:
  - Conference presentations
  - Seminars/lectures

HOW TO VISUALIZE

R

- Open-source statistical software with powerful visualization capabilities

Microsoft Excel/PowerPoint

- Widely used proprietary software (free for students) with graphical user interfaces (limited reproducibility).

Matlab

- Proprietary software with robust computational and data visualization capabilities.

Tableau

- Proprietary software (discount for students) which is very popular for data visualization in industry.

Python

- Programming language with many powerful data visualization packages.

ArcGIS

- Proprietary software (free for students) that is the gold standard for visualizing and analyzing geospatial data in 2D or 3D.

Javascript

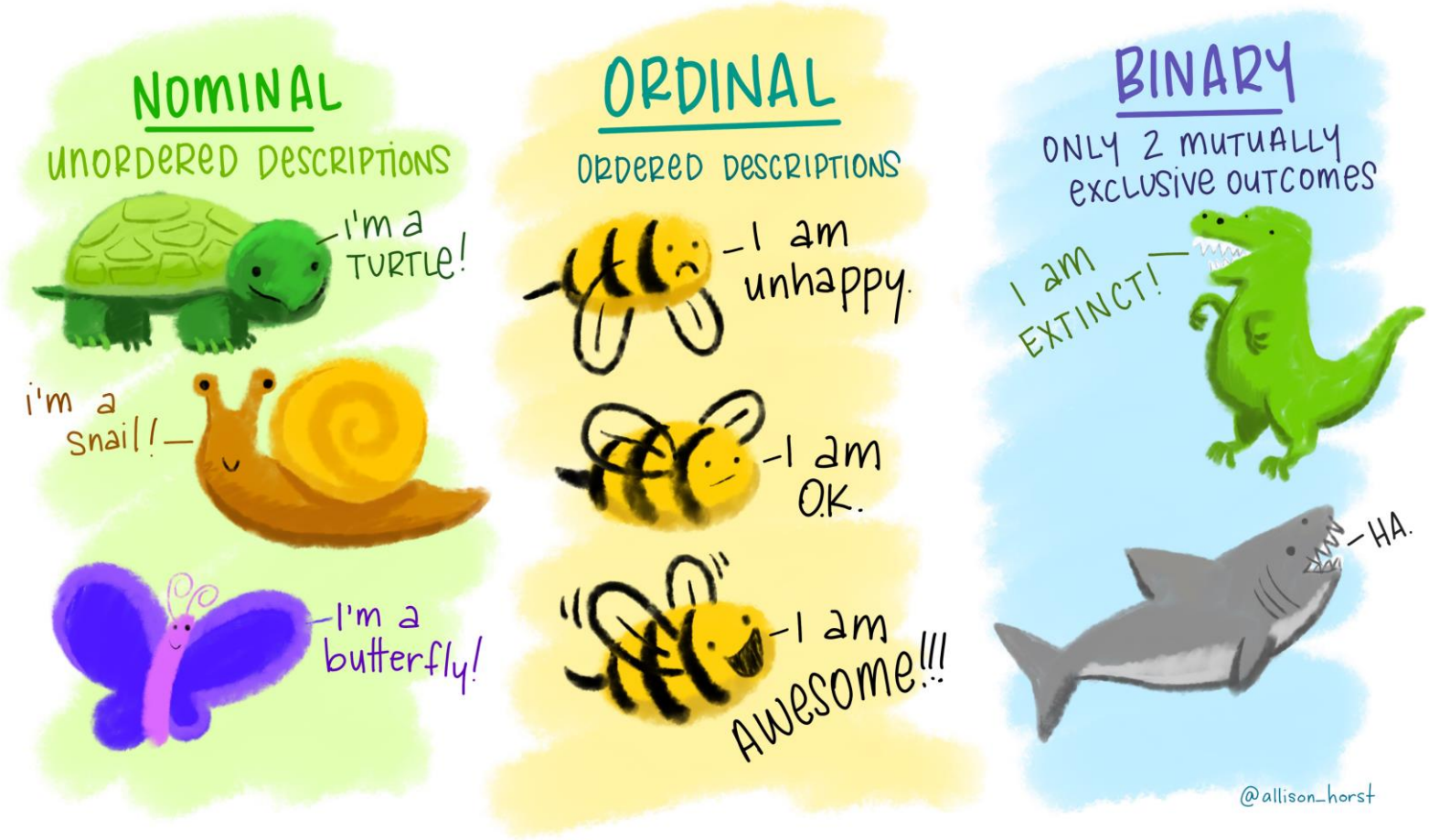
- Programming language with broad applications in interactive web design including libraries p5.js & d3.js

