Lecture 25
How to present

Slides/content credit:
• MIT 6.UAT, Tony Eng
• Aiora Zabala UK cancer research
• Microsoft Research
How to present

1. Figures

2. Paper organization

3. Presentation
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>4-week course</th>
<th>Topic</th>
<th>Lec</th>
<th>Read*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mon, Jul 15</td>
<td>Day 1</td>
<td>Intro Bio Algos ML</td>
<td>L1</td>
<td>Ch1</td>
</tr>
<tr>
<td></td>
<td>Mon, Jul 15</td>
<td>Day 2</td>
<td>Algos Alignment DynProg BLAST</td>
<td>L2</td>
<td>Ch2,3</td>
</tr>
<tr>
<td></td>
<td>Tue, Jul 16</td>
<td>Day 3</td>
<td>Prob Bayes HMM</td>
<td>L3</td>
<td>Ch3</td>
</tr>
<tr>
<td></td>
<td>Wed, Jul 17</td>
<td>Day 4</td>
<td>Trees Phylogenies</td>
<td>L4</td>
<td>Ch7,8</td>
</tr>
<tr>
<td></td>
<td>Thu, Jul 18</td>
<td>Day 5</td>
<td>Comparative Genomics Assembly</td>
<td>L5</td>
<td>Ch7,8</td>
</tr>
<tr>
<td></td>
<td>Fri, Jul 19</td>
<td>Day 6</td>
<td>ML Clustering Classification Expression</td>
<td>L6</td>
<td>Ch15,16</td>
</tr>
<tr>
<td></td>
<td>Tue, Jul 23</td>
<td>Day 7</td>
<td>Epigenomics 3Dgenome</td>
<td>L7</td>
<td>Ch19</td>
</tr>
<tr>
<td></td>
<td>Wed, Jul 24</td>
<td>Day 8</td>
<td>Motifs EM Gibbs Sampling MCMC</td>
<td>L8</td>
<td>Ch19</td>
</tr>
<tr>
<td></td>
<td>Thu, Jul 25</td>
<td>Day 9</td>
<td>Deep Learning</td>
<td>L9</td>
<td>Ch22</td>
</tr>
<tr>
<td></td>
<td>Fri, Jul 26</td>
<td>Day 10</td>
<td>SNPs, Haplotypes, GWAS</td>
<td>L10</td>
<td>Ch31</td>
</tr>
<tr>
<td>2</td>
<td>Mon, Jul 29</td>
<td>Day 11</td>
<td>Mediation, eQTLs, Pop Gen, Htistory</td>
<td>L11</td>
<td>Ch20,21</td>
</tr>
<tr>
<td></td>
<td>Tue, Jul 30</td>
<td>Day 12</td>
<td>Polygenicity, EHRs, Heritability</td>
<td>L12</td>
<td>Ch20,7</td>
</tr>
<tr>
<td></td>
<td>Wed, Jul 31</td>
<td>Day 13</td>
<td>Single Cell Genomics</td>
<td>L13</td>
<td>Ch30</td>
</tr>
<tr>
<td></td>
<td>Thu, Aug 1</td>
<td>Day 14</td>
<td>Cancer Genomics</td>
<td>L14</td>
<td>Ch35</td>
</tr>
<tr>
<td></td>
<td>Fri, Aug 2</td>
<td>Day 15</td>
<td>Genome Engineering</td>
<td>L15</td>
<td>Ch36</td>
</tr>
</tbody>
</table>
Designing more effective scientific figures

Aiora Zabala
PhD Environment. VTP Graphic Design
az296, aiora.zabala@gmail.com
Structure of this course

THEORY

Morning
1. Why figure design?
   - Principles of figure design
   - Elements of a figure
   - Colour & ethics

Afternoon
3. Dealing with complexity
   - Choosing the right figure
   - Typography
   - Composition & layout

PRACTICAL

2. Gimp – bitmap (e.g. jpeg)
   - Setting up a canvas
   - Layers and importing files
   - Editing colour
   - Export formats and qualities

4. Inkscape – vectorial (e.g. pdf)
   - Document properties
   - Create & manipulate objects
   - Composition
   - Import & export for publication
Key ingredients: the tools

Elements: marks and channels
- Data
- Points, lines, areas
- Colour
- Typography

Composition
- Grid and alignments
- Balance
- Hierarchy and focus
**Marks** (geometric primitives): used to represent data

**Channels** control the graphical appearance of marks: used to encode data, can be combined

Images from Munzner
Types of channel

Identity channels: categorical/qualitative attributes

- Position on common scale
- Length (1D size)
- Tilt/angle
- Area (2D size)
- Color luminance
- Color saturation
- Curvature
- Volume (3D size)

Magnitude channels: ordered/quantitative attributes

- Spatial region
- Color hue
- Shape

Images from Munzner
Types of channel (continued)

Rolandi et al 2011
Effectiveness of each channel: Quantitation perception

The perceived magnitude of sensory channels follows a power law: $S = I^N$

Depending on the $N$ of a given type of sensation, its perception is magnified (e.g. colour saturation) or compressed (e.g. brightness)

