Data-Driven Animation

for Science Communication

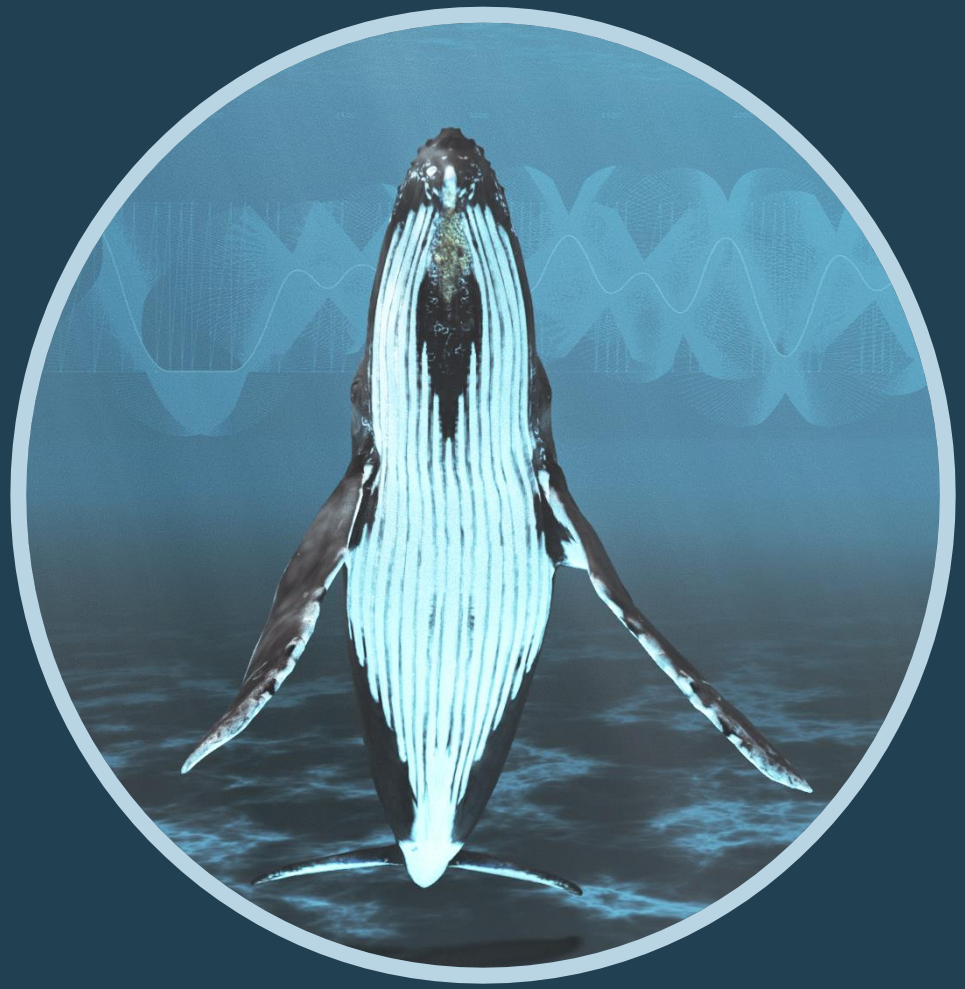
Jessica Kendall-Bar

July 18-29
CSUMB Summer of Science Illustration

DAY 1

Introductions & Collaboration

Data-Driven Animation
for Science Communication



PART 1

WELCOME

Course Overview

Course goals, structure, and expectations - 20 min

OVERVIEW

Course Goals

- Course goals:
  - Build students' intersectional identities as science communicators, programmers, scientists, & artists
  - Build students' agency to teach these skills to coworkers, mentees, and students
  - Build students' agency as science communicators- to take on new projects
- Course description:
  - Each student creates a scientific animation that tells a story with data to better communicate scientific results – along the way they will learn programming, science writing, and technical animation skills.

OVERVIEW

Learning Outcomes

By the end of the class, students will gain skills in:

- *Science Communication*
- *Digital Art & Animation*
- *Data Visualization and Programming*
- *Professional Development*
- *Interdisciplinary data-driven science communication*

OUTLINE

Course structure

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
	Jul 18	Jul 19	Jul 20	Jul 21	Jul 22	Jul 25	Jul 26	Jul 27	Jul 28	Jul 29
Topic	***Introductions & Collaboration***	***Conceptualization***	***Digital Art and Design***	***Data Visualization***	***Animation & Motion Graphics***	***Animating 2D Data***	***Intro to 3D Animation***	***Animating 3D Data***	***Editing & Compositing***	***Final Critique & Communication Strategy***
Program	Adobe Premiere Pro	Adobe Premiere Pro	Adobe Photoshop & Illustrator	Adobe Illustrator & R	After Effects	After Effects	Autodesk Maya	Autodesk Maya	Adobe After Effects/Premiere Pro	Social Media
Starting products	Draft scientific paper with key figures and points, any existing assets (videos, illustrations, or 3D models).	Style Guide & Script	Reference images and list of key assets and animatic	One key figure	Animatic	Made-over key figure	3D asset	Animated 3D scene	Rendered image sequences	Final composition
Main output	Style Guide, Budget, Contract, & Script	Storyboard & Animatic	Custom 2D raster & vector graphics	Made-over key figure	Scene with motion graphics	Animated key figure	Animated 3D scene	Data-driven 3D scene	Final composition (mp4 with narration, annotations, custom musical score)	Science Communication Strategy document
Interview with industry Expert - Guest lecture	**Sara El Shafie** - Distilling Complexity; Science through Story	**Ilgavak (Peter Williams)** - Storytelling and place-based learning	**Alex Boersma** - Scientific illustrations and animations for high-impact science	**Allison Horst** - Art to build agency for budding data scientists	**Bailee Desrocher** - Animations for science storytelling: NASA & beyond	**Katherine Vlamis CrossTown LA** - COVID data visualizations for large cities amidst a global pandemic	**Johnson Martin** - Digital Life 3D: Realistic animal models for science and education	**Geraldine Fauville;** VR for environmental education	**Connor Vance** - Musical Compositions for Data Storytelling	**Sal Alper** - Science communication and outreach through the SF Exploratorium

OUTLINE

CASE STUDIES

- **1: Comparative dive physiology of marine mammals for comparative medicine**
  This suite of animations visualizes the diving physiology and behavior of several marine mammals that display extreme adaptations to oxygen and sleep deprivation. Visualizations of physiology and behavior facilitate comparative physiology and our ability to learn about human sleep, seizures, and oxygen-mediated injury.
- **2: The Flood Protection Benefits of Coastal Ecosystems for Communities**
  This animation shows the coastal damages caused by increasing climate hazards, flood protection provided by coral reefs and mangroves, and the value of these coastal ecosystems to protect vulnerable coastal communities.
- **3: Local & Indigenous Knowledge of Alaskan Ecosystems**
  This video explores the complex dynamics between local ecosystems, commercial fisheries, and traditional Indigenous knowledge. Specifically, this video looks at the spatial patterns and ecology of otter and shellfish through interviews of the Tlingit tribal people from Sitka, Alaska.

OVERVIEW

Daily Agenda

2:00 - 2:20: Agenda & questions (20 min)
2:20 - 2:50: Opening Activity - Interactive activity where you present your work and receive feedback (30 min)
2:50 - 3:00: Break / Reflection (10 min)
3:00 - 3:30: Lecture - Lecture with background information on the topic of the day (30 min)

- 20-minute lecture
- 10 minutes for questions / discussion

3:30 - 4:00: Work time - Topic-based brainstorming and reflection (30 min)
4:00 - 4:10: Break (10 min)
4:10 - 4:40: Closing Activity (Instructions) - Demo / specific guidance on completing tasks (30 min)
4:40 - 5:20: Work time - Individual work time (40 min)
5:20 - 5:30: Break (10 min)
5:30 - 6:30: Guest speaker interview with time for questions (30 min interview)

- 40 minutes of Q&A with pre-prepared questions (see draft questions here)
- 20 minutes of office-hour-type consultation where students may ask questions

PART 1

Today's agenda

2:00 - 2:20: Agenda & questions - Course Outline & Welcome! (20 min)
2:20 - 2:50: Opening Activity - Abstract switch, introductions, and reflection (30 min)
2:50 - 3:00: Break / Reflection (10 min)
3:00 - 3:30: Lecture: Intro to Data Visualization & Design (30 min)
3:30 - 4:00: Work time - Data Description, Style Guides, Audience Brainstorming (30 min)
4:00 - 4:10: Break (10 min)
4:10 - 4:40: Closing Activity (Instructions) - Scripts / Contracts / Budgets (30 min)
4:40 - 5:20: Work time - Scripts / Contracts / Budgets / Approvals (40 min)
5:20 - 5:30: Break (10 min)
5:30 - 6:30: Guest speaker - Science through Story with Sara ElShafie

DAY 1

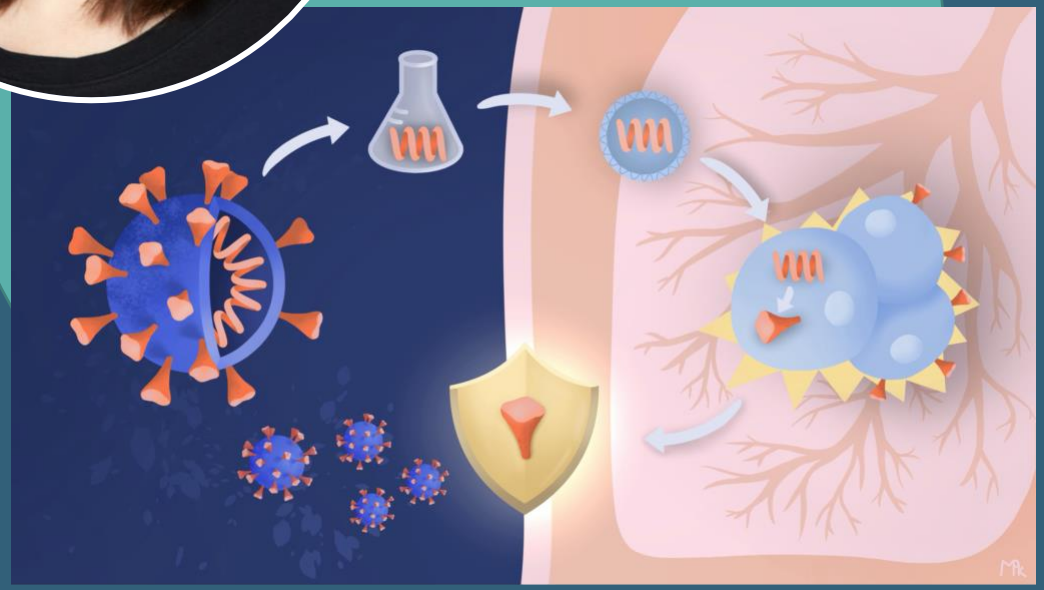
GUEST SPEAKER

Distilling Complexity: Science through Story

Sara ElShafie, PhD

Founder & Principal, Science Through Story, LLC

Contact: sara@sciencethroughstory.org



OVERVIEW

COVID & In-person instruction

Please take care to comply with all CSUMB university guidelines about masking in indoor settings, performing daily symptom checks, testing as required by the campus vaccine policy, self-isolating in the event of exposure, and respecting others' comfort with distancing.

