AI-Assisted Data Visualization

From Curiosity to Dashboard in Hours, Not Weeks

Ray Uzwyshyn, Ph.D. MBA MLIS

Acting AUL for Research & Technology

and Director of Research Services

UC Riverside Libraries

LinkedIn • Vita

No coding experience required—just curiosity! ✨

What This Workshop Will Explore

- "Vibe Coding" – Intuitive, natural language approach to AI-assisted development
- Anthropic Claude's AI Coding Window – Artifacts, Publishing and Customization
- Human/AI Collaboration and Iterative Co-Intelligence – Working with AI as a creative partner
- Website and Publication Ready Data Driven Visualizations – From exploration to publication-ready
- Strategies you can immediately use in your research – Practical workflows you can apply today

Transforming Data, Curiosity and Research Subject Interest into Sophisticated Interactive Data Driven Dashboards

What is "Vibe Coding"?

"Vibe coding" is programming through intuitive conversation with AI.

- Describe your data visualization goals in natural language
- AI generates the code and data-driven interactive visualizations
- Work with the model and model suggestions iteratively
- Refine through conversation, not syntax debugging
- Focus on analytical questions and data visualization

What is Data Driven Visualization?

- **Data Visualization:** The graphical representation of information and data using visual elements like charts, graphs, and maps to make complex patterns and insights accessible and understandable
- **Data-Driven Dashboards:** Interactive interfaces that consolidate multiple visualizations and metrics in real-time, enabling dynamic exploration and decision-making
- **Purpose:** Transform raw data into actionable insights through visual storytelling and interactive exploration
- **Interactivity:** Allow users to filter, zoom, drill-down, and manipulate views to discover patterns and answer questions
- **Impact:** Bridge the gap between complex datasets and human cognition, making sophisticated analysis accessible to all researchers

Many Areas for Data Visualization

Science, Social Sciences, Humanities and Popular Culture

Financial Analysis
Treasury bonds, derivatives, real-time market data with AI APIs

Labor Economics
Graduate employment paradox, cross-national wage trends

AI Model Intelligence
Performance benchmarks, pricing analysis across providers

Academic Research
Library analytics, citation networks, research impact

Business Intelligence
NASDAQ innovation mapping, market capitalization analysis

Social Networks
LinkedIn influence analysis, knowledge flow visualization

All built through conversation with AI – hours, not weeks

The Iterative Workflow and Sensemaking Process

1. Start with Curiosity and Your Prompt

What research question drives you?

What story needs telling in your data?

2. Describe or Find Your Data and Research

Research or experiment

AI Model (Deep Research possibilities)

3. Imagine Data Visualizations

Interactivity and produce MVP (Minimal Viable Product)

Descartes, Cartesian Grid
(Algebra + Geometry)

4. Continue to Converse and Edit with AI

No programming needed

but use this language if you have it

5. Refine and Test Versions Together

Improve through iterative feedback

Test with real data and users

6. Produce and Publish Final Product

PDF, Graphic, Website, Powerpoint,

Essay or Combination

Remember: It's a creative partnership co-emergence and co-intelligence not strict command line

Demo 1: AI Model Intelligence Dashboard

Interactive Model Comparison

Price performance rankings and market intelligence across 10+ AI models

Original Dashboard **2026 Update 1** **2026 Update 2**

The Conversation That Built It

My Prompt:

```
Create an interactive dashboard comparing AI language models: Models to include: - GPT-4 -
Claude 3.5 Sonnet - Gemini 1.5 Pro - etc. Show: - Input/output pricing per million tokens -
Context window size - Performance benchmarks (MMLU, HumanEval) - Release dates - Key
capabilities Features: - Interactive filters by provider - Visual charts showing price vs
performance - Clean professional styling - Comparison capabilities across multiple dimensions
Please ask me questions if you have about the data or research.
```

→ **Built in 2 hours** (traditional coding: 2+ weeks)

Critical Step: Verification & Evaluation

Always verify AI-generated outputs

- **Source Verification:** Check where data originates—AI may hallucinate or misattribute
- **Data Integrity:** Validate calculations against original datasets
- **Statistical Accuracy:** Confirm that visualizations represent data correctly
- **Iterative Prompting:** Ask AI to cite sources, explain methodology, show calculations
- **Peer Review:** Have domain experts examine outputs before publication

AI is a powerful tool, but scholarly rigor still requires human judgment and verification

Demo 2: Graduate Employment Paradox

Multi-National Labor Market Analysis

New York Federal Reserve, Statistics Canada, and UK Universities labor market data synthesis

Open Dashboard

The Conversation

My Prompt:

Create an interactive visualization exploring graduate employment trends using: Data sources: - New York Federal Reserve (underemployment by degree) - Statistics Canada (wage premiums by field) - UK Universities (graduate outcomes) Show: - Unemployment vs underemployment rates by major - Wage trajectories over 5-10 years post-graduation - Cross-country comparisons - Interactive filters by field and time period Include: - Scatter plots - Line charts - Summary statistics showing the employment paradox Please ask me questions if you have about the data or research.