Image from Munzner 2015
Choosing the type of figure

- Text, table or figure?
  - Text: one or two numbers
  - Table:
    - Exact numerical values
    - Small datasets (a figure may be best avoided if it has low data density)
    - When the data presentation requires many localised comparisons

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment 1</td>
<td>0.01</td>
</tr>
<tr>
<td>Treatment 2</td>
<td>0.13</td>
</tr>
<tr>
<td>Treatment 3</td>
<td>0.30</td>
</tr>
</tbody>
</table>
Things you can illustrate

- Relationship
- Comparison
- Composition
- Distribution
Each figure tells a different story.
Each figure tells a story differently.
Stripchart – comparison

- Only one of the axis is meaningful
- To explore small datasets \((n < 100)\) and compare categories
- The most basic plot (rarely in publications)
Line chart – relationships

- To show a trend of **continuous** data (usually over time)
- For matched, paired or repeated data, and for time-series
- To tell a story: how data change, rather than the discrete values of the data

*Carter 2013*
Bar chart – comparison

• To compare discrete quantities of non-continuous data

For presenting results and emphasise differences (not so much to explore)

Carter 2013
Bar chart – comparison

The choice of the x axis and of point of reference can affect how comparisons are perceived.
Bar chart variations

Stacked bar chart

Normalised stacked bar chart

- For categorical data; heed the sample size
Pie chart – composition/proportion

- To show relative proportions of a whole
- Not a great idea, ‘given their low data-density and failure to order numbers along a visual dimension’ (Tufte)

Alternative:

Polar area chart

Wickham, 2010
Bar chart alternative for comparisons: Dotchart with confidence intervals

- Focuses attention on the relative values and their measure of variability, rather than on the absolute values
  (absolute values are better conveyed using the heights – in a barplot)
Histogram – distribution

- To show the distribution of a variable and the relative frequency of values; to explore the data
- Better on big datasets
- Estimate of the probability distribution of the variable
- The number of bins (resolution) affects the perceived shape of the distribution; the same perceptive distortion can occur when using histograms with discrete data
- Rules: Number of intervals $\approx \sqrt{N}$ and Interval width $\approx \text{Range} \div \sqrt{N}$
Boxplot – distribution

- Also box-and-whisker plot
- Shows the central value, the extremes, and the area where 50% of the values are located.
  - Usually median, minimum, maximum, lowest and highest quartiles
- Particularly useful to understand distribution of not-normal data
Boxplot variation: Violin/Bean plots

- To the above, it adds a stripchart of the actual datapoints
- Shows the data density
- To understand the distribution in more detail

A bean = a ‘batch’ of data

Stripchart shows individual data

Data density mirrored by the shape of the polygon

Image from Babraham Bioinformatics
Scatterplot – relationships

To show the relationship between two continuous variables
Scatterplot – relationships

For high-density data: use colours or transparency

Problem: very big dataset

Solution: smoothed densities colour representation
Scatterplot variations

Bubble scatterplot
It adds a 3rd dimension (but only for small datasets)
Scatterplot variations

Scatterplot matrix (correlogram)
Useful to explore bivariate associations in a large dataset

Built using corrgram package for R
**Heatmap – relationship**

- Shows more complex relationships, e.g. many conditions
- **Steps:** normalisation, clustering
- **Representation:** colouring, filtering

*Babraham Bioinformatics*
Heatmap

A heatmap is basically a table that has colours in place of numbers.
Heatmap

Colour scheme for grouping: **Clustering** (done usually via Euclidean distances – differences between values)
Heatmaps are great but:
- Careful with clustering
- Plot data that are changing

Remove unchanging points to focus on differences
Maps (a very quick look)

Information shown over maps has great communication power
Maps (a very quick look)

But they are also highly prone to distortions and to biasing perceptions
Maps (a very quick look)

What is the message you want to emphasise?

Geographical distribution? □
Proportions? □
Chart Suggestions—A Thought-Starter

Comparison

What would you like to show?

Relationship

Distribution

Composition

www.ExtremePresentation.com
© 2009 A. Abela — a.abela@gmail.com
## Summary

<table>
<thead>
<tr>
<th>Plot</th>
<th>Aim</th>
<th>Main R function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stripchart</td>
<td>distribution</td>
<td>stripchart()</td>
</tr>
<tr>
<td>Line chart</td>
<td>relationships</td>
<td>plot(type=&quot;l&quot;)</td>
</tr>
<tr>
<td>Bar chart (stacked, norm. stacked)</td>
<td>comparison (and composition)</td>
<td>barplot()</td>
</tr>
<tr>
<td>Dotchart with CI</td>
<td>comparison</td>
<td>dotchart()</td>
</tr>
<tr>
<td>Histogram</td>
<td>distribution</td>
<td>hist()</td>
</tr>
<tr>
<td>Boxplot (violin/ bean)</td>
<td>distribution</td>
<td>boxplot(), vioplot()</td>
</tr>
<tr>
<td>Scatterplot (correlogram)</td>
<td>relationships</td>
<td>plot(x, y), corrgram package</td>
</tr>
<tr>
<td>Pie chart</td>
<td>composition</td>
<td>pie()</td>
</tr>
<tr>
<td>Heatmap</td>
<td>relationship</td>
<td>heatmap()</td>
</tr>
</tbody>
</table>
Dealing with complexity