If you experience an illness or exposure that requires you to miss class sessions or to attend remotely, please communicate with me as soon as possible and I will provide you with options to allow you to continue making progress in the class. While we have designed the course to operate primarily in person, we do not want to encourage folks to show up if they are sick. If you are sick, I will do my best to create a virtual learning option (following along in this journal and providing recordings or Zoom meetings when possible).

OVERVIEW

Course Resources

- **CANVAS:** https://canvas.ucsc.edu/courses/54357
  - Lectures, assignment submissions
- **Shared Google Drive**
  - Multimedia file-sharing
- **Data-Driven Animation Journal** Google Document
  - Step-by-step guides, instructions, and self-assessment rubric
- **DISCORD:** https://discord.gg/qQpYDNybaE
  - Informal discussions, troubleshooting, feedback, and help

Should you need to contact the teaching team to ask a question, please send an email ("Dear Teaching Team,") and CC the three of us so that we can assist you in a timely manner.

Before emailing the teaching team, make sure to:
1. Search the google document for the information you are looking for
2. Look in our Discord server for the answer to your question (first in #general and then in the topic-specific channels) : https://discord.gg/qQpYDNybaE
3. If your question could be relevant to others, post your question in the Discord server.

Name	Role	Email
Dr. Jessica Kendall-Bar (she/her)	Instructor	jkb@ucsc.edu
Salma Abdel-Raheem (she/her)	Instructional Assistant	stabdelraheem@gmail.com
Aaron Zachmeier (he/him)	Instructional Designer	zachmeier@ucsc.edu

OVERVIEW

Prerequisites

While this course is designed for beginners with no prior experience in art, science, or programming, you will be learning many programs and techniques within a short period of time. If you would like to practice using some of the software or techniques beforehand, we suggest that you explore our online learning portal at https://jessiekb.com/artforscicomm and other online tutorials for the programs we explore in this course (listed below).

OVERVIEW

Software

For the summer CSUMB course, we will have access to computers in the computer lab for those who have computational limitations. However, for those who would like to continue using these programs after the course, we suggest that you download and get access to the following programs:

Required:

- **Adobe Creative Cloud:** Illustrator, Photoshop, After Effects, Premiere Pro (institutional licenses available through CSUMB or UCSC during instruction)
- **Autodesk:** Autodesk Maya 2020 or newer (Go here for educational license)
- **R/RStudio:** free (download R here and RStudio here).
- **Microsoft Office 365:** Excel, Powerpoint

Optional - Other programs that might be useful

- **ESRI: ArcGIS Pro** for geospatial data
- **JMP Statistical Software** for quick data visualizations and statistics

OVERVIEW

Assignments & Grading

We will be following a single rubric throughout the course. Please find a list of all assignments on the CANVAS website and a self-assessment version of this rubric at the very end of this comprehensive Data-Driven Animation Journal. If you lose any points along the way during the daily checkpoints, it is possible to recuperate these points. In order to request a re-grading of earlier assignments, please attach a step-by-step explanation (<1 page) to your final animation submission, explaining how you have addressed missing, incomplete, or incorrect elements from earlier assignments.

OVERVIEW

Community Guidelines

When providing feedback regarding data visualizations, stay focused on what could be done to improve clarity, accessibility, and succinctness to a diverse audience.

I am committed to providing an atmosphere for learning that respects diversity and supports inclusivity. We need to work together to build this community of learning. I ask all members of this class to:

- be open to and interested in the views of others
- consider the possibility that your views may change over the course of the term
- be aware that this course asks you to reconsider some "common sense" notions you may hold
- honor the unique life experiences of your colleagues
- appreciate the opportunity that we have to learn from each other
- listen to each other's opinions and communicate in a respectful manner
- keep confidential discussions that the community has of a personal (or professional) nature
- ground your comments in the texts we are studying. Refer frequently to the texts and make them the focus of your questions, comments, and arguments. This is the single most effective way to ensure respectful discussion and to create a space where we are all learning together.

PREPARE

What data do we need?

- Will need to provide:
  - Abstract and draft scientific paper (in draft or finished form),
  - Key messages of the paper,
  - Key audience of the animation,
  - Single dataset (CSV) that you could animate in 2D and/or 3D (with column descriptions)
  - Key figure that you'd like animated.
    - Also provide: CSV data and commented code used to generate figure
  - List of funding sources/permit numbers to be included on credit slide
- Data structure: https://github.com/jmkendallbar/VisualizingLifeintheDeep

What are your commitments as a data contributor?

- Will need to (promptly) review:
  - Script
  - Data description
  - Style guide
    - Color palette
    - Credit slide (including funding sources and acknowledgments)
    - Spelling/grammar
  - Contract/sample budget
  - Storyboard
  - Animatic (storyboard)
  - Final product
- Will need to provide feedback and help troubleshoot data issues/questions throughout the course to avoid issues.

PART 2

OPENING ACTIVITY

Abstract Switch & Introductions

Switch, discuss, present, reflect - 40 min

OPENING ACTIVITY

Abstract switch

- Scientists, give your abstract and key figure to your artist (scientist to animator or scientist-animators exchange). Artists, you have 10 minutes to read the abstract and learn about their work. The focus here is to understand the science (how it was done, what the results were, and why this is useful). You will introduce your partner and their work to the class.
- To introduce your partner, share:
  - What did they do?
  - What did they find?
  - Why does it matter?

REFLECTION

Reflection

- For scientists, when did you find yourself wanting to interrupt and correct your introduction? How can you work to make these points clearer in your abstract and especially in your animation? What visuals might help? Discuss with your partner and clarify any questions.

BREAK

10 min - Return at 3:00 PM

PART 3

LECTURE

Introduction to Data Visualization

Why visualize, types of data, types of visualizations - 20 min

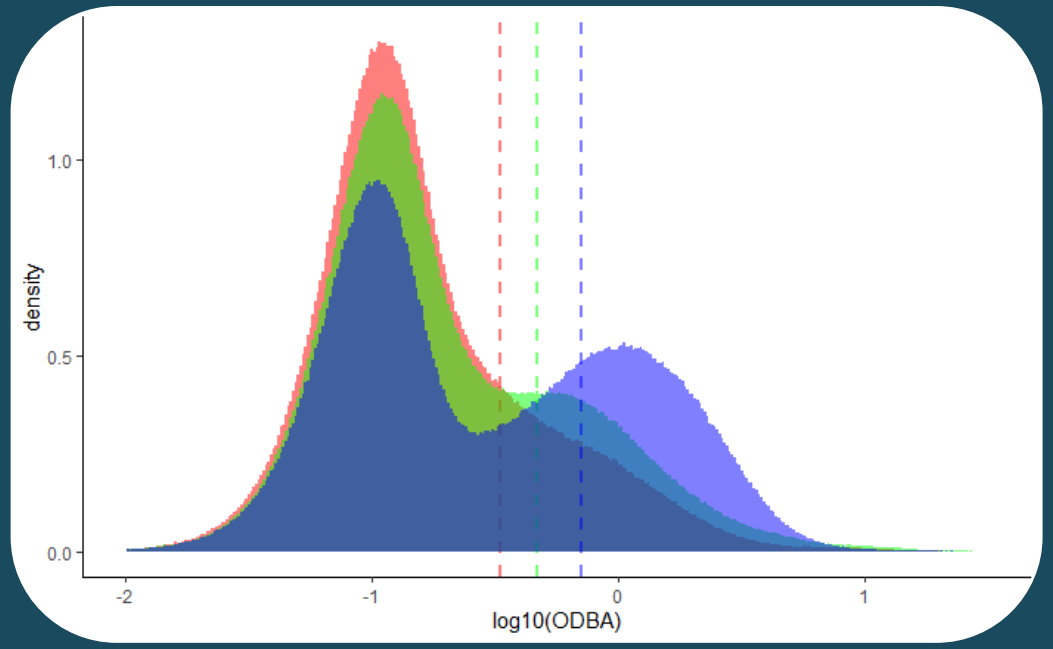
Intro to Data Visualization

Why, how, and using what tools.

WHY VISUALIZE

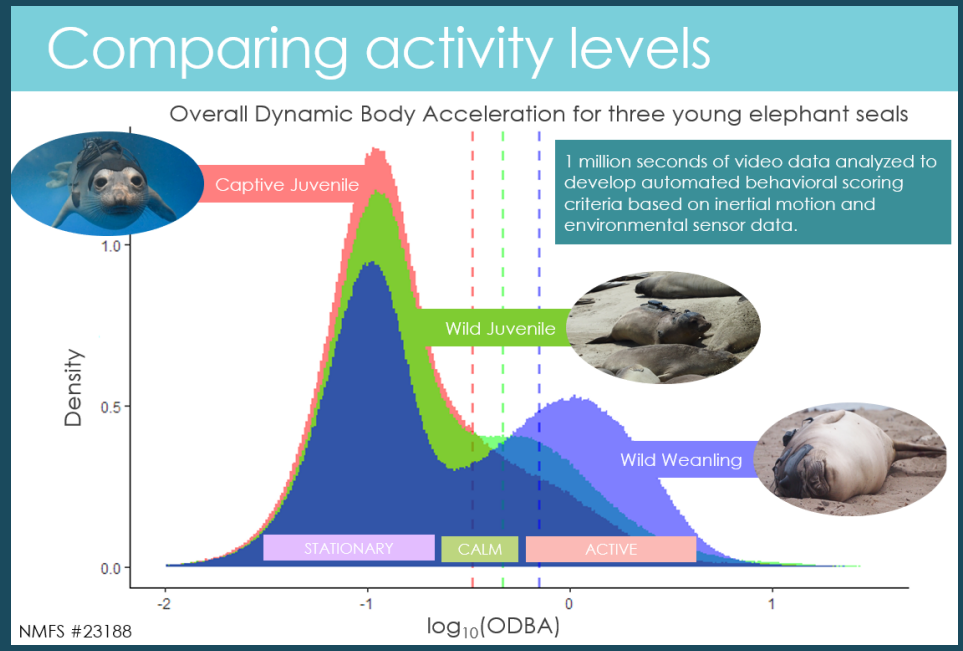
EXPLORATION

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
  - Students
  - Researchers
  - Data analysts
  - Biostatisticians
  - & 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.