TYPES OF DATA

Quantitative / Numeric

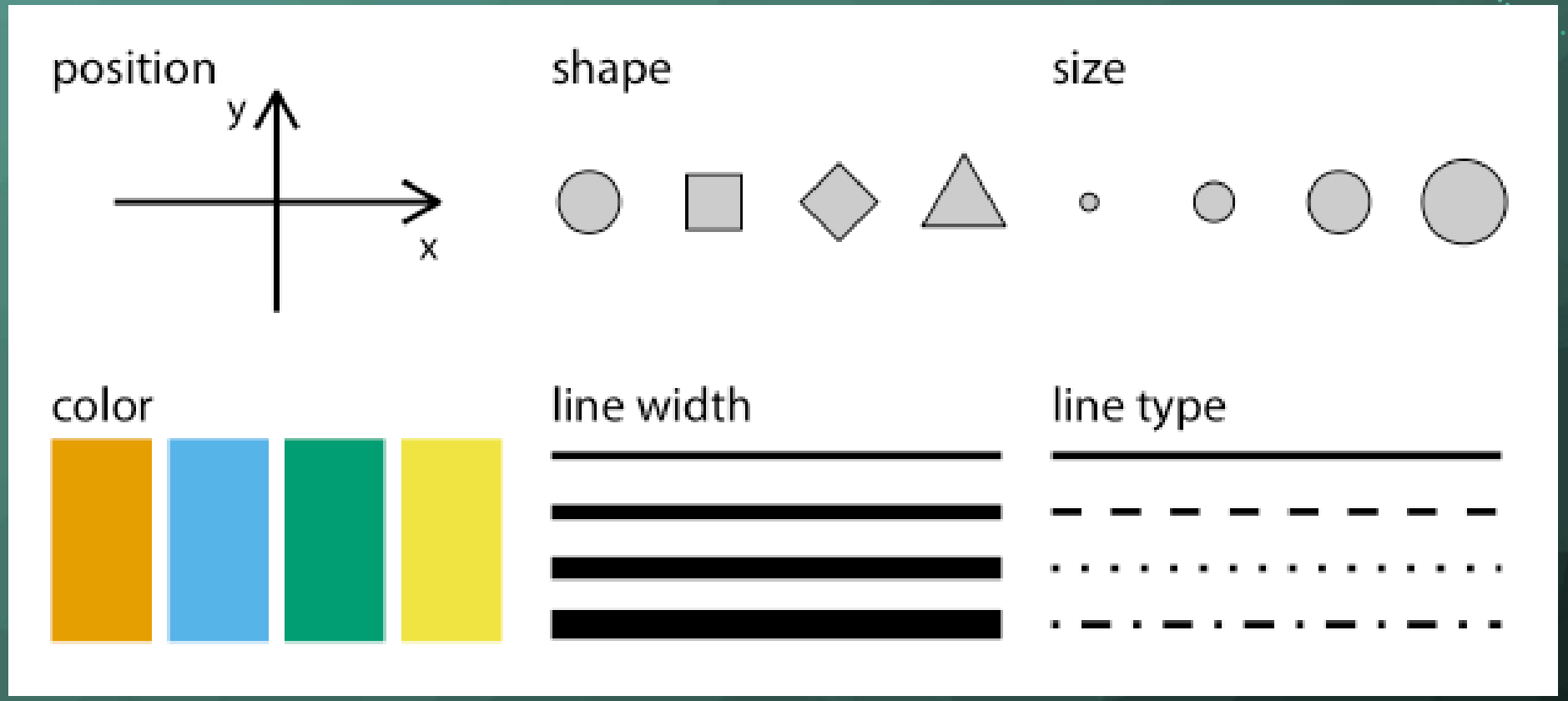
Artwork by @allison_horst

TYPES OF DATA Qualitative / Categorical



Artwork by @allison_horst

MAPPING DATA ONTO SCALES

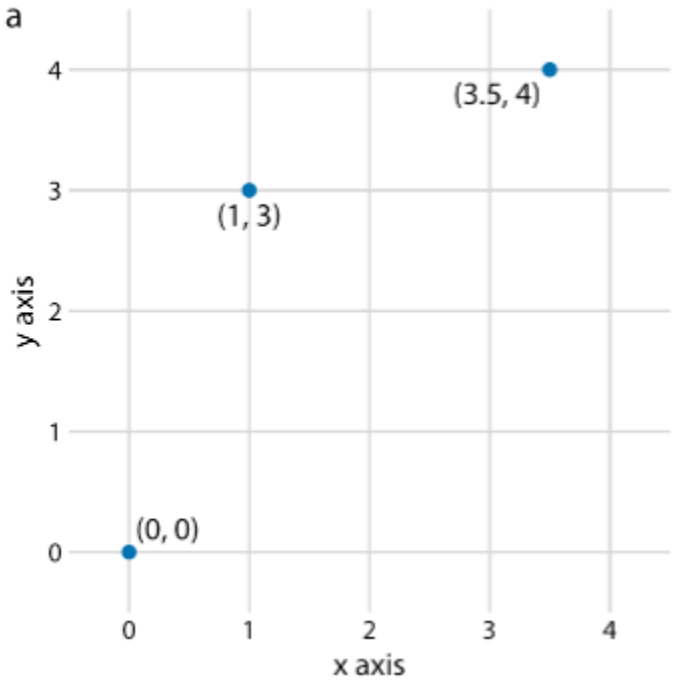


Data Visualization by Claus Wilke

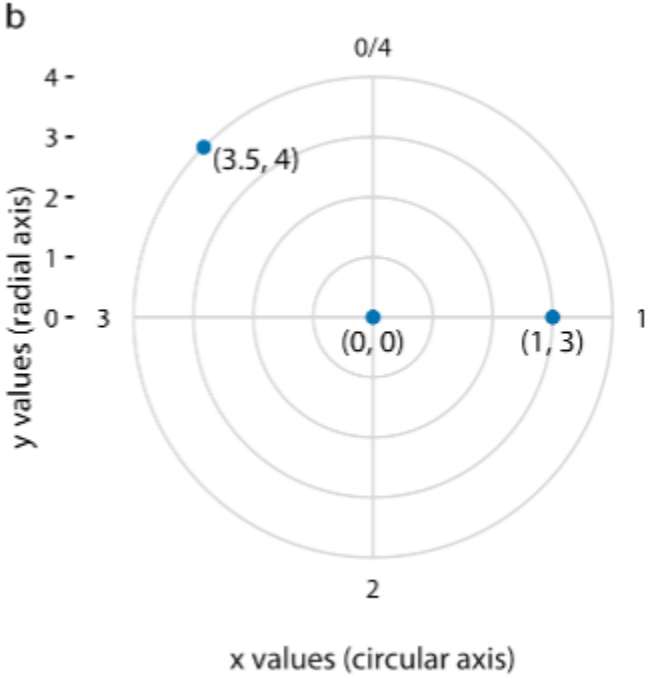
+ others: 3D, time

TYPES OF POSITION

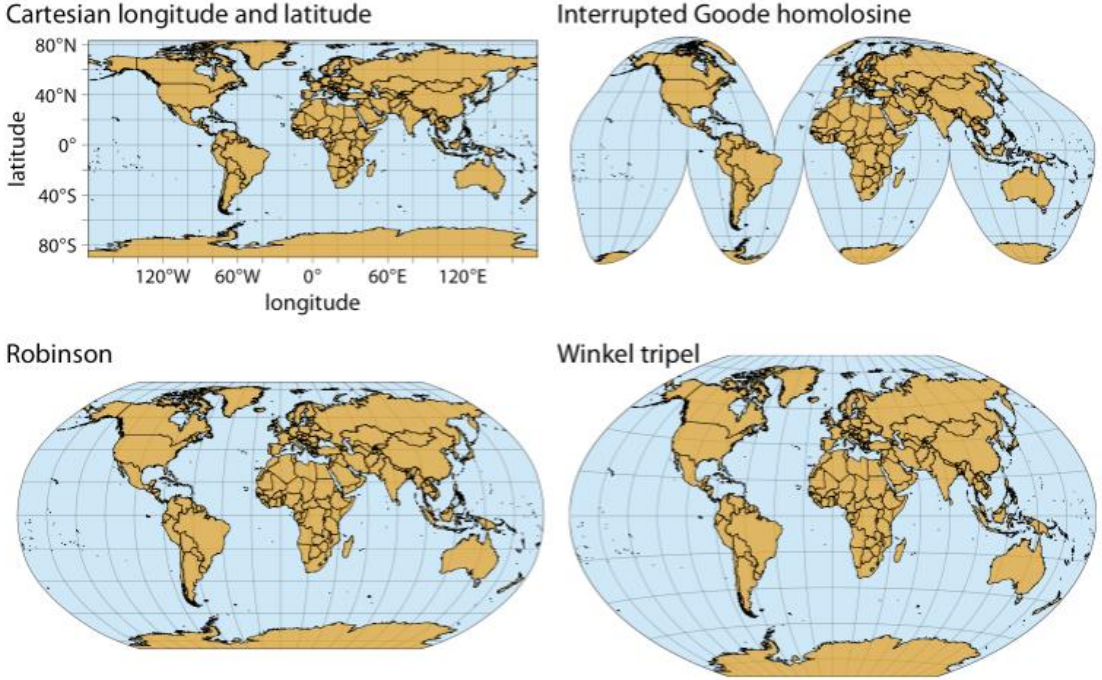
Cartesian



Polar



Geospatial data



Data Visualization by Claus Wilke

COLOR SCALES

Categorical

Color as a tool to distinguish groups

Numeric or ordered

Color to represent data values

Categorical

