What resource limitations are we faced with?
• computational limits
  – processing time
  – system memory
• human limits
  – human attention, cognition, and memory
• display limits
  – pixels are precious resource, the most constrained resource
  – information density: ratio of space used to encode info vs unused whitespace
  – tradeoff between clutter and wasting space, find sweet spot between dense and sparse displays

Why use an external representation?
Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively.

Why do visualization work?
• limits of memory & cognition
  – change blindness
• power of perception to reveal
  – how many V’s?

Why does visualization work?
• limits of memory & cognition
• record information
• see data in context
• support computational analysis
• explain hypotheses
• expand memory
• find/reveal patterns
• generate hypotheses
• inspire
• make decisions

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Which subway map is better? Why?

Many definitions
• The purpose of visualization is insight, not pictures
• Visualization is really about external cognition, that is, how resources outside the mind can be used to boost the cognitive capabilities of the mind
• Good data visualization...
  – makes data accessible
  – combines strengths of humans and computers
  – enables insights
  – promotes system analytics
  – visualizes = human data interaction

My own favorite definition
Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively.

Why focus on tasks and effectiveness?
• effectiveness requires match between data/task and representation
  – set of representations is huge
  – human in the loop needs the details & no trusted automatic solution exists
  – each system has a different set of strengths and weaknesses

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Why focus on tasks and effectiveness?
• effectiveness requires match between data/task and representation
  – set of representations is huge
  – many are ineffective mismatch for specific data/task combo
  – increases chance of finding good solutions if you understand full space of possibilities

What does visualization do?
• reveals patterns
• assesses validity of statistical model
• summarizes lose information, details matter
• confirms expected and finds unexpected patterns
• assess availability of resources

Reveal patterns

Visualize definition & motivation
Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively.

Visualization is suitable when there is a need to augment human capabilities rather than replace people with computational decision-making methods.

• human in the loop needs the details & no trusted automatic solution exists
  – doesn’t know exactly what questions to ask in advance
  – exploratory data analysis
  – speed up through human-in-the-loop visual data analyzers
  – presents brown results to others
  – stepping stone towards automation
  – before model creation to provide understanding
  – during algorithm creation to refine, debug, set parameters
  – before or during deployment to build trust and monitor

Communicate ideas to others

Getting help
- labs with TAs
  - 3 slots on Fridays: 9-10, 11-12, 4-5
  - all in ICICS/CS Room 015
  - first lab Jan 17
  - consultation on D3 exercises and final project
- my office hours Tue right after class (3:30-4:30pm)
- by appointment, email me to arrange (tmm@cs.ubc.ca)
  - unlikely to catch me by dropping by, I'm usually either in meeting or elsewhere
- X661 (X-Wing of ICICS/CS bldg)
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Why analyze visualizations?
- imposes structure on huge design space
  - scaffold to help you think systematically
- guiding the exploration steps
  - Navigate Select Filter Aggregate

Exercise
- Which gender and income level shows a different effect of age on triglyceride levels?

Why does visualization work?
- limits of memory & cognition
  - change blindness
  - power of perception to reveal
- limits on number of possibilities ineffective for particular task/scenario combination

Course structure
- theoretical foundations, all term
  - in-class lecture twice/week, 2-3:20pm Tue/Thu
  - in-class in-class exercises leading into foundations exercises
  - post-class: finish foundations exercises
- D3 programming, weeks 1-8
  - partially flipped
  - pre-class: watch videos (plus a few readings)
  - pre-class: pre-lab quizzes, due by Fri before the lab
  - in-class work on programming exercises in Friday labs
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Grading Scheme
- Exams: 30%
  - Midterm Exam: 15%, Final Exam: 15%
- Final Project: 30%
  - Programming Assignment: 50% of project
  - Foundations Assignment: 40% of project
  - Process Log: 10% of project
- Programming Assignments: 12%
  - 3 instances, 4% each
  - Foundations Assignments: 12%
  - 3 instances, 4% each
  - Participation: 10%
  - in-class exercises/Piazza discussion
  - Pre-Lab Prep Quizzes: 6%
  - 2 quizzes, 6 of them count 1% each (worst score dropped)

Resources
- optional textbook for further reading
  - Tamara Munzner
  - Visualization Analysis and Design
  - https://www.cs.ubc.ca/~tmm/vadbook/
  - UBC library has multiple free ebook copies
  - content will be covered in lecture

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- Instructor:
  - Tamara Munzner
  - pronouns: she/her
- TAs:
  - Michael Oppermann
  - Zipeng Liu
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- Piazza:
  - is the best way to reach us
  - use for all discussion and questions (not email)
  - https://piazza.com/class/k41qv94wb3r4uq
  - my office hours start today, right after class (X661)
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Course structure
- final projects, weeks 6-14
  - integrate programming and foundations
  - self-chosen teams of 3
    - stages
      - milestone 1: pitch (due Mar 6)
      - milestone 2: work in progress (due Mar 20)
      - milestone 3: final version (due Apr 8)
  - exams
    - midterms (Mar 12)
    - final (May 28)
    - primary focus will be on foundations
  - participation
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Information
- web page course is the vortex
  - mirror/temporary now up: https://www.cs.ubc.ca/~tmm/courses/436V-20/
  - permanent URL coming soon: https://students.cs.ubc.ca/~cs-436v/20/
  - don't forget to refresh frequent updates
- Socrative software clicker
  - https://api.socrative.com/rc/FwT2fa
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