Data Visualization Short Course Notes

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1 Poster Concepts

1.1 Benefits to you
- Make your work more readable and accessible
- Break the ice with design
- Few designers outside of CVAD
- Outrun the bear

1.2 Paper Sizes and Content
- Above all, conform to the conference rules
- Std poster size around $44'' \times 34''$
  - ‘E’ size, or a bit over B1
- Text and images
- Research topic, [intermediate] results, methodology
- Readable, attractive...marketing
- Some conferences allow larger paper
  - $48''$ or even $60''$
- Proportions of E size: $60'' \times 46''$
- Proportions of $\phi$: $60'' \times 37''$
- Temptation is great to over-fill
- Do not change content between sizes
1.3 What Goes Into a Poster

The Poster is Not your Paper: It must be condensed; you must sacrifice detail and most of the nuance from your longer work or works.

- Built for quick consumption
- Nuance is hard: choose wisely what you want to keep
- Background, methods, & core finding
- “Elevator Speech”
- Skip acknowledgements unless required
- Skip almost all lit review
- Never, ever copy and paste paragraphs
  - Even shorten your abstract, if you plan to include it
- Body text: about 36 point font
- Title text: 100–144 point font
- Subtitle & authors: about 72 point font

But the Poster is Still your Research: You can’t make the poster all fluff and cute graphics; your research is serious, and this marketing effort (i.e. the poster) must have plenty of substance behind it.

- Provide core anchors & insights
- Problem + your contribution + your current results
- Ruthlessly concise, but with enough content to support further discussion
- Hologram analogy

Content: be simple. Be direct. Make everything obvious.

- Careful, short title
- Purpose (maybe abstract)
- Theory statement, ‘hook’
- Methodology if relevant
- Results in 2 places
- Punchline big & brief
- Primary finding must take center stage
- Poster viewers generally too lazy to read your paper
- Don’t make them search for your core contribution

Text Content: you don’t have much room for text. Be spare. Keep the whole poster under 450 words
• Spelling & grammar critical
• Concise prose is not easy
• Keep sentences simple; long sentences are hard to follow – made harder by noisy conferences and constant interruptions.
• Audience perceptions depend mostly on your graphics and text; they may find your poster appealing enough to check it out, but convincing them your work is innovative and correct requires clear text and good graphics.
• Recruit friends to help figure out if the text is right for a poster

Poster Ethics: You can’t ignore every convention of a paper.

• Ethics requires that your provide some citation
• Credit authors as appropriate
• Any image modifications must be explained (even if briefly)

2 Poster Design

Making posters not is not a trivial task or an afterthought. Poster design is a learned skill with numerous sub-skills. You may need, or benefit from, learning to use software other than MS Office.

• Photoshop/GIMP/GraphicConverter
• Illustrator/Inkscape
• InDesign/Scribus
• SPSS/Stata/R/SAS/Mathematica
• Use Microsoft products as a last resort (PowerPoint is evil, and not designed for the task of making posters)
• Also consider programming languages like Python, Processing, or even Visual Basic (though really, VB isn’t what you’re after when designing a poster)

2.1 Design Mechanics

Organization: make everything easy to locate

• Organization means readership
• Err on the side of simplicity
• Don’t make folks search for the findings

Eye tracking: If you know where they will look... you can put the important stuff there, and draw viewers’ eyes to places they might not normally scan with good artwork.
Where do peoples’ eyes generally go when seeing a poster?
- Helps prioritize content locations
- You can influence eye tracking some
- Better to work with nature than against it

**Vector Graphics:** line drawings that are infinitely scalable; use vector graphics whenever possible, then convert to an image as a final step (note: you can skip this step if you’re laying out your graphics in Inkscape, InDesign, Illustrator or Scribus— you can do the final export to PDF or PNG all at once)

**Raster Graphics:** pixel-based images that are scalable only to a point; beyond that point, the image looks blurry and pixelated
- 72 dpi OK for data projectors
- 300 dpi **required** for print
- Photoshop/GIMP/GraphicConverter

