Data Visualization Software Proficiency: Overview and Learning Goals

- Proficiency means tool fluency, chart judgment, and workflow reliability — not just buttons
- Visualization appears in 73–86% of BI and analyst postings; method transfers across tools
- Roadmap: perception, tool landscape, chart choice, hands-on BI build, spreadsheets, code
- Governance, accessibility, ethics, and a capstone round out the course
- Outcomes: right tool and chart, build in two environments, reports that survive review



Core Concepts: Data Types and Visual Encoding

- Four data types: categorical, ordinal, quantitative, temporal — each constrains expressive encodings
- Encodings: position, length, angle, area, luminance, saturation, shape
- Position read from a fixed anchor is most accurate for quantities
- Channel rankings shift by task: area is poor for magnitude but strong for pop-out
- Learn the concepts, not one tool's words — dimensions vs. measures, marks vs. aesthetics

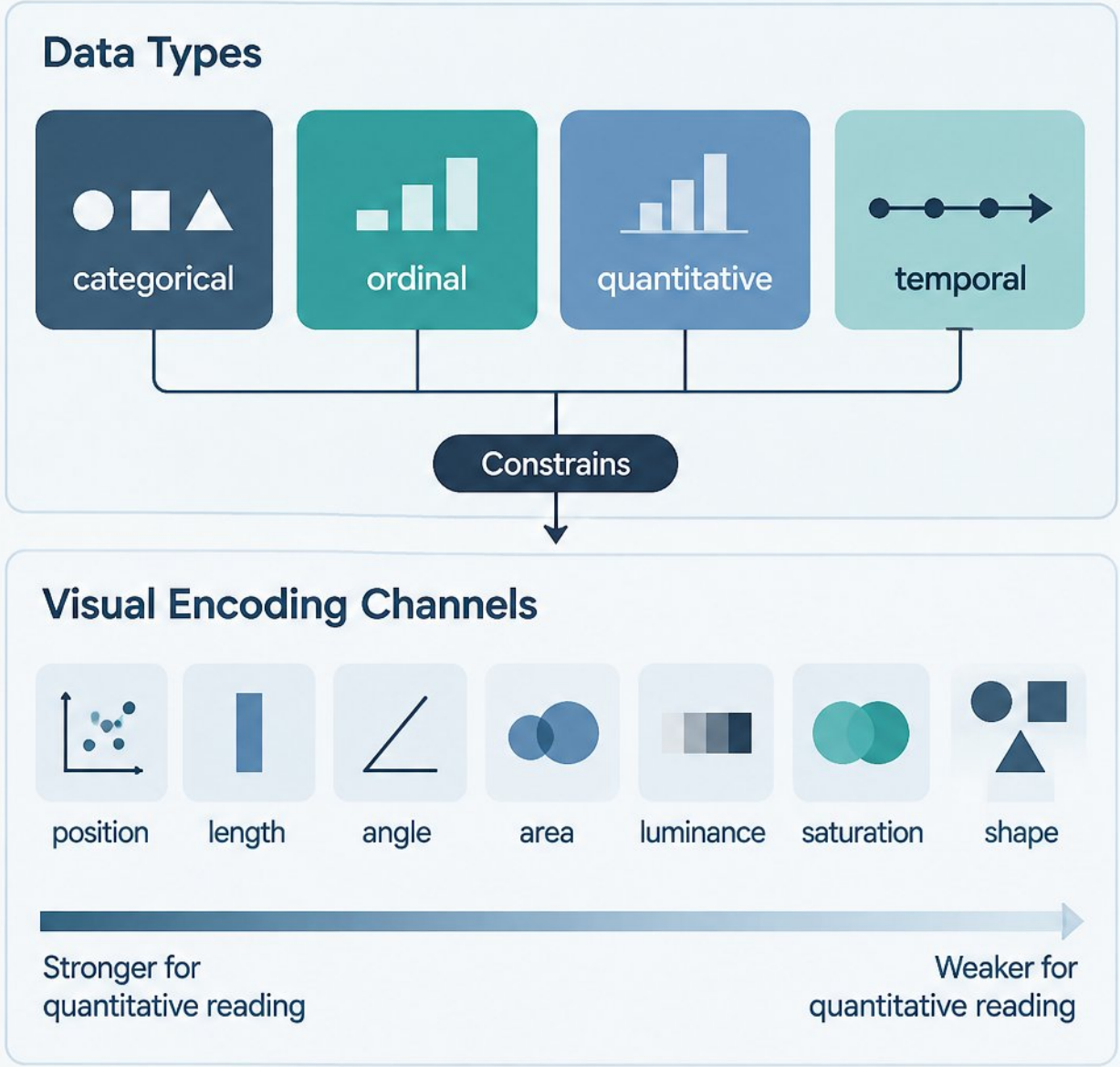
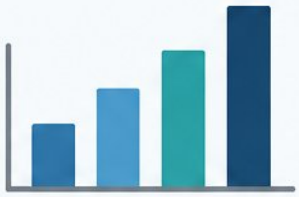