- To focus the viewer’s attention onto the main point you want to convey (e.g. on specific subsets of data)
- To require less cognitive load for the viewer to understand the message
Grouping
Ordering (only for categories)
Filter, link, embed

McInerny & Krzywinski 2015
Small multiples
Small multiples
Small multiples

McInerny & Krzywinski 2015
• All the elements need to be labelled

• The essential criteria for choosing fonts is **readability**:
  - **Scalability** (readable at small sizes)
  - **Contrast** with the background

• Fonts convey a personality, mood or attitude (some more than others)
Typography

- **Serif** for large blocks of text, **sans-serif** for titles, labels and annotating figures
  - Sans-serif is easier to read at smaller sizes

**Sizing**: the size of fonts is given in points, and it’s the size of an imaginary block of metal that is used in printing.
  - In practice, the only way to know exactly how well your font will be read is to print.
Typography

- **Monospace** is good for code, or for text intended to be aligned from line to line (e.g. pseudo-tables)
  \[ g. \quad m \textrm{ vs } m; \quad i \textrm{ vs } i \]

- **Casing**:
  - UPPERCASE,
  - lowercase,
  - Sentence case,
  - Title Case.

- Check the journal guidelines for font types

---

Monospace font keeps the alignments tidy. (this is monospace!)

Monospace font keeps the alignments tidy. (not monospace font)

Each of the lines above has 20 characters.
Avoid aspect-ratio distortions: changing font height or size.

- The same applies to images and circular objects
- Scale axes using comparable units
Typography: Guidelines

Minimise text; keep it simple
Typography: Typesetting

- Is the arrangement (spacing) of characters in words, lines or paragraphs
  - **Tracking**: space between characters
  - **Leading**: line height
  - **Paragraph alignment**: left, justified, etc.
- Important considerations where figures have many annotations, and in axis and figure titles.
Typography: **Guidelines**

- **Avoid colour** in text, particularly in figures (to maximise contrast)
- **Do not tilt** text, always horizontal (or vertical)
- Check **scalability**: text should be readable after resizing

✔ Typeset in blocks of text that are **solid shapes**

❌ Avoid typeset in blocks of text that are not **solid shapes**
Typography:

Heed the numbers in your font

- Each font has different styles of numbers
- Make sure that the font you choose distinguishes them well (e.g. I in *Gill Sans*) and is legible at small sizes
Typography:

Think your words carefully

- Avoid wordiness… it’s a figure!
- Choose words that “precisely convey what you mean”
- Avoid contractions and spell out whenever possible
Composition and layout

- Draft
  - Grid and alignments
  - Balance and hierarchy
Composition and layout

- Have an idea of what your final figure will look like
  - What message are you trying to convey?
  - How does each figure contribute to that message?
  - Identify what is essential (Supporting Information)
- Outlines can reduce time spent moving or resizing images
Grids

- Grids are the invisible structure behind a composition that makes it look balanced.
- Every alignment (of a box, column, text line and text margin) creates a visual line in the grid.
- Conversely, a composition where elements are aligned to a grid creates a sense of balance.

Grids can help to organize the spaces around and in-between elements. *Rolandi et al 2011*
Alignments
Alignments

Use tools to align objects, don’t do it by eye!

Most programmes have tools for automatic alignment and to distribute objects with equal space.
Using grids
Visual balance and hierarchy

The composition of a graphic object and the **emphasis** on each element will determine what is the **hierarchy between elements**, and how the eye will **flow** and where it will **focus**

Keep a balance between **white space**, text and figures

**Visual weight/ emphasis:**

- How much an object on the page attracts and retains the attention of your viewer Depends on size, colour, position, etc.
- Should match the relevance of the information

These are some questions you can make to assess visual balance and flow: *Is there a clear (and justified) hierarchy or arrangement between elements? Can adjustments be made to make more relevant connections? Does the place feel cluttered/scattered?* (Krause, 2004)
Visual weight and balance

**Visual weight:** A measure of how much an object on the page attracts and retains the attention of your viewer.

In the left figure, the black diamond and, to a lesser extent, the circle stand out *(is this our intention?)*.

There is also little separation between the charts, which makes the figure look cluttered.
YOU FOCUSED ON THIS FIRST

YOU FOCUSED ON THIS SECOND
Visual weight and balance

**Visual weight:** A measure of how much an object on the page attracts and retains the attention of your viewer.

Can help to guide the viewer’s eye through the figure.
Use of white space
General tips

Don’t-s:

- Don’t distort the data
- No unnecessary figures or elements: do we really need a figure? or a table would suffice?
- Don’t rely absolutely on colour
- No 3D: in most cases it distorts perception

Do-s:

- One point per figure
- Summarise to clarify
- Have a clear purpose/message
- Link to accompanying text and statistics
Can you find ten ways to improve this figure?

