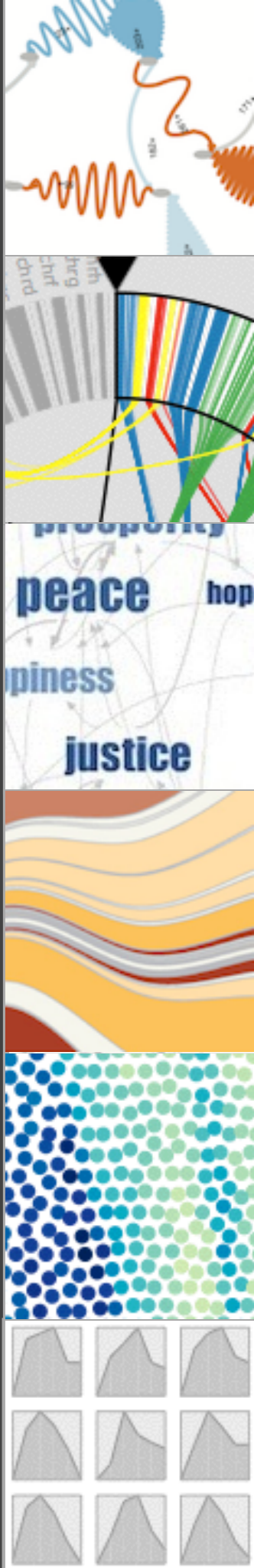


cs6630 | Aug 26 2014

VISUALIZATION

Miriah Meyer
University of Utah



-WHAT

-WHY

-WHO

-HOW

-WHAT

-WHY

-WHO

-HOW

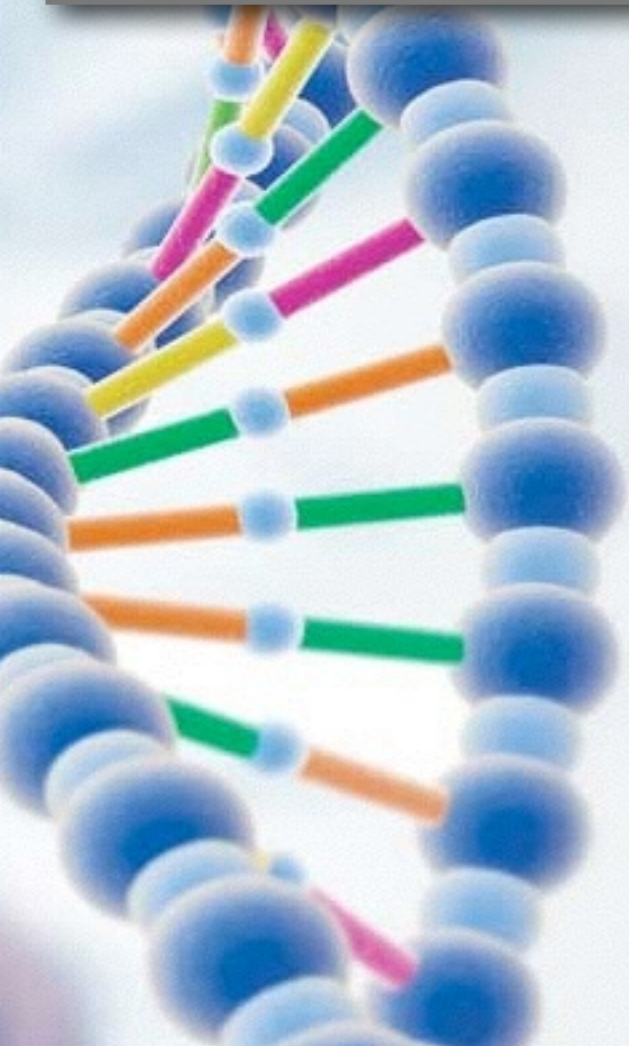
data



data



SHAKESPEARE QUARTERLY





data

data
government

SHAKESPEARE
QUARTERLY

INDUSTRIAL REVOLUTION OF DATA

Joe Hellerstein, UC Berkley, 2008



HOW MUCH DATA IS THERE?

2010: 1.2 zettabytes

2013: 4.4 zettabytes

2020: ~40 zettabytes

2010: 1.2 zettabytes

2013: 4.4 zettabytes

2020: ~40 zettabytes

zettabyte \approx 1,000,000,000,000,000,000,000 or 10^{21}

2010: 1.2 zettabytes

2013: 4.4 zettabytes

2020: ~40 zettabytes

zettabyte \approx 1,000,000,000,000,000,000,000 or 10^{21}

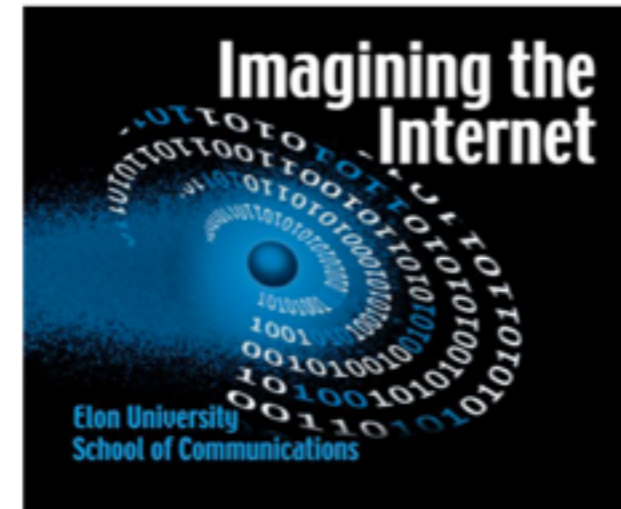
200x all words ever spoken by humans

The ability to take data—to be able to **understand** it, to **process** it, to **extract value** from it, to **visualize** it, to **communicate** it—that's going to be a hugely important skill in the next decades...

Because now we really do have essentially free and ubiquitous data. So the complimentary scarce factor is the ability to understand that data and extract value from it.

Hal Varian, Google's Chief Economist
The McKinsey Quarterly, Jan 2009

PewResearchCenter



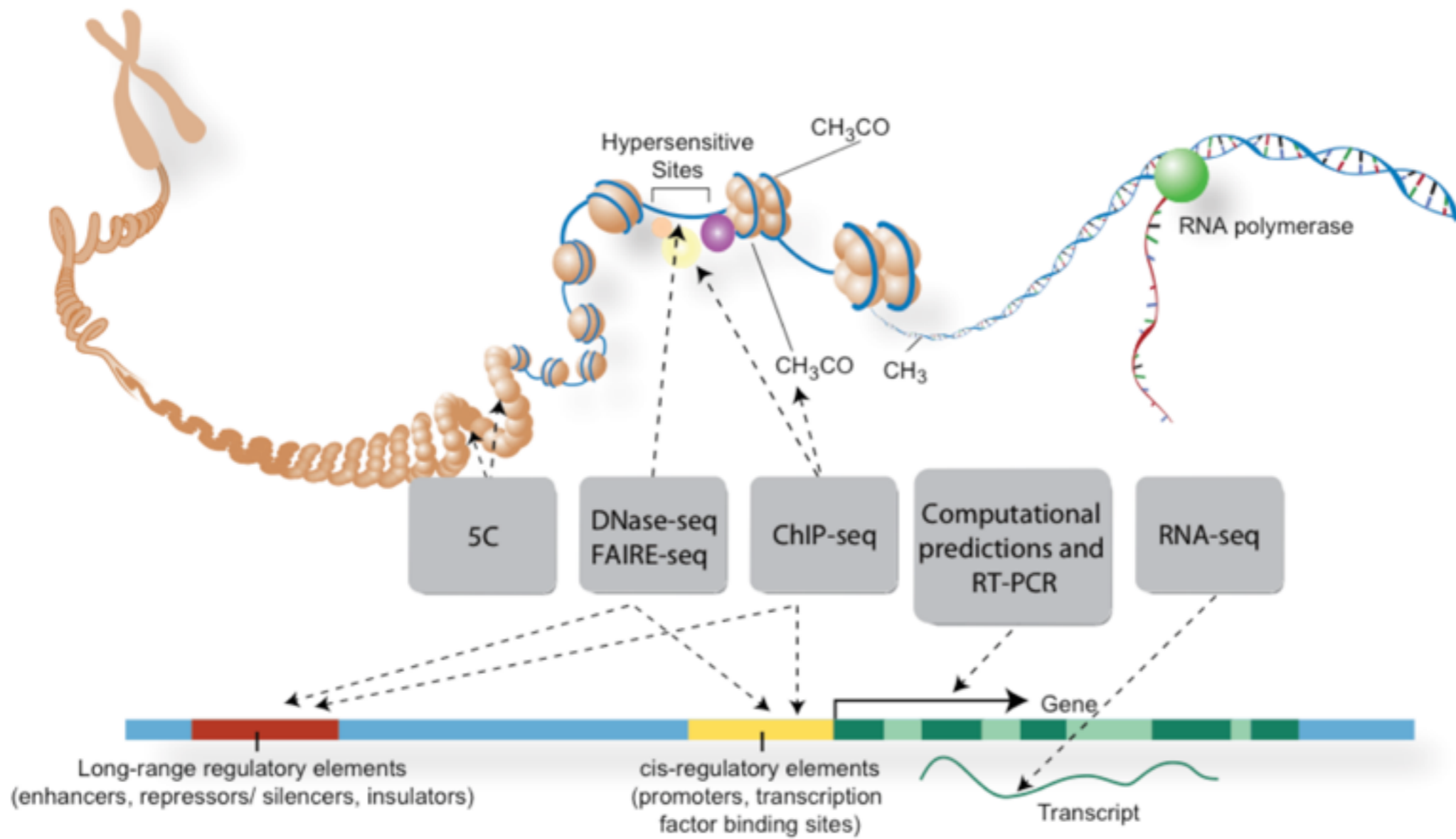
Big Data: Experts say new forms of information analysis will help people be more nimble and adaptive, but worry over humans' capacity to understand and use these new tools well