**Text:** Remember, you’ve only got 450 words or less for the whole thing, or, about 1 1/2 pages of double spaced, 12-point font text.
- Limit text quantity
  - Encourage viewer to read your paper
- Make the text large!
  - Readable from 5–7 feet away
  - Thus, 36 point body text
  - Avoid all caps
- Reduce personal space intrusions
- Sell your paper with abstract & findings
- The process of putting text on a poster requires editing & discipline
- **Remember:** if they want more, they’ll read the paper
- Limit font variety
  - Non-standard fonts distract
  - Content is important, not font palette
- Established serif/sans-serif font for text
- Readable font for title, headings
- **No ‘cute’ fonts!**
- Use bullets for lists, not numbers
- No sub-lists
- List items don’t have to be sentences
  - But be consistent among list items
3 Data Visualization

3.1 Good Graphics

- Show the data without distortion
- Present substance foremost
- Make large data coherent
- Encourage comparison
- Provide multiple levels of detail
- High information:ink ratio
- Honest representation of your work
- Clear presentation of complex idea(s)
- Make good use of color
- Immediate grasp of
  - topic
  - logic
  - findings
- Don’t lie!
- Or Distort (perception is reality)
- “Lie Factor:” \[
\frac{\text{size of effect shown in graphic}}{\text{size of effect in data}}
\]

3.2 Graphics Pitfalls

Graphical ‘Hacks:’ Useless and/or unnecessary decorations

Design & Data Variation: Don’t make it hard to interpret each additional graph.

- Do not change scales on one graph
- Avoid changing scales between similar graphs (the reader expects them to be the same)
- Don’t use odd or funny graphics as metrics or scales
- And, while I shouldn’t have to say it, don’t change the scale from one data point to the next\(^1\).

\(^1\)An unlikely temptation unless you go to work for cable news, a partisan blog, or Congress.
3.3 Graphic Excellence

Tufte says excellent graphics:

- Present complex ideas with clarity, precision, & efficiency
- “...that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space.”
- Like good design and good titles, great graphics draw the eye and demand the viewer examine them
- Graphic skill is a [very] long term project, but even the skills of a beginner can be superior to those around them
- Good graphics pack a lot of information into a single graphic. And on a poster, where space is limited (even precious), this density of information is quite valuable.

3.4 Graphically Representing Data

Your theory, data, or results tell a story. Your core contribution should include a graphic, where possible, to both telegraph the importance of the key finding, and to draw eyes toward it.

- First, and foremost: tell the truth
- Second: don’t mislead (remember the lie factor)
- Graphics require thought and careful choices
- Choose simplicity first
- Maximize “data to ink” ratio
- Consistency is important across all graphics, even those that do different things
- Show data variation, not design-of-the-graphic variation. Maintain as much consistency among graphics as possible
  - Not least, elements like fonts, lines, labels, outlier designators, axis styles and markings
  - But also scale (especially if you’re asking them to compare two experiments or outcomes): try to ensure that both (or all) axes are on the same scale and have the same minimum and maximum, if you plan to put the graphics side by side
- If you need more than one graphic, assign one pre-eminence
- “Cute” is unhelpful
• Precision is not always king: sometimes a ‘smoothed’ output is better than a ruthlessly ‘true’ output

• Simplest display of information is with numbers in a table

• But coefficients & numbers, while true, often lack instant accessibility

Tables: a simple spreadsheet-like display of numbers may be enough

• Tables with up to 20 numbers probably clearer than graphs, though not as attention-getting as a [tasteful] colorful graphic

• Some circumstances require both tables and graphs

• Tables, in many cases, maximize the information-to-ink ratio because of their compactness

• On the other hand:
  – Tables can’t show multiple levels of information without a lot of ink
  – Numbers often fail to display a trend with anything approaching ease
  – Graphs are usually superior for showing trends
  – Similarly, graphs are usually superior to equations, where possible. Equations can take a long time to parse in your reader’s head – provided they’re willing to do so at all!