Work in progress...
Work in progress...
Is your figure effective?

- The figure is **self contained**: understandable without additional information
- Every element is **labelled** or explained in the caption, including x and y units
- x and y axis: **scales** show appropriate variation of the data, or are comparable
- **Readability** and **contrast** are appropriate
- Every use of **colour** has a reason
- The figure works in **grayscale** (except for very complex figures)
- If there are **groupings**, they help understand the message without manipulating
- There are no channel **inconsistencies** within the figure
- It is as **simple** as possible: i.e. no decorations, every piece that could be eliminated without losing information has been eliminated
- Has been **validated** with other people…
Data Visualisation Process

1. Collect Raw Data
2. Process and Filter Data
3. Clean Dataset
4. Generate Exploration Analysis & Visualisation
5. Draft figure for Illustrative visualisation (e.g. by hand)
6. Produce raw figure (e.g. in R or Excel)
7. Edit design details (e.g. in Inkscape)
8. Export as a journal-ready figure
9. Share it with peers
Validation

- Always try to validate plots you create
- You have seen your data too often to get an unbiased view
- Show the plot to someone not familiar with the data
  - What does this plot tell you?
  - Is this the message you wanted to convey?
  - If they pick multiple points, do they choose the most important one first?
Not covered in this session

Diagram
- Define the purpose: essential elements to depict and their relation.
- Draft the structure of the diagram by hand, share and discuss it.
- Use grids and think carefully about the label choice and position.
- Types: Venn diagrams (composition of datasets), flowcharts (for decision making processes), tree diagrams, timelines, networks, pathways, procedural diagrams.

Remember: the key “is not the quality of the diagram or drawing, but the clarity of the information.” Carter p128

Photo
- Avoid unethical manipulation (deleting noise, etc.), even if it doesn’t change the results.
- Crop to emphasize important bits. Rule of thirds.
- Use good quality images (sufficient resolution and colour/brightness settings).
- Format differences: JPEG, TIFF, GIF, PNG. Resolution, Cropping, and image composition.
- Image size and proportions.
- In context: contrast and relation with surrounding content.
- Check license for use.
Some useful resources

- **Short papers**

- **Design for scientists/data**
  - Carter. 2013. Designing science presentations – *not just for figures*, very clear
  - Munzner. 2014. Visualization, analysis and design
    - from a computer-graphics perspective
  - Tufte. 2001. The visual display of quantitative information
    - from a theory-of-design perspective
    - advanced information visualizations (maps, time-space, flows)
  - Meirelles. 2013. Design for information

- Graphic design more generally:
  - Krause. 2004. Design basics index – very concise and to the point
  - Samara. 2014. Design elements: a graphic design manual –

- **Nature Points of View**
  - [blog](http://blogs.nature.com/methagora/2013/07/data-visualization-points-of-view.html)

If you need additional references, help or want to collaborate: aiora.zabala@gmail.com
Labeling your axes

“Count”

• ➔ Number of enhancers
• ➔ Number of enhancers showing differential enrichment

“-log_{10} P-value”

➔ -log_{10} P-value (association is random)
➔ T2D association

(-log_{10} P-value)
Labeling your axes
Region tiled: chr16:12,707,145-12,707,529 (hg19), selected in HepG2, high dip score

Normalized MPRA reporter expression measurement for each barcode (HepG2)

DNA sequence and HNF4 motif

Tile #4

Tile #5

48 barcode measurements (24 in each replicate, see panel d)

48 barcode measurements (24 in each replicate, see panel)

30 bp unique to #4

115 bp common between #4 and #5

30 bp unique to #5

TTGTCAATTTCAATGAAATGTTTGTAAATTATTAGATGAAAAGTC, CGGACA

HNF4 motif (known 1, rev)
How to present

1. Figures

2. Paper organization

3. Presentation
1. When to write:

→ early!

- Writing papers: mechanism for doing research (not just reporting research)

Forces us to be clear, focused
Crystallises what we don’t understand
Opens the way to dialogue with others: reality check, critique, and collaboration
2. The idea

Idea:
A re-usable insight, useful to the reader

• Your paper should have just one “ping”: one clear, sharp idea
• You may not know exactly what the ping is when you start writing; but you must know when you finish
• If you have lots of ideas, write lots of papers
• Many papers contain good ideas, but do not distil what they are.
• Make certain that the reader is in no doubt what the idea is. Be 100% explicit:
  • “The main idea of this paper is....”
  • “In this section we present the main contribution(s) of the paper.”
Whiteboard:
1. Problem
2. It’s interesting
3. It’s unsolved
4. Here is my idea
5. My idea works (details, data)
6. Here’s how my idea compares to other people’s approaches

Paper:
1. Title (1000 readers)
2. Abstract (4 sentences, 100 readers)
3. Introduction (1 page, 100 readers)
4. The problem (1 page, 10 readers)
5. My idea (2 pages, 10 readers)
6. The details (5 pages, 3 readers)
7. Why it’s better than related work
8. Conclusions and further work (0.5 pages)
Intuition is paramount!