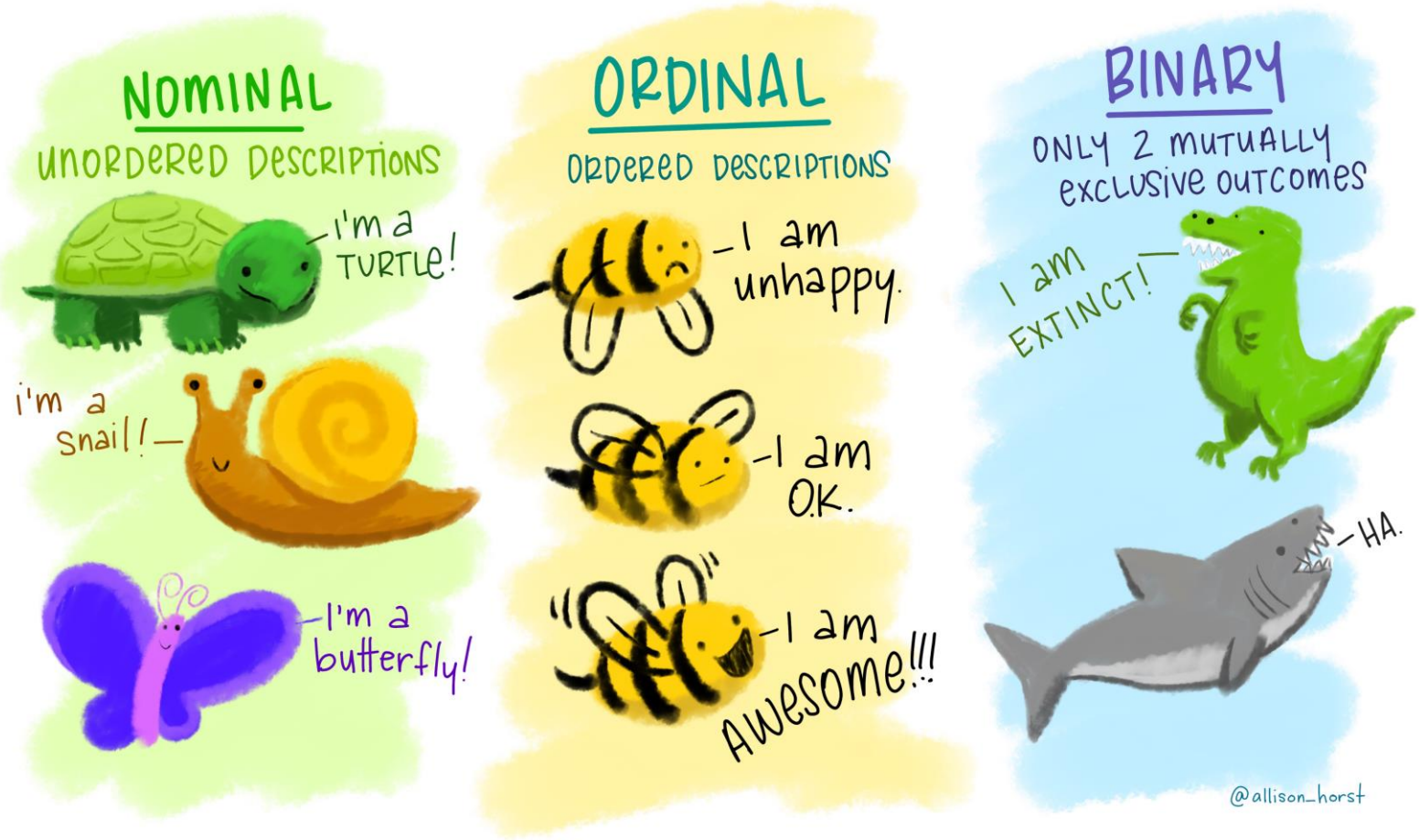
Javascript

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

TYPES OF DATA Quantitative / Numeric

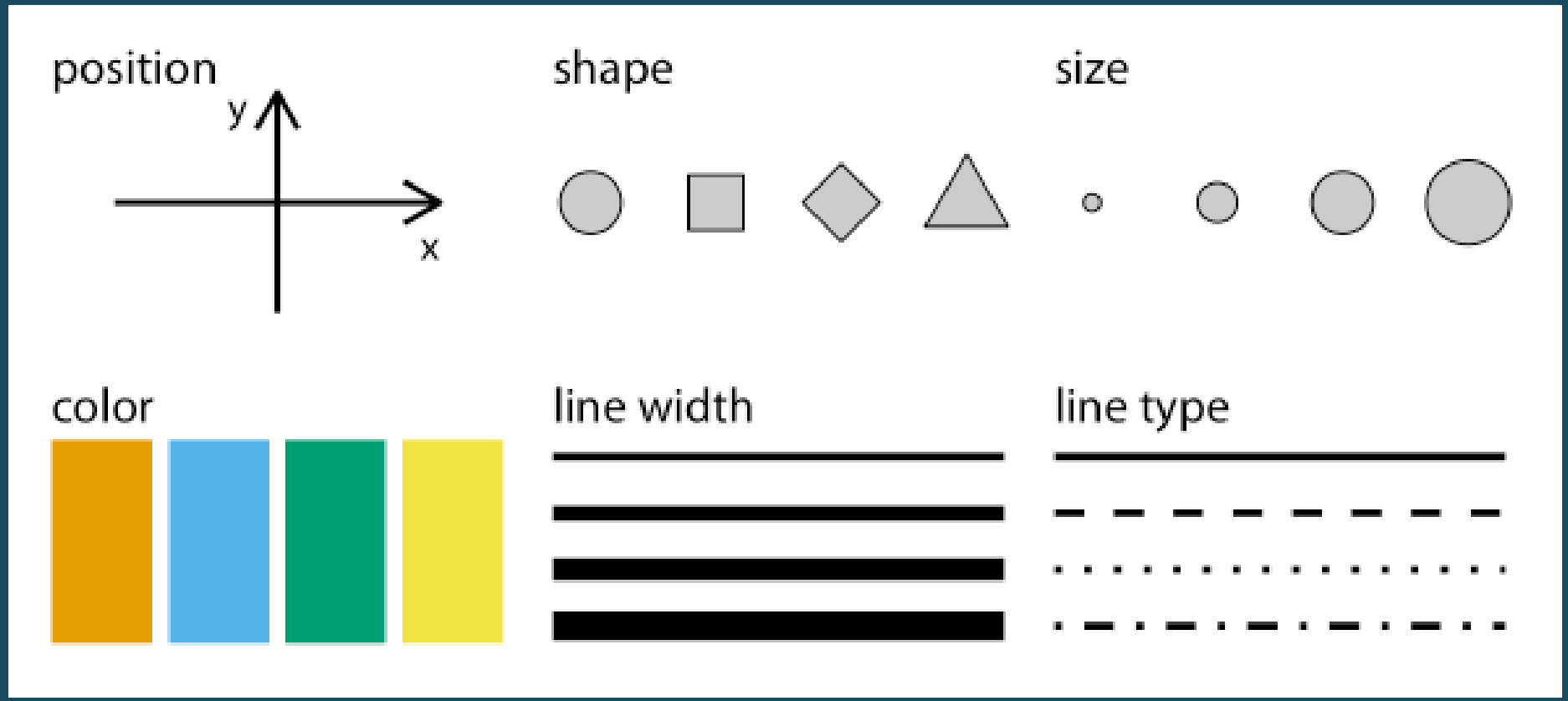
Artwork by @allison_horst

TYPES OF DATA Qualitative / Categorical



Artwork by @allison_horst

MAPPING DATA ONTO SCALES

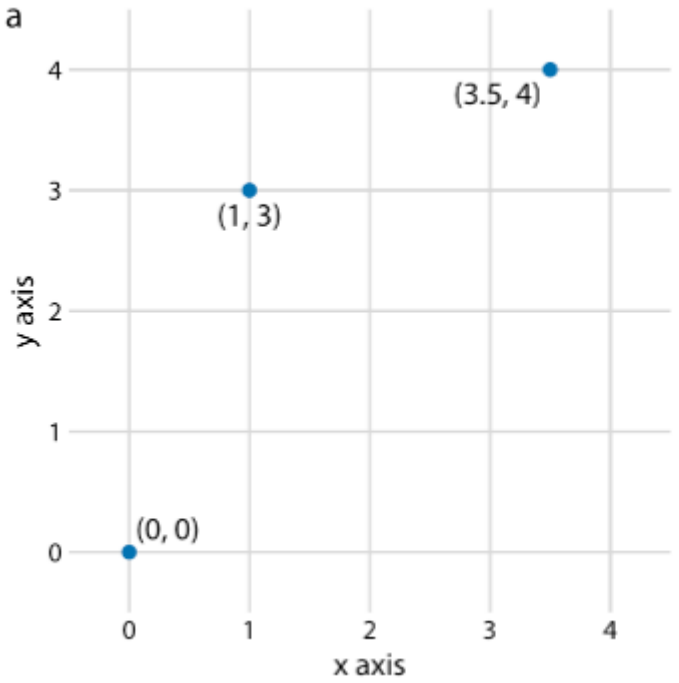


Data Visualization by Claus Wilke

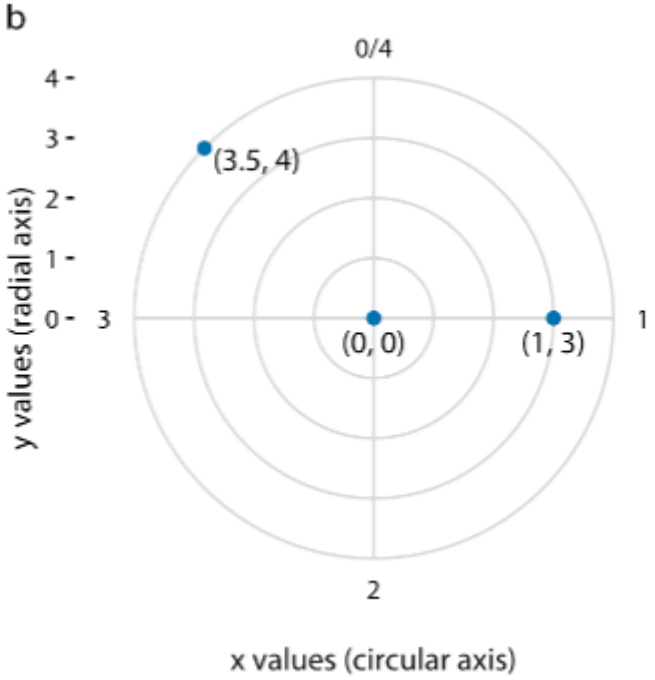
+ others: 3D, time

TYPES OF POSITION

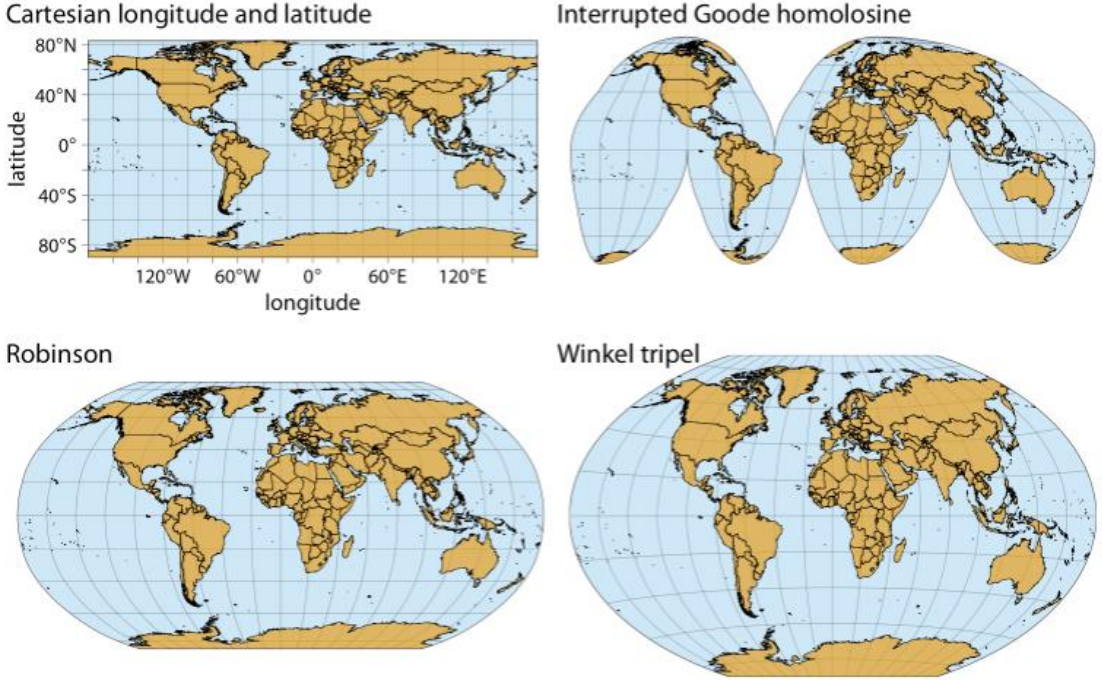
Cartesian



Polar

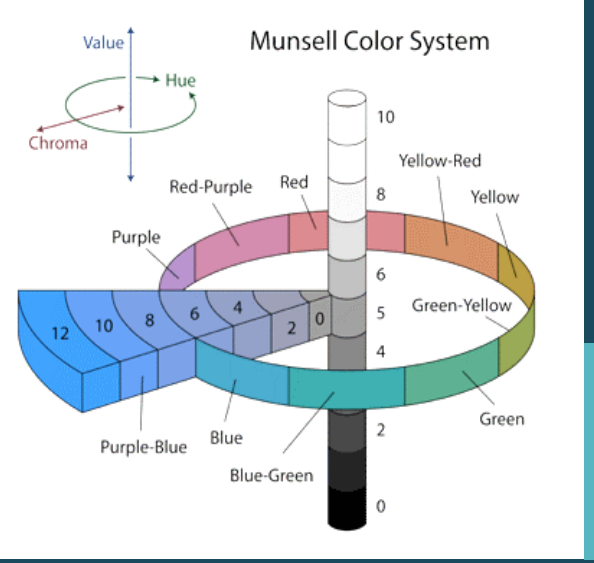


Geospatial data



Intro to Design

Building simple, effective, and inclusive designs



LET'S 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 SCALES

Numeric or ordered

Color to represent data values

Categorical

Color as a tool to distinguish groups

Categorical

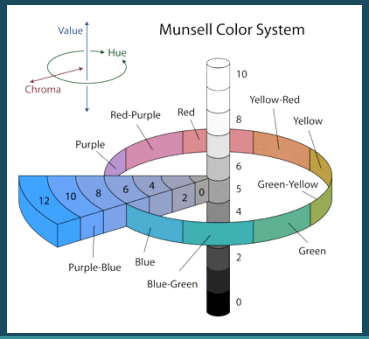
Color as a tool to highlight groups