Complex Data Sets (i.e. Cross-National Data Integration)

Other Complex Type Data Sets and Integrative Possibilities:

- **Medical Research:** Integrating patient outcomes, clinical trials, genomic data, and treatment protocols across multiple hospitals and research centers
- **Biotech Applications:** Combining protein structures, gene expression data, drug interactions, and metabolic pathways from diverse biological databases
- **Business Intelligence:** Merging sales data, customer behavior, market trends, supply chain metrics, and competitor analysis across global operations
- **Environmental Science:** Synthesizing climate data, satellite imagery, biodiversity records, and pollution measurements from international monitoring networks

✨ **What makes this special:** AI harmonizes different data formats across sources automatically

Core Principles for Data Visualization Excellence

- **Reduce Cognitive Load:** Don't overwhelm—reveal complexity progressively through interaction
- **Enable Exploration:** Interactive filtering, zooming, drill-down for user-driven discovery
- **Maintain Integrity:** Ensure visual representation accurately reflects underlying data relationships
- **Visual Variables Matter (Bertin):** Position is most accurate for comparison; use size, color strategically
- **Use Color and Line to Enhance Aesthetic Beauty:** Use colorblind-safe palettes; reserve color for meaning, not decoration

Demo 3: Treasury Bond ETF Relationships

Complex Financial Instrument Visualization

TLT prices, treasury yields, Federal Reserve rates, and economic indicators with real-time AI API updates

Original Dashboard **Update with Latest Data**

The Conversation

My Prompt:

Create a financial dashboard showing relationships between: Variables: - TLT (20-year Treasury Bond ETF) price - US Treasury yields (2yr, 10yr, 30yr) - Federal Reserve funds rate - Economic indicators (inflation, unemployment) Visualizations: - Time series showing inverse yield/price relationship - Correlation matrix - Animated yield curve over time - Fed rate policy overlays - Interactive date range selector Use professional financial styling (green/red). Enable real-time updates via AI API integration. Please ask me questions if you have about the data or research.

The Power of AI APIs: Connecting to the Giant Brain

Trillion-Parameter Intelligence at Your Service

- **Real-Time Data Access:** Connect your visualizations directly to live data sources through AI-powered APIs
- **Massive Computational Power:** Leverage models trained on trillions of parameters to process and analyze complex datasets instantly
- **Automated Updates:** Dashboards that refresh automatically as new data becomes available
- **Natural Language Queries:** Ask questions in plain English and receive data-driven answers in real-time
- **Unprecedented Affordances:** What once required entire data science teams can now be prototyped in a single afternoon

View Real-Time Dashboard Example

Core Principles for Data Visualization Excellence

- **Narrative Structure:** Guide users through insights with visual hierarchy and annotations
- **Responsive Design:** Test on multiple devices and screen sizes
- **Performance:** Optimize for large datasets—aggregate, sample, or use server-side processing
- **Documentation:** Include clear legends, axis labels, data sources, and methodology notes
- **Maximize Data-Ink Ratio (Tufte):** Remove chartjunk, emphasize data over decoration

Demo 4: AI Innovation in Academic Research Libraries

Advanced Data Analytics Dashboard

Tracking research services transformation and AI integration across UC Riverside Libraries

Open Dashboard

Best Practices: Working with Research Documents & Data

- **Maintain Data Provenance:** Document all data sources, transformations, and AI-assisted steps for reproducibility
- **Version Control:** Save iterations of your prompts and outputs to track analytical evolution
- **Validate Calculations:** Always cross-check AI-generated statistics against manual calculations or established tools
- **Cite AI Assistance:** Be transparent about AI's role in data analysis and visualization in your methods section
- **Peer Review Process:** Have domain experts review both the visualization design and underlying analytical logic

Demo 5: LinkedIn Network Analysis

(10 Most Cited Research Papers of All Time)

Citation Patterns & Knowledge Flow Visualization

Advanced network analysis combining academic citations with social media engagement metrics

Open Dashboard

LinkedIn Socio-Economic Profile Viewing Patterns Analysis

Advanced Prompting Methodologies

LinkedIn Profile Interest Article

The Conversation

My Prompt:

Create a network analysis dashboard combining: Data: - LinkedIn post performance (views, engagement, reach) - Academic citation patterns from publications - Knowledge flow between research topics Features: - Network graph showing topic connections - Time-based animation of idea diffusion - Engagement metrics dashboard - Topic clustering (community detection algorithms) - Interactive node exploration with drill-down - Export functionality for further analysis Use force-directed layout for network visualization. Please ask me questions if you have about the data or research.