Color as a tool to highlight groups

Data Visualization by Claus Wilke

GENERAL GUIDELINES

Hierarchy of data visualization:

1) Is it *correct*?
2) Is it *clear*?
3) Does it communicate the data *responsibly*?
4) Does it look *awesome*?

Adapted from Allison Horst's Data Visualization lecture

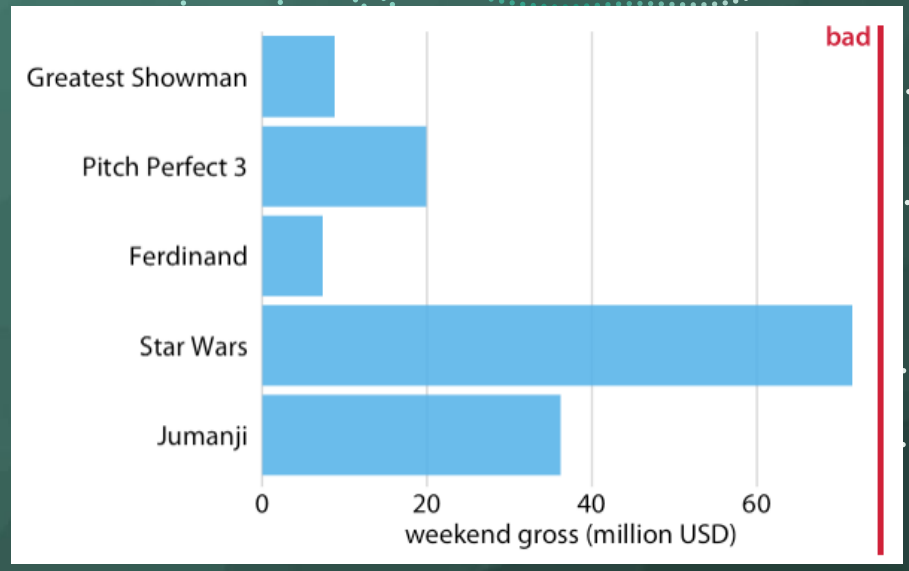
1) IS IT CORRECT?

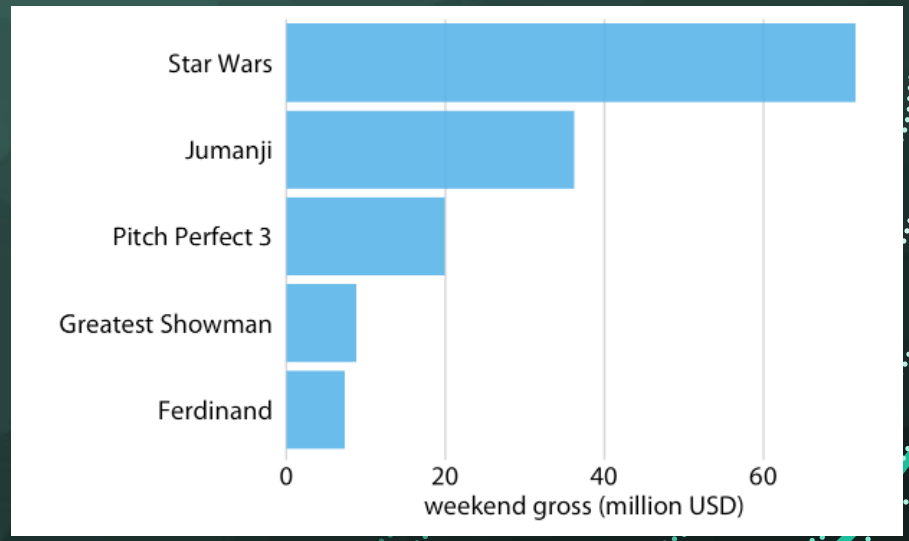
- Experimental design
- Data wrangling
  - Keep and display raw data whenever possible
  - Triple check your data wrangling steps
  - Annotate your code
  - Have someone check your code
  - Check conclusions
- Keep your axes accurate!