Examples

Data infographics

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.

560 kilograms!

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.

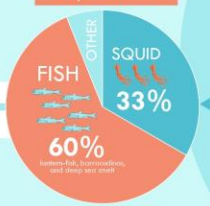
9

MASS (kg) 600 500 400 300

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:



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.

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!

SPRING April-June

MOLTING SEASON
ADULTS & JUVENILES

SUMMER July-September

SEA LION TAKEOVER
Most elephant seals gone

Post-Molt FORAGING TRIP

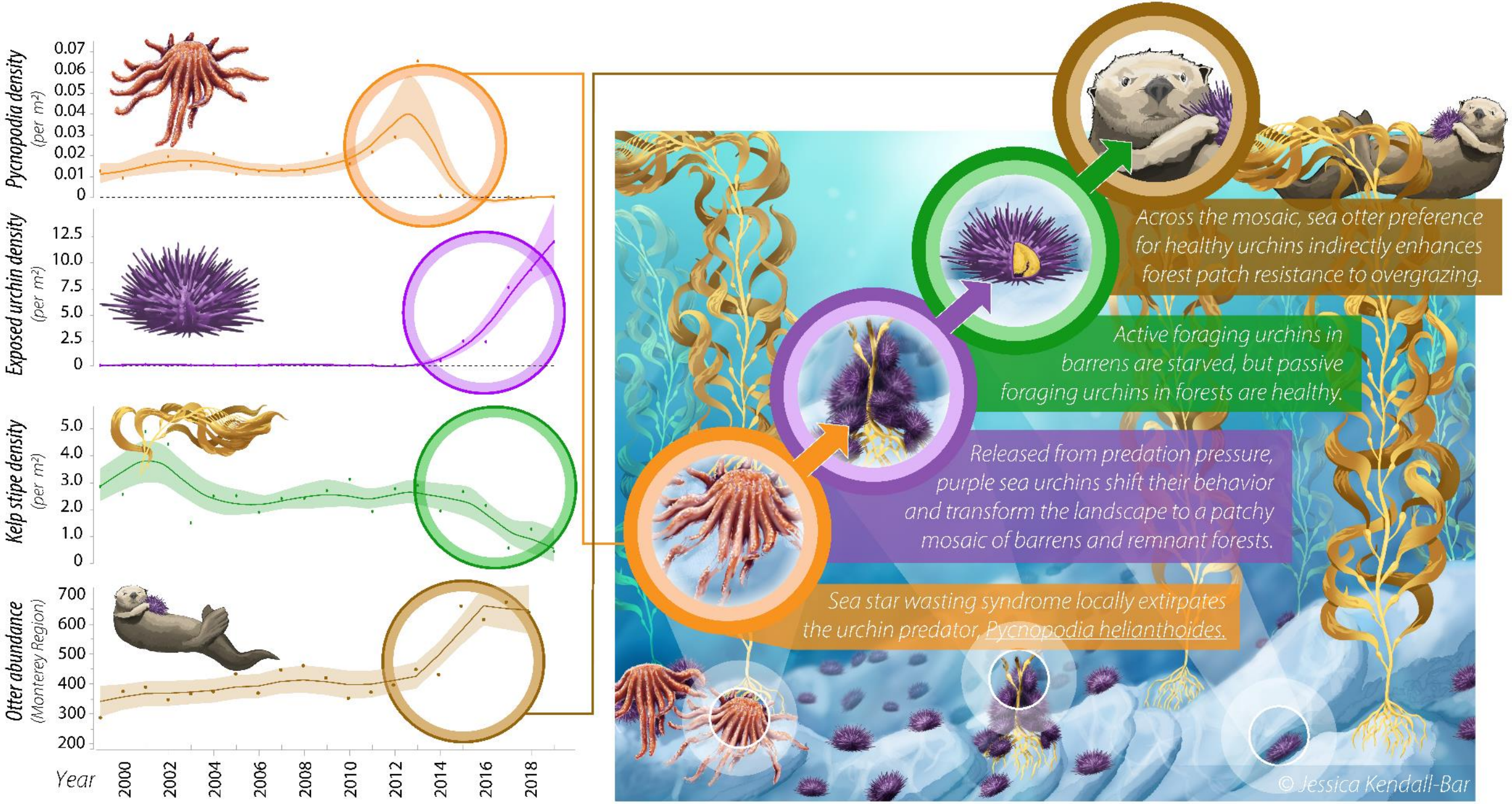
Post-Breeding FORAGING TRIP

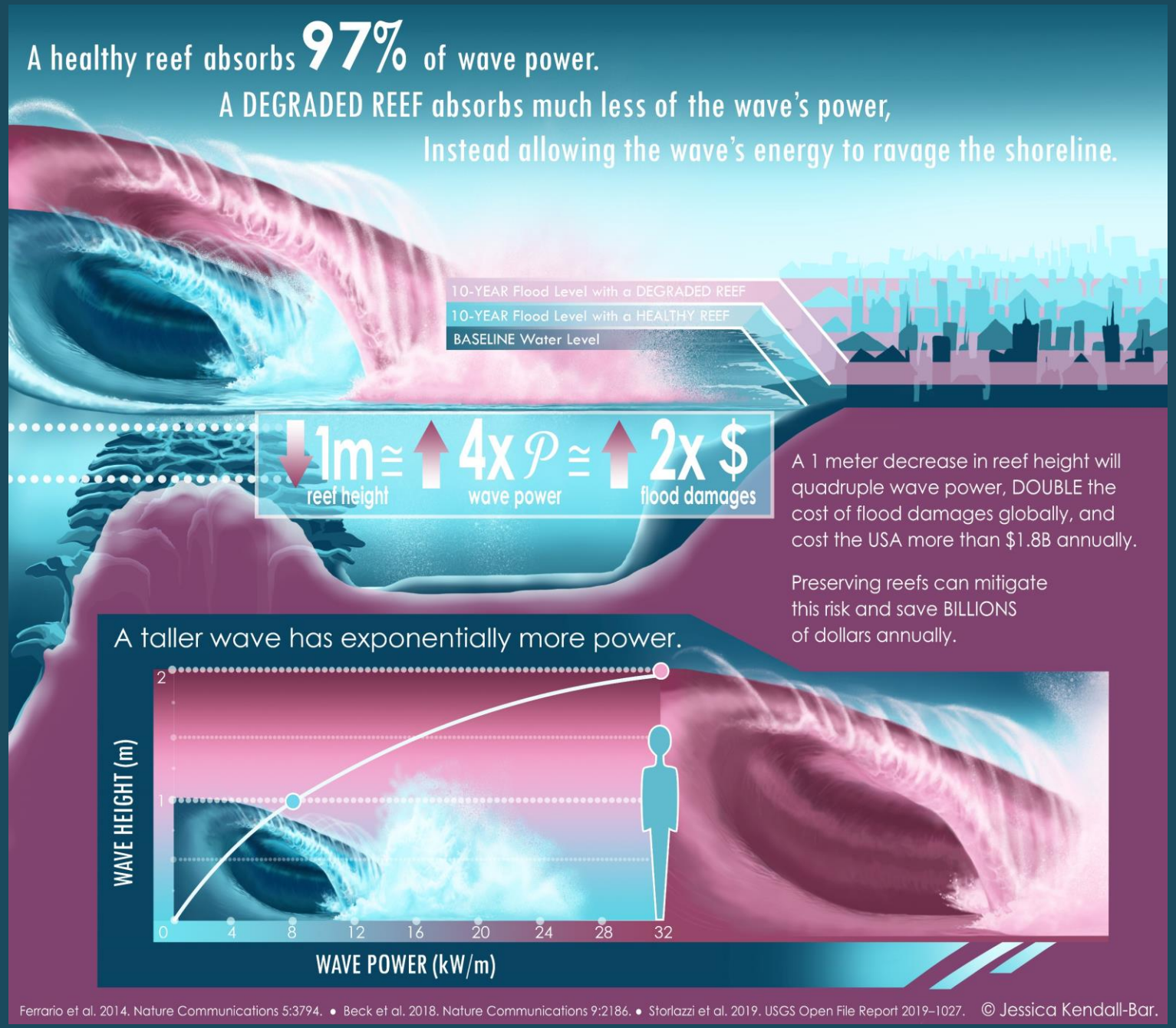
Graphics by Jessica Kendall-Bar.
Drone photos taken by Patrick Robinson under NMFS permit 19108 and MBNMS-2017-018 and stitched by Sarah Wood and Roxanne Beltran. We thank Steve & Phyllis Sooy for their generous contributions to elephant seal research.