Key Innovation: Analyzing Multi-Layer Complex Networks

Network Analysis Applications Beyond LinkedIn:

- **STEM Research:** Mapping collaboration networks between laboratories, tracking knowledge diffusion across disciplines, visualizing citation patterns in emerging fields
- **Biology:** Protein-protein interaction networks, neural connectivity maps, gene regulatory networks, metabolic pathways, disease transmission patterns
- **Sociology:** Social movement dynamics, community structure analysis, information spread in populations, organizational hierarchies, cultural transmission patterns
- **Economics:** Supply chain networks, trade relationships, financial system interconnections, innovation ecosystems, market influence patterns

✨ **What makes this special:** Multi-layer network combining academic and social dimensions with algorithmic community detection

Final Review: Your Advanced AI Toolkit

for Data Visualization and Deep Research Reports

Anthropic Claude Artifacts (Opus and Sonnet)

Best for: Custom interactive dashboards, full web applications, Easy AI API addition

Strength: Complex visualizations, real-time data, Trillion Parameter AI Brain

(What I used for all 10 dashboards)

ChatGPT and Gemini Advanced Data Analysis and Scientific Verification

Best for: Exploratory data analysis, Python notebooks

Strength: Statistical analysis, data cleaning

(Great for initial exploration)

NotebookLM

Best for: Research synthesis, literature reviews, simplifying research

Creates: Audio podcasts, video overviews, infographics

(Perfect for synthesizing multiple sources)

GitHub Copilot

Best for: Custom development, code generation

Strength: IDE integration, completion, Version and Code Archiving

(For advanced customization)

Deep Research Models

Best For: Base Research Reports for Data

Strength: Interrogating Data, Finding Data, Verifying Sources Preliminarily

(Comprehensive research foundation)

Best Practices for AI-Assisted Visualization

✓ Do This:

- Start with clear research questions
- Provide sample data structure
- Iterate incrementally through conversation
- Validate all outputs against source data
- Document your prompts and iterations
- Test accessibility and responsiveness
- Embrace experimental discovery

✗ Avoid This:

- Skipping verification and validation
- Trusting complex calculations blindly
- Ignoring accessibility standards
- Over-complicating visualizations
- Forgetting to cite AI & Data Sources and Assistance
- Going for Perfection and One Shot
- Assuming first output is final

FAIR Principles for AI-Assisted Research and Data

FAIR for AI & Data

Findable: Document AI models used (version, provider), persistent IDs for datasets

Accessible: Share prompts, code artifacts, raw data with proper authentication

Interoperable: Use standard formats (JSON, CSV), export from AI tools to open standards

Reusable: License AI-generated outputs clearly, document all AI assistance in methods

Data and AI-Specific Ethics

Privacy: Never feed sensitive/personal data to AI without anonymization

Algorithmic Bias: AI models inherit training data biases—validate outputs critically

Transparency: Disclose which AI tools generated which components (analysis, code, visualization)

Reproducibility: Save exact prompts, model versions, timestamps, random seeds

AI amplifies both rigor and errors—maintain scholarly standards

Five Keys to AI Data Visualization Excellence

1. Let Data Tell Its Story – Remove all barriers between insight and understanding

2. Design for Discovery – Every interaction should reveal something new

3. Honor Your Data's Integrity – Beauty, accuracy and failure are not enemies

4. Make It Accessible to All – Great visualization transcends barriers

5. Iterate and Version Fearlessly – With AI, perfection is a conversation, not a fixed destination (12-20 versions are not uncommon to get a great product)

Comments and Questions?

Share your thoughts, challenges, and questions—let's learn together!

Bibliography: Data Visualization Best Practices

Foundational Works:

Bertin, J. (1983). *Semiology of Graphics: Diagrams, Networks, Maps*. University of Wisconsin Press.

Tufte, E. R. (2001). *The Visual Display of Quantitative Information* (2nd ed.). Graphics Press.

