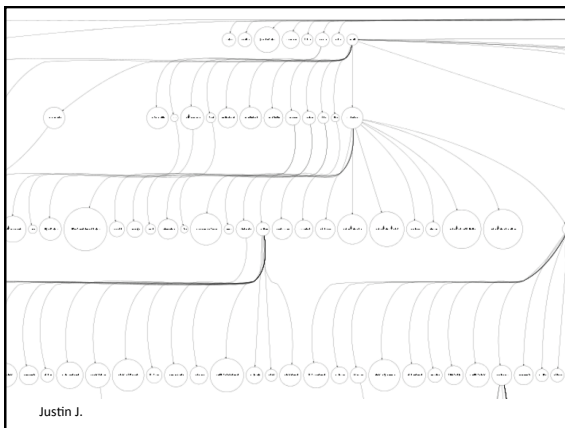
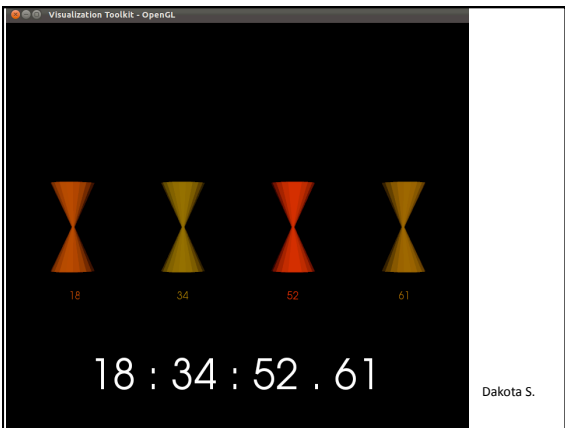
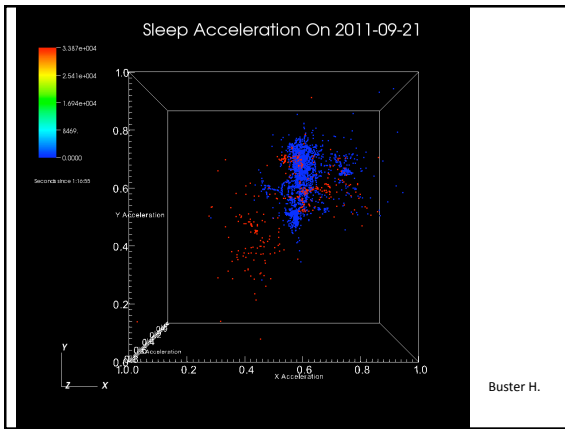
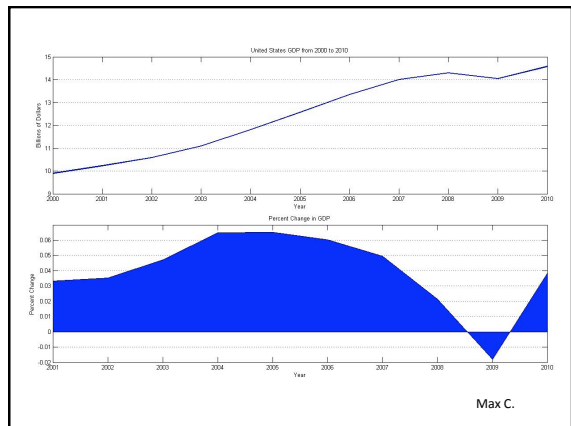
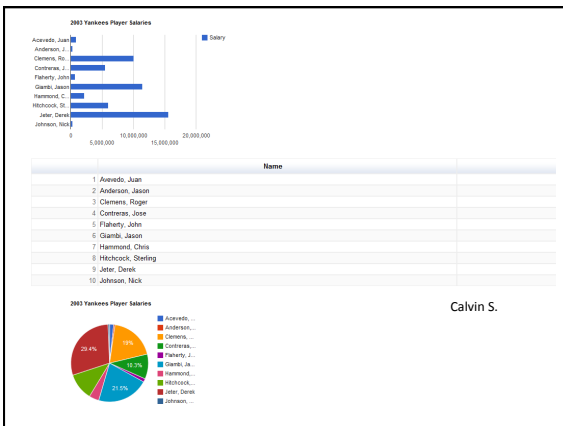
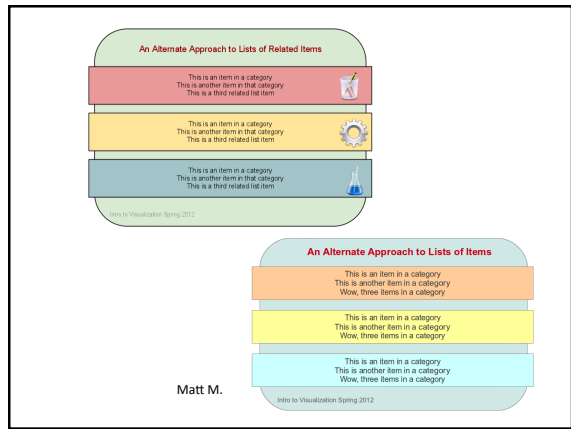
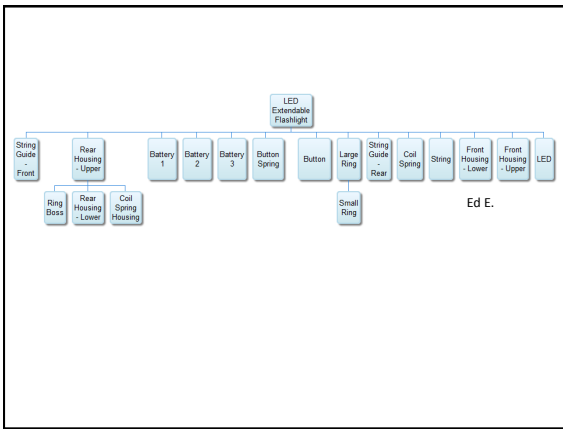
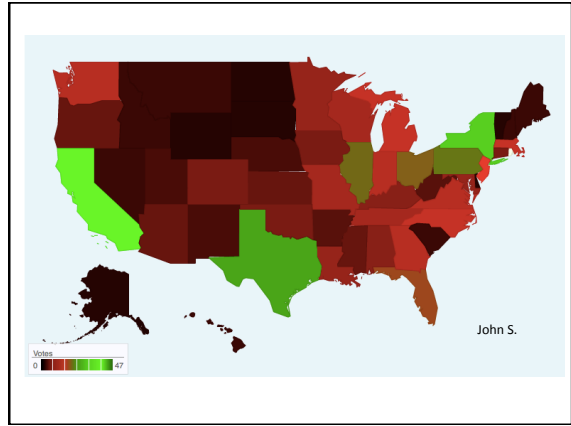
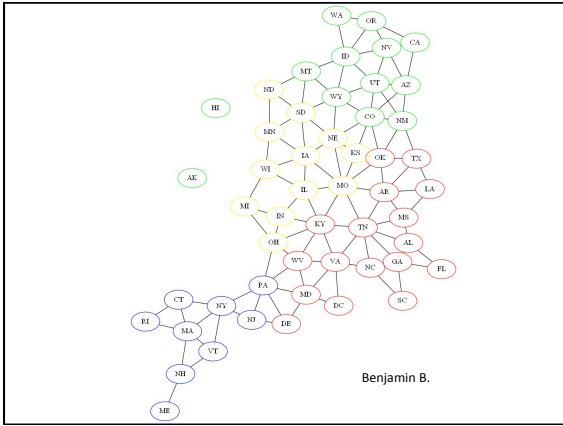