- Explain it as if you were speaking to someone using a whiteboard
- Conveying the intuition is primary, not secondary
- Once your reader has the intuition, she can follow the details (but not vice versa)
- Even if she skips the details, she still takes away something valuable

- Introduce the problem, and your idea, using EXAMPLES and only then present the general case
• Do not recapitulate your personal journey of discovery. This route may be soaked with your blood, but that is not interesting to the reader.

• Instead, choose the most direct route to the idea.
Get others to read your paper

- Experts are good
- Non-experts are also very good
- Each reader can only read your paper for the first time once! So use them carefully
- Explain carefully what you want ("I got lost here" is much more important than "Jarva is mis-spelt").

Get your paper read by as many friendly folks as possible
• A good plan: when you think you are done, send the draft to the competition saying “could you help me ensure that I describe your work fairly?”.
• Often they will respond with helpful critique (they are interested in the area)
• They are likely to be your referees anyway, so getting their comments or criticism up front is Jolly Good.
Incorporate feedback

• Read every criticism as a positive suggestion for something you could explain more clearly
• DO NOT respond “you stupid person, I meant X”.
• INSTEAD: fix the paper so that X is apparent even to the stupidest reader.
• Thank them warmly. They have given up their time for you.
Summary

1. Don’t wait: write
2. Identify your key idea
3. Tell a story
4. Nail your contributions
5. Related work: later
6. Put your readers first (examples)
7. Listen to your readers

From:
www.microsoft.com/research/people/simonpj
Use the active voice

The passive voice is “respectable” but it deadens your paper. Avoid it at all costs.

No!

It can be seen that...

34 tests were run

These properties were thought desirable

It might be thought that this would be a type error

Yes!

We can see that...

We ran 34 tests

We wanted to retain these properties

You might think this would be a type error
Use simple, direct language

No! Yes!

The object under study was displaced horizontally

On an annual basis

Endeavour to ascertain

It could be considered that the speed of storage reclamation left something to be desired

The ball moved sideways

Yearly

Find out

The garbage collector was really slow
How to present

1. Figures

2. Paper organization

3. Presentation
### Goals for today: How to present

#### 1. Importance of conveying your work
- Technical skills are often the emphasis, presentations skills often lack
- Goal: clarity, persuasion, confidence, integrity, audience match

#### 2. How to speak clearly: self-introduction video
- Posture, voice, rhetoric, eye contact, facial expression, hook, flow, creativity
- First impressions matter, influence talk perception. Practice. Use resources

#### 3. How to plan your talk: storyboarding, signposts, recovery
- Flow: Common story arcs, logic, innovation, surprise, signposting, adaptation
- Recovery: dealing with unexpected, keep attention on talk, achieve goals

#### 4. Convincing/rhetoric: effective and efficient, ethos/pathos/logos
- All stages: Prepare (message), practice (familiar), present (natural, excited)
- Ethos: credibility/trust (you). Pathos: emotion (them). Logos: logic (content)

#### 5. Connect with your audience, achieve your goals, match them
- It’s all about them, not you. Help them understand, appreciate, guide them
- Adapt your talk to the audience: jargon, detail, explanations, attire, posture

#### 6. Take-home: delivery, recovery, credibility, goals, visibility
Goals for today: How to present

1. Importance of conveying your work
   - Technical skills are often the emphasis, presentations skills often lack
   - Goal: clarity, persuasion, confidence, integrity, audience match

2. How to speak clearly: self-introduction video
   - Posture, voice, rhetoric, eye contact, facial expression, hook, flow, creativity
   - First impressions matter, influence talk perception. Practice. Use resources

3. How to plan your talk: storyboarding, signposts, recovery
   - Flow: Common story arcs, logic, innovation, surprise, signposting, adaptation
   - Recovery: dealing with unexpected, keep attention on talk, achieve goals

4. Convincing/rhetoric: effective and efficient, ethos/pathos/logos
   - All stages: Prepare (message), practice (familiar), present (natural, excited)
   - Ethos: credibility/trust (you). Pathos: emotion (them). Logos: logic (content)

5. Connect with your audience, achieve your goals, match them
   - It’s all about them, not you. Help them understand, appreciate, guide them
   - Adapt your talk to the audience: jargon, detail, explanations, attire, posture

6. Take-home: delivery, recovery, credibility, goals, visibility
Exercise – Self introduction: Film yourself & listen

- Describe (1) your background, (2) something interesting about yourself, (3) why you're taking this class, (4) what you want to do with the knowledge later, (4) what are your next career steps, (5) your longer-term plans for the future. Goal: 60-90 seconds
- Base grade of 3.3 for turning in a self-introduction video.