Contemporary Methods:

Cairo, A. (2016). *The Truthful Art: Data, Charts, and Maps for Communication*. New Riders.

Few, S. (2012). *Show Me the Numbers: Designing Tables and Graphs to Enlighten* (2nd ed.). Analytics Press.

Knaflic, C. N. (2015). *Storytelling with Data: A Data Visualization Guide for Business Professionals*. Wiley.

Munzner, T. (2014). *Visualization Analysis and Design*. CRC Press.

Wilkinson, L. (2005). *The Grammar of Graphics* (2nd ed.). Springer.

Wilkinson, M. D., et al. (2016). The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data, 3*, 160018.

AI-Assisted Development & Human-AI Collaboration Bibliography

Anthropic. (2024). *Claude AI Documentation*. https://docs.anthropic.com

D3.js Documentation. (2024). *Data-Driven Documents*. https://d3js.org

Google. (2024). *NotebookLM: AI-Powered Research Assistant*. https://notebooklm.google

Observable. (2024). *The Collaborative Data Visualization Platform*. https://observablehq.com

OpenAI. (2024). *GPT-4 Technical Report*. https://openai.com/research/gpt-4

Plotly. (2024). *Python Graphing Library Documentation*. https://plotly.com/python/

UC System Resources: https://uc.ai (UC AI initiatives and guidelines)

UC Riverside Libraries. Research Data Services. https://library.ucr.edu/research-services

---

Uzwyshyn, R. — Human/AI Collaboration & Research:

Uzwyshyn, R. (2023). Open Science and Datasets to AI and Discovery. *Trends and Issues in Library Technology*. https://rayuzwyshyn.net/MSU2023/TILT2023/OpenScienceAIUzwyshyn2023.pdf

Uzwyshyn, R. (2025). Best Practices for Human/AI Research Collaboration. https://www.linkedin.com/pulse/best-practices-humanai-research-collaboration-phd-ai-uzwyshyn-ph-d--jusic/

Uzwyshyn, R. (2025). Co-Intelligence: New Models for Human-AI Collaboration (Presentation). https://www.linkedin.com/posts/rayuzwyshyn_co-intelligence-new-models-for-human-ai-activity-7339389639331368964-3bUl/

Uzwyshyn, R. (2025). Co-Intelligence, Entangled Partnerships & New Models for Human-AI Collaboration. https://www.linkedin.com/pulse/co-intelligence-entangled-partnerships-modles-raymond-uzwyshyn-ph-d--5mgmc/

Data Visualization Apps

Uzwyshyn, R. Data Driven Dashboards, Interactive Data Visualization and Information Visualization Apps:

Advanced Citation & LinkedIn Analysis Dashboard. Interactive Visualization of Citation Patterns, Knowledge Flows and LinkedIn Post Performance. April 2025.

AI Innovation in Academic Research Libraries. Advanced Data Analytics and Visualization Dashboard. May 2025.

AI Model Intelligence and Economics Dashboard, Version 14 Revision. (Price Performance, Ranking, Market Intelligence). June 2025.

AI's Impact on Knowledge Workers: Real-Time Analysis of Economic Transformation on Professional Work v.6 (Interactive Data Visualization). June 2025.

Athena Capital Financial Derivatives Sell Side Puts Quant App. V. 2 FinTech. (AI API). May 2025.

Collider Bias: The Elite Athlete Paradox. Multivariate Complex Statistics Explained through Interactive Visualization (Background). 2025.

Complex Treasury Bond ETF Yield Relationships (TLT). Interactive Visualization of TLT Price Relationship vs Treasury Yields and Federal Reserve Fund Rate. 2025.

Enhanced Socio-Economic Analysis of LinkedIn User Profile Interest Networks. Interactive Visualization. 2025.

NASDAQ Companies Mapped to Demis Hassabis Creativity Architecture. April 2025.

NASDAQ Corporations Across Demis Hassabis Probability Landscape. (Business App Mapping Innovation Stages to Market Capitalization). June 2025.

The Graduate Employment Paradox: Interactive Data Visualization and Synthesis. New York Federal Reserve, Stats Canada and UK Universities Labor Market Sources et al. 2026.

Thank You!

You now have the data tools and AI to visualize your research,
Use them wisely!

Ray Uzwyshyn, Ph.D. MBA MLIS

Acting AUL for Research & Technology

and Director of Research Services

UC Riverside Libraries

linkedin.com/in/rayuzwyshyn
rayuzwyshyn.net

All dashboards available at: rayuzwyshyn.net

💙 Thank you for being part of UC Loves Data Week!