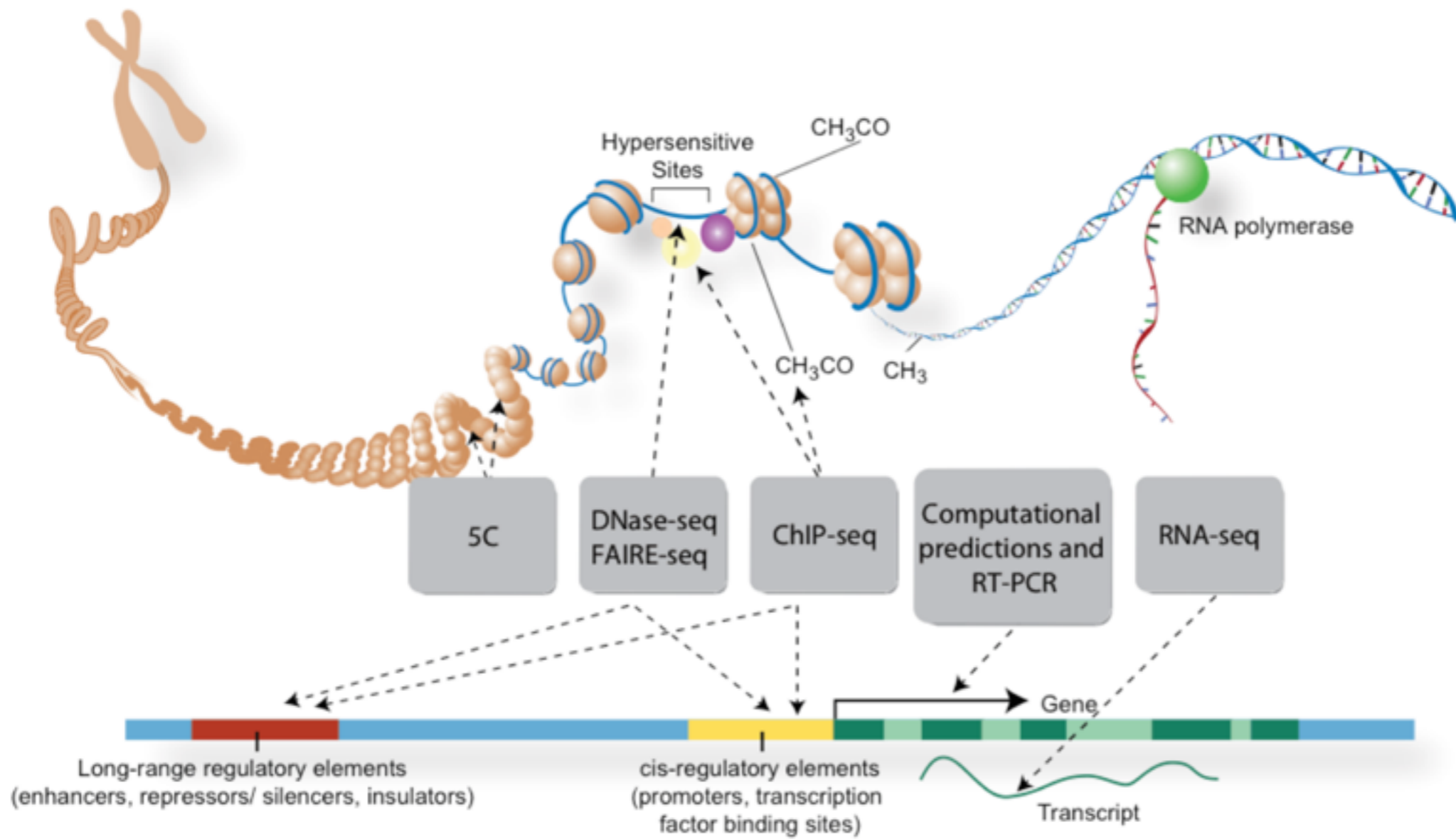
Tech experts believe the vast quantities of data that humans and machines will be creating by the year 2020 could enhance productivity, improve organizational transparency, and expand the frontier of the "knowable future." But they worry about "humanity's dashboard" being in government and corporate hands and they are anxious about people's ability to analyze it wisely