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

A. Allen, A. Brown, A. Favilla, A. Foster, A. Fox, A. Hooper, A. Khalsa, A. Kosztowny, A. Mao, A. Moreland, A. Pearson, A. Takahashi, A. Taylor, A. Valenzuela, A.L. Harrison, B. Funari, B. Hatfield, B. Lyon, B. McDonald, B. Shaw, B. Stewart, B. Wenzel, B.J. Le Boeuf, C. Barcelo, C. Bednar, C. Campagna, C. Casey, C. Champagne, C. Cooper, C. Debier, C. Deutsch, C. Goetsch, C. Holmes, C. Hume-Flannery, C. Kuhn, C. Lester, C. Louis, C. Nair, C. Oliver, C. Reichmuth, C. Rojas, C. Rojas-Leyton, C. Sick, C. Whalen, D. Collet, D. Costa, D. Crocker, D. Hasiid, D. Houser, D. Kruck, D. Lambourn, D. Merino, D. Noren, D. Somo, E. Engert, E. Gruber, E. Hickli, E. Keith, E. Kelso, E. Kocina, E. Levy, E. McHuron, E. Pickett, E. Sheehan, E. Shortwell, E. Staffery, F. Galimberti, F. Loayza, G. Derango, G. Fielding, G. James, G. Labadie, G. Oliver, G. Solsburg, G. Worthy, H. Barrett, H. Huber, H. Liwanag, J. Adams, J. Bachelier, J. Belden, J. Burns, J. Cisilini, J. Cole, J. Corbin, J. Cutler, J. Ensworth, J. Hanaway, J. Harley, J. Hassrick, J. Jackson-Ricketts, J. Johnson, J. Kendall-Bar, J. Khudyakov, J. Linossier, J. Lundin, J. Maresh, J. Massa, J. Reiter, J. Scordino, J. Sharick, J. Tolman, J. Vela-docent, J. Wexler, J. Williams, K. Holser, K. Ichimaru, K. Iida, K. Pelon, K. Richer, K. Shrader, L. Cooley, L. Huckstadt, L. Johansen, L. Linossier, L. McHuron, L. Pallin, L. Rea, L. Schwarz, L. Sonnenstedt, M. Allaback, M. Castellini, M. Cole, M. Conners, M. Emard, M. Fowler, M. Goguen, M. Kretzmann, M. McCormley, M. McCune, M. Peterson, M. Reidman, M. Tift, M. Voisinet, N. Dwyer, N. Forsman, N. Teutschel, N. Mastick, N. Schnur, N. Wagner, P. Adams, P. Forman, P. Morris, P. Robinson, P. Thorson, R. Bandar, R. Beltran, R. Berger, R. Condit, R. Cuthbertson, R. Grant, R. Holser, R. Orben, R. Schultz, R. Tran, S. Allen, S. Bent, S. Blackwell, S. Boaz, S. Evangelista, S. Fregosi, S. Gleason, S. Hannah, S. Hsu, S. Insley, S. Kienle, S. Kirby, S. Kolen, S. Maxwell, S. Melin, S. Mesnick, S. Miner, S. Peterson, S. Shaffer, S. Simmons, S. Spurlin, S. Tavoni, S. Villegas, S. Wilson, T. Adachi, T. Barclay, T. Hogarth, T. Keates, T. Norin, T. Russell, V. Delnavaz, V. Hess, V. Johnson, X. Rojas-Rocha, Y. Milani, Z. Hampson

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).


Pycnopodia density
(per m²)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Exposed urchin density
(per m²)
12.5
10.0
7.5
5.0
2.5
0
Kelp stipe density
(per m²)
5.0
4.0
3.0
2.0
1.0
0
Otter abundance
(Monterey Region)
700
600
500
400
300
200
Year
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
Across the mosaic, sea otter preference for healthy urchins indirectly enhances forest patch resistance to overgrazing.
Active foraging urchins in barrens are starved, but passive foraging urchins in forests are healthy.
Released from predation pressure, purple sea urchins shift their behavior and transform the landscape to a patchy mosaic of barrens and remnant forests.
Sea star wasting syndrome locally extirpates the urchin predator, Pycnopodia helianthoides.
© Jessica Kendall-Bar

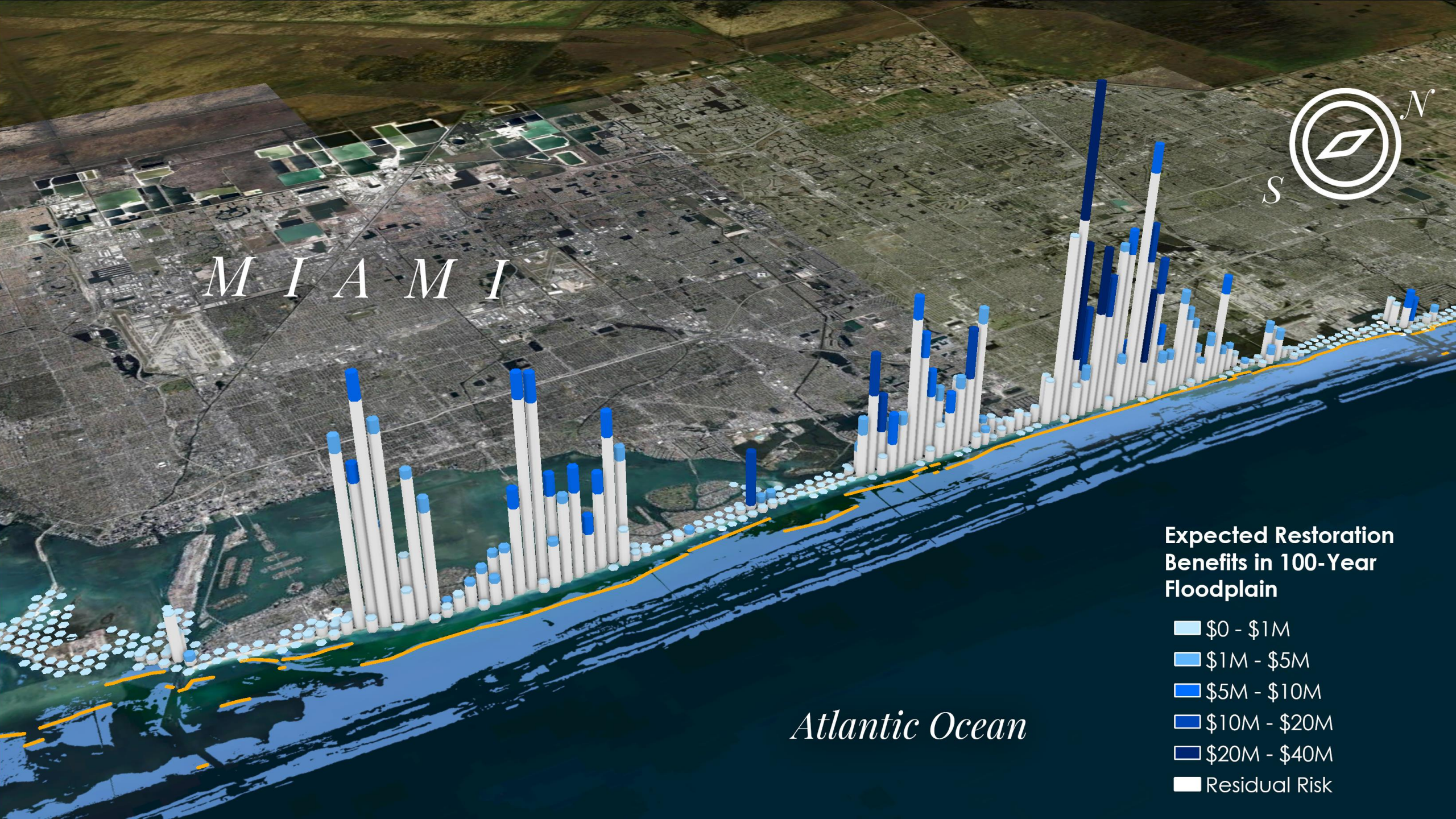


Rasters: **Procreate & Photoshop for iPad**

Composition:
Illustrator for desktop

Plot:
Powerpoint

Final Composition:
Illustrator


MIAMI
N
S
Atlantic Ocean
Expected Restoration Benefits in 100-Year Floodplain
$0 - $1M
$1M - $5M
$5M - $10M
$10M - $20M
$20M - $40M
Residual Risk

THE MILLION DOLLAR REEFS OF O‘AHU

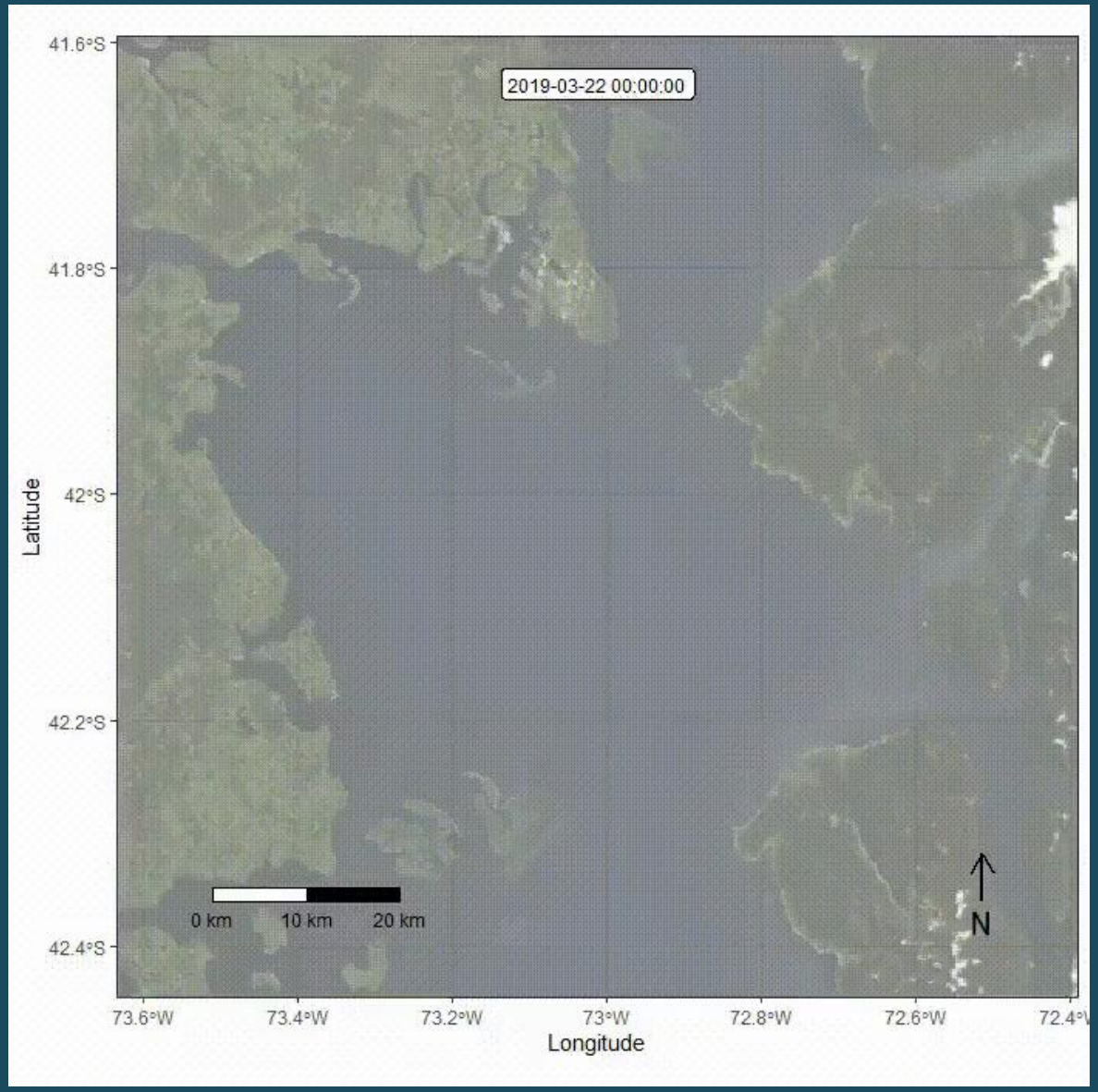
Each kilometer of these highlighted reefs provides over one million dollars in flood protection benefits each year.