Adapted from Allison Horst's Data Visualization lecture

2) IS IT CLEAR?

- Everything present should serve a purpose
- Simplify your message and story
- Emphasize your takeaway
- Order your variables (largest to smallest)
- Avoid rotated labels
- Legends: minimize use, simplify, and consider placement

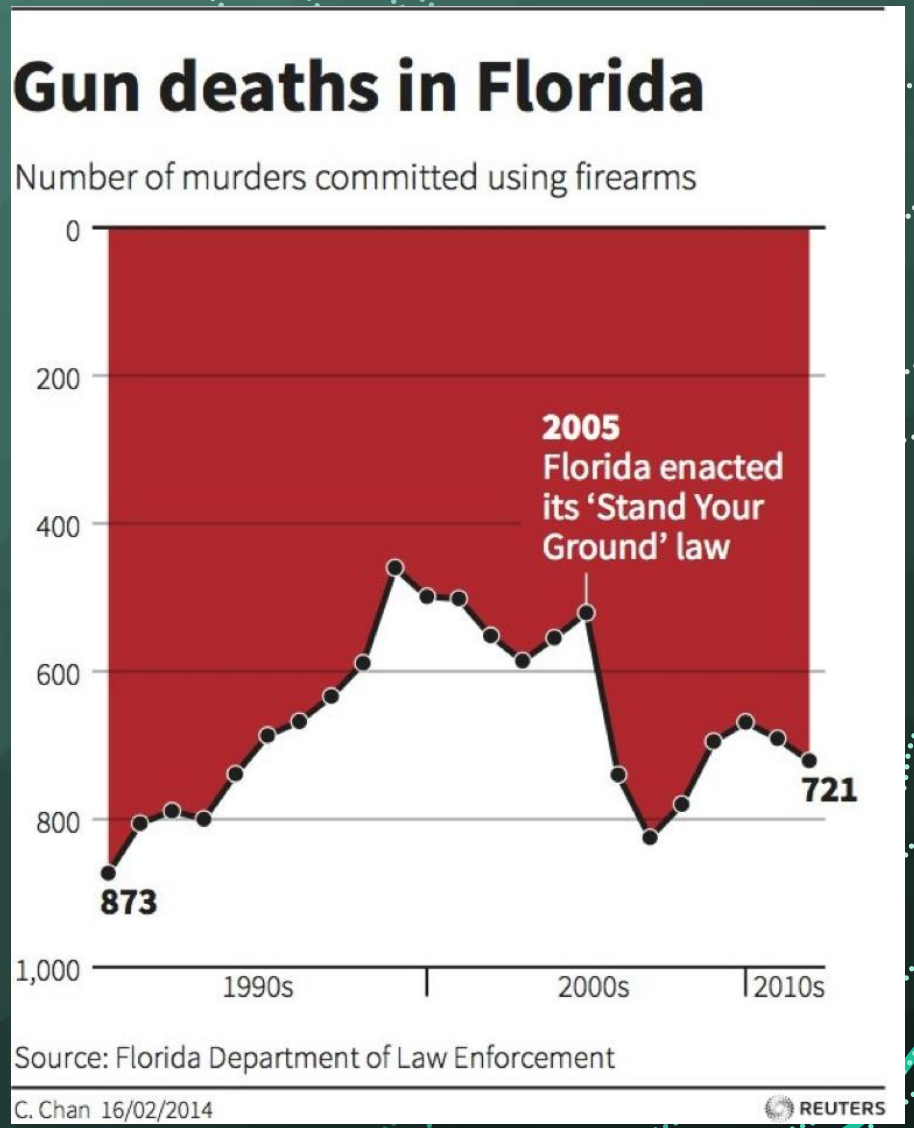




Adapted from Allison Horst's Data Visualization lecture

3) IS IT RESPONSIBLE?

- Although they may be correct, some data visualizations are misleading



Adapted from Allison Horst's Data Visualization lecture

4) DOES IT LOOK AWESOME?

- …transition to digital art & design!

Adapted from Allison Horst's Data Visualization lecture

FIGURE IMPROVEMENT WORKSHOP

Box plots showing changes in wave attenuation across the marsh. Wave attenuation metrics are on the y axis of all box plots, including: distance to 95% wave height reduction (D95, top row), wave height at the marsh platform (Hs, second row), wave induced setup at the marsh platform (third row), and peak runup (bottom row); characteristics of marsh morphology and hydrodynamic conditions are on the x axis of all box plots, including: vegetation density, vegetation elevation, mudflat slope, marshflat elevation, low marsh slope, frictional coefficient (Cd), waver level, wave height, and wave steepness. Red lines indicate medians, blue rectangles indicate the interquartile range, and blue dots indicate outliers. There are many positive outliers that are caused by coincidence of high water levels and low Cd. Vegetation density loss causes the largest decrease in wave attenuation.