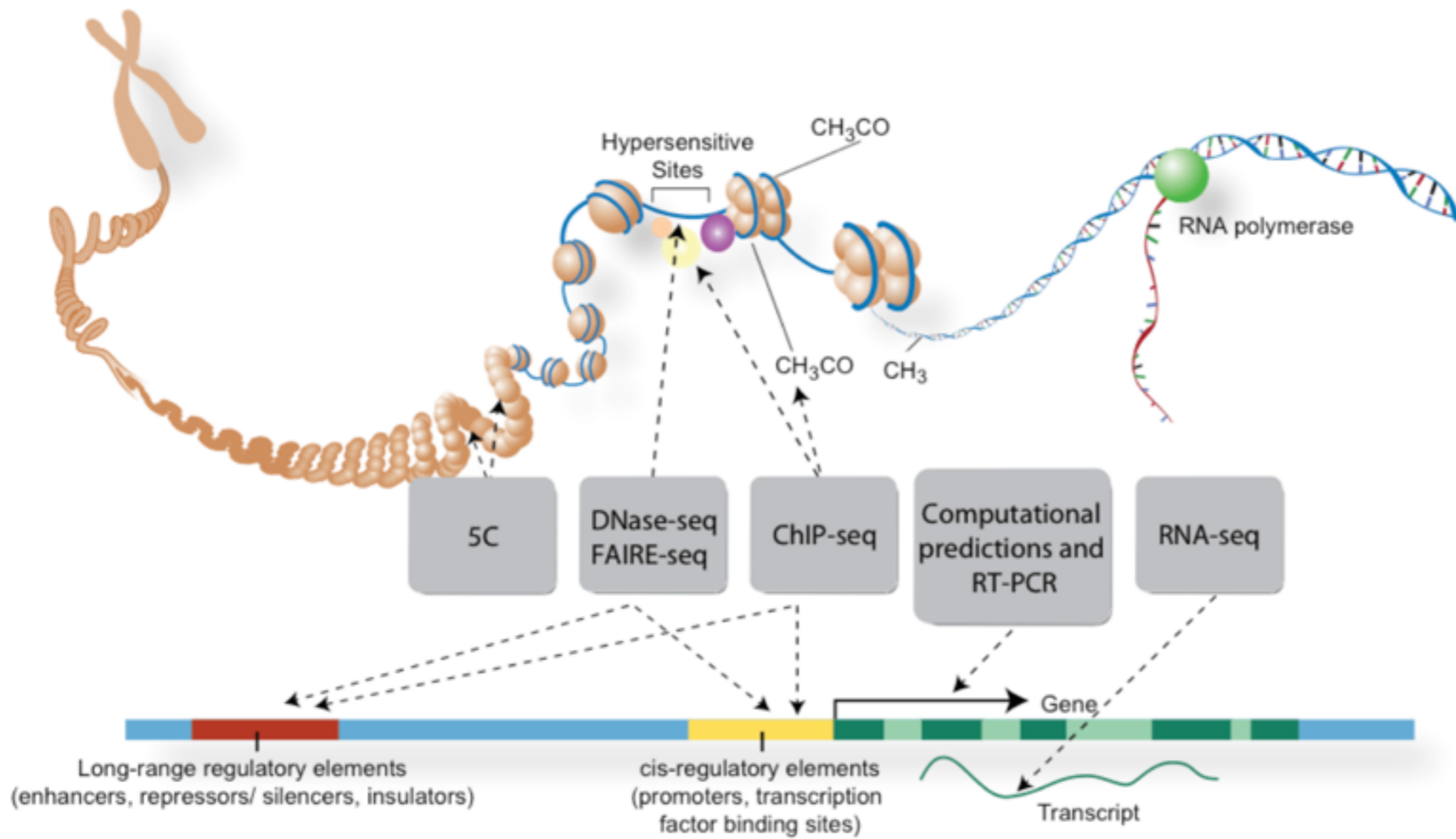
Janna Quitney Anderson, Elon University

Lee Rainie, Pew Research Center's Internet & American Life Project

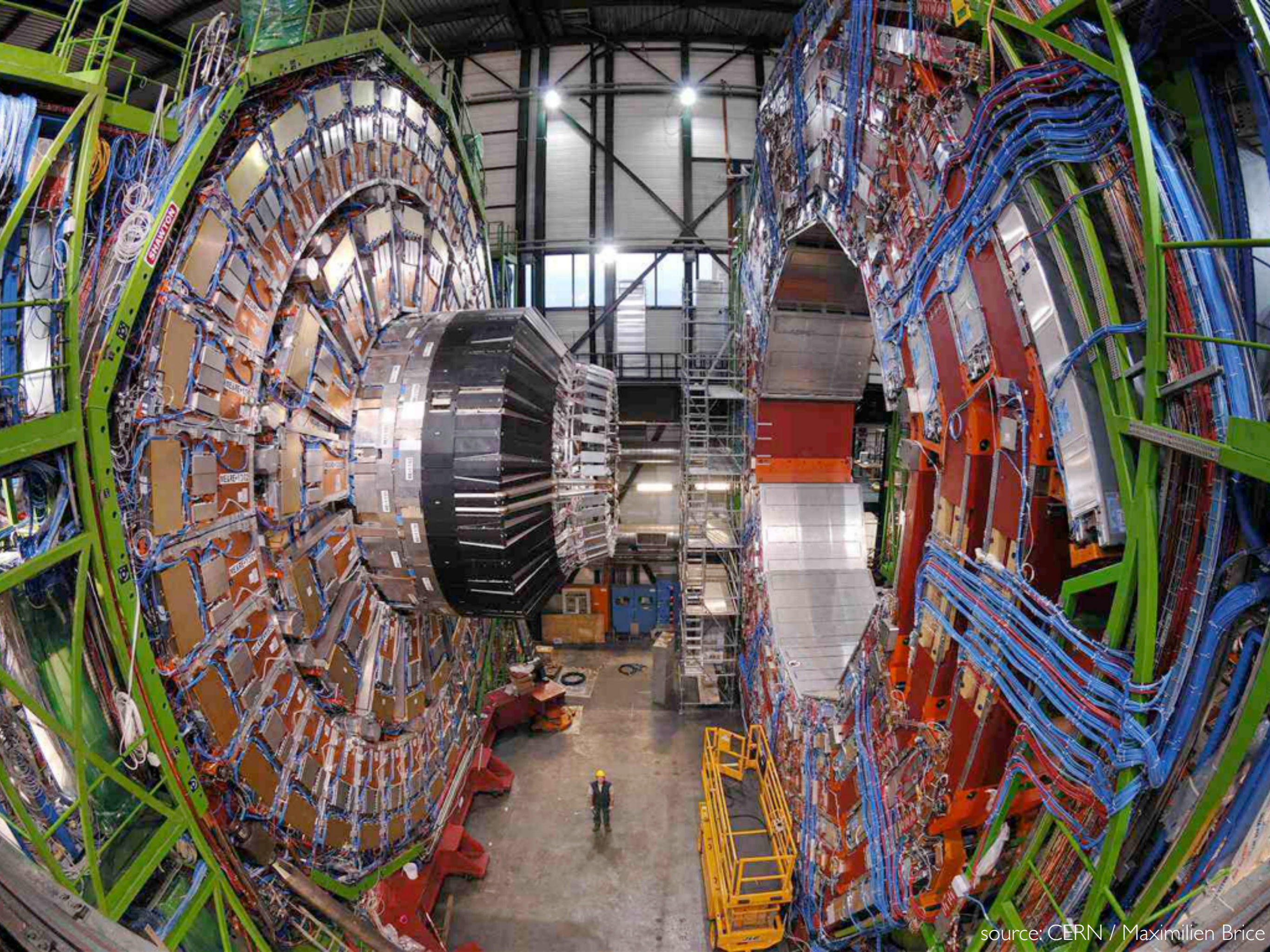
July 20, 2012

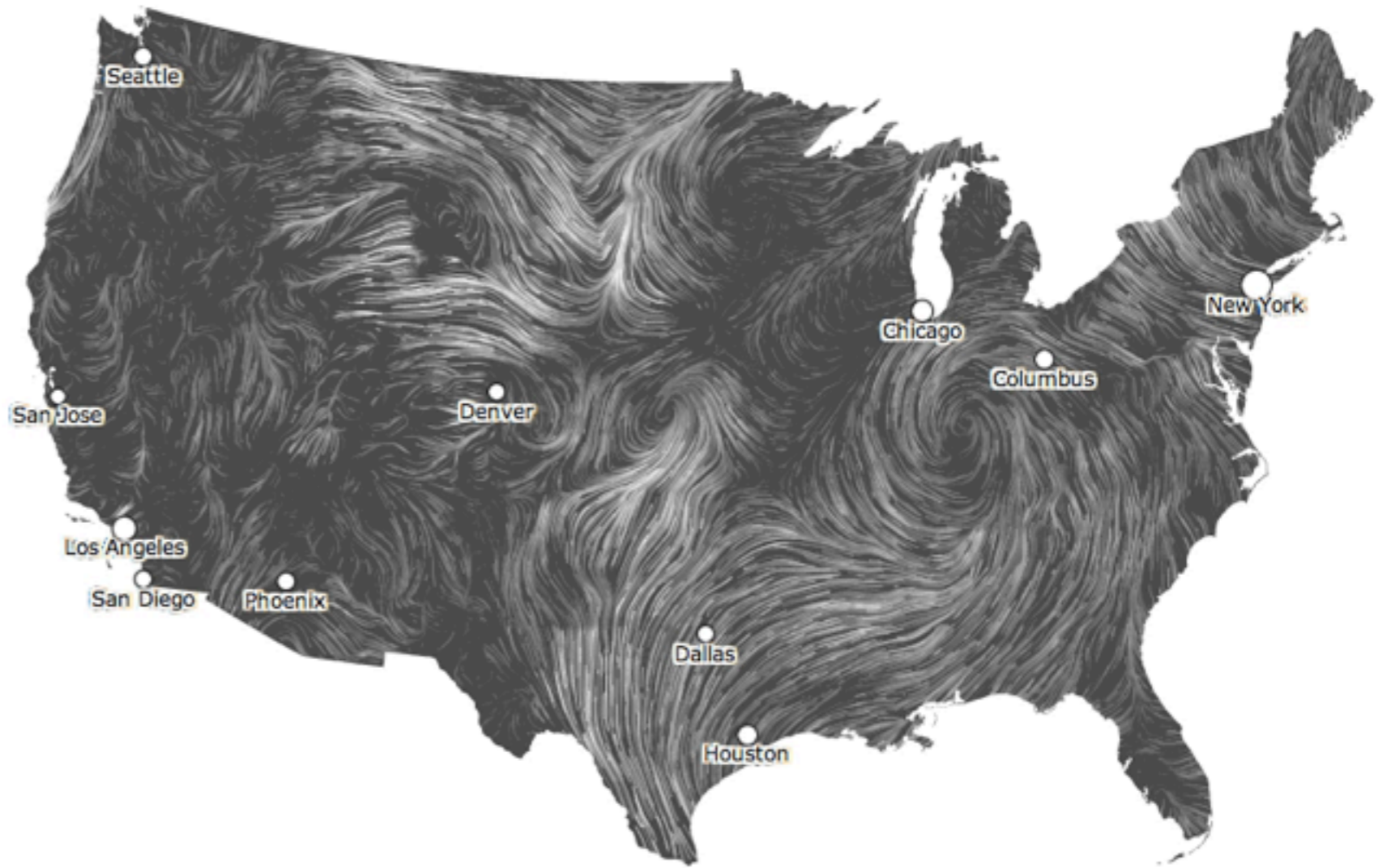
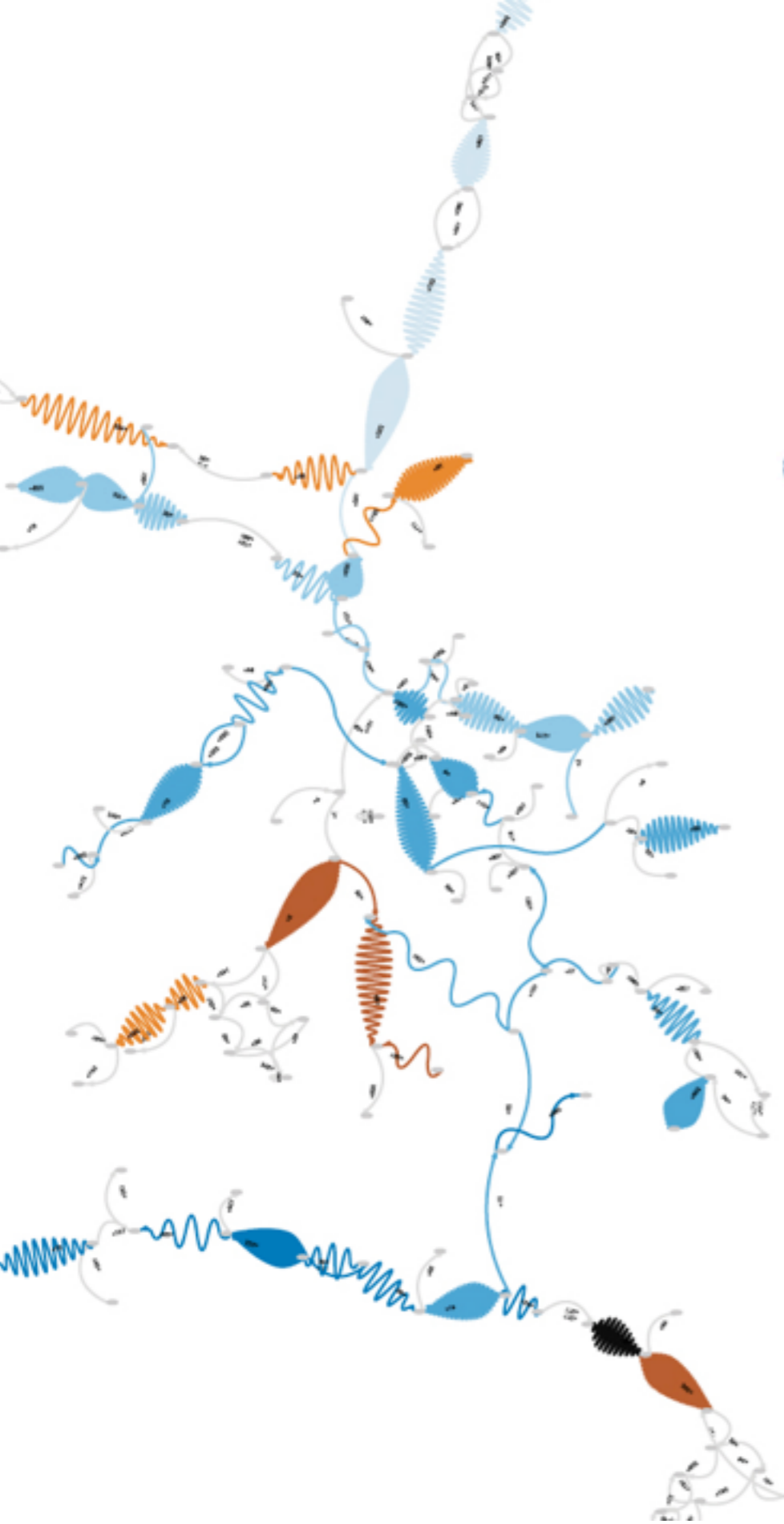




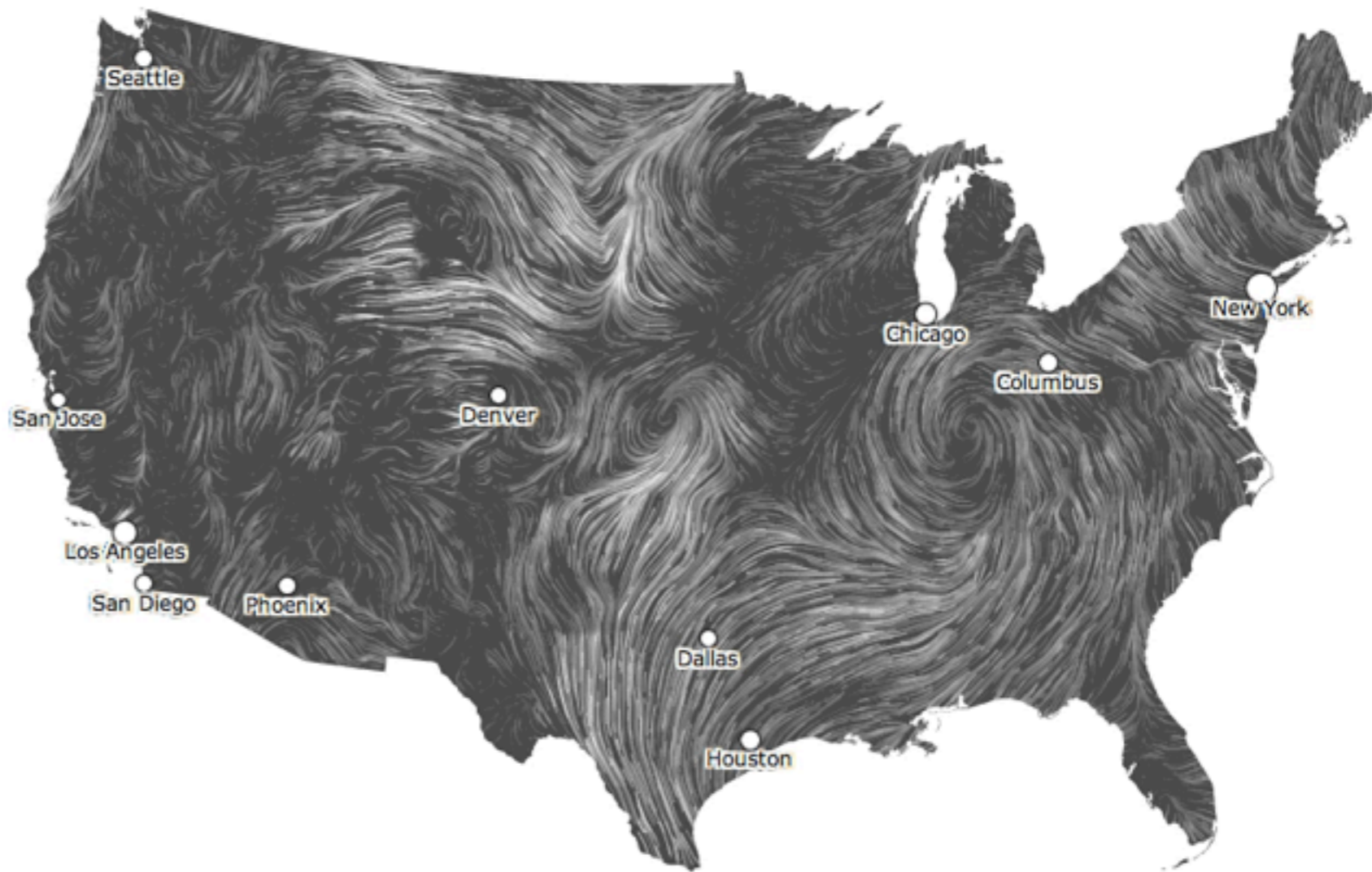
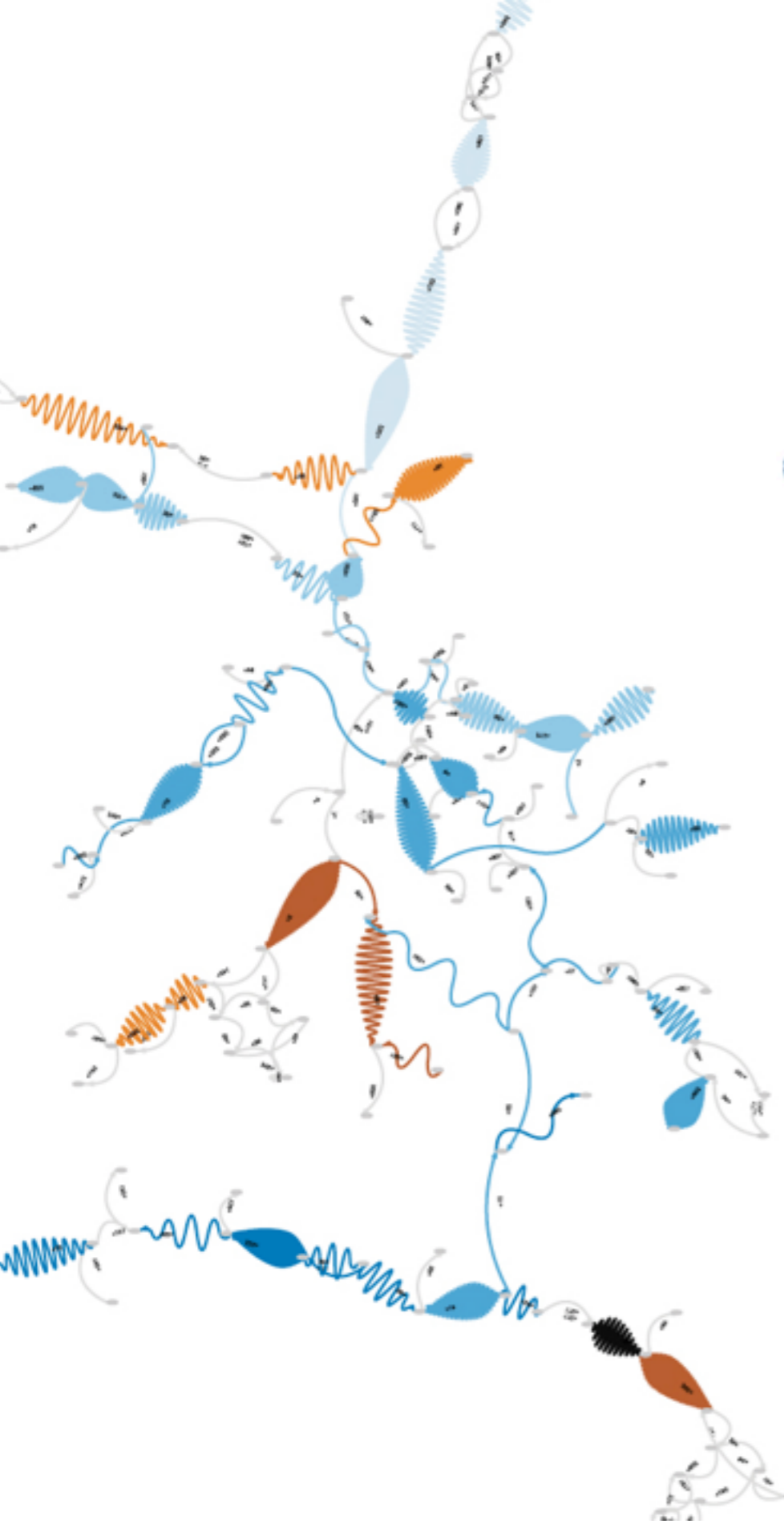