Chart Judgment: Matching Chart Type to Analytical Question

Analytical Question → Recommended Chart Type

Comparison



Trend



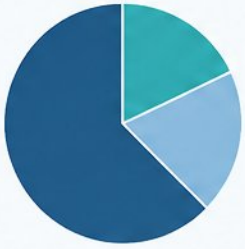
Distribution



Relationship

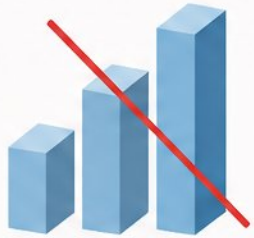


Composition

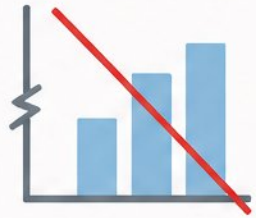


Common Anti-Patterns to Avoid

3D effects



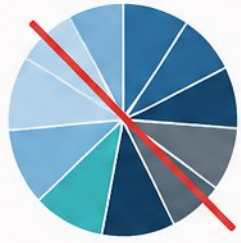
Truncated y-axes



Dual-axis charts



Pies with many slices





- Write the question first: comparison, trend, distribution, relationship, or composition
- Sorted bars compare categories; lines show change over time
- Scatter plots reveal relationships; histograms and box plots show spread
- Recognize anti-patterns: 3D effects, truncated y-axes, dual-axis charts, pies with many slices
- Prioritize key values; remove data-ink that carries no meaning

The Tool Landscape: Choosing the Right Software

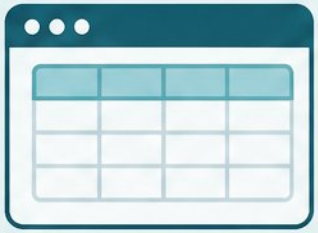
BI platforms



Fit: Refresh and permissions

License: Per reader (for Power BI Pro)

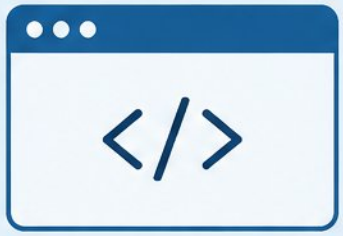
Spreadsheets



Fit: Small static reports

License: Included with software

Code libraries



Fit: Reproducibility

License: Open source or free

No-code web tools



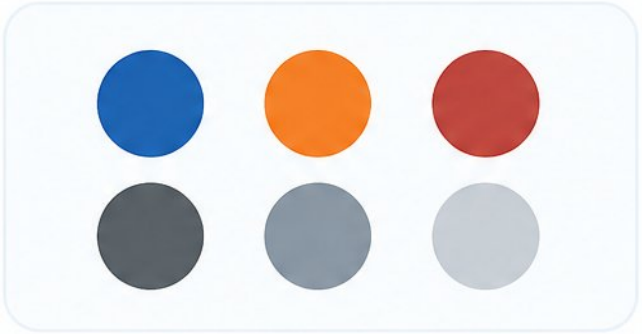
Fit: Easy to build and share

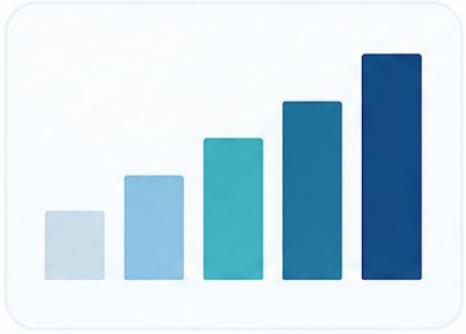
License: Readers are free (for Looker Studio)