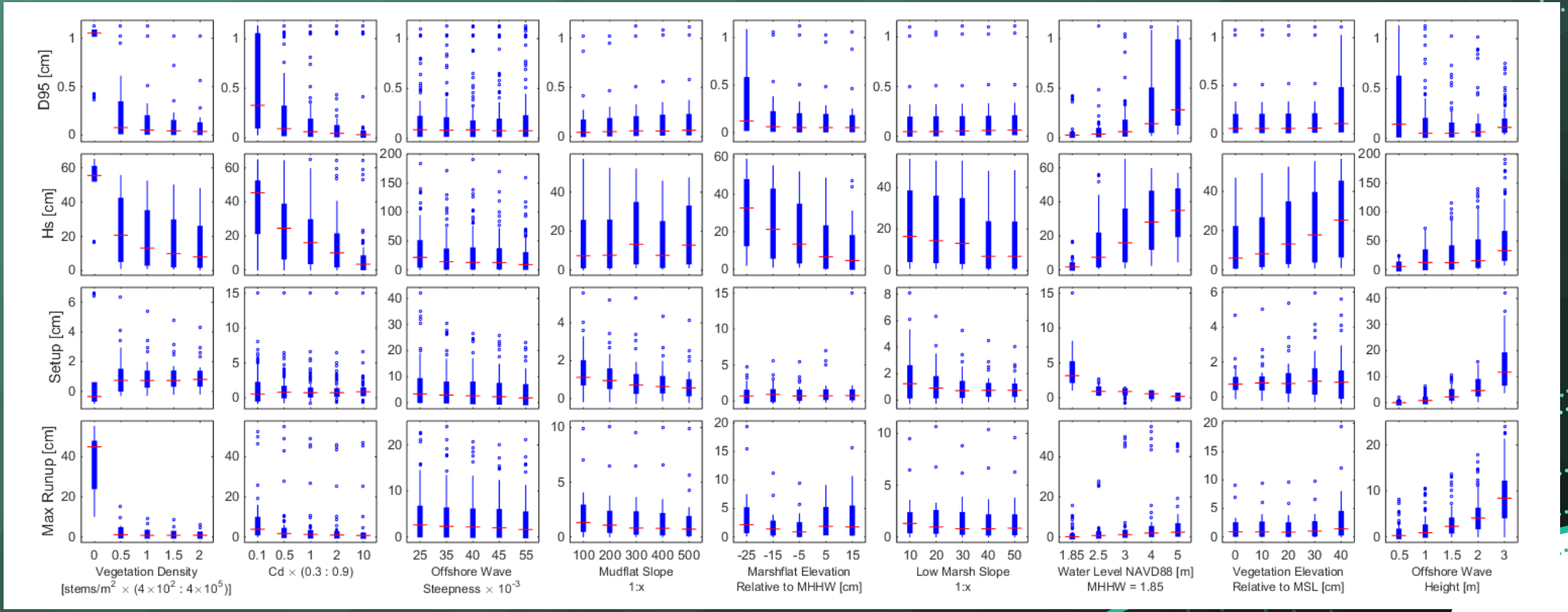
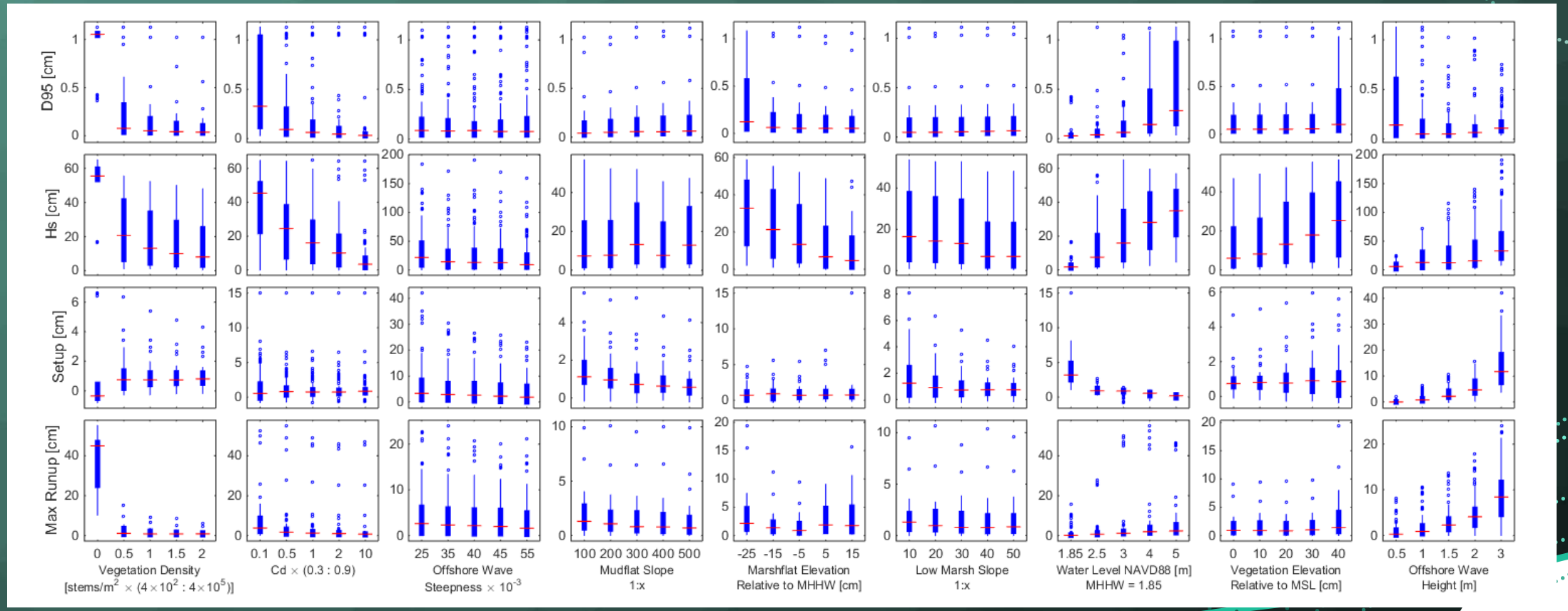


FIGURE IMPROVEMENT WORKSHOP

The main points for the box plots are:

1. changes in marsh morphology and hydrodynamic conditions impact the marsh's ability to reduce waves and flooding
2. the ability of a marsh to reduce waves and flooding decreases when there is a combination of high water levels and low cd, which is shown by the presence of so many positive outliers
3. vegetation density loss has the strongest control on a marsh's ability to reduce waves and flooding



Intro to Digital Art

Vector versus raster graphics

VECTOR v. RASTER ARTWORK

"Rasterizing"

RASTER GRAPHIC

- Composed of pixels.
- Draw curves only by pixel approximat
- Enlarging causes loss of resolution.
- Can "paint" gradients and smooth blending.

