Lecture 11
Table, Figure, and Effective Presentation

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Figures and tables matter!

Figures and tables convey facts, ideas, and relationships more clearly and concisely than descriptive text;

Figures and tables are one of the first part of a scientific paper that is reviewed by the editors and readers;

Quality of figures and tables plays a key role in determining whether a paper gets reviewed and accepted by the journal and whether a paper is read by a reader.

When do we use tables?

Tables are used only when data cannot be easily described in the text. if there are only few numbers or message conveyed by the table can be described easily in text, a table is unnecessary.

Table 16.2. Effect of temperature on growth of oak (*Quercus*) seedlings[a]

Temp (°C)	Growth in 48 h (mm)
−50	0
−40	0
−30	0
−20	0
−10	0
0	0
10	0
20	7
30	8
40	1
50	0
60	0
70	0
80	0
90	0
100	0

Table 16.4. Bacteriological failure rates

Nocillin	K Penicillin
5/35 (14)[a]	9/34 (26)

[a]Results expressed as number of failures/total, which is then converted to a percentage (within parentheses). $P = 0.21$.

Table 16.1. Effect of aeration on growth of *Streptomyces coelicolor*

Temp (°C)	No. of expt	Aeration of growth medium	Growth[a]
24	5	+[b]	78
24	5	−	0

Examples of unnecessary tables

Designing tables

Organize the table so that it is easy to read. For example, when the table intended for comparison, it is preferential to list them vertically.

Table 16.6. Characteristics of antibiotic-producing *Streptomyces*

Determination	S. fluoricolor	S. griseus	S. coelicolor	S. nocolor
Optimal growth temp (°C)	−10	24	28	92
Color of mycelium	Tan	Gray	Red	Purple
Antibiotic produced	Fluoricillinmycin	Streptomycin	Rholmondelay[a]	Nomycin
Yield of antibiotic (mg/ml)	4,108	78	2	0

[a]Pronounced "Rumley" by the British.

Table 16.7. Characteristics of antibiotic-producing *Streptomyces*

| Organism	Optimal growth temp (°C)	Color of mycelium	Antibiotic produced	Yield of antibiotic (mg/ml)
S. fluoricolor	−10	Tan	Fluoricillinmycin	4,108
S. griseus	24	Gray	Streptomycin	78
S. coelicolor	28	Red	Rholmondelay[a]	2
S. nocolor	92	Purple	Nomycin	0

[a]Where the flying fishes play.

Forms follow function

Choose a figure type based on data type and the intended message the figure conveys.
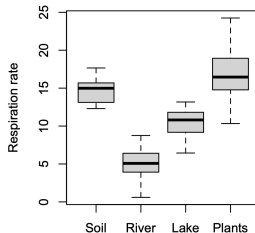

Histogram: show statistical distribution
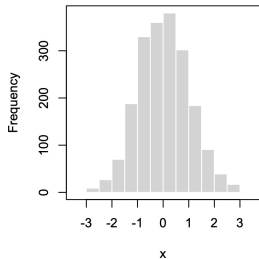
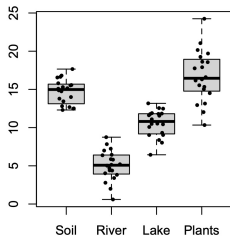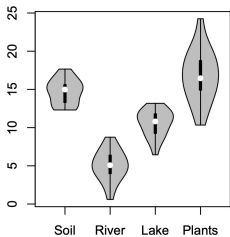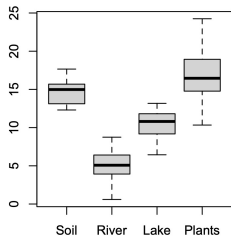Scatter plot: show bivariate relationship
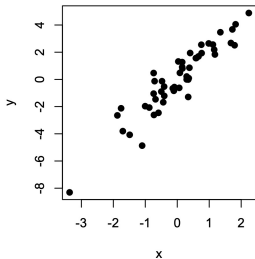
Boxplot: show comparison across categories
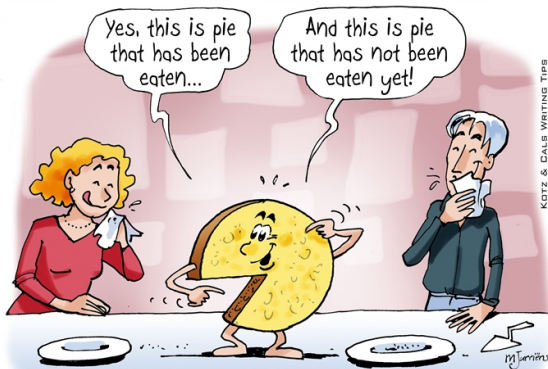
Make figures informative

It is often useful to show as much raw data as possible in the figure. Showing the raw data makes the paper more transparent. This is particularly useful when showing distribution of the data.

