HCDE 548 Advanced Topics in Information Visualization

Winter 2014

TTh 2:30-4:20 Sieg 226

Class website: http://faculty.washington.edu/aragon/classes/hcde548/w14/

Class discussion board: https://catalyst.uw.edu/gopost/board/aragon/35041/

This partial-studio, partial-seminar class will combine discussion of current infovis topics with hands-on design exercises and critiques. Every two-hour session will consist of one hour of hands-on work relevant to a particular visualization topic. The second hour will be comprised of discussion of recent papers on that topic. Topics to be covered include: appropriate allocation of visual attributes to data variables, designing with color and luminance contrast, the psychology of human vision and perception, visual analytics, interaction, storytelling, text visual analytics, big data visualization, uncertainty visualization, network visualization, cartographic visualization, animation and time series visualization, and class preferences. Students are encouraged to bring in ongoing research, but the studio part of the course will consist of several projects that focus on intermediate progress, iteration, and critique.

The final group project will consist of the design and implementation of an interactive visualization. This project may be an iteration of an in-class project or may relate to the student's existing research goals. Project topics will be determined jointly by students and instructor. Examples of interactive visualization can be seen at http://www.wefeelfine.org/ or http://www.gapminder.org. These are professional efforts and are intended to serve as aspirational. Class projects will focus on a single design goal and are intended to be much smaller in scope. Previous class projects can be seen at http://faculty.washington.edu/aragon/classes/hcde548/w14/.

Prerequisite: HCDE 411, 511, or other information visualization class.

Goals and Expectations

During a class session, students can expect:

- 50 minutes of seminar/lecture/discussion. This will consist of reading recent research publications on various topics, taking turns presenting the papers and leading class discussion, review of online paper discussion, developing thoughtful questions, and delving into research topics in depth.

- 50 minutes of studio time. This will involve various hands-on exercises such as: sketching, creating paper prototypes (with post-its, translucent paper, markers, etc.) of common interactive visualization techniques such as brushing and linking, using ColorAid cards to facilitate describing color interactions, selecting and evaluating design goals, group critique, usability evaluations, use of laptops and online tools.

Learning Objectives

Learning objectives for the **seminar** portion consist of:

- Based on existing foundation of information visualization knowledge and skills, further develop knowledge of human visual system, visual perception, and attention.
- Understand selected advanced research topics in information visualization in depth.
- Develop skills in presenting information and leading discussions on advanced research topics.
- Acquire and enlarge capacity to inquire, discover, create, innovate, and challenge ideas, techniques, and knowledge in information visualization.

Learning objectives for the **studio** portion consist of:

- Develop visual and design imagination.
- Develop practical skills in selecting and evaluating design goals for interactive visualizations.
- Develop practical skills in designing, evaluating, and implementing interactive visualizations.
- Develop and practice specific skills in visual literacy such as sketching, paper prototyping, area estimation, critique, and usability evaluation to become independent, creative designers and researchers in information visualization.

Grading:

- Class participation (studio work, in-class and online forum discussion, paper write-ups and presentations) 80%
- Project 20%

Participation and Extra Credit Policy:

- As a studio class, class participation is critical. If you need to be absent from class, please notify instructor via e-mail in advance with the reason for your absence. You are allowed no more than two absences in the term. You are expected to make up any work that you miss during an absence by presenting extra information from readings or making a summary of the class on the GoPost.

Class Schedule (Winter 2014)

Week 1, Tue (1/7/14): Intro and Review of Data Types
Seminar:
- Intro, review of data types. Cars dataset exercise.

Studios:
- Brainstorming of the cars dataset. Sketching design alternatives.

Week 1, Thu (1/9/14): Color. *Guest Lecturer: Maureen Stone*
Seminar:
- Color -- Maureen Stone.

Readings:
- Chapter 5 from Tufte's Envisioning Information
- Expert Color Choices by Maureen Stone
- After the Storm by Pauline Baker and Colleen Bushell

Studios:
- Brown applets on metamers; Albers exercises on background, ordering color swaths by lightness regardless of hue.