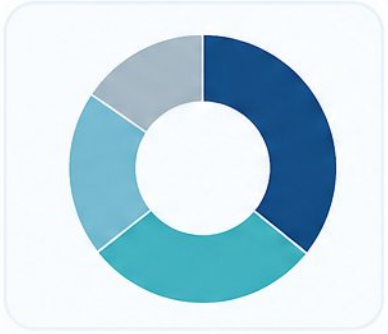
- Four families: BI platforms, spreadsheets, code libraries, no-code web tools
- Match selection criteria to your situation: data volume, interactivity, governance, cost, readers
- Power BI Pro charges per reader; Tableau needs one Creator; Looker Studio readers are free
- Small static reports: spreadsheets. Refresh and permissions: BI platform. Reproducibility: code
- Learn one platform deeply, based on your employer’s stack

Design Fundamentals: Color, Labels, and Clarity

- Match palette to role: categorical, sequential, divergent
- Blue with orange or red is the safest colorblind-safe pair
- Vary lightness so charts survive grayscale printing
- Limit to ~5 colors (nine max); never use color alone
- Label series directly; push legends as close as possible
- Consistent scales, clear titles, one annotation per key finding









Hands-On Part 1: From Raw Data to a First Report in a BI Tool

1



- Connect a CSV or Excel file; review data types before building anything

2



- Clean and shape in Power Query: promote headers, set types, drop null and zero rows

3



- Build four visuals only: two KPI cards, a sorted bar by segment, a line by month

4



- Add a date-range slicer and test all, none, and single-value edge cases

5



- Save locally, then publish to a workspace — Desktop is free, sharing needs a license

Hands-On Part 2: Publishing, Sharing, and Common Beginner Errors

Desktop
Free authoring app



Cloud service
Publishes, refreshes, and sets access



Common beginner errors

- No date table
- No star schema
- Too many visuals
- Unsorted bars
- Inconsistent formats

1. Reports: multi-page and interactive; dashboards: single-page pinned tiles for monitoring
2. Desktop is the free authoring app; the cloud service publishes, refreshes, and sets access
3. Beginner errors: no date table, no star schema, too many visuals, unsorted bars, inconsistent formats
4. Format once in the model so every visual inherits it; sort bars by value
5. Document refresh schedule and ownership at publish time, not after someone asks

Spreadsheet and Presentation Tool Proficiency

- Fastest for quick, small, static charts; breaks on large or multi-source data
- Pivot charts restructure instantly for recurring reports
- For polished one-off exhibits, chart a copied plain range instead
- Dynamic charts (Excel Tables, arrays, slicers) auto-expand as data grows
- Slides: export high-res or paste linked; verify fonts and colors survive
- Version control and refresh discipline prevent broken-link charts



Programmatic Visualization with Python and R

R (ggplot2) — Declarative

Map data to aesthetics, then add geoms.

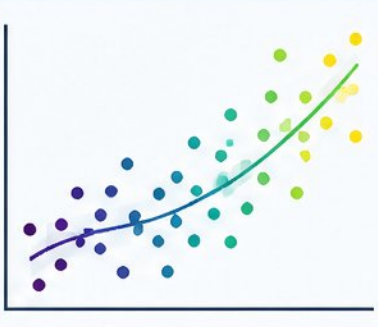
```
ggplot(data, aes(x = x, y = y,
  color = group)) +
geom_point() +
geom_smooth()
```



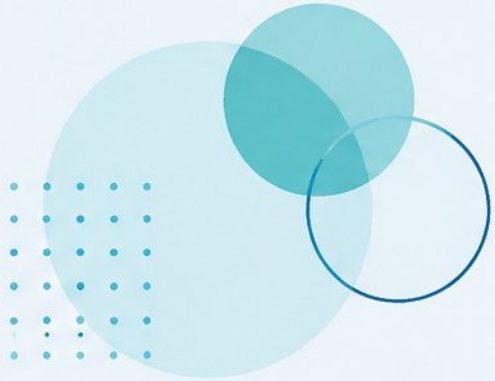
Python (matplotlib) — Imperative

You draw each element yourself.

```
fig, ax = plt.subplots()
ax.scatter(x, y, c=group)
ax.plot(x, y)
ax.set_xlabel("x")
ax.set_ylabel("y")
```