Data-driven Animation

Motion graphics to bring data to life

WHY ANIMATE?

Adding time to your data visualization can build anticipation, tension, and help tell your story, while making it more engaging.



This is approximately a 7 day period of Chile's Golfo de Ancud. A couple comments have indicated this article as the source study: https://www.nature.com/articles/s41598-021-82220-5

PART 4

WORK TIME

30 min – Stop & break at 4:00 PM

Before you animate:

Understand your data: Data Description

Agree on a style: Style Guide

Know who you're talking to: Audience Brainstorming

ACTIVITY

Before you animate:

- Understand your data: Data Description
- Agree on a style: Style Guide
- Know who you're talking to: Audience Brainstorming

ACTIVITY

Data Description

- Describe the dataset(s) you will be working with. This is your chance to review the data, identify issues in the data, and ask the scientist clarifying questions. Modify the example below to add as many rows or columns as necessary. If it is easier, feel free to comment on the Excel file directly and paste your data description as an image in your journal.

	1	2	3	4	5	6
Variable name	**Time**	**Depth**	**Pitch**	**Roll**	**Heading**	**Stroke Detected**
Units or Format	mm/dd/yyyy hh:mm:ss.00	meters	degrees			0 or 1
Type of data	Numeric - discrete (sample freq. 10 Hz)	Numeric - discrete (resolution 0.5m)	Numeric - continuous			Categorical - binary
Scale to visualize	Position (horizontal) or time	Position (vertical) or	Rotation (up or down)	Rotation (side to side)	Rotation (direction of animal)	Swimming behavior
2D or 3D	2D & 3D	2D & 3D	3D only	3D only	3D only	3D only
Maximum value	End date	400 m	±90°	±180°	±180°	1
Meaning of min/max value	Begin/End of recording	Surface / Deepest z-position	Pitched down / up	Rolled upside down	Headed south	Begin stroke detected or not

ACTIVITY

Style Guide

Dark on light	Dark on light	Dark on light
Dark on light	Dark on light	Dark on light
Light on dark	Light on dark	Light on dark

- **Verbal description**

Describe the intended emotion or feeling of your animation. List words that you would like your audience to feel, observe, or experience.

- **Font**

Pick a font that is legible and consistent with your verbal description above. Change the font in the color palette table below to match your selected font. https://fonts.adobe.com/

- **Color palette**

Use the Adobe color tool (https://color.adobe.com/) to help you pick 3 main hues (3 values for each hue) ; 3 main hues must be distinguishable and colorblind friendly; text and background colors must have enough contrast (https://color.adobe.com/create/color-contrast-analyzer).

- **Credit Slide and Watermarks, Permit #s, Logos, etc.**

Consult with your collaborating scientist(s) to ensure that you have properly listed all funding agencies and contributors. (e.g. USGS has very specific requirements for videos hosted on their site). On the right, a sample frame from the animation should show any and all required watermarks and logos (e.g. NMFS Permit # displayed for marine mammal research/data visualizations).

To check your color palette, go to https://color.adobe.com/. Press 'Extract Theme' and drag & drop a screenshot of the table above. Go to 'Accessibility Tools' and 'Color Blind Safe' and/or the 'Contrast Checker' to analyze your image.

ACTIVITY

Audience

- Think about your most challenging audience members and how you might go about reaching them.

Who is your audience?

Let's focus on your most challenging audience members:

THE SKEPTIC

Audience members who ***are opposed*** to your work.

What does this person think about?

What does this person care about?

THE OVERWHELMED

Audience members who ***do not understand*** the details of your work.

What does this person think about?

What does this person care about?

THE INDIFFERENT

Audience members who ***do not care*** about your work (yet).

What does this person think about:

What does this person care about?

Your hook should grab even your most difficult audience members' attention. Your methods and results should make sense to even your most general audience. Simplify your message enough to keep the attention of your ***overwhelmed or indifferent*** audience members, while convincing the ***skeptics***. At the end, appeal to something universal across your most difficult audience members' priorities (examples include: protecting nature, people, or livelihoods).

PART 5

CLOSING ACTIVITY

Scripts, Contracts, & Budgets

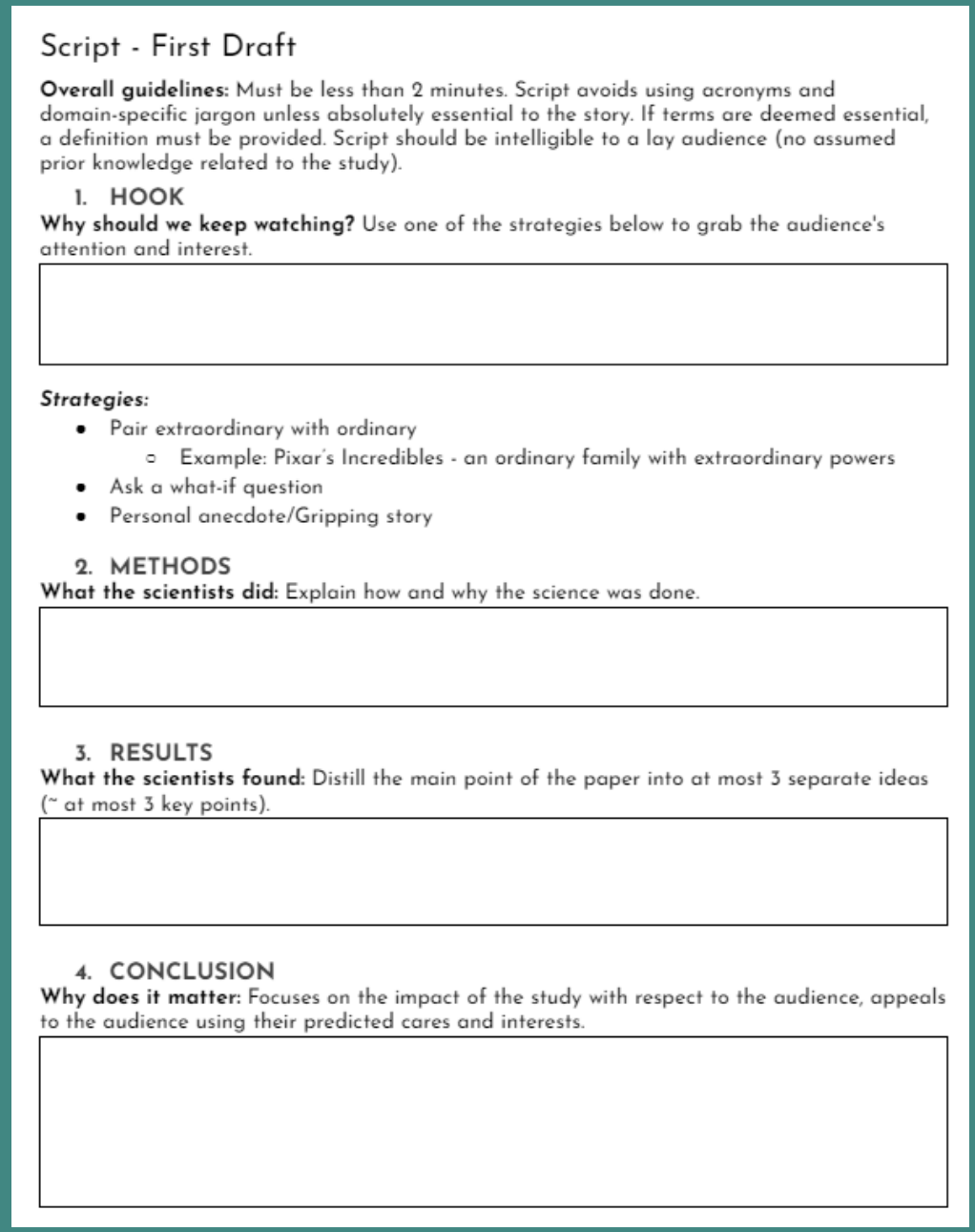
Distill the science & establish expectations - 20 min

CLOSING ACTIVITY

Script – First Draft

- Hook – why should we keep watching?
- Methods – what did the scientists do?
- Results – what did the scientists find?
- Conclusion – why does it matter?

Once you have a first draft, pair up, deliver your script, and review your partner's script with the peer-/self-assessment rubric at the end of the journal.



Script - First Draft

Overall guidelines: Must be less than 2 minutes. Script avoids using acronyms and domain-specific jargon unless absolutely essential to the story. If terms are deemed essential, a definition must be provided. Script should be intelligible to a lay audience (no assumed prior knowledge related to the study).

1. HOOK

Why should we keep watching? Use one of the strategies below to grab the audience's attention and interest.

Strategies:

- Pair extraordinary with ordinary
  - Example: Pixar's Incredibles - an ordinary family with extraordinary powers
- Ask a what-if question
- Personal anecdote/Gripping story

2. METHODS

What the scientists did: Explain how and why the science was done.

3. RESULTS

What the scientists found: Distill the main point of the paper into at most 3 separate ideas (~ at most 3 key points).

4. CONCLUSION

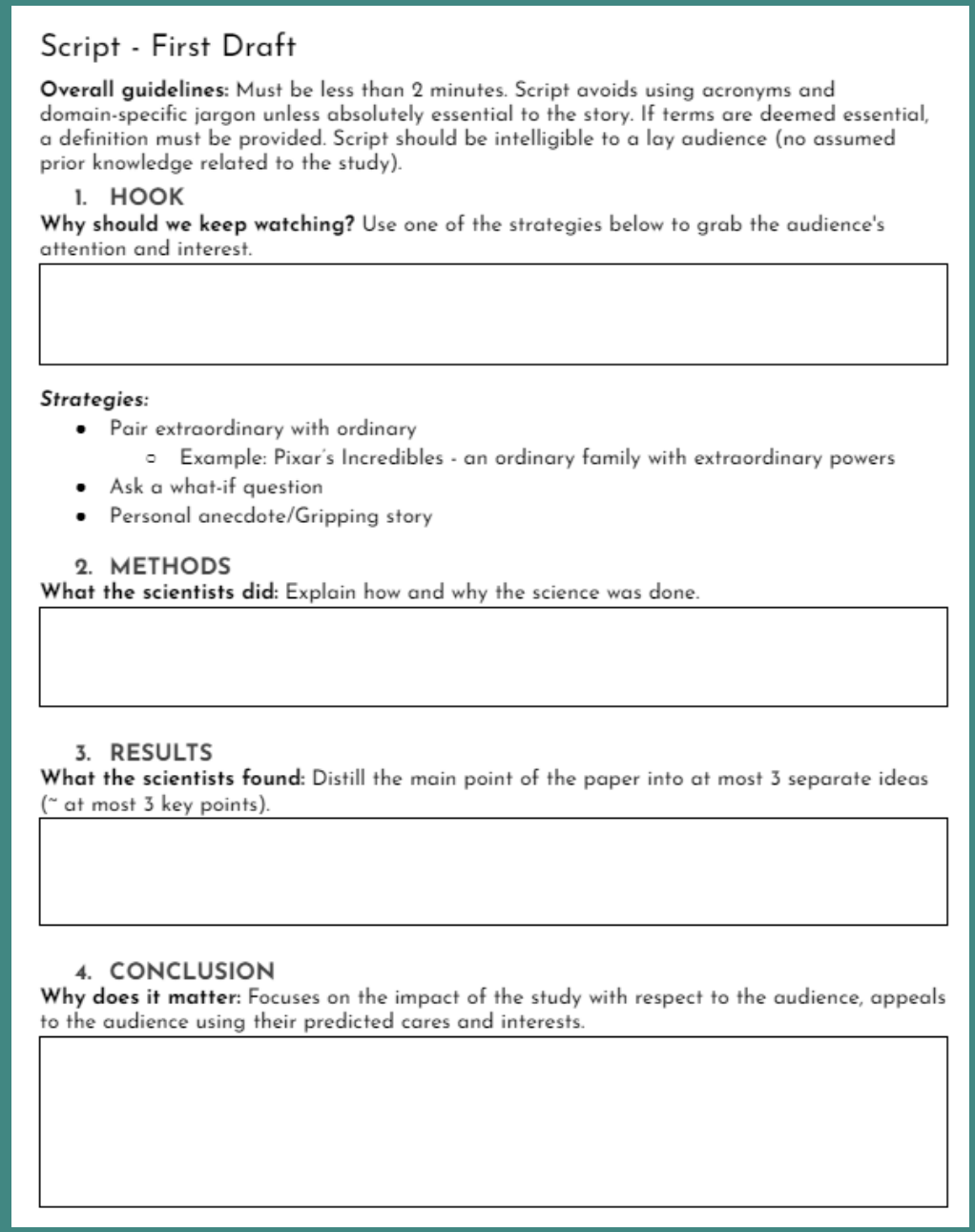
Why does it matter: Focuses on the impact of the study with respect to the audience, appeals to the audience using their predicted cares and interests.