Week 2, Tue (1/14/14): Color (part 2). *Guest Lecturer: Maureen Stone*
Seminar:
- Designing color palettes using Tableau -- Maureen Stone

Studios:
- Design your own color palette for Tableau (Bring laptop with Tableau installed)

Week 2, Thu (1/16/14): Designing with Luminance Contrast
Seminar:
- Designing with luminance contrast

Readings:
- Designing with Luminance Contrast -- NASA Color Usage Lab

Studios:
- Exercises on the screen: http://colorusage.arc.nasa.gov/design_lum_0.php
- Maps: http://www-personal.umich.edu/~mejn/election/2012/
- http://www.coopercenter.org/demographics/Racial-Dot-Map
- Draw your own map on butcher paper.

Week 3, Tue (1/21/14): Visual Motion Perception
Seminar:
- Visual motion perception

Readings:
- **Chapter 10** from Palmer, S.E. (1999). Vision Science. MIT Press, Cambridge MA, USA.

- **Motion Demos**: http://www.skidmore.edu/~hfoley/PercLabs/Motion.htm
- **Visual motion perception lecture:**
  http://www.cns.nyu.edu/~david/courses/perception/lecturenotes/motion/motion.html
- **NY Times article:** http://bits.blogs.nytimes.com/2014/01/06/a-makeover-for-maps/
- **Effectiveness of Animation in Trend Visualization** (Robertson, Fernandez, Fisher, Bongshin Lee, Stasko) http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=4658146

Studios:
- Paper workshopping

Week 3, Thu (1/23/14): Perceptual Differences Between Individuals

Readings:
- "The Influence of Culture on Visual Perception" by MARSHALL H. SEGALL, DONALD T. CAMPBELL AND MELVILLE J. HERSKOVIT
- "The Credible Shrinking Room" -- a traditional experiment that assesses children's ability to understand visual representations of reality using an imaginary "shrinking machine" to make a tiny version of the room the children view.

Studios:
- Map visualizations (representing different aspects/variables in common map projections)

Week 4, Tue (1/28/14): Interaction

Seminar:
- Interactive Visualizations on Large and Small Displays
- Angular brushing of extended parallel coordinates

Readings:
- "Angular Brushing of Extended Parallel Coordinates", Hauser, Ledermann, Doleisch, Proceedings of IEEE Symposium on Information Visualization, 2014.
- "Interactive Visualizations on Large and Small Displays: The Interrelation of Display Size, Information Space, and Scale", Jakobsen and Hornbaek, IEEE Trans. on Visualization and Computer Graphics, Vol. 19, No. 12, Dec. 2013.

Week 4, Thu (1/30/14): Storytelling

Seminar:
- Storytelling: The Next Step for Visualization
- Maneesh Agrawala, Storytelling Tools, 3:30 PM EEB 105.

Readings:
- "Storytelling: The Next Step for Visualization.", Robert Kosara and Jock Mackinlay, 2013

Week 5, Tue (2/4/14): Big Data Visualization

Seminar:

- [Visualization at Supercomputing Centers: The Tale of Little Big Iron and the Three Skinny Guys](#)
- [Getting an Intuition for Big Data](#)

Readings:
- ["Getting an Intuition for Big Data"](#) , Forrest Shull, from IEEE Software
- ["Visualization at Supercomputing Centers: The Tale of Little Big Iron and the Three Skinny Guys"](#) , Bethel, E.W. et al, from IEEE CG&A

Studios:
- Paper prototypes for "overview first, zoom & filter, details on demand" and "brushing & linking"

Week 5, Thu (2/6/14): Big Data Visualization. *Guest Lecturer: Danyel Fisher*

Seminar:
- [Big Data Visualization](#)

Readings:
- ["Trust Me, I'm Partially Right"](#) (CHI 2012)
- ["Interactions with Big Data Analytics"](#) (ACM Interactions magazine, May 2012)

Week 6, Tue (2/11/14): Visual Analytics

Seminar:
- [Visual Analytics](#)

Reading:
- ["Visual analytics: Definition, process, and challenges,"](#) D. Keim, G. Andrienko, J.-D. Fekete, C. Görg, J. Kohlhammer, and G. Melançon, Information Visualization, LCNS, pp. 154–175, 2008.

Optional:
- ["Characterizing users' visual analytic activity for insight provenance"](#), Gotz, D., & Zhou, M. X. (2009). Information Visualization, 8(1), 42-55.
- ["Characterizing the intelligence analysis process: Informing visual analytics design through a longitudinal field study"](#) , Kang, Y. A., & Stasko, J. (2011). In Visual Analytics Science and Technology (VAST), 2011 IEEE Conference on (pp. 21-30). IEEE.