We will watch your video once and then will add +0.1 points for each of the following to the base grade for a max score of 4.0:

- Memorability (Overall)
- Hook (Content)
- Use of Rhetorical Devices (Content)
- Expressiveness in Voice (Delivery)
- Eye Contact (Delivery)
- Facial Expression (Delivery)
- Flow (Storyboard)
- Creativity (in any aspect)

Then, -0.1 points are deducted from the above score for:

- Poor Quality – volume, lighting
- Duration – too short or too long
- Speaker Position – not standing
- Frame – if speaker’s head, torso and hands are not all visible
- Format – uncommon format / other reason causing video to not play
- Filename - failure to name file properly
- File size - resulting file too big (thus hard to download)
First impressions matter

What they think of you will influence how they interpret your words. Their impression is influenced by many factors:

- The company you work for
- Your reputation / credentials
- Reputation of those who spoke before you
- Your speech **content** (what you say)
- Your speech delivery (how you say it)
- Voice - volume/quality/tone
- Attire
- Age
- Body language
- Poise + posture
- Facial expression
- Eye contact
- Knowledge
- Confidence
- Active listening
- Company you keep
- How you treat others
- Mood/emotion
- Proximity
- Your writing style
- Deeds
- Handshake
- Punctuality
- Humor
- Physical attributes
- Hygiene
- Uniqueness

What they think of you will influence how they interpret your words. Their impression is influenced by many factors.
## Resources to improve different aspects of delivery

<table>
<thead>
<tr>
<th></th>
<th>Eye Contact</th>
<th>Gestures</th>
<th>Space</th>
<th>Facial</th>
<th>Body / Posture</th>
<th>Volume</th>
<th>Word Choice</th>
<th>Intonation</th>
<th>Expressiveness</th>
<th>Silence / Pacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mime</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross Lingual Comm</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Play-reading</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magic / Showmanship</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Musical Theatre</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speech-reading</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storytelling</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standup Comedy</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Acting</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Goals for today: How to present

1. Importance of conveying your work
   - Technical skills are often the emphasis, presentations skills often lack
   - Goal: clarity, persuasion, confidence, integrity, audience match

2. How to speak clearly: self-introduction video
   - Posture, voice, rhetoric, eye contact, facial expression, hook, flow, creativity
   - First impressions matter, influence talk perception. Practice. Use resources

3. How to plan your talk: storyboarding, signposts, recovery
   - Flow: Common story arcs, logic, innovation, surprise, signposting, adaptation
   - Recovery: dealing with unexpected, keep attention on talk, achieve goals

4. Convincing/rhetoric: effective and efficient, ethos/pathos/logos
   - All stages: Prepare (message), practice (familiar), present (natural, excited)
   - Ethos: credibility/trust (you). Pathos: emotion (them). Logos: logic (content)

5. Connect with your audience, achieve your goals, match them
   - It’s all about them, not you. Help them understand, appreciate, guide them
   - Adapt your talk to the audience: jargon, detail, explanations, attire, posture

6. Take-home: delivery, recovery, credibility, goals, visibility
Planning your talk, building a story: Storyboarding

Where We Are Heading
Unused Variables? Remove or Callback

Once upon a time...
And every day...
Until one day...
Because of that (3x)...
Until finally...
And ever since that day...
As a result...
The moral of the story is...

Where We’ve Been
Undeclared Variables? Setup

Context

Payload

Situation (Setup)
Conflict (Problem)
Stakes/Pain
Stakes or Resolution
Resolution (Solution)
Consequences (Delta)
Take Away (Point)
Typical movie storyboards

Scientific talks have storyboards
Many follow the same formulation
But you can be creative about it
Stand out? Impress? Match context? Specific goal? Someone has to leave early? Flexibility!

Unusual storyboards

Linear
Memory
Flash Forward
Flash Back

- world-weary heavily fighting cable car AC/DC
- cop/soldier/ mercenary explosions
- accented villain sequence on!
- frenemies quirky I can explain!
- lonely montage right in front of you!
- ukelele Cure cover
- Philip long train ride arbitrary edits silence vague
- Glass smoking
- expository technobabble
- angry robots/aliens/ dystopian what have we done?
- John Williams
- herd of weird rural Todd? split up wuwugghhh!!
- die Zombie
Example: 4-slide talk on fuel cells nanotechnology

Expanding Fuel Cell Markets using Nanotechnology

Yang Shao-Horn
Electrochemical Energy Laboratory
Mechanical Engineering at MIT

These slides are a modified version of Professor Shao-Horn's April 2002 Desphande Center talk

[Diagram showing the comparison of lithium batteries and fuel cells in terms of watts]

[Bipolar plate (6% of fuel cell cost), end plate (1% of fuel cell cost), membrane (25% of fuel cell cost), electrode (55% of fuel cell cost)]

[Diagram showing the process of nanofiber formation through pressure and polymer solution, leading to a fiber mat on a collector with a high voltage]
Many storyboards are possible: Change start

<table>
<thead>
<tr>
<th>Title</th>
<th>Problem</th>
<th>Background</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel cells are expensive and large</td>
<td>Surface area is key factor for fuel cell reaction efficiency</td>
<td>Created material with high surface area / volume ratio</td>
<td>Expanding Fuel Cell Markets using Nanotechnology</td>
</tr>
</tbody>
</table>
Many storyboards are possible: Change order

1. Fuel cells are expensive and large
2. Surface area is key factor for fuel cell reaction efficiency
3. Created material with high surface area / volume ratio

4. Problem

2. Background

3. Contribution

4. Context

2. Payload
Recovery: Be graceful and ready for everything

• Projector doesn’t work, system malfunctions, room not set up properly
  – Ask for help, work together, be kind, make a joke

• Someone is really asking a lot of annoying questions:
  – Tell them nicely: “Great questions, and my next few slides will address them. Please ask me again at the end if I haven’t fully addressed your comments”.