Programs: **Adobe Photoshop (expensive), Procreate ($10, Apple only), GIMP (free)**

File types: .jpg, .tif, **.png***

.png's are ideal for Powerpoint because they can be compressed for web and they can have a transparent background

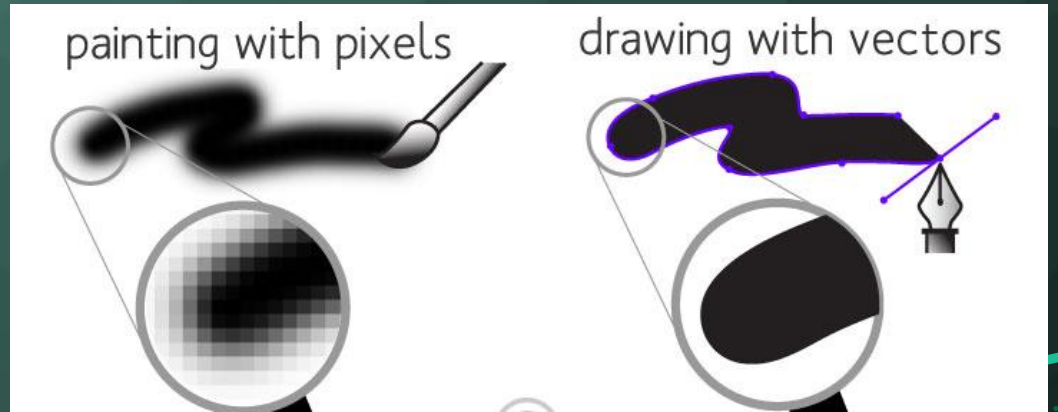
"Image Trace"

VECTOR GRAPHIC

- Co osed of mathematical paths.
- Co nuous and smooth lines.
- E arging **does not** cause loss of resolution.
- Usually have sharp, graphic look with crisp lines.