CLOSING ACTIVITY

Script - Revised

- Revise your script according to your partner's feedback
- When ready, share it with your collaborating scientist for review & approval.

Once this revised draft is approved, you are ready for your homework assignment where you will record this script.



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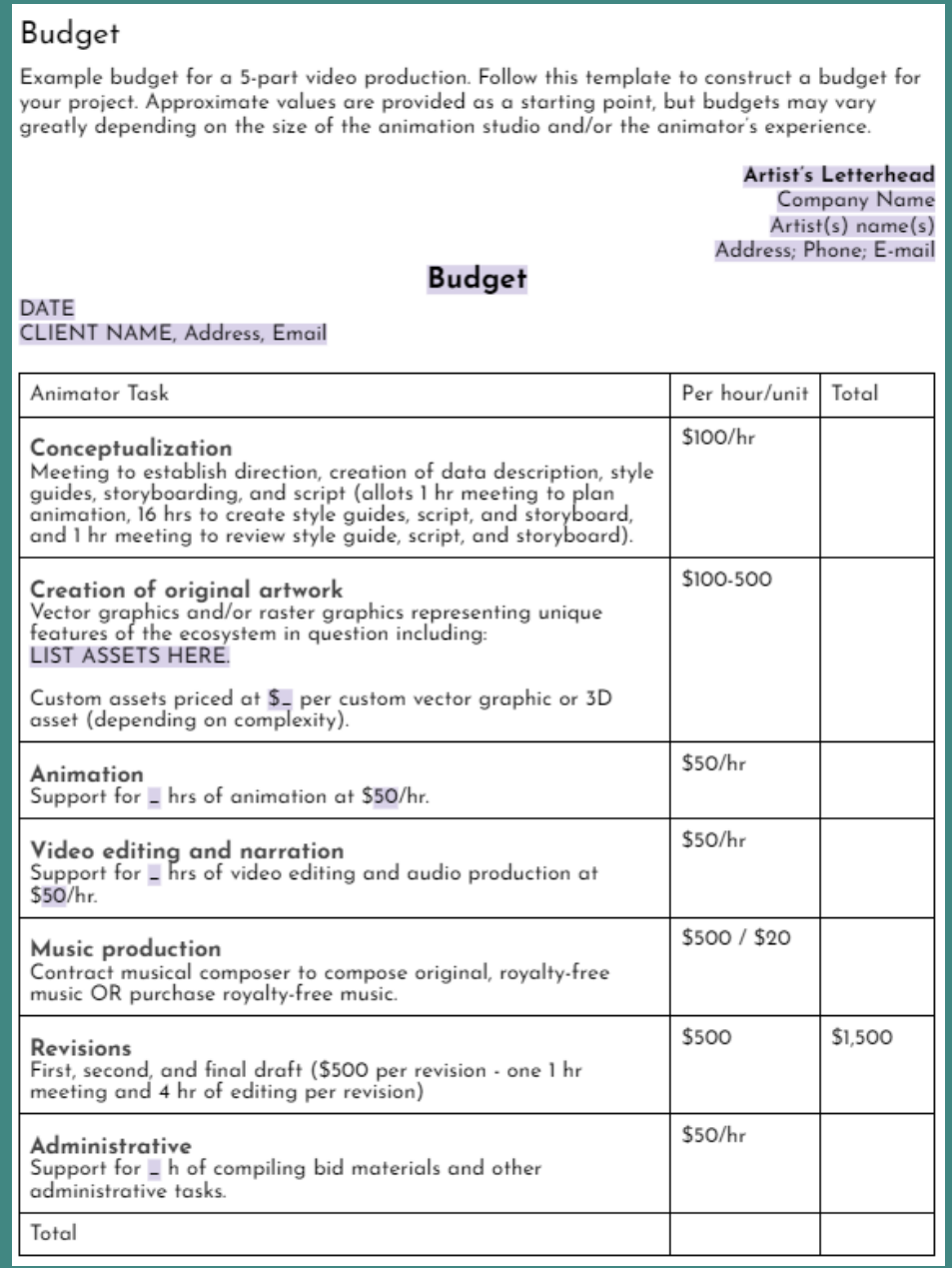
Why does it matter: Focuses on the impact of the study with respect to the audience, appeals to the audience using their predicted cares and interests.

CLOSING ACTIVITY

Budget

- Block out how much time you will put towards this project (using the course outline and any time you expect to put in after class).
- Sample budget provided in Animation Journal for reference.



Budget

Example budget for a 5-part video production. Follow this template to construct a budget for your project. Approximate values are provided as a starting point, but budgets may vary greatly depending on the size of the animation studio and/or the animator's experience.

Artist's Letterhead
Company Name
Artist(s) name(s)
Address; Phone; E-mail

Budget

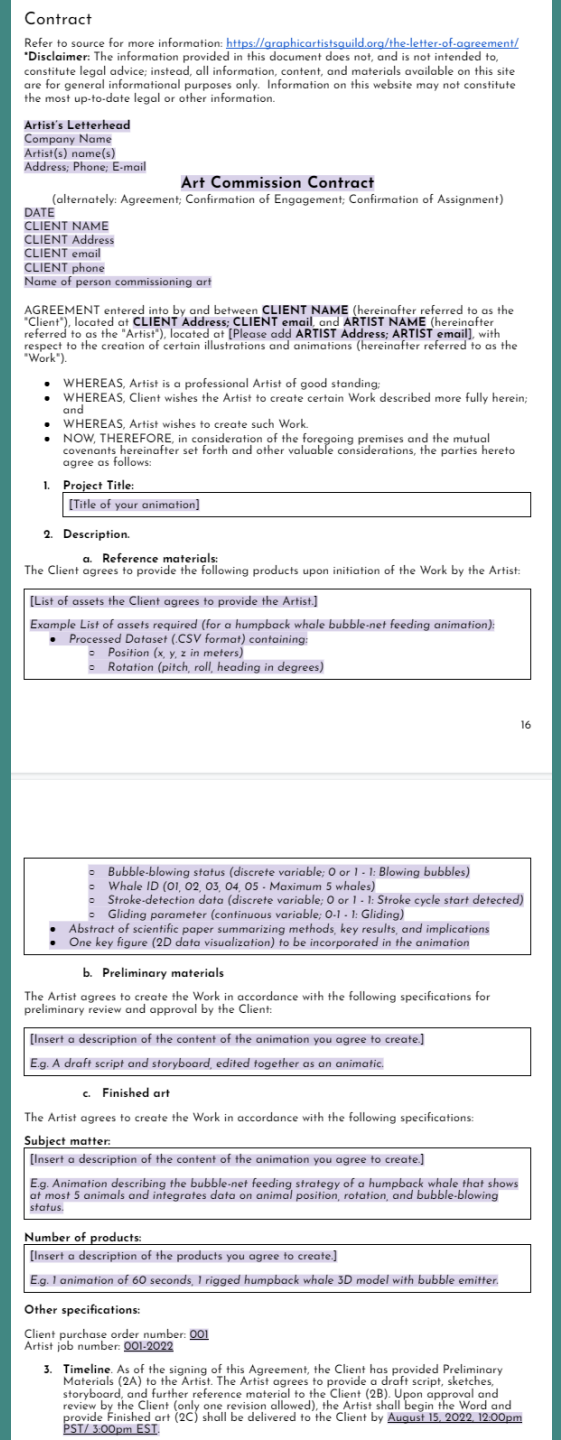
DATE
CLIENT NAME, Address, Email

Animator Task	Per hour/unit	Total
Conceptualization Meeting to establish direction, creation of data description, style guides, storyboarding, and script (allots 1 hr meeting to plan animation, 16 hrs to create style guides, script, and storyboard, and 1 hr meeting to review style guide, script, and storyboard).	$100/hr	
Creation of original artwork Vector graphics and/or raster graphics representing unique features of the ecosystem in question including: LIST ASSETS HERE. Custom assets priced at $_ per custom vector graphic or 3D asset (depending on complexity).	$100-500	
Animation Support for _ hrs of animation at $50/hr.	$50/hr	
Video editing and narration Support for _ hrs of video editing and audio production at $50/hr.	$50/hr	
Music production Contract musical composer to compose original, royalty-free music OR purchase royalty-free music.	$500 / $20	
Revisions First, second, and final draft ($500 per revision - one 1 hr meeting and 4 hr of editing per revision)	$500	$1,500
Administrative Support for _ h of compiling bid materials and other administrative tasks.	$50/hr	
Total		

CLOSING ACTIVITY

Contract

- Think of how you will work with your scientist and institute any rules to constrain the amount of work you agree to, how the work will be shared, etc.
- Be as explicit as possible and come up with a "backup plan". In case the science is never ready to be published, can the animation ever be used for anything? Restricted to educational uses?
- Example contract provided for reference.



Contract

Refer to source for more information: https://graphicartistsguild.org/the-letter-of-agreement/
***Disclaimer:** The information provided in this document does not, and is not intended to, constitute legal advice; instead, all information, content, and materials available on this site are for general informational purposes only. Information on this website may not constitute the most up-to-date legal or other information.

Artist's Letterhead
Company Name
Artist(s) name(s)
Address; Phone; E-mail

Art Commission Contract
(alternately: Agreement; Confirmation of Engagement; Confirmation of Assignment)
DATE
CLIENT NAME
CLIENT Address
CLIENT email
CLIENT phone
Name of person commissioning art

AGREEMENT entered into by and between **CLIENT NAME** (hereinafter referred to as the "Client"), located at **CLIENT Address; CLIENT email**, and **ARTIST NAME** (hereinafter referred to as the "Artist"), located at [Please add **ARTIST Address; ARTIST email**], with respect to the creation of certain illustrations and animations (hereinafter referred to as the "Work").