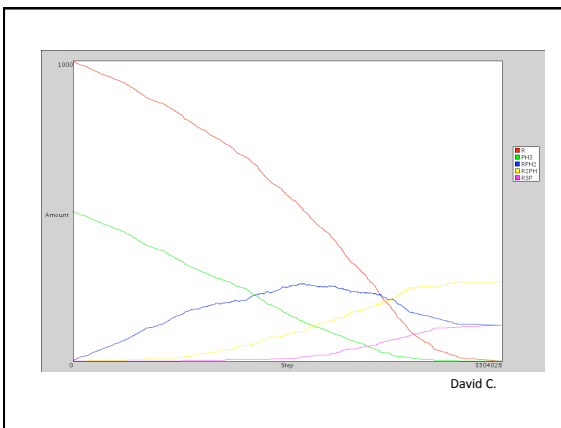
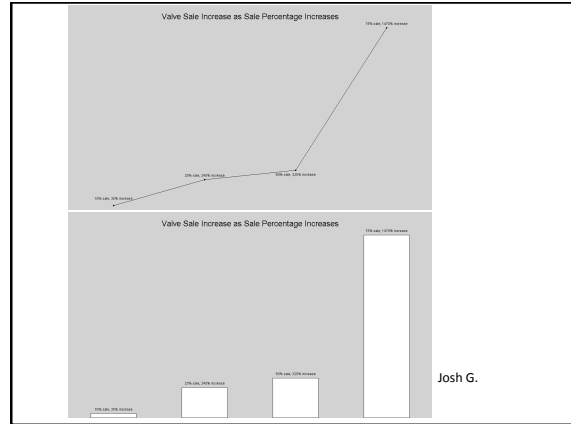
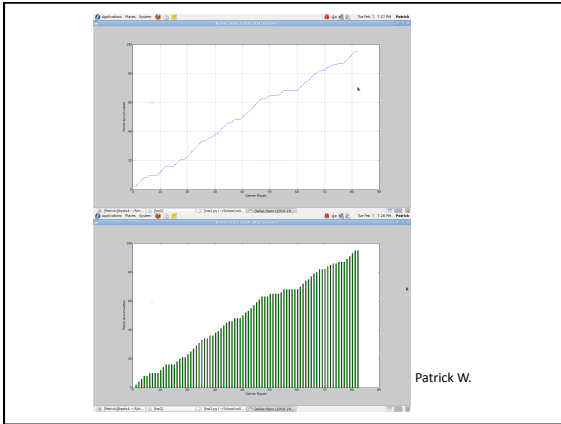
Graph Drawing & New (to you) Visualization Tools