More information on raw data displayed

Figures should be self-contained

Figures should be self-explanatory. The readers should be able to understand the figure without reading the text.

Tip 7 – Tables and figures: make them self-explanatory!

Figures should be self-contained

Use legends and caption to make the table understandable by itself.

Fig. 1 Seasonal and annual variations in soil respiration (**a**), soil temperature at 5 cm depth (**b**), soil moisture at 5 cm depth and precipitation (**c**) in the in-situ warming experiment. Colored lines represent smoothed (7-days running mean) times series of soil respiration, soil temperature and moisture at 5 cm depth under control (blue) and warming (red) treatments. Times series of soil respiration and soil temperature also shown as colored areas between smoothed (7-days running mean) daily maximum and smoothed (7-days running mean) daily minimum values. The blank and shading periods represent growing seasons and non-growing seasons, respectively

(Wang et al 2021, Plant and Soil)

Address complexities

Combining multiple types of graphs in one figure could be an effective way to visualize different aspects of the data.
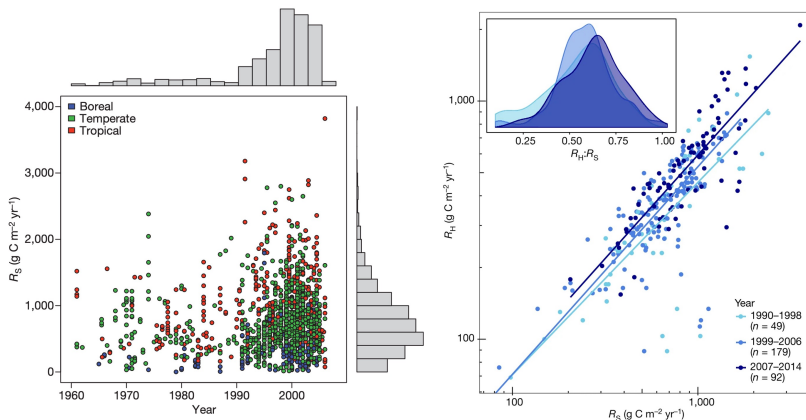
(Bond-Lamberty and Thompson 2010, Nature; Bond-Lamberty et al 2018, Nature)

Avoid redundancy

Visual elements in the figure should serve a purpose. Design elements that do not convey any meaning should be removed. For example, unnecessary color or lines can be removed from the figure.
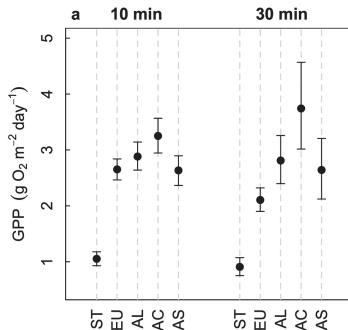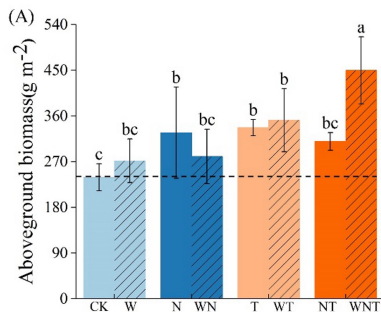
Figures with unnecessary color (left) or grid lines (right)

Avoid redundancy

Be cautious in using connecting lines. If there are no data between the dots, connecting lines may give the false impression that there are data in between.
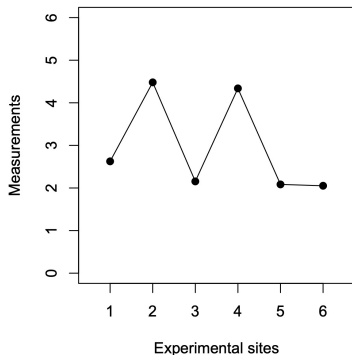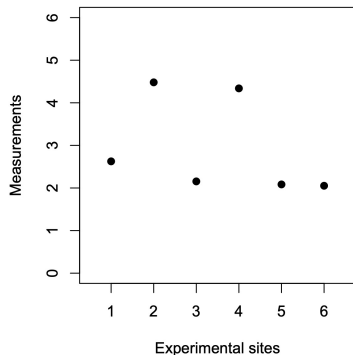
Typography

Serif fonts are commonly used for large blocks of text while sans serif fonts are used for titles, labels, and annotating figures. This becomes a convention because sans serif is more legible when printed in small size.