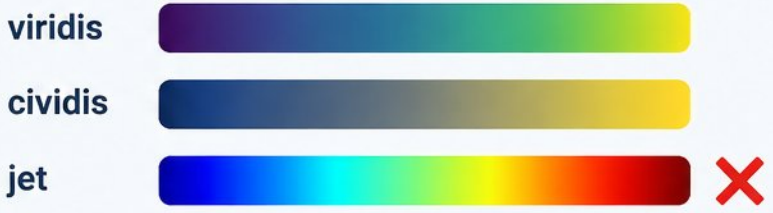
- Code wins for reproducibility, scale, custom design, version-controlled reporting
- ggplot2 is declarative: map data to aesthetics, then add geoms
- matplotlib is imperative: you draw each element yourself
- Python: matplotlib for control, seaborn for stats, Plotly for interactivity
- R: ggplot2 plus Plotly or Leaflet for interactivity and maps
- Workflow: load, map variables, render, export to PNG/SVG/PDF/HTML
- Use viridis or cividis; avoid jet; code makes accessibility reproducible



Workflow



Color for Accessibility



Data Quality, Accuracy, and Governance in Reports

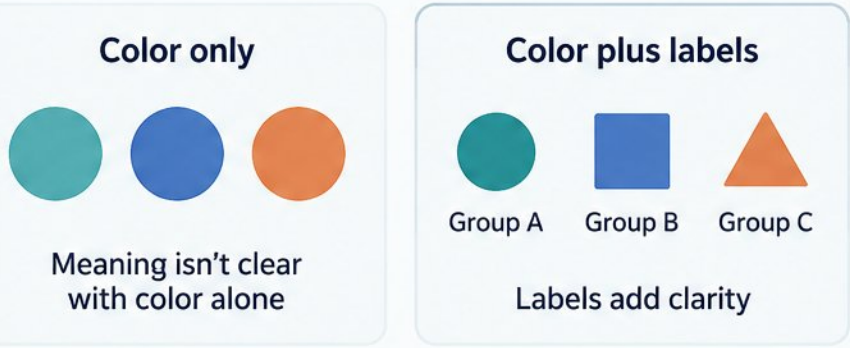
- Validate and reconcile source data before visualizing — wrong numbers beat no numbers
- Certified datasets need technical completeness, steward validation, and documented ownership
- Lineage visibility shows what breaks downstream before you deprecate a source
- Document assumptions, filters, refresh schedules, and metric definitions beside every report
- State limitations explicitly — what the output can and cannot support



Accessibility: Contrast, Color, Alternatives, and Keyboard Access

- Contrast: 4.5:1 for text, 3:1 for chart elements
- Never encode meaning with color alone—add labels, shapes, or patterns
- Alt text states the takeaway; pair it with an accessible data table
- Keyboards: visible focus, logical tab order, no hover-only data
- Test with simulators and checkers; built-in themes help but don't guarantee conformance







Ethics and Honest Persuasion in Data Visuals

- Catch misleading patterns in your own work: truncated axes, false dual axes, area distortion, cherry-picked ranges
- Persuasion is legitimate when it selects and annotates real signals — not when it distorts them
- Show context: baselines, comparison periods, sample sizes, and omitted categories in the chart or caption
- Separate facts, calculations, interpretations, hypotheses, limitations, and recommendations clearly
- Run a pre-publish checklist for bias, clarity, and honesty — ideally with an outside reviewer