Programs: **Adobe Illustrator (expensive), Inkscape (free)**

File types:
.svg*, .emf*, .pdf*, .eps



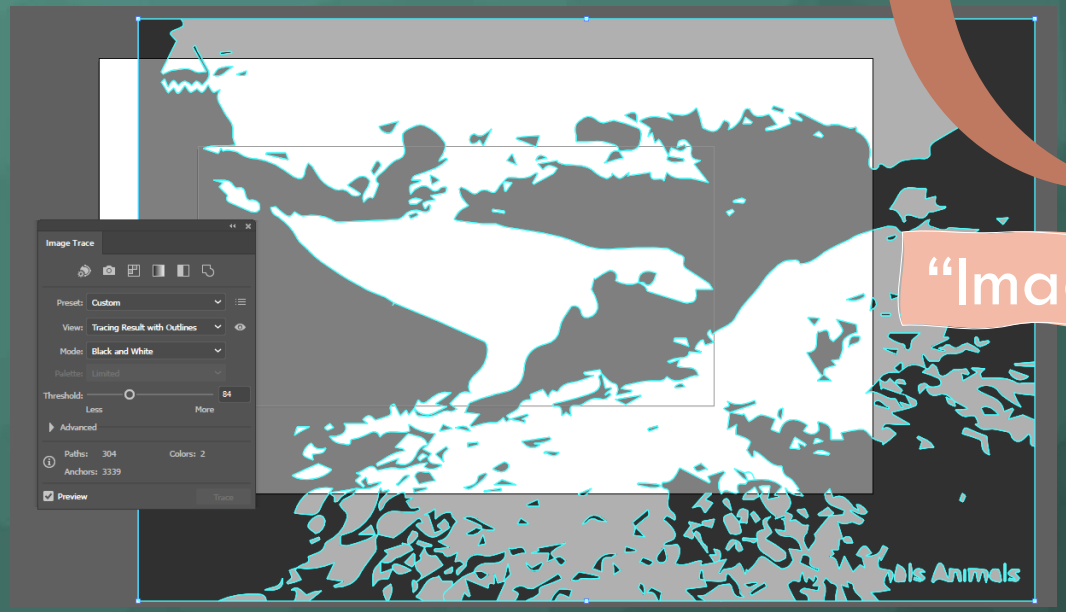
VECTOR v. RASTER ARTWORK

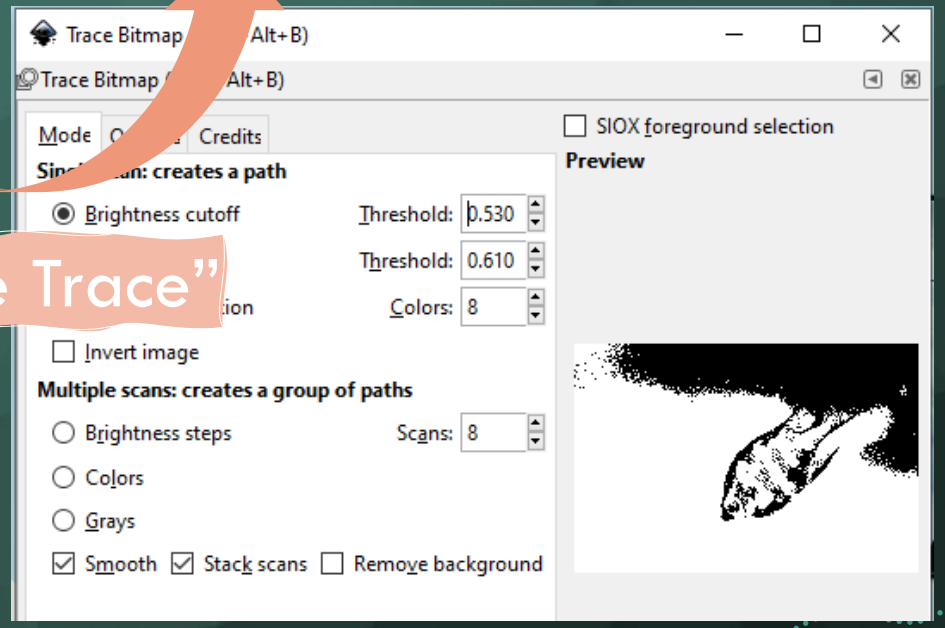
"Rasterizing"

RASTER GRAPHIC

VECTOR GRAPHIC

"Image Trace"





Illustrator: Object> Image Trace

Inkscape: Path> Trace Bitmap

DIGITAL ART

- ORGANIZATION IS KEY!
  - Create many versions (save often!) and layers with meaningful filenames.
- Make use of layers/Selection Pane to organize elements.
- Use **guidelines**, **align**, and **distribute**! Hold down shift to snap to regular positions.
- **Duplicate objects** to speed up the process of aligning (hold down Ctrl + Shift and drag your new object to its new location)

SHORTCUTS:

	ILLUSTRATOR	INKSCAPE	POWERPOINT
Paste in place	**Ctrl + F**	**Ctrl + alt + V**	default if in new slide or if original object is moved.
Zoom in/out	**Ctrl** + "+" or "-"	"+" or "-"	**Ctrl + scroll up / down**
Move canvas	**Spacebar + click & drag**	**Spacebar**	Scroll.
Duplicate	**Hold Alt + drag** (hold Shift down as well to keep aligned)	**Ctrl + D** duplicates the object in the same location as the initial object.	Hold Ctrl + drag (hold Shift down as well to keep aligned)
Resize with locked proportions	**hold Shift** while dragging	**hold Ctrl** while dragging	**hold Shift** while dragging
Rotate	**Hover outside** object while selected to see rotation icon	**Click once, then twice** on object to show rotation handles	Rotate **with rotation icon** above object when selected
Reflect	Object> Transform> **Reflect**	**H** for horizontal reflection or **V** for vertical reflection	Arrange> Rotate> **Flip Horiz/Vertical**
Edit points of path/object	Use **direct selection (V)** tool to select path segments or points	**Double click** on object to enter **"Edit Path by Nodes"** where you can select path segments or points	**Right click** line or path and select **"Edit Points"**

SOFTWARE & WORKFLOW

RASTER GRAPHIC


Photoshop


Procreate


GIMP

VECTOR GRAPHIC


Illustrator

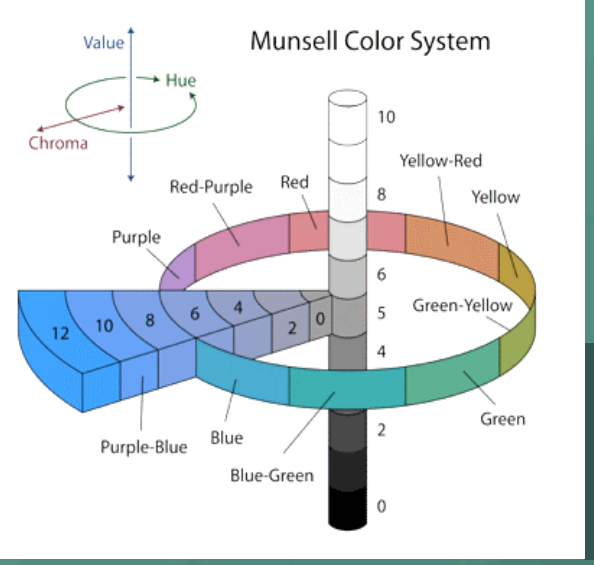

Inkscape

COMPOSITING


Using Creative Cloud Libraries

Intro to Design

Building simple, effective, and inclusive designs



HOW TO TALK ABOUT COLOR

same saturation & hue

VALUE

"lightness"

Darker colors make white text easier to see.

LIGHT — DARK

DARK

same hue & value

SATURATION

"intensity" or chroma

Very saturated colors are often hard on the eyes.

UNSATURATED — SATURATED

same saturation & value

HUE

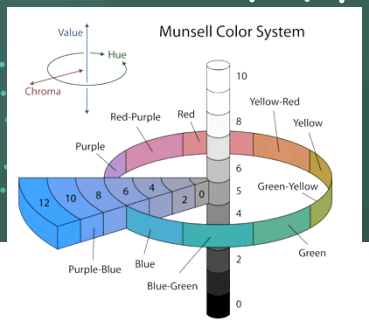
"color"

Stick to ~3 hues to keep things simple.

RED — PURPLE

COLOR PALETTE EXAMPLE

1 2 3



same saturation & hue

VALUE

"lightness"

same hue & value

SATURATION

"intensity" or chroma

same saturation & value

HUE

"color"

A year in the life of Phyllis...

AN ADULT FEMALE NORTHERN ELEPHANT SEAL

FALL October-December

JUVENILE HAULOUT
Juveniles & Subadult Males

What's in a name?

Phyllis migrates for **7 MONTHS**, over **10,000 kilometers,** swimming halfway to Japan and back to feed on abundant fish and squid in the open ocean. Phyllis was a real seal we tracked, who was named after a beloved Año Nuevo docent and philanthropist. The seal named Phyllis set a record by traveling farther west than any other tracked elephant seal.