sources: AbyssExplorer, hint.fm/wind, Wordle



why does visualization work?

why does visualization work?

- 1. cognition is limited



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The "Door" Study

profsimons [Subscribe](#) 10 videos



Like | Add to | Share | 260,166 views

Uploaded by [profsimons](#) on Mar 13, 2010
This video shows footage from a 1998 study by Daniel Simons and Daniel Levin in which a participant fails to notice when the person he is talking to is replaced by someone else. The study was among the first to demonstrate that the phenomenon of "change blindness" can occur outside the laboratory.

249 likes, 5 dislikes
As Seen On: [DefensiveCarry Conceal...](#)

Show more

Top Comments

This explains a lot about one of my ex-boyfriends. "If it looks like a girl, and it feels like a girl, and it smells like a girl, and it acts like a girl... it must be my girlfriend."
[ataaah](#) 1 year ago 141 likes

Change Blindness 1
by yebblind
36,759 views
0:22
Featured Video

Gradual Change Test 1
by profsimons
34,443 views
1:20

Change Blindness
by trutapes
25,498 views
5:57

Test Your Awareness.....
by beepsquick
43,847 views
1:34

Perception of beauty
by andreic27
92,589 views
1:14

Amazing Fire & Gas Trick!
by brusspup
1,078,932 views
1:20

Try To Watch This Without Laughing Or
by 88ownsnascar
2,042,315 views
1:15

How much is: 75 + 26
Sociopath Test
by Daanando
213,997 views
1:29

Awareness Test
by JOEKthePANDA

why does visualization work?

1. cognition is limited

2. memory is limited

calculation exercise . . .

calculation exercise . . . $\begin{array}{r} 34 \\ \times 28 \\ \hline \end{array}$

calculation exercise . . .

calculation exercise . . . $\begin{array}{r} 79 \\ \times 16 \\ \hline \end{array}$

visualization

I. uses perception to point out interesting things.

MTHIVLWYADCEQGHKILKMTWYN
ARDCAIREQGHVLMFPSTWYARN
GFPSVCEILQGKMFPSNDRCEQDIFP
SGHLMFHKMVPSTWYACEQTWRN

MTHI**V**LWYADCEQGHKILKMTWYN
ARDCAIREQGH**L**KMFPSTWYARN
GFPS**V**CEILQGKMFPSNDRCEQDIFPS
GHLMFH**K**M**V**PSTWYACEQTWRN

visualization

1. uses perception to point out interesting things.
2. uses pictures to enhance working memory.

| | | |
|----|----|----|
| 15 | 19 | 60 |
| 33 | 11 | 75 |
| 57 | 34 | 79 |
| 18 | 51 | 92 |
| 73 | 22 | 13 |
| 71 | 60 | 22 |
| 17 | 10 | 68 |
| 73 | 18 | 55 |
| 65 | 46 | 29 |
| 60 | 73 | 22 |
| 46 | 92 | 97 |
| 10 | 58 | 46 |
| 57 | 17 | 83 |
| 26 | 99 | 33 |
| 88 | 92 | 60 |
| 91 | 29 | 57 |
| 96 | 12 | 47 |

given these 50 numbers . . .

. . . what number appears most often?

100
80
60
40
20
0



given these 50 numbers . . .
... what number appears most often?

vi · su · al · i · za · tion

noun, plural -s

1. formation of mental visual images
2. the act or process of interpreting in visual terms or of putting into visible form

vi · su · al · i · za · tion

noun, plural -s

1. formation of mental visual images
2. the act or process of interpreting in visual terms or of putting into visible form

“Computer-based **visualization** systems provide visual representations of datasets intended to help people carry out tasks more effectively.”

Tamara Munzner

-WHAT

-WHY

-WHO

-HOW

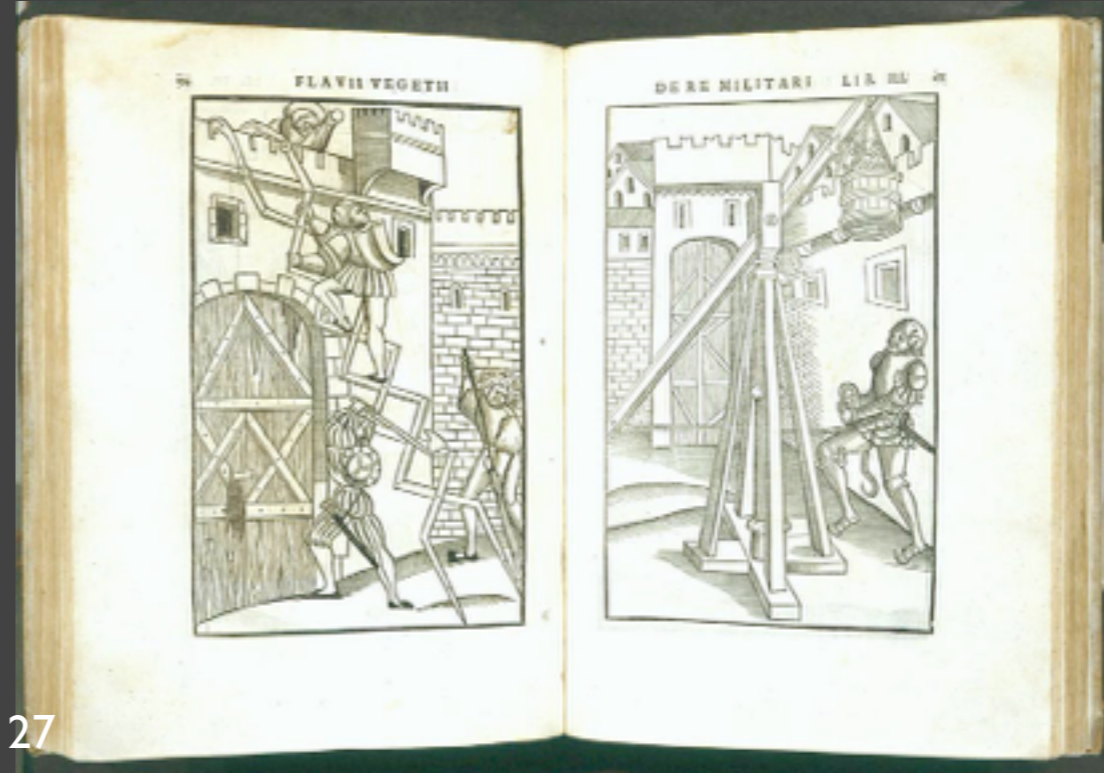
"It is things that make us smart"