In figures, the common recommendation is to **use sans serif fonts**, i.e., Arial, Helvetica, etc

SERIF

SANS-SERIF

Aa

Aa

Color scheme should be chosen to reflect the nature of the data:

- **Sequential**: ordered data that progress from low to high;
- **Diverging**: equal emphasis on mid-range and extremes. Most effective when the class breaks at the middle;
- **Qualitative**: categories that do not imply differences in magnitude.
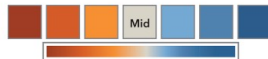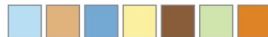
Color scheme

Other considerations when choosing color schemes:

- **Colorbind safe**: choosing a color scheme that does not confuse red-green color blindness;
- **Photocopy friendly**: choosing a color scheme that withstand black and while printing or photocopying. Divering scheme usually works well for black and while printing.

Use tools to help you choose a proper color scheme:

- https://colorbrewer2.org
- https://www.color-hex.com

Color scheme

Example: changing color scheme to make the figure colorblind friendly.
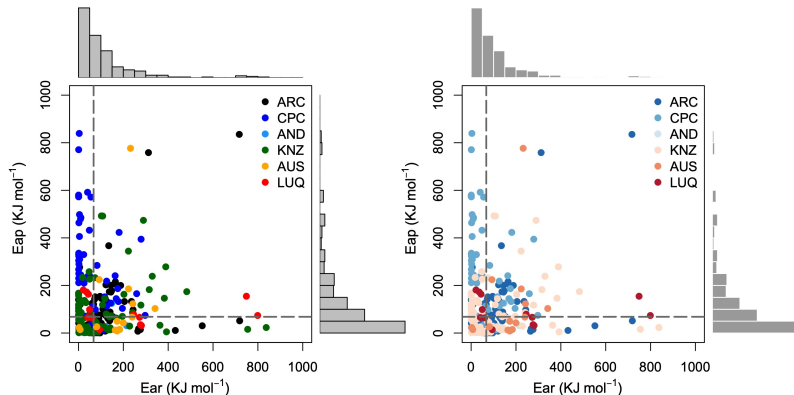
Cange the color scheme from one that is not colorblind friendly (left)
to a colorblind friendly scheme (right)

Graph quality

When submitting a paper, figures should have sufficient resolution for satisfactory publication quality.

- Line charts or scatter plots can be made as vector graphics. Vector graphics can be scaled up or down without losing any quality;
- Resolution of raster image should be at least 300 ppi;
- Pay attention to specific requirements from the journal.
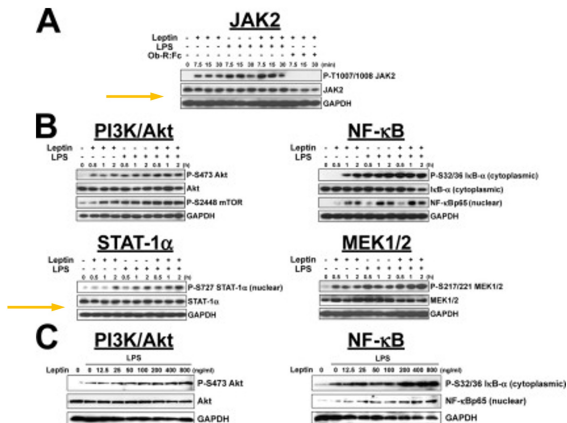
Avoid image manipulation

Inappropriate image due to duplication and manipulation is a major issue in many research fields.
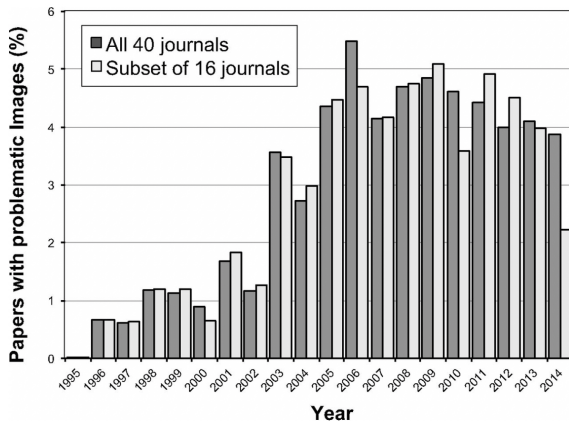
(Bik et al 2016, mBio)

Avoid image manipulation

Example: inappropriate and unexplainable image duplication led to the retraction of the paper.

