What resource limitations are we faced with?
- computational limits
  - processing time
  - system memory
- human limits
- 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 space

What does 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
- change blindness
- power of perception to reveal
  - how many V's?

Communicate ideas to others
- present known results to others
  - before or during deployment to build trust and monitor
- during algorithm creation to refine, debug, set parameters
- before model creation to provide understanding

Why do we create visualizations?
- analyzes data to support reasoning
- answer questions
- communicate ideas to others
- confirm hypotheses
- expand memory
- find/reveal patterns
- generate hypotheses
- inspire
- make decisions
- record information
- see data in context
- support computational analysis

Reveal patterns
- Anscombe's Quartet: Raw Data
  - x/y correlation
  - y mean
  - x variance
  - Anscombe's quartet: raw data

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 space

Why use an external representation?
- external representation: replace cognition with perception
  - makes data accessible
  - combines strengths of humans and computers
  - enables insights
  - extends human limits

Why use an external representation?
- external representation: replace cognition with perception
  - makes data accessible
  - combines strengths of humans and computers
  - enables insights
  - extends human limits

Why choose visualization?
- limits of memory & cognition
  - change blindness
  - generate hypotheses

Why does 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
  - change blindness
  - power of perception to reveal
  - how many V's?
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
• my office hours Tue right after class (3:30-4:30pm)
  – or by appointment, email me to arrange (tmm@cs.ubc.ca)
  – unlikely to catch me by dropping by if I’m usually in office or elsewhere

Why analyze visualizations?
• imposes structure on huge design space
• difficult to help you think systematically
• about choices
• adapting existing or stepping stone to designing new
• analyzing ineffective for particular task/situation combination

Why does visualization work?
• limits of memory & cognition
  – change blindness
• power of perception to reveal
  – how much Y?• which of these 50 numbers appears most often?
  15 19 60 33 11 75 57 34 79 18 51 92 73 22 13 71 60 22
  17 10 68 73 18 55 66 29 60 73 22 46 92 97 10 58 46
  57 17 83 99 33 88 92 60 91 29 57 96 12 47

Course structure
• theoretical foundations, all term
  – in-class: lectures twice/week, 2-3:20pm Tue/Thu
  – in-class: in-class exercises leading into foundations exercises
  – pre-class: finish exercises in Friday labs
  – individual consultation with TAs
  – past-class: finish exercises at home, to hand in

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
    – how many Y?
    – which of these 50 numbers appears most often?

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

Course structure
• final projects, weeks 6-14
  – integrate programming and foundations
  – self-chosen teams of 3
  – milestones 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 (TBD)
• participation
  – in-class exercises, Piazza discussion
• Grading Scheme
  – Exams: 30%
    – Midterm Exam: 10%, Final Exam: 20%
  – Final Project: 30%
    – Programming Achievement: 40% of project
    – Foundations Design: 40% of project
    – Process (group work): 20% of project
  – Programming Assignments: 12%
    – 5 instances, 4% each
  – Foundations Assignments: 12%
    – 6 instances, 2% each
  – Participation: 10%
  – Pre-Lab Prep Quizzes: 6%
    – 7 quizzes, 6 of them count 1% each (worst score dropped)

Getting help
• labs with TAs
  – 3 slots on Friday 9-10, 11-12, 4-5
  – all in ICICS/CS Room 015
• my office hours Tue right after class (3-3:30)
  – or by appointment, email me to arrange (tmm@cs.ubc.ca)
  – unlikely to catch me by dropping by if I’m usually in office or elsewhere

Resources
• optional textbook for further reading
  – Tamara Munzner
  – https://www.cs.ubc.ca/~tmm/visbook
  – UBC library has multiple free ebook copies
• UBC videos to watch this week
  – refresher only if you need it: JS/HTML [90 min]
  – Intro to D3 programming, weeks 1-8

Todo this week
• D3 videos to watch this week
  – refresher only if you need it: JS/HTML (90 min)
  – process (group work): 20% of project
• Exam
  – midterms (Mar 6)
  – final (TBD)
• lab Friday
  – in-class exercises leading into foundations exercises

Information
• web page course is the vortex
  – mirror/temporary now up: https://www.cs.ubc.ca/~tmm/courses/436L20
  – permanent URL coming soon: https://www.students.cs.ubc.ca/~cs-436v20
• Don’t forget to refresh, frequent updates!
• Socrative: software clicker
  – https://go.socrative.com/Fv72 installing a game and logo into space tree.
  – Canvas: pre-lab quizzes
    – https://vamr.ubc.ca/course/44149
  – github, classy
    – stay tuned

Course staff
• Instructor:
  – Tamara Munzner
  – pronouns: she/her
• TAs:
  – Michael Oppermann
  – Zipeng Liu
  – pronouns: he/him
• Piazza is the best way to reach us
  – use for all discussion and questions (not email)
  – https://piazza.com/class/k41qv94wb3r4uq
  – Alex Lex & Miriah Meyer,
  – optional textbook for further reading
  – triglyceride levels?

Credits
• Visualization Analysis and Design (Ch 1)
• Alex Lex & Miriah Meyer, http://dataviscourse.net/