Post-Molt FORAGING TRIP

SEA LION TAKEOVER
Most elephant seals gone

SUMMER July-September

WINTER January-March

BREEDING SEASON
ADULTS & PUPS

Can you spot the lightkeeper's house in all the photos? Follow shifts in beach morphology, animal abundance, and distribution across the seasons at Año Nuevo Island!

Post-Breeding FORAGING TRIP

MOLTING SEASON
ADULTS & JUVENILES

SPRING April-June

560 kilograms!

MASS (kg) 600 500 400 300

1 Phyllis returns home from an 7-month trip to sea:

2 Phyllis gives birth to a 35 kg pup.

3 Phyllis feeds her pup 52% fat milk for 26 days.

4 Phyllis leaves to forage for food at sea:

320 kilograms

5 Phyllis travels >5,000 km, diving to depths >800 m for >20 min each time.

400 kilograms

6 Phyllis returns to molt on land.

7 It takes about 10 days for Phyllis to abruptly molt her skin and fur.

280 kilograms!

8 After 6 weeks on land and losing over 100 kg, Phyllis returns to the sea.

9

BREEDING (30 days) · Post-Breeding Trip (75 days) · MOLTING (40 days) · Post-Molt Trip (7 mo.)

DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV

Phyllis' diet:

FISH 60% (lanternfish, barracudinas, and deep sea smelt) · SQUID 33% · OTHER

Males v. Females

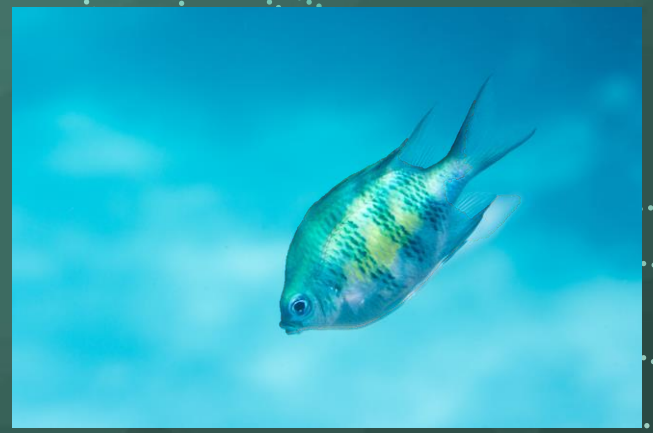
The foraging patterns of females and males differ greatly, with males typically foraging along the continental shelf and females staying farther offshore.

Graphics by Jessica Kendall-Bar.
Drone photos taken by Patrick Robinson under NMFS permit 19108 and MBNMS-2017-018 and stitched by Sarah Wood and Roxanne Beltran. We thank Steve & Phyllis Sooy for their generous contributions to elephant seal research.

We thank the Costa Lab, past and present, for their contributions to this effort:

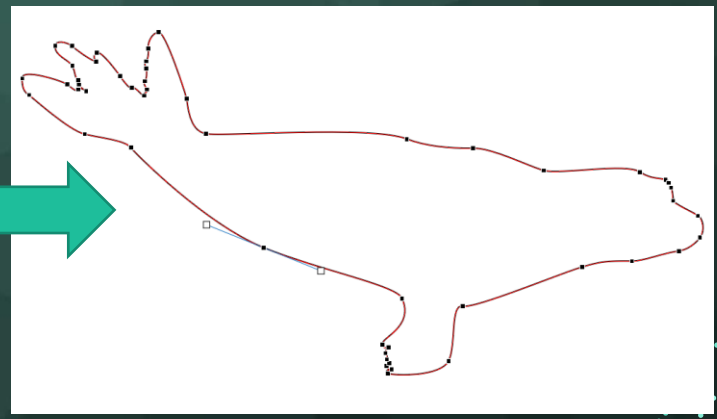
REFERENCES: Costa, D. P. *et al.* J. Zool. 209, 21–33 (1986). McDonald, B. I. & Crocker, D. E. Physiol. Biochem. Zool. 79, 484–496 (2006). Robinson, P. W. *et al.* PLoS One 7, (2012). Goetsch, C. *et al.* Front. Mar. Sci. 5, 1–19 (2018). Kienle, S. S. (University of California Santa Cruz, 2019).

POWERPOINT DESIGN TIPS



TIPS:

- Can change color of images to mat your theme.
- Edit curves and lines just like in Illustrator/Inkscape by converting to shape and right clicking>"Edit Points.
- Don't remove the background in Powerpoint… use Photoshop or GIMP.
- "Sketched outlines"
- Selection Pane! In "Arrange" menu
- Duplicate, align, and distribute!



DESIGNING YOUR PRESENTATION

TIPS

- **Display an outline** at the bottom of slides.
- Keep **text to a minimum**; use graphics!
- **Practice** your talk, transitions, and animations; don't be surprised by your slides!
- Stick to **3 fonts** for Titles, Subheadings, and body text and **3 colors** to keep things simple.

TRICKS

- Navigate to *ANY* slide by typing in the number of the slide and pressing enter, while presenting (e.g. here, press "10" to come back)
- Right click while presenting to **"See All Slides"** to let your audience see thumbnails of all slides and click on them to open.
- **F5** to begin presentation at beginning. **Shift+F5** at current slide
- **Slide Master**! Next slide…

Slide Master..

Filling out Style Guide Template

- Keep it simple
- Come up with a few words that describe your style
- Find a color palette with 3 main color hues
- Find 3 fonts to work with: Headings, subheadings, and body
- There are no “right” answers – have fun with it!

Post-meeting to do's

- Work with contributors to come up with a style guide and Slide Master they like (fonts, colors, and image style). Create some custom vector and raster graphics, go to Photoshop & Illustrator in helpful links for help.
- Create custom vector graphics of your study organism
- Watch PowerPoint tips & tricks tutorial (1hr)