(Lam et al 2007, Journal of Biological Chemistry, retracted)

Avoid image manipulation

When processing images, pay attention to the following points:

- Specific features within an image should not be enhanced, obscured, moved, removed or added;

- Adjustments to brightness or contract should apply equally across the entire image and to control;

- Excessive processing to emphasize one region of the image at the expense of others are inappropriate;

- Nonlinear adjustments or deleting portions of a recording must be disclosed in the figure legend or caption;

- Constructing figures from different gels, fields, exposures, and experimental series is discouraged. When this is necessary, the component parts of composite images should be indicated by dividing lines clearly demarcated and described in the figure.

Presentation is storytelling

An effective presentation tells a story that attracts the audience. It is usually composed of the following parts:

- **Background**: introduce background, highlight research questions;
- **Results**/**discussions**: main body of presentation; can be divided based on different parts of the work to be presented
- **Conclusions**: succinct take-home messages; need to directly address research questions.

Presentation needs a hook

Each presentation should have a hook – a central question/theory – that goes through the entire presentation.

Having a **central diagram** and using it repeatedly throughout the presentation helps keep the audience on the hook.
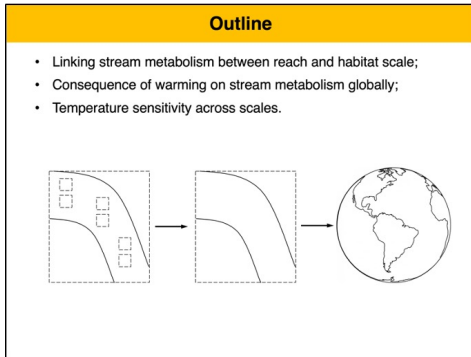
An example of a central diagram in presentation. This diagram is for a talk on how carbon flux changes with spatial scales.

An outline may help

An outline along with a central diagram can help audience understand the structure and follow you during the talk;

Avoid uninformative outlines. They add very little, if anything, to the talk.
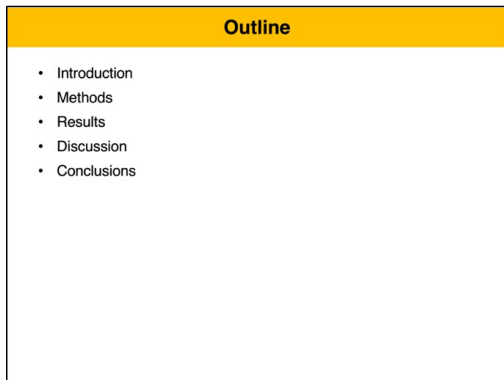
An outline that contains generic section names is not informative.

Combine text with a central diagram makes the talk outline much more appealing and engaging.
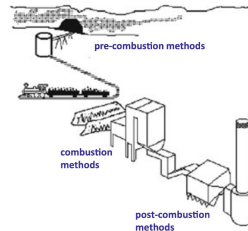
Compared to pure text outline, a diagram with text
makes the outline easier to follow.

Keep your audience on the hook

Throughout the presentation, come back repeatedly to the central diagram and remind the audience where you are on that diagram, this helps you keep the audience with you.
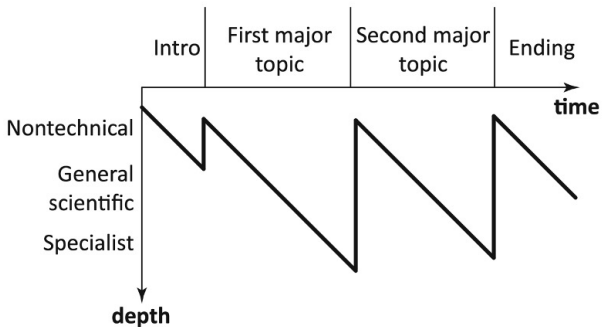
(Alley 2013, The Craft of Scientific Presentation)

Layout and design

Keep the design elements, such as the background, font, color etc., consistent throughout the presentation.