• Someone is making a lot of noise, eating, shuffling, etc
  – Ignore first, then gently say: “I’ll pause for a moment while you finish unpacking”. Or just say “Please be a bit quieter, so that everyone can hear”.

• Everyone is getting ready to leave lecture.
  – I only have a few moments more, please wait for a moment.

• Talk time cut short. Major VIP is leaving.
  – Rearrange slides, rework storyboard, skip sections, only give main points.

• Wrong slide deck is loaded, old talk, some slides missing
  – If minor, roll with it. If major, take moment to rearrange / preview. Always load talk on phone in Dropbox, know what’s coming next. Presenter mode.

• Fonts are all off, animations not working, images not showing.
  – Make a kind joke about it, connect with the audience, they’re just as surprised
Common storyboards for research talks

• Structure: Beginning Middle End
• Storyarc: Payload and Point

Common storyboards:
1. Problem - Solution
2. Technology - Application
3. Individual Trends - Merger of Trends
4. We Did It! – How We Did It
5. Past - Now (- Future)
7. Simple - Complex

Good storyboards
• Flows (logically) well
• Material is setup properly/minimally
• Takeaway highlighted in payload position
• Is an ordering you naturally recall
• Grabs interest
• Sustains interest and momentum.
• Match the audience
How to build your own storyboard

• Assemble Ideas
• Develop Ideas
  – Flesh out an idea into multiple slides if necessary
  – Merge ideas from slides
  – Prune ideas
• Storyboard
  – Chunk ideas together
  – Form story from start
  – Pay attention to flow
• Anything special for intro or conclusion
• Make slides simple & presentable

• Examples of Optimizing Flow
  – Fast items first in list
  – Idea on slide or as transition?
  – Reordering of points to avoid “as I said”.
• Delta/So What:
  – What’s changed?
• Examples
  – What did you learn?
  – How well does it work?
  – How is system better now?
  – How is user experience improved?
Goals for today: How to present

1. Importance of conveying your work
   – Technical skills are often the emphasis, presentations skills often lack
   – Goal: clarity, persuasion, confidence, integrity, audience match

2. How to speak clearly: self-introduction video
   – Posture, voice, rhetoric, eye contact, facial expression, hook, flow, creativity
   – First impressions matter, influence talk perception. Practice. Use resources

3. How to plan your talk: storyboarding, signposts, recovery
   – Flow: Common story arcs, logic, innovation, surprise, signposting, adaptation
   – Recovery: dealing with unexpected, keep attention on talk, achieve goals

4. Convincing/rhetoric: effective and efficient, ethos/pathos/logos
   – All stages: Prepare (message), practice (familiar), present (natural, excited)

5. Connect with your audience, achieve your goals, match them
   – It’s all about them, not you. Help them understand, appreciate, guide them
   – Adapt your talk to the audience: jargon, detail, explanations, attire, posture

6. Take-home: delivery, recovery, credibility, goals, visibility
Being Effective and Efficient

When Preparing
- Determine message
- Create story
- Use narrative
- Work on slides
  - Only if necessary
  - Just enough on slide
  - Superposition
- Plan boardwork
- Anticipate problems
- Determine intro, concl

When Practicing
- Do not memorize!
- Impromptu speak
- Piecemeal practicing
- Re-storyboard

When Presenting
- Do not regurgitate
- Interact with slides/board
- Take an interest in your audience
- Modify jargon
- Buy the audience time
- Use verbal punctuation
- Use visual punctuation
  - Just enough gesturing
- Control audience focus
Rhetorical devices: Ethos, Pathos, Logos

**LOGOS**

Logic/reason/proof

Main techniques:
- Structure of the speech (opening/body/conclusion)
- References to studies, statistics, case studies...
- Comparisons, analogies, and metaphors.

**ETHOS**

Credibility/trust

Main techniques:
- Personal branding
- Confidence in delivery
- Cites credible sources

**PATHOS**

Emotions/Values

Main techniques:
- Stories
- Inspirational quotes
- Vivid language
Goals for today: How to present

1. Importance of conveying your work
   – Technical skills are often the emphasis, presentations skills often lack
   – Goal: clarity, persuasion, confidence, integrity, audience match

2. How to speak clearly: self-introduction video
   – Posture, voice, rhetoric, eye contact, facial expression, hook, flow, creativity
   – First impressions matter, influence talk perception. Practice. Use resources

3. How to plan your talk: storyboarding, signposts, recovery
   – Flow: Common story arcs, logic, innovation, surprise, signposting, adaptation
   – Recovery: dealing with unexpected, keep attention on talk, achieve goals