Donald Norman



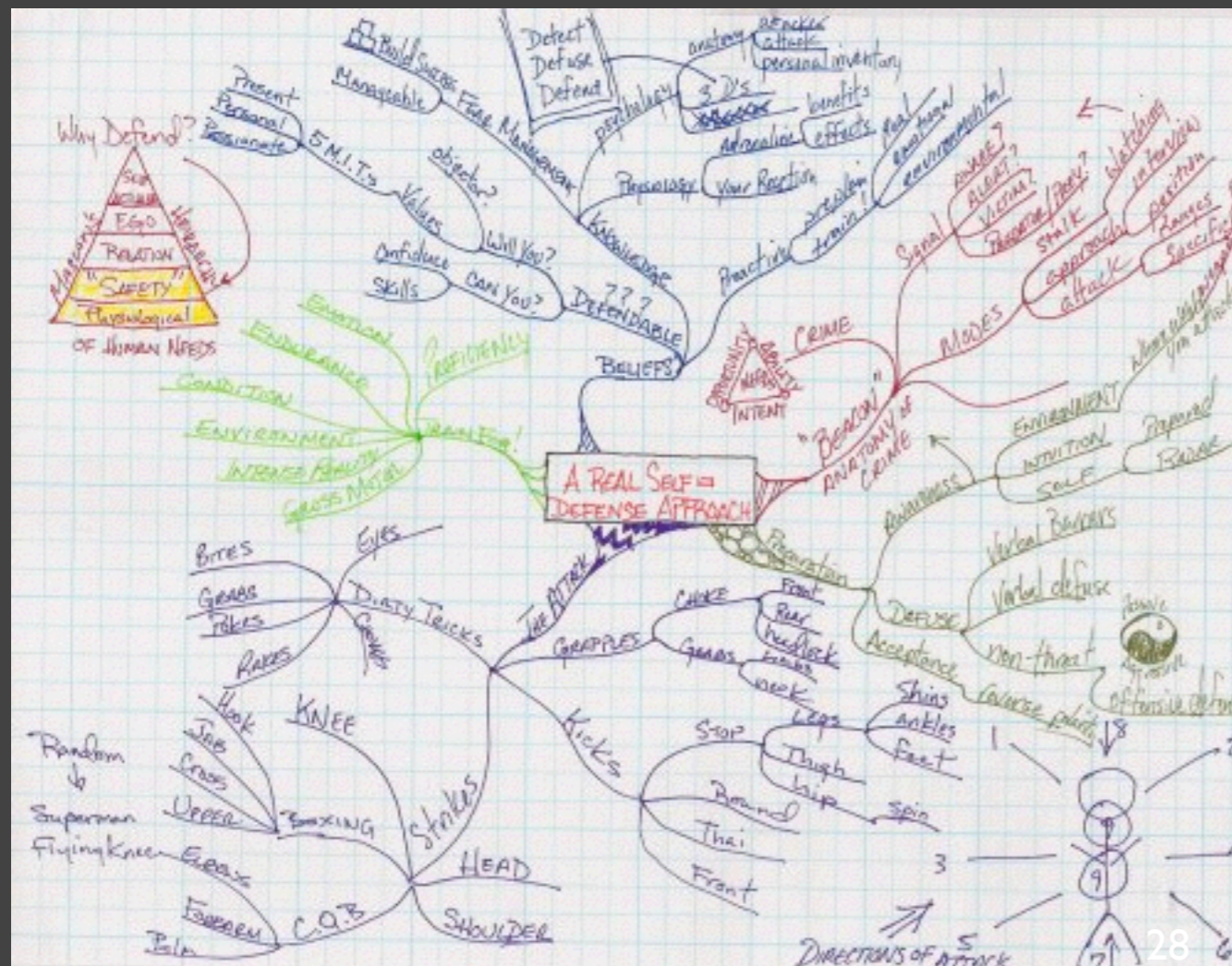
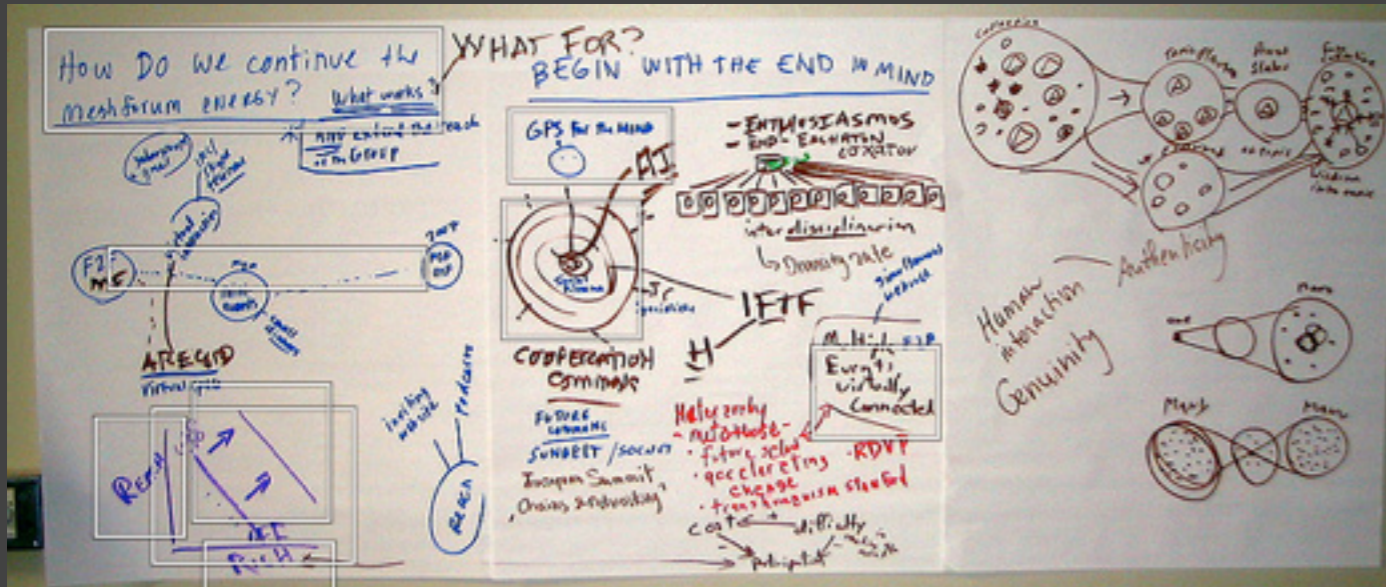
"It is things that make us smart"

Donald Norman



"It is things that make us smart"

Donald Norman



Visual Thinking Collection, Dave Grey

query exercise . . .

query exercise . . .

TRIGLYCERIDE LEVEL

| | Males | | Females | |
|---------------------|-----------------|-------------------|-----------------|-------------------|
| Income Group | Under 65 | 65 or Over | Under 65 | 65 or Over |
| 0-\$24,999 | 250 | 200 | 375 | 550 |
| \$25,000+ | 430 | 300 | 700 | 500 |

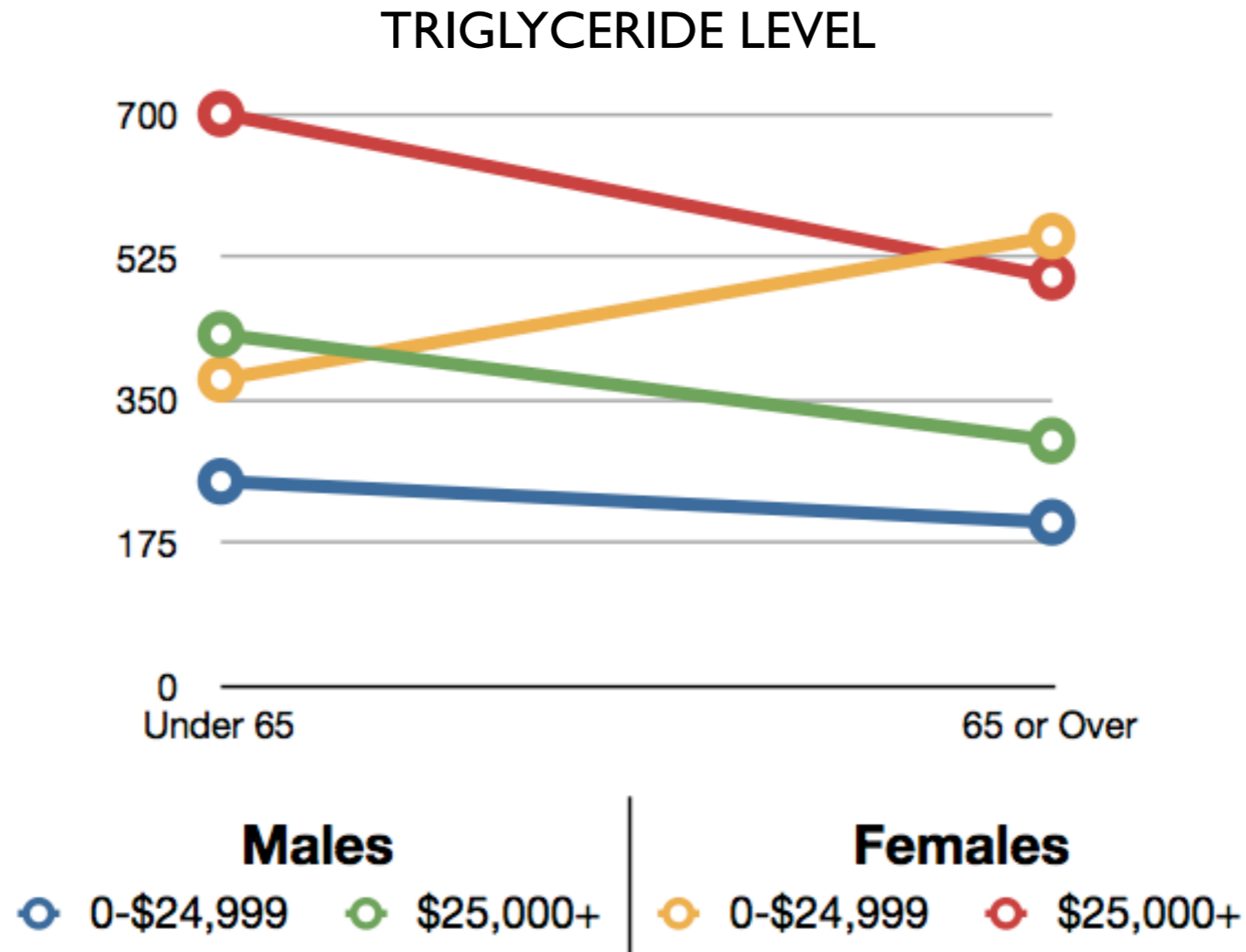
query exercise . . .

TRIGLYCERIDE LEVEL

| Income Group | Males | | Females | |
|--------------|----------|------------|----------|------------|
| | Under 65 | 65 or Over | Under 65 | 65 or Over |
| 0-\$24,999 | 250 | 200 | 375 | 550 |
| \$25,000+ | 430 | 300 | 700 | 500 |

QUESTION:

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



QUESTION:

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

Why do we create visualizations?

Why do we create visualizations?

- answer questions

Why do we create visualizations?

- answer questions
- generate hypotheses

Why do we create visualizations?

- answer questions
- generate hypotheses
- make decisions

Why do we create visualizations?

- answer questions
- generate hypotheses
- make decisions
- see data in context

Why do we create visualizations?

- answer questions
- generate hypotheses
- make decisions
- see data in context
- expand memory

Why do we create visualizations?

- answer questions
- generate hypotheses
- make decisions
- see data in context
- expand memory
- support computational analysis

Why do we create visualizations?

- answer questions
- generate hypotheses
- make decisions
- see data in context
- expand memory
- support computational analysis
- find patterns

Why do we create visualizations?

- answer questions
- generate hypotheses
- make decisions
- see data in context
- expand memory
- support computational analysis
- find patterns
- tell a story

Why do we create visualizations?

- answer questions
- generate hypotheses
- make decisions
- see data in context
- expand memory
- support computational analysis
- find patterns
- tell a story
- inspire