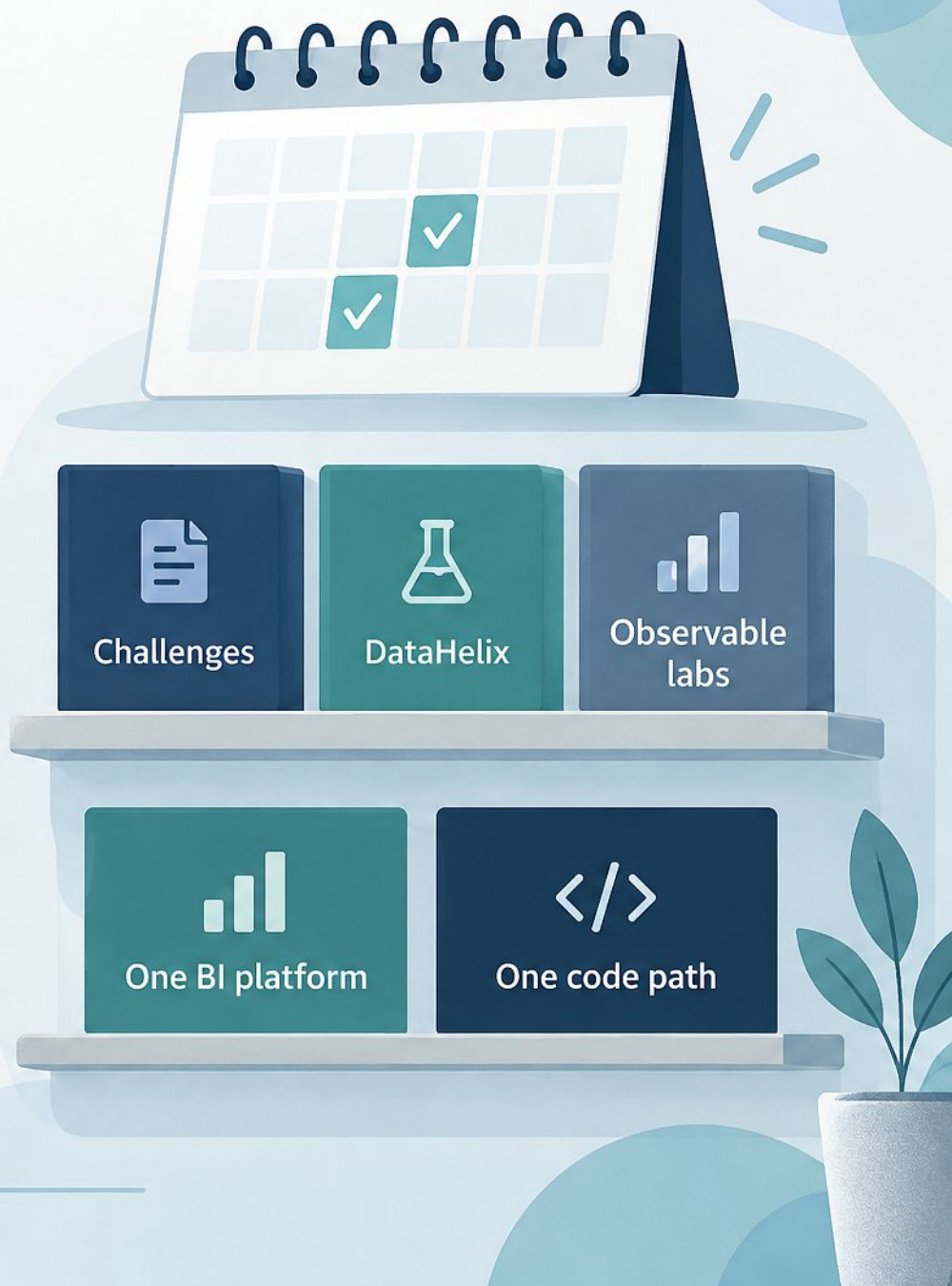
Capstone Brief:
From Raw Data to Delivered Report

- **Scope first:** pick a dataset, define the audience and decision, write questions before charts
- **Build end to end:** prepare data, model, select charts, annotate, publish
- **Deliver three artifacts:** interactive view, static slide or PDF, underlying data table
- **Peer review against a rubric:** clarity, accuracy, accessibility, documentation
- **Self-assess against course outcomes;** name the one skill to practice next



Practice Rhythm, Resources, and Next Steps

- Adopt a bi-weekly chart prompt to keep skills sharp
- Practice with downloadable challenges: B2VB, DataHelix, Observable labs
- Reverse-engineer published visuals to learn chart and formatting choices
- Build a portfolio across one BI platform plus one code path
- Keep learning the method; interfaces change, judgment transfers



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Scan the code or click anywhere to watch this course live, with voice Q&A

personwise.ai/t/53071e24/public