4. Convincing/rhetoric: effective and efficient, ethos/pathos/logos
   – All stages: Prepare (message), practice (familiar), present (natural, excited)

5. Connect with your audience, achieve your goals, match them
   – It’s all about them, not you. Help them understand, appreciate, guide them
   – Adapt your talk to the audience: jargon, detail, explanations, attire, posture

6. Take-home: delivery, recovery, credibility, goals, visibility
It’s all about your audience

• Help them appreciate your technical contribution
• Break any rule as long as they are helped / not bothered
• By end of intro, know overall direction of talk,
• By end of intro, understand your title,
• Cover everything on your slide
• What you say is consistent with what is on the slide
• Don’t tell them anything they won’t need later
• Tell them what they need to know before they need it
• Verbally/nonverbally help them parse what is important
• The more time you spend, the more important it is
• The more you repeat, the more important it is
• You tie everything together with a sense of finality
• Be memorable, be creative, be different, teach them smth
Explaining – meeting your audience halfway

- Relation Statement
- Narrative
- By Statement
- Intuition

Payload:
- Hard core technical details for how something works

Questions:
- Why?
- What?
- How?
- How specifically?
- So what?

Context
- Signposting
- Storyboarding
Avoid mistakes in meeting your audience

- too watered down
- no payload
- not technical
- “notation” changes
- no interaction
- poor storyboard
- poor setup
- what is problem
- what is solution
- what is intuition
- ok, so what
- jargon
- complex
- confusing
- too technical
- jumps too big
- misunderstandings
Goals for today: How to present

1. Importance of conveying your work
   – Technical skills are often the emphasis, presentations skills often lack
   – Goal: clarity, persuasion, confidence, integrity, audience match

2. How to speak clearly: self-introduction video
   – Posture, voice, rhetoric, eye contact, facial expression, hook, flow, creativity
   – First impressions matter, influence talk perception. Practice. Use resources

3. How to plan your talk: storyboarding, signposts, recovery
   – Flow: Common story arcs, logic, innovation, surprise, signposting, adaptation
   – Recovery: dealing with unexpected, keep attention on talk, achieve goals

4. Convincing/rhetoric: effective and efficient, ethos/pathos/logos
   – All stages: Prepare (message), practice (familiar), present (natural, excited)

5. Connect with your audience, achieve your goals, match them
   – It’s all about them, not you. Help them understand, appreciate, guide them
   – Adapt your talk to the audience: jargon, detail, explanations, attire, posture

6. Take-home: delivery, recovery, credibility, goals, visibility
Take-home messages

1. Master delivery
   • Genuinely care ➔ most interesting to watch
   • Eye contact ➔ connection
   • Gesturing ➔ illustration (visual punctuation)
   • Space ➔ comfort (visual punctuation)
   • Facial Expr ➔ enthusiasm
   • Posture ➔ confidence
   • Volume ➔ power, confidence
   • Word choice ➔ control
   • Intonation ➔ credibility
   • Expressiveness ➔ verbal punctuation
   • Silence / Pacing ➔ comfort

2. Minimize surprises
   • Anticipate questions / problem areas
   • Visit room beforehand
   • Upload slides / bring on USB thumb drive
   • Name files appropriately
   • Send slides to slide coordinator
   • Test slides / demo beforehand
   • Arrive early
   • Dynamically adjust to time / understanding

3. Build Credibility
   – Built up before: get in door
   – When you’re in: sustain it!

4. Focus on goals
   – Introduction hook
   – Relation Statement
   – Negotiation
   – Proposals (Pitching)
   – Giving Feedback
   – Networking / Small Talk.

5. Gain visibility
   – Not who you know, but who knows you
   – Take ownership
   – Ask good questions
   – Be the one they go to
   – Pay attention to detail
   – Take credit (when appropriate)
   – Take initiative
   – Present your own ideas
   – Give a better presentation
   – Differentiate yourself.
Goals for today: How to present

1. Importance of conveying your work
   - Technical skills are often the emphasis, presentations skills often lack
   - Goal: clarity, persuasion, confidence, integrity, audience match

2. How to speak clearly: self-introduction video
   - Posture, voice, rhetoric, eye contact, facial expression, hook, flow, creativity
   - First impressions matter, influence talk perception. Practice. Use resources

3. How to plan your talk: storyboarding, signposts, recovery
   - Flow: Common story arcs, logic, innovation, surprise, signposting, adaptation
   - Recovery: dealing with unexpected, keep attention on talk, achieve goals

4. Convincing/rhetoric: effective and efficient, ethos/pathos/logos
   - All stages: Prepare (message), practice (familiar), present (natural, excited)
   - Ethos: credibility/trust (you). Pathos: emotion (them). Logos: logic (content)

5. Connect with your audience, achieve your goals, match them
   - It’s all about them, not you. Help them understand, appreciate, guide them
   - Adapt your talk to the audience: jargon, detail, explanations, attire, posture

6. Take-home: delivery, recovery, credibility, goals, visibility