Week 6, Thu (2/13/14): Visual Analytics

Seminar:
- [Design considerations for collaborative visual analytics](#)
- [Beyond usability: Evaluation aspects of visual analytic environments](#)

Readings:
- ["Design considerations for collaborative visual analytics"](#), Heer, J., and Agrawala, M. (2008). Information Visualization 7, 49–62.
- ["Beyond usability: Evaluation aspects of visual analytic environments"](#), Scholtz, J. (2006). 2006 IEEE Symposium on Visual Analytics Science And Technology, pp. 145–150.

Studios:
- Paper prototyping. How does one represent interactivity in a paper prototype?

Week 7, Tue (2/18/14): Uncertainty

Seminar:

- [Visualizing Uncertainty](#)
- [A Taxonomy of Uncertainty Visualization](#)

Readings:

- ["From Quantification to Visualization: A Taxonomy of Uncertainty Visualization Approaches"](#) by Potter, Rosen, and Johnson
- ["Visualizing Uncertainty for Improved Decision Making" by Griethe and Schumann](#)

Studios:

- Paper prototypes of final project proposals. Each group will present.

Week 7, Thu (2/20/14): Text Visualization

Readings:

- ["Information Visualization for Text Analysis"](#), by Marti Hearst, Chapter 11 of *Search User Interfaces*, Cambridge University Press, 2009.
- ["Interpretation and trust: designing model-driven visualizations for text analysis." (2012) Jason Chuang, Daniel Ramage, Christopher Manning, and Jeffrey Heer. (CHI '12)](#)

Studios:

- Paper prototypes of final project proposals. Critique session.

Week 8, Tue (2/25/14): Cartographic Visualization

Readings:

- **WORLDMAPPER: the world as you've never seen it before** (IEEE, 2006)
  http://ieeexplore.ieee.org.offcampus.lib.washington.edu/xpl/articleDetails.jsp?tp=&arnumber=4015427&queryText%3DWORLDMAPPER
- **Adaptive Composite Map Projections** (TVCG, 2012)
  http://cartography.oregonstate.edu/pdf/2012_Jenny_AdaptiveCompositeMapProjections.pdf

Studios:

- Presentation of informal usability evaluation of final project low-fidelity prototypes. Bring paper prototypes, sketches, photos, and describe results of user evaluations. Class will give feedback on design iterations.

Week 8, Thu (2/27/14): Effective Uses of Animation/Temporal Visualization

Readings:

- **Animated Transitions in Statistical Data Graphics** (IEEE, 2007)
  http://ieeexplore.ieee.org.offcampus.lib.washington.edu/search/searchresult.jsp?newsearch=true&queryText=Animated+Transitions+in+Statistical+Data+Graphics&x=0&y=0

Optional background readings:

- **Animation: From Cartoons to the User Interface** (ACM, 1995)
  http://dl.acm.org/citation.cfm?id=974941&coll=DL&dl=GUIDE&CFID=294832638&CFTOKEN=40964301

Studios:

- Projects – Another design iteration, including an informal usability evaluation with at least two users.

Week 9, Tue (3/4/14): Network Visualization. *Guest Lecturer: Jevin West*.
Readings:
- *Mapping Change in Large Networks* by Martin Rosvall and Carl Bergstrom (2010 PLOS One).
Studios:
- Project discussion – Integration.

Week 9, Thu (3/6/14): Chartjunk Debate
Readings:
- **Benefiting InfoVis with Visual Difficulties** by Jessica Hullman et al.,
  http://misc.si.umich.edu/media/papers/difficulties_infovis.pdf

- The response by **Stephen Few**:
  http://www.perceptualedge.com/articles/visual_business_intelligence/visual_difficulties.pdf

- The rebuttal and defense of Hullman by **Robert Kosara**: http://eagereyes.org/watchlist/jessica-hullman

Week 10, Tue (3/11/14): Final Projects
Studios:
- Project work – Implementation and integration.

Week 10, Thu (3/13/14): Final Projects
Studios:
- Project work – Implementation and integration.

Finals Week, Tue (3/18/14): Final Project Presentations
Group Presentations:
- Final project presentations and demos.