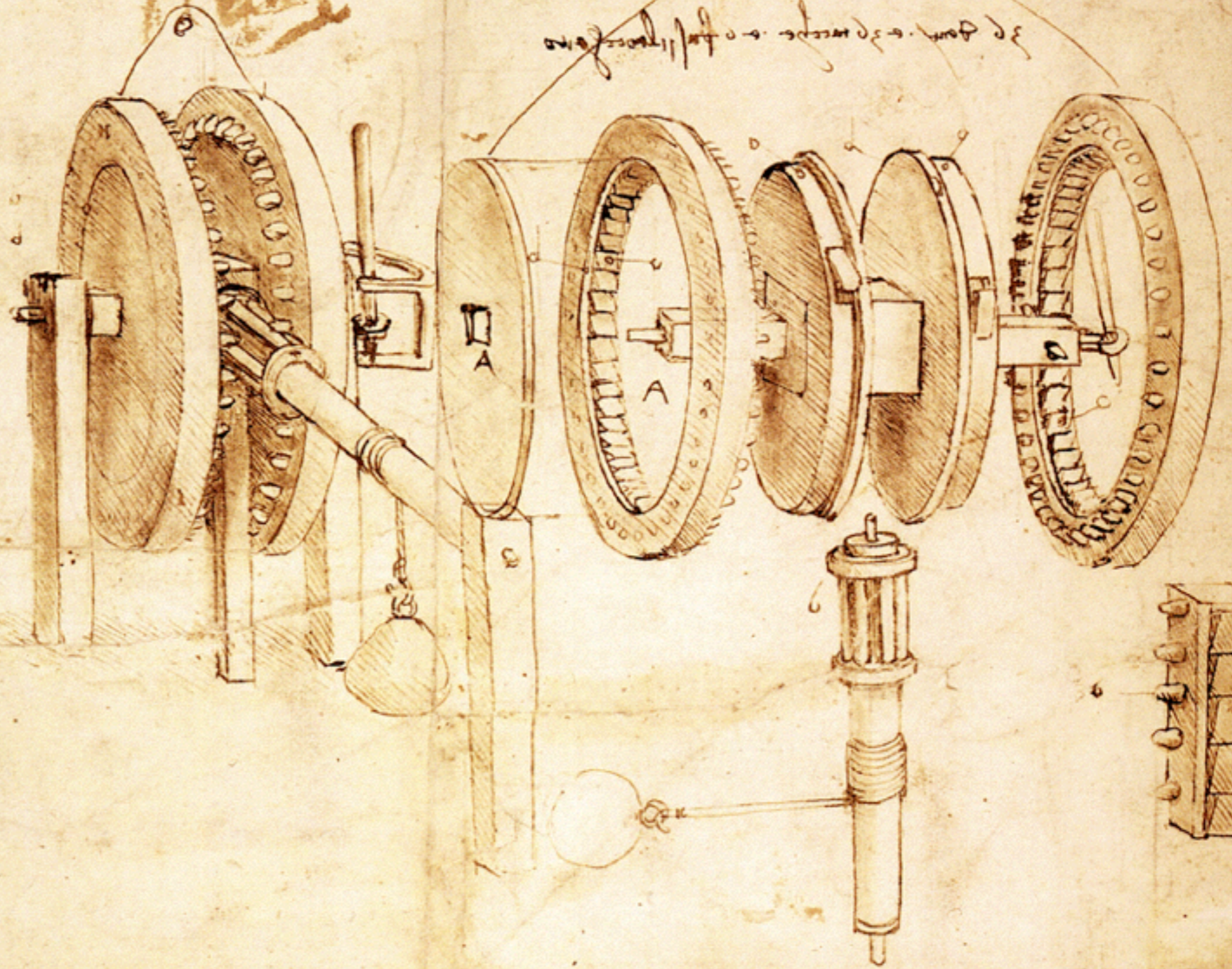
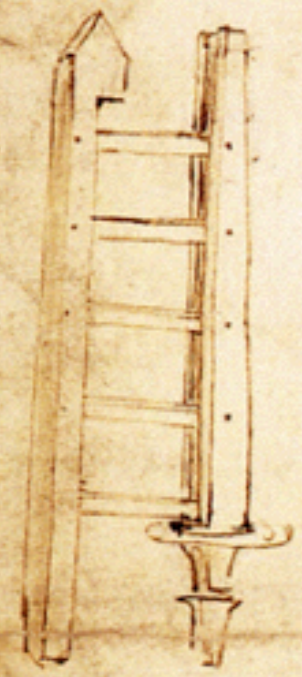
VISUALIZATION GOALS

- record** information
- analyze** data to support reasoning
- confirm** hypotheses
- communicate** ideas to others

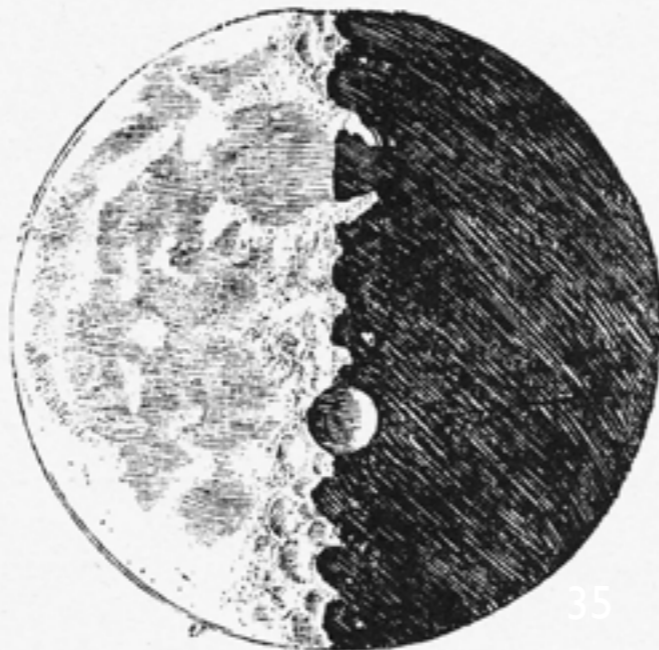
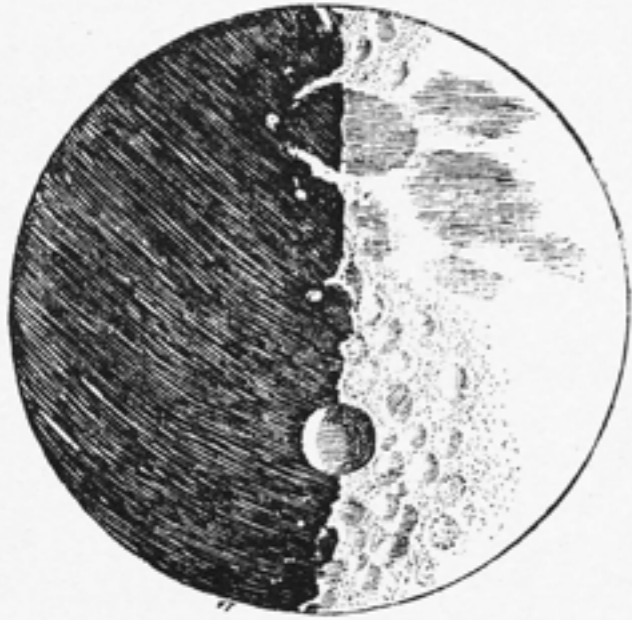
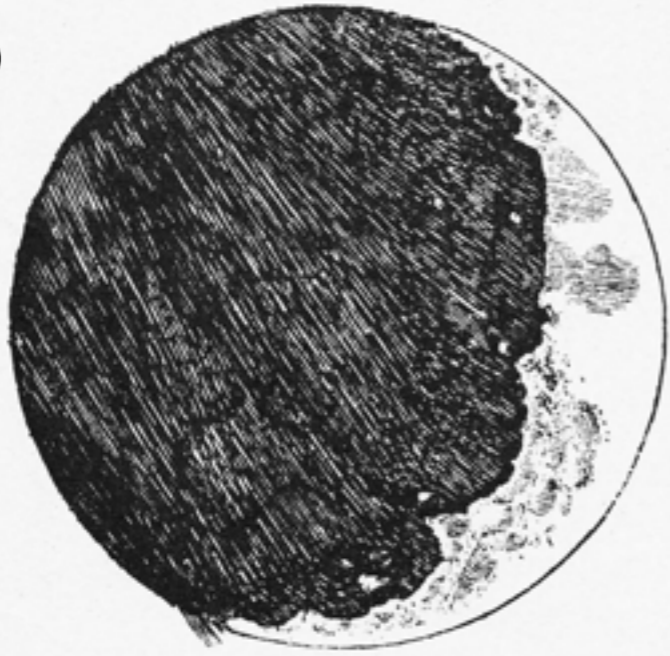
RECORD INFORMATION

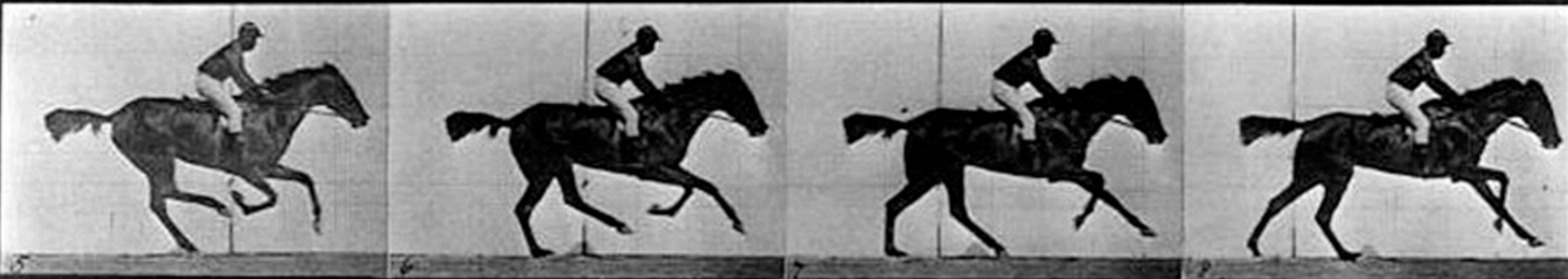
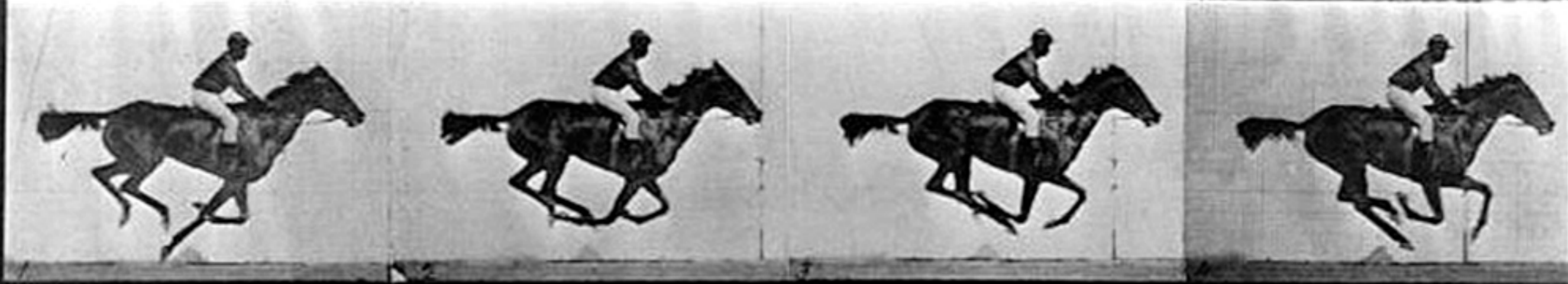


3r. part. e. 3r. parte. e. o. fall. r. parte. e. m.