- ## Today
- Tools used in HW #2
 - Highlights from HW #2
 - Readings for this week
 - Force-based Graph Layout
 - A graph problem from materials research

- ## Tools used
- Google Chart Tools (3)
 - Google Docs
 - Libre Office
 - GraphVis (2)
 - VTK (3)
 - Processing (3)
 - High charts
 - Matlab & MatVTK
 - Matplotlib & PyGTK
 - VisIt
 - SoFMIS







Today

- Tools used in HW #2
- Highlights from HW #2
- Readings for this week
- Force-based Graph Layout
- A graph problem from materials research

Readings for This Week

- "A Short Note on the History of Graph Drawing" Kruja, Marks, Blair, and Waters, Graph Drawing 2001
- "Graph Drawing", Tamassia, 1997, Lecture Notes in Computer Science
- "Lombardi drawings of graphs", Duncan, Eppstein, Goodrich, Kobourov, Nollenberg, Graph Drawing 2010

Today

- Tools used in HW #2
- Highlights from HW #2
- Readings for this week
- Force-based Graph Layout
- A graph problem from materials research

"Graph drawing by force-directed placement", Fruchterman & Reingold, 1991

String/Cloth Simulation

- Springs link the particles
- Springs try to keep their rest lengths and preserve the length of the string

Interactive Animation of Structured Deformable Objects Desbrun, Schröder, & Barr 1999

Enumerating *Non-Planar* Foam Polyhedra

Enumerating *Non-Planar* Foam Polyhedra

- 3-regular (cubic) connected planar graph

Enumerating *Non-Planar* Foam Polyhedra

- Definitely non-planar....

Enumerating *Non-Planar* Foam Polyhedra

- Edges must be curved too...

Starting Configuration

- Each vertex has "receptors" for 3 edge links
- **ADD AN EDGE** between 1 & 2
- All other vertices are unlinked and their relative positions are unspecified

Random Graph Generation

- Pick 2 vertices at random that each have ≥ 1 open receptor

Random Graph Generation

- If one vertex was already linked in the graph & the other was not linked,
- **ADD THE EDGE**
- (If > 1 receptor is open at a vertex, choose randomly from the open receptors)

Random Graph Generation

- If neither vertex is in the graph yet,
- **SKIP THIS PAIR**
- (It may be selected and successfully added later)

Random Graph Generation

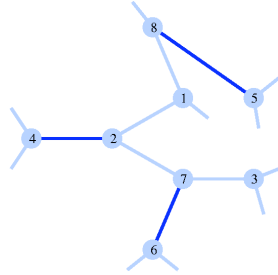
- (After adding a couple more edges)

Random Graph Generation

- If both vertices are in the graph, check for an edge crossing:
- If the open receptors are *not adjacent* in a traversal of the open receptors on the border of the graph,
- **SKIP THIS PAIR**
- (This pair may be selected and successfully added later)

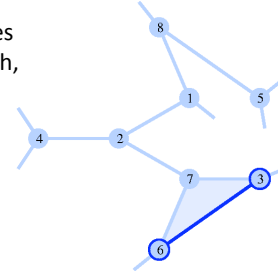
Random Graph Generation

- (After adding a few more edges)



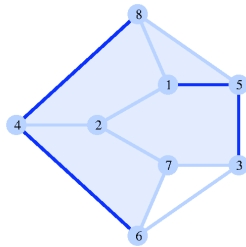
Random Graph Generation

- If both selected vertices are already in the graph, and the open receptors for each vertex are adjacent,
- **ADD THIS EDGE**
- (BTW, you have just created a polygonal face!)

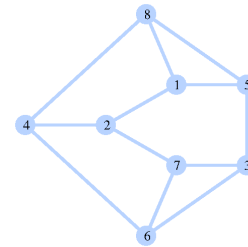


Random Graph Generation

- (After adding the final edges and faces)



Finished Graph

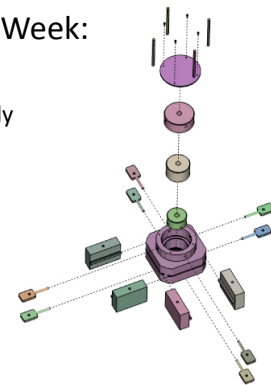


Homework Assignment 3: due Tuesday @ 11:59pm Team Projects & Design/Execution

- Work with 1 (or 2) other people
- Continue learning more about new (to you) visualization tools
- Create a visualization to “Teach someone something”
- Focus: Visualization Design & Visualization Execution

Reading for Next Week:

- "Designing Effective Step-By-Step Assembly Instructions"
Agrawala et al., 2003



Reading for Next Week:

- Maneesh Agrawala & Chris Stolte, "Rendering Effective Route Maps: Improving Usability Through Generalization", SIGGRAPH 2001