Flat minimalist design usually works better for academic talk than lots of shade, shadow, glow, reflection.

Animation or transition effects often do not add anything to the substance of a scientific presentation. Thus my opinion is that we usually do not use them.

Title slide

The title slide should contain the basic information of the talk, such as the title, author names, afflications, and date.

Title slide can use art or photo relevant to the topic of the talk. Title can also contain institution logos or similar elements.
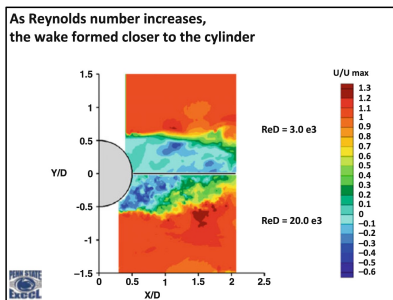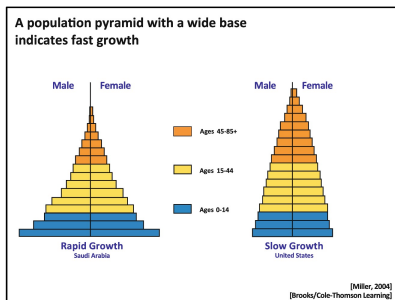

Pictures can help make the title slide more engaging)

Layout and design

Each slide should convey a clear message. Slide title can be used for that.

A slide should not be too crowded. Use figures and tables to present. Avoid putting too many words on a single slide.

Example of concise and effective slide design.

Layout and design

Avoid using picture as the background. It makes text hard to read. If you must, change the color saturation and transparency to make text legible.

Presenting figures

A few suggestions on presenting figures:

- Figures should be large enough to be legible;
- Explain what the axes are and what the figure shows;
- Do not put too many figures in one slide;
- Highlight the important part of the figure if necessary;
- For complex figures, step through it in sequence.
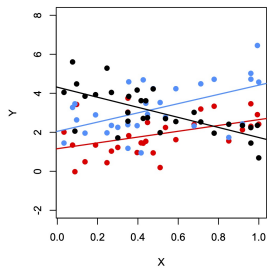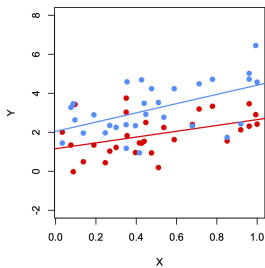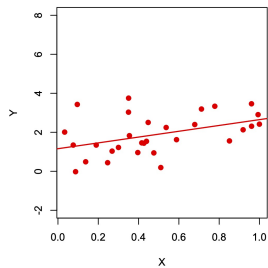
Step through complex figures sequentially instead of show it all at once.

Use graphic illustration

Use illustrative figures instead of text whenever possible. Illustration is easier and more intuitive to see and understand than text.
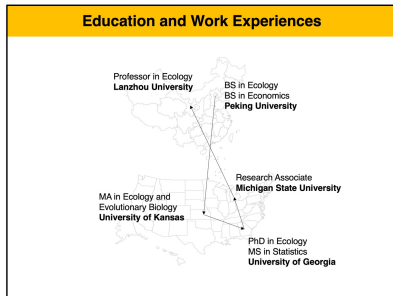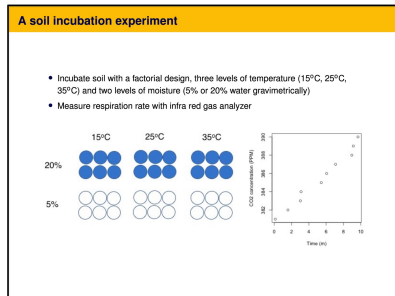
Example: use illustrative figures to show experimental design or education experiences.

Text

A few tips on using texts in presentation:

- Avoid large block of text as they are hard to read and distract the audience. Use short phrases instead;

- Try to limit text blocks to 2–3 lines;

- When presenting large block of texts or bullet points, let them in the slides one by one;

- Ensure that the text is large enough to be legible by the audience;

- Capitalize the first word.

Effective delivery of a presentation

A few tips for effectively delivering a presentation:

- Preparation in advance is the key to a smooth delivery;

- Presentation is a performance, show your enthusiasms;

- Do not recite or read notes. Only write key pieces of information for reference. This helps you speak more naturally during the presentation.

- Do not overuse laser pointer.

- Avoid filler words or other similar bad speaking habit.