- WHEREAS, Artist is a professional Artist of good standing;
- WHEREAS, Client wishes the Artist to create certain Work described more fully herein; and
- WHEREAS, Artist wishes to create such Work.
- NOW, THEREFORE, in consideration of the foregoing premises and the mutual covenants hereinafter set forth and other valuable considerations, the parties hereto agree as follows:

1. **Project Title:**

[Title of your animation]

2. **Description.**

a. **Reference materials:**

The Client agrees to provide the following products upon initiation of the Work by the Artist:

[List of assets the Client agrees to provide the Artist.]

Example List of assets required (for a humpback whale bubble-net feeding animation):
- *Processed Dataset (.CSV format) containing:*
  - *Position (x, y, z in meters)*
  - *Rotation (pitch, roll, heading in degrees)*

16

  - *Bubble-blowing status (discrete variable; 0 or 1 - 1: Blowing bubbles)*
  - *Whale ID (01, 02, 03, 04, 05 - Maximum 5 whales)*
  - *Stroke-detection data (discrete variable; 0 or 1 - 1: Stroke cycle start detected)*
  - *Gliding parameter (continuous variable; 0-1 - 1: Gliding)*
- *Abstract of scientific paper summarizing methods, key results, and implications*
- *One key figure (2D data visualization) to be incorporated in the animation*

b. **Preliminary materials**

The Artist agrees to create the Work in accordance with the following specifications for preliminary review and approval by the Client:

[Insert a description of the content of the animation you agree to create.]

E.g. A draft script and storyboard, edited together as an animatic.

c. **Finished art**

The Artist agrees to create the Work in accordance with the following specifications:

Subject matter:

[Insert a description of the content of the animation you agree to create.]

E.g. Animation describing the bubble-net feeding strategy of a humpback whale that shows at most 5 animals and integrates data on animal position, rotation, and bubble-blowing status.

Number of products:

[Insert a description of the products you agree to create.]

E.g. 1 animation of 60 seconds, 1 rigged humpback whale 3D model with bubble emitter.

Other specifications:

Client purchase order number: 001
Artist job number: 001-2022

3. **Timeline.** As of the signing of this Agreement, the Client has provided Preliminary Materials (2A) to the Artist. The Artist agrees to provide a draft script, sketches, storyboard, and further reference material to the Client (2B). Upon approval and review by the Client (only one revision allowed), the Artist shall begin the Word and provide Finished art (2C) shall be delivered to the Client by August 15, 2022, 12:00pm PST/ 3:00pm EST.

CLOSING ACTIVITY

Script – Examples

- Hook – why should we keep watching?
- Methods – what did the scientists do?
- Results – what did the scientists find?
- Conclusion – why does it matter?

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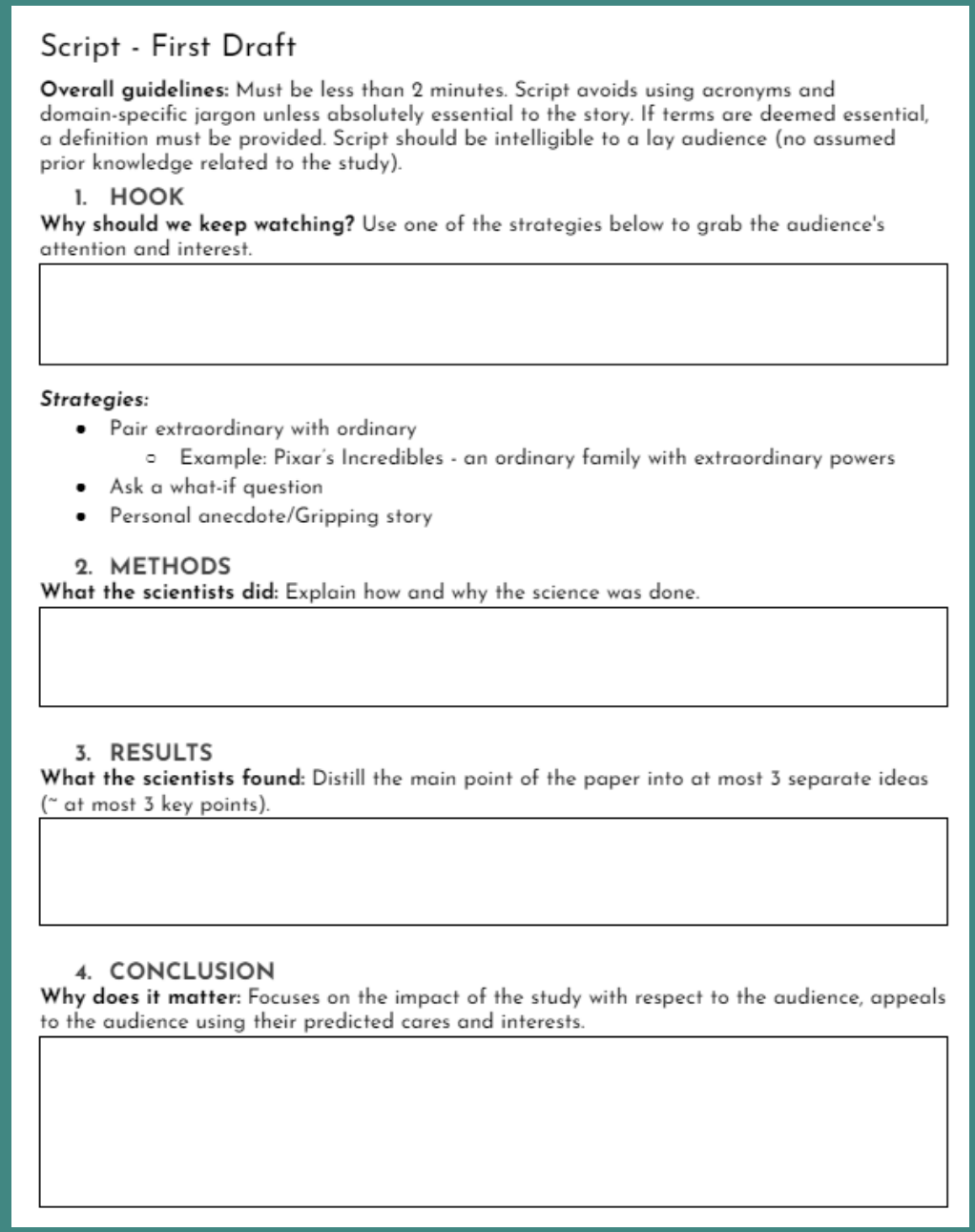

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4. CONCLUSION

Why does it matter: Focuses on the impact of the study with respect to the audience, appeals to the audience using their predicted cares and interests.

HOMEWORK

Organize your files

- Consider how you will want to organize your files and decide on a naming convention.
- I provide an example in the Animation Journal Google Doc.

File Organization

Before you start your project, you will want to organize your project. Here is a project organization strategy from my own experience.

File naming convention:
My strategy:
Job#_Nickname-ClientInitials_ProcessingStep_Description.ext

Job#: Unique ID for all my animation/freelance work
Nickname: Short name for project (this and your Job# combined will be the unique identifier)
Processing Step: A two digit identifier to match the step of your processing pipeline with other scripts and data for the project

E.g. '05_Narwhal-TW_00_August normal dive pre seis.csv'
This is my 5th animation job, about a narwhal for Terrie Williams and is a raw data file (Processing step 00) that the client provided. I've kept the original file name so that I can find the file in my email if I ever need to look back at what the client sent originally.

What is your unique job identifier (Job#_Nickname-ClientInitials)?

Folder structure:
My strategy:

Visualization

This is a root project directory where I tell my codes to start looking for fun things. For example, when using Maya, you will set your project this directory (see screenshot below).
Let's look inside:

> Data

Here is where I store my data, named in the format above.

> Scripts

Here is where I store my scripts and tools. I name these with the same processing step as the data files that are created as a result of the script.

> Assets

Here is where I store my animation assets. This could be anything from a .wav recording of a heartbeat, to a 2D vector graphic, to a 3D model or an animated seal cycle. You should think of these as the building blocks to create your scenes (next folder). I normally organize these in folders with unique names like:

- 2D_Vector-Graphics
- 2D_Background-Textures
- Emperor-Penguin_Rigged_External-Anatomy

Be specific with your names! It's incredible how many "Elephant Seal 3D Model"s one can end up with... :)
Generally, it is good practice to have a version number at the end. For example:
00_Asset-Description_V0001.ext

> Shots

Here is where I store my shots that reference different Assets.
Setting project directory in Maya:

HOMEWORK

Record your script

Once your scientist approves your script, style guide, contract, and budget, create a PDF version to upload. Then, record a high-quality audio recording (.mp3) of your script. It is possible to obtain high-quality audio even with relatively low-cost equipment. The key is: the recording environment is critical.

1. **Submit your Script, Style Guide, Contract, and Budget as a single PDF named 01_Script-StyleGuide-Budget-Contract_FirstName_LastName.mp3:**
    1. **To the shared Google Drive (in the** 🗀 01_Script-Recording_mp3 folder): https://drive.google.com/open?id=1nVBeRIbfALQWN6P1dbnQl4FVQ0Dg6518&authuser=jmkendal%40ucsc.edu&usp=drive_fs
    2. **Submit it in CANVAS** (under "Script Recording"): https://canvas.ucsc.edu/courses/54357/assignments/343531
2. **Upload your recording named 01_Script_FirstName_LastName.mp3:**
    3. **To the shared Google Drive (in the** 🗀 01_Script-Recording_mp3 folder): https://drive.google.com/open?id=1nSvHbTIFnBcgc1sCndZ4Y-FHoux5cZu0&authuser=jmkendal%40ucsc.edu&usp=drive_fs
    4. **Submit it in CANVAS** (under "Script Recording"): https://canvas.ucsc.edu/courses/54357/assignments/343526

Here are some tips to ensure your environment is conducive to recording high-quality audio (borrowed from USC Annenberg's Home Studio Recording Tips) :

Choosing a room

If you are setting up an interview or a more permanent recording space, here are a few things to keep in mind when choosing a location.

•One of the easiest home studios you can set up is throwing an oversized thick blanket over your head. This works well to isolate your voice and give the recording more warmth, but it may force you to hunch and squeeze your diaphragm and vocal chords. You can make it more stable by rigging it with some string or broom handles to help secure the blanket around a set position. Get creative. You can drape a blanket over a high dining room table or two barstools.

•Another great location is using a coat closet or walk-in closet where the hanging clothes and coats help absorb the sound.

Control the surfaces:

- Soft surfaces are your friend, hard surfaces are your enemy.

- Avoid tiled rooms or rooms with a lot of glass like the kitchens and bathrooms. Instead, choose smaller bedrooms or offices with carpets, bedding, window drapes.

- Choose a suitable surface. Avoid unstable surfaces or those that cause vibration.

Control the ambience

- Avoid TVs, traffic sounds, fans, AC, refrigerators.

- Be on alert for unexpected sounds like phones, dogs barking, loud machinery (like leaf blowers), ice makers, etc.

- Before you start recording, do the following:

- *o Turn off TVs, fans or air conditioning*
- *o Put your phone on silent*
- *o Put all smart devices on silent*
- *o Turn your computer sound down*
- *o Close all windows and doors*
- *o Let everyone in your location know you are recording*

PART 6

WORK TIME

40 min – Stop & break at 5:20 PM

BREAK

10 min - Return at 5:30 PM

DAY 1

GUEST SPEAKER

Distilling Complexity: Science through Story

Sara ElShafie, PhD

Founder & Principal, Science Through Story, LLC

Contact: sara@sciencethroughstory.org