Which graph, then? While not an absolute rule, and especially since there are other kinds of graphs than those listed, this proposed list is a starting point.

• Simple bar graph: 1 variable, few values, absolute frequencies

• Pie graph: 1 variable, few values, relative frequencies

• Histogram: 1 variable, many values, absolute or relative frequencies

• Cluster bar graph: >1 variable, few values, relative frequencies

• Scatterplot: >1 variable, many values

What about something besides a graph? There are other ways to graphically display results, decisions, or a process.

• Spatial components? Use a GIS map

• Re-work a process? Use a flow chart or charts

• Perhaps there are better ways to display counts or frequencies, too; rather than using a table, you might choose a “word cloud” (although these are severely overused at present) or another such graphic that does not depend on a linear ordering of outcomes

Color: Beware! Color can quickly overwhelm a viewer. On the other hand, grayscale isn’t very inspiring, it’s true.
• Color naturally draws the eye
• Bright (oversaturated) colors can be hard to look at
• Overuse of color muddies the poster
• Emphasize color with dark backgrounds
• Minimize color with white backgrounds
• Beware the limits of color/shading/icons – you can perhaps get away with a color ramp plus a hatching pattern or an icon size, but doing all three would be a huge task and might require a lot of re-work
• Use color spread to show variation
• Choose colors thematically: red is usually considered an “intense” color, and green a “low-intensity” color, so don’t put green as the highest or most intense color.

Movies and interactive content: Can be part of the presentation (say, on a tablet computer or laptop), or part of the online appendix.

• Yeah, making movies, animations, or other interactive content are yet more skill sets
• It’s a content medium between “poster” & “paper”
• A means to continue the conversation

4 Presenting a Poster

4.1 The table
• Likely a small table or a square of wall
• Dish of candy (obligatory)
• Hard copies of your paper
• Have a USB flash drive w/PDF
• Business cards (optional)
• One-sheet summaries of your paper

4.2 One-sheet summaries
• Intermediate between:
  – Poster (“advertising”)
  – Paper (“all business”)
• Avoids “lecture” problem
• Print poster on 1 side of $8\frac{1}{2} \times 11$
• Key points outlined on back
• Include complete contact info!

4.3 You

• Dress nice (check if dress code)
• Social mores of conferences vary
• But you’re not a carnival barker
• Keep ‘presentation’ short: 1–2 mins.
• Practice
• Water bottle
• Tablet computer, if you have additional content to use

4.4 Your “Go-Bag”

Even if you don’t need every item in the kit, you might save someone’s bacon. Further, this kit enables you to relax and know that whatever situation the conference provides, you can make your poster work.

• Gaffer’s/duct tape, pkg. tape, super glue
• Binder clips, paper clips & stapler
• Sharpies
• White-out (liquid or tape)
• Tacks/push-pins & “Command Strips”
• Ziploc bags
• Scissors/multi-tool & straightedge
• Pre-sectioned foam core panels

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I thank Brian O’Connor for the go-bag content list.
5 Nuts & Bolts of Printing

There are basically two options for printing: either a sheet that can be rolled up and hung/adhered to a wall later, or a poster that is mounted to a sheet of foam-core and sliced up into panels (usually 9 panels) that are taped together at the conference. Note that printing a poster in a conference city will be expensive but more convenient.

5.1 Single sheet
- Easier to hang & display
- No seams
- Harder & riskier to transport
- Paper curl, or else foam core
- Probably reusable

5.2 Poster tiles
- Easier to transport, but bulky
- Flexible production, editing, & rescue
- Must match seams
- Must tape together on-site
- May need yardstick or dowel
- “Noisier” viewing
- Fits in carry-on bag
- Already mounted to foam core

5.3 Editing
- Print on letter paper
- Show it around (including at the RAVE)
- Ask specific questions
  - “what’s the poster about?”
  - “is this graphic helpful?”
- Take notes
- Revise