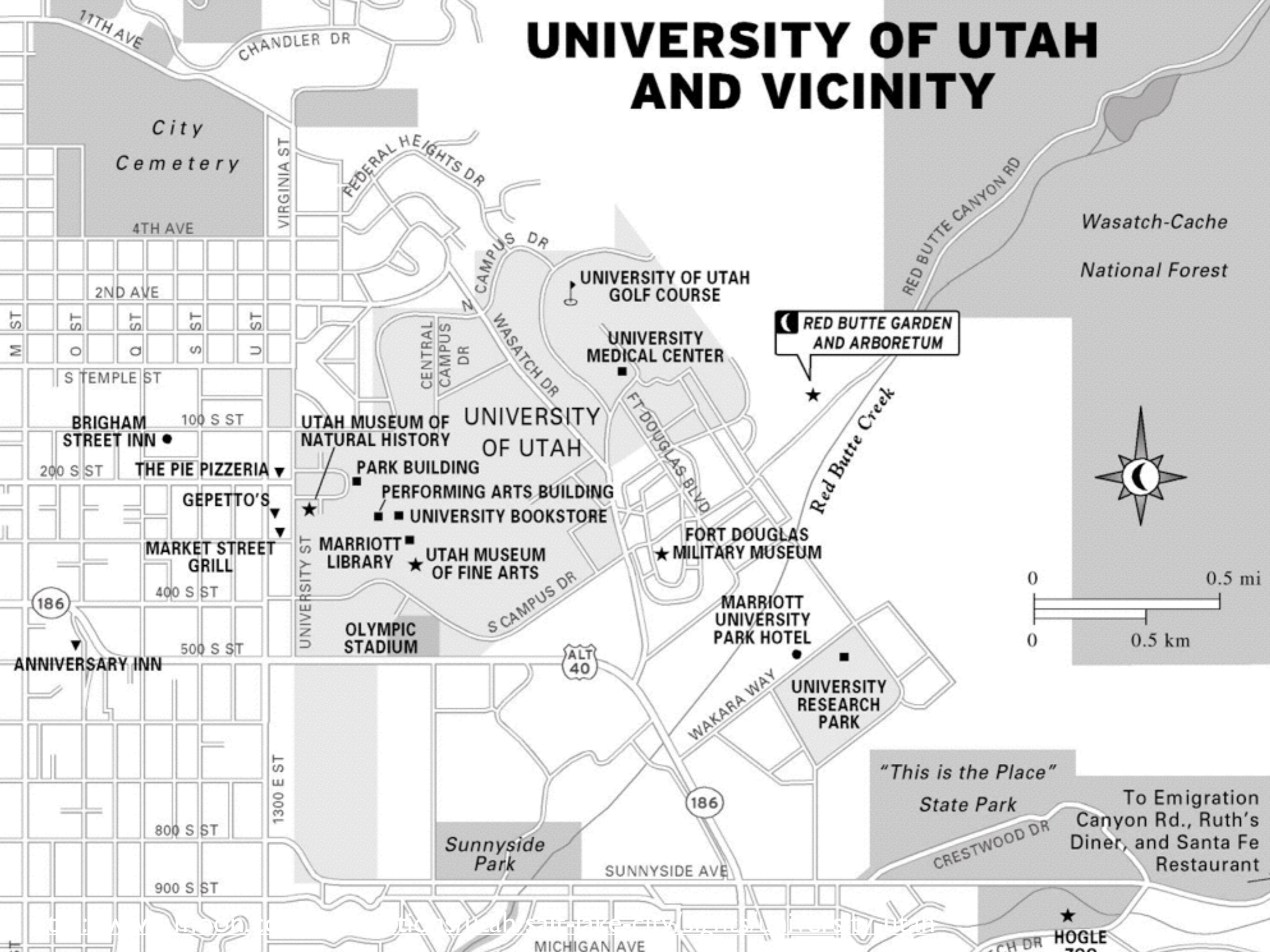
Leonardo da Vinci 1485





E. J. Muybridge 1878

UNIVERSITY OF UTAH AND VICINITY



ANALYZE DATA

THE CHALLENGER DISASTER



HISTORY OF O-RING DAMAGE ON SRM FIELD JOINTS

1167
OCT 30, 1985

| SRM No. | Cross Sectional View | | | Top View | | Clocking Location (deg) | MOTOR | O-RING |
|-------------------------------|----------------------|--------------------------|--------------------|-----------------------------|----------------------------------|-------------------------|--------|--------|
| | Erosion Depth (in.) | Perimeter Affected (deg) | Nominal Dia. (in.) | Length Of Max Erosion (in.) | Total Heat Affected Length (in.) | | | |
| 61A LH Center Field** | None | None | 0.280 | None | None | 36° -- 66° | DM-1 | 47 |
| 61A LH CENTER FIELD** | NONE | NONE | 0.280 | NONE | NONE | 338° - 18° | DM-2 | 52 |
| 51C LH Forward Field** | 0.010 | 154.0 | 0.280 | 4.25 | 5.25 | 163 | QM-3 | 48 |
| 51C RH Center Field (prim)*** | 0.038 | 130.0 | 0.280 | 12.50 | 58.75 | 354 | QM-4 | 51 |
| 51C RH Center Field (sec)*** | None | 45.0 | 0.280 | None | 29.50 | 354 | SRM-15 | 53 |
| 41D RH Forward Field | 0.028 | 110.0 | 0.280 | 3.00 | None | 275 | SRM-22 | 75 |
| 41C LH Aft Field* | None | None | 0.280 | None | None | -- | SRM-25 | 29 |
| 41B LH Forward Field | 0.040 | 217.0 | 0.280 | 3.00 | 14.50 | 351 | | 27 |
| STS-2 RH Aft Field | 0.053 | 116.0 | 0.280 | -- | -- | 90 | | |

*Hot gas path detected in putty. Indication of heat on O-ring, but no damage.
 **Soot behind primary O-ring.
 ***Soot behind primary O-ring, heat affected secondary O-ring.

Clocking location of leak check port - 0 deg.

OTHER SRM-15 FIELD JOINTS HAD NO BLOWHOLES IN PUTTY AND NO SOOT NEAR OR BEYOND THE PRIMARY O-RING.

SRM-22 FORWARD FIELD JOINT HAD PUTTY PATH TO PRIMARY O-RING, BUT NO O-RING EROSION AND NO SOOT BLOWBY, OTHER SRM-22 FIELD JOINTS HAD NO BLOWHOLES IN PUTTY.

BLOW BY HISTORY

SRM-15 WORST BLOW-BY

- o 2 CASE JOINTS (80°), (110°) ARC
- o MUCH WORSE VISUALLY THAN SRM-22

SRM 22 BLOW-BY

- o 2 CASE JOINTS (30-40°)

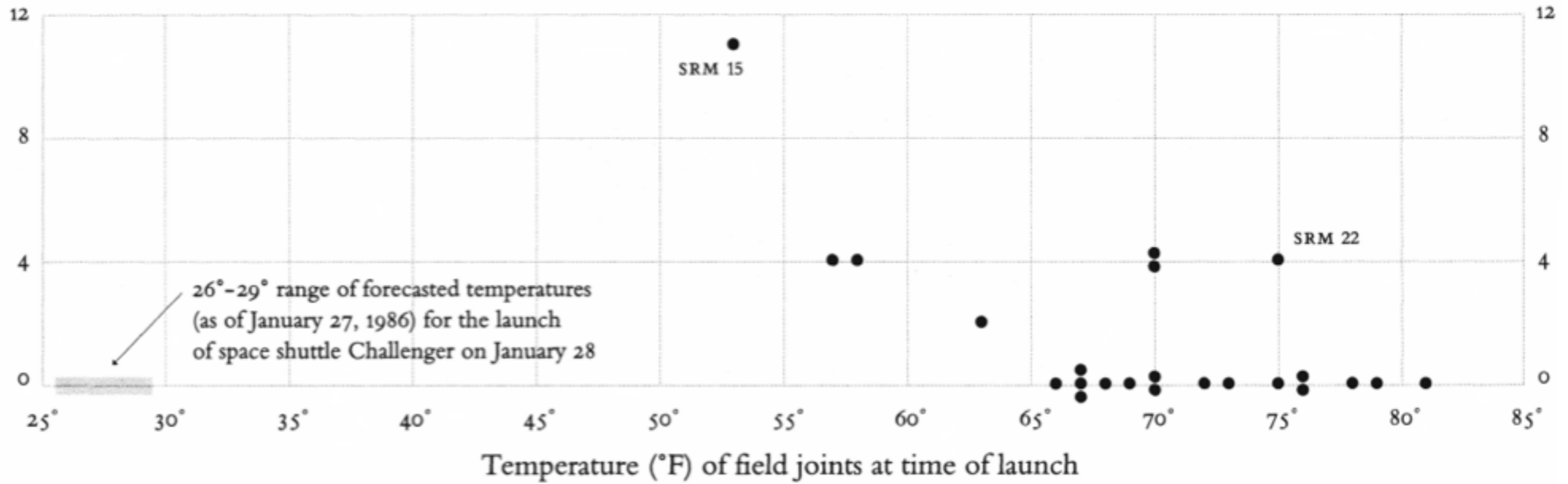
SRM-13A, 15, 16A, 18, 23A 24A

- o NOZZLE BLOW-BY

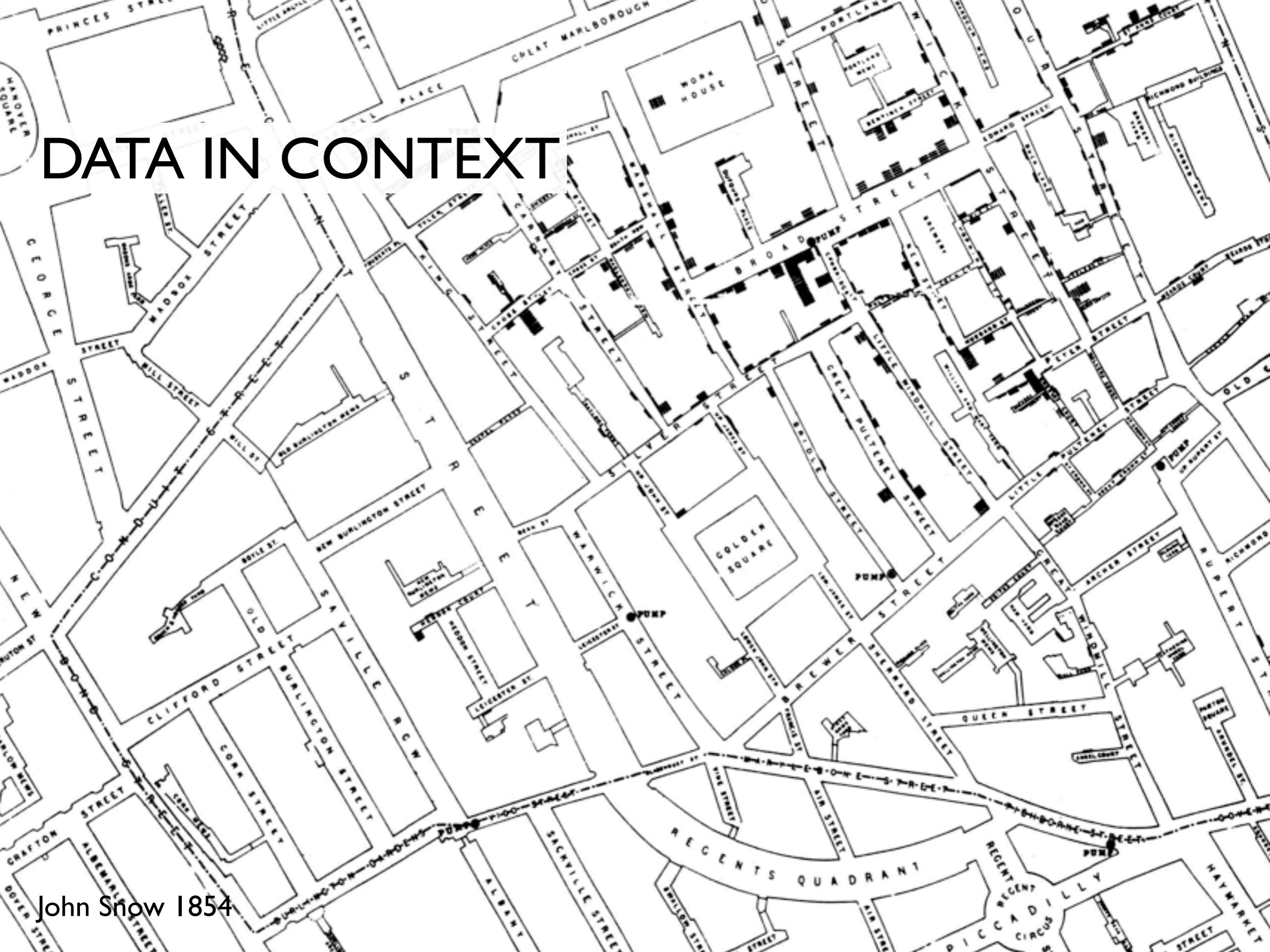
HISTORY OF O-RING TEMPERATURES (DEGREES - F)

| MOTOR | MBT | AMB | O-RING | WIND |
|--------|------|-----|--------|--------|
| DM-1 | 68 | 36 | 47 | 10 MPH |
| DM-2 | 76 | 45 | 52 | 10 MPH |
| QM-3 | 72.5 | 40 | 48 | 10 MPH |
| QM-4 | 76 | 48 | 51 | 10 MPH |
| SRM-15 | 52 | 64 | 53 | 10 MPH |
| SRM-22 | 77 | 78 | 75 | 10 MPH |
| SRM-25 | 55 | 26 | 29 | 10 MPH |
| | | | 27 | 25 MPH |

O-ring damage index, each launch

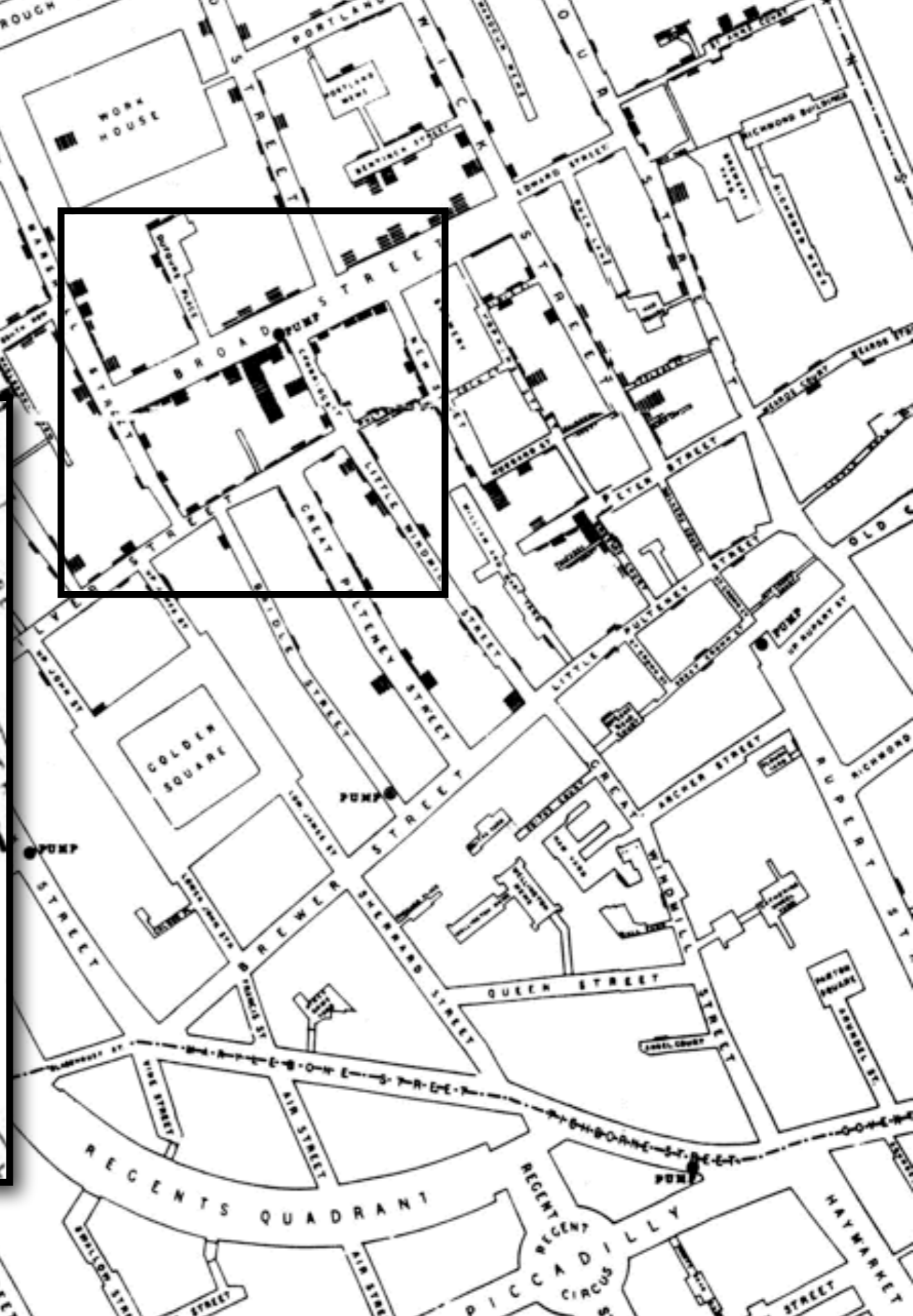


DATA IN CONTEXT



John Snow 1854

DATA IN CONTEXT



John Snow 1854

Google offers beta
 Deals on the great places to eat, shop, and play in Salt Lake City.
[Sign up now](#)
 Advertise on NYTimes.com

Published: January 8, 2010
A Peek Into Netflix Queues
 Examine Netflix rental patterns, neighborhood by neighborhood, in a dozen cities. Some titles with distinct patterns are Mad Men, Obsessed and Last Chance Harvey. [Comments \(135\)](#)

100 titles that were frequently rented from Netflix in 2009
 Change how movies are sorted
 Most rented | Alphabetical | By metacore
 < Previous | Next > | Most rented | Least rented

Seven Pounds

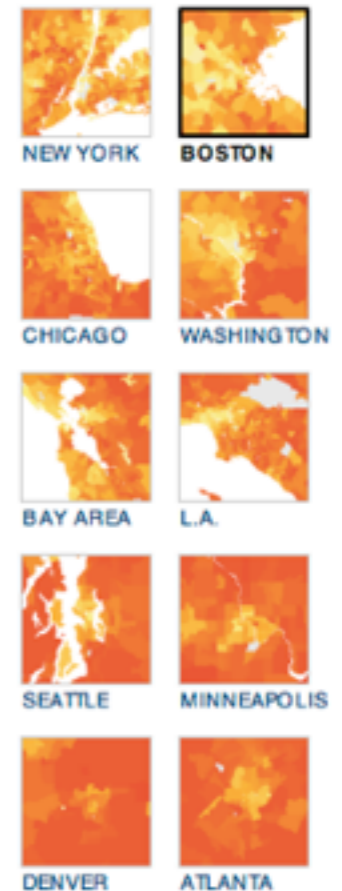
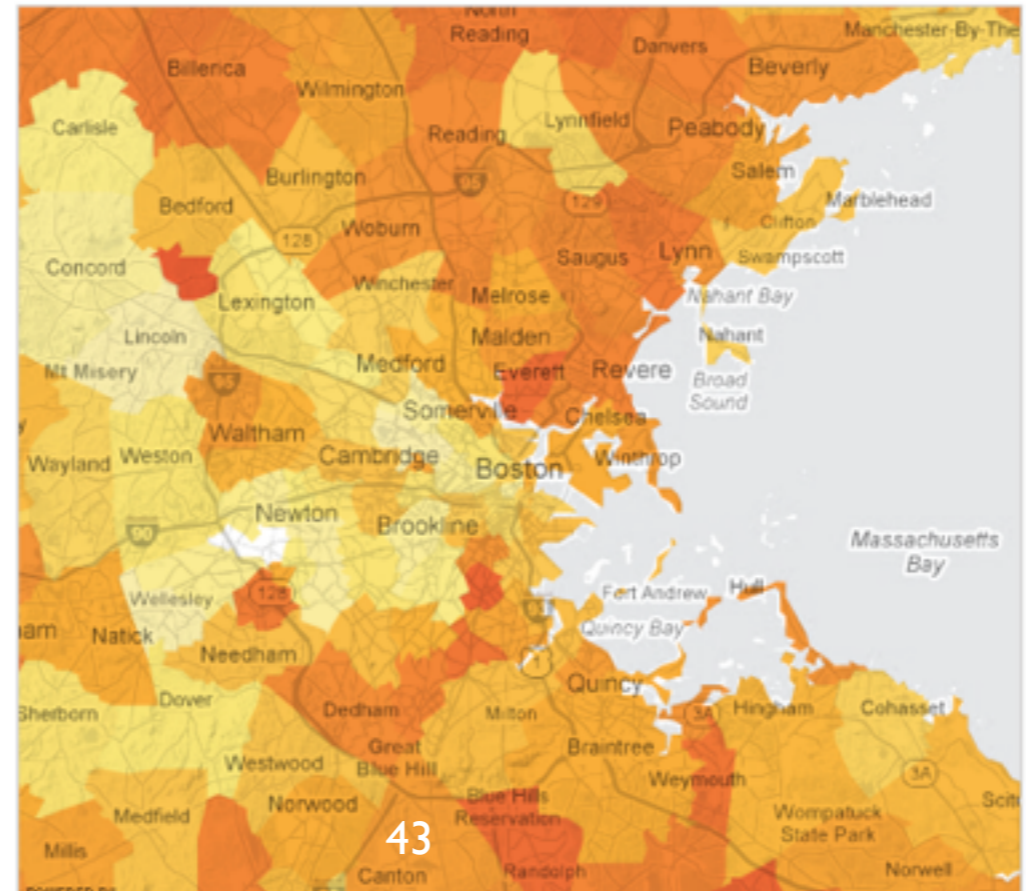


36
 Metacritic score
 100=loved by critics, 0=hated

"Seven Pounds," which reunites Will Smith with Gabriele Muccino (who directed him in "The Pursuit of Happyness"), begins with a series of riddling, chronologically scrambled scenes. A man calls 911 to report his own suicide. He badgers a blind call-center employee — whom we suspect will be a significant character, since he's played by Woody Harrelson — with complaints and insults. He embraces a lovely woman in an even lovelier beach house. He visits a nursing home where he terrorizes an administrator and comforts a resident.

[Read Rest of NYT Review >](#)

The ZIP codes are shaded according to each movie's rank. **Ranked No. 1** **No. 50**



Coraline trailer movie advertisement on Boston T subway

dagda16 [Subscribe](#) 699 videos



Like Add to Share **873** views 1 like, 0 dislikes

Uploaded by [dagda16](#) on Jul 19, 2009
most amazing/trippiest movie ad I've ever seen. single posters on the walls of the subway tunnel between Harvard and Central Square in Cambridge, and you would fly past them on the T, watching them like a flip book or zoetrope displaying the trailer. pretty creepy when you're not expecting it.
[Show more](#)

All Comments (3) [see all](#)

Respond to this video...

I remember my trip to Boston in around the time this video was posted, and My mind was blown when I saw that. <3
I wonder if it's still there...
[kidcat3000](#) 1 year ago

- Walk a Ways -by- WE PLAN ON SLEEPING**
by weplanonsleeping
813 view FEATURED VIDEO
1:49
- Makkah Metro Train**
by aunital1
211,161 views
12:52
- BLOODY TRAIN FIGHT LEAKS OUT TO**
by realguttaproductions
391,377 views
4:16
- Una sesión de rap improvisado en el**
by elpaiscom
67,936 views
3:50
- Dubai Metro in HD**
by Dubaiinformer
341,786 views
6:30
- Coraline - Making Faces**
by kdImd243
51,911 views
2:00
- Funniest ads 2011**
by 3Dcookie22
3,199,473 views
4:09
- Coraline MBTA flipbook ad**
by kevinlew1
586 views
0:10
- NYC fight on train!**
by TalaVersalStudios
317,876 views
3:59

REVEAL PATTERNS



POLITICS HOME THE CAUCUS FIVETHIRTY EIGHT G.O.P. CANDIDATES G.O.P. PRIMARY INSIDE CONGRESS POLL WATCH VIDEO



UPDATED February 12, 2012

RECOMMEND TWITTER LINKEDIN E-MAIL SHARE

Four Ways to Slice Obama's 2013 Budget Proposal

Explore every nook and cranny of President Obama's federal budget proposal.

All Spending Types of Spending Changes Department Totals

How \$3.7 Trillion Is Spent

Mr. Obama's budget proposal includes \$3.7 trillion in spending in 2013, and forecasts a \$901 billion deficit.

Circles are sized according to the proposed spending.



Color shows amount of cut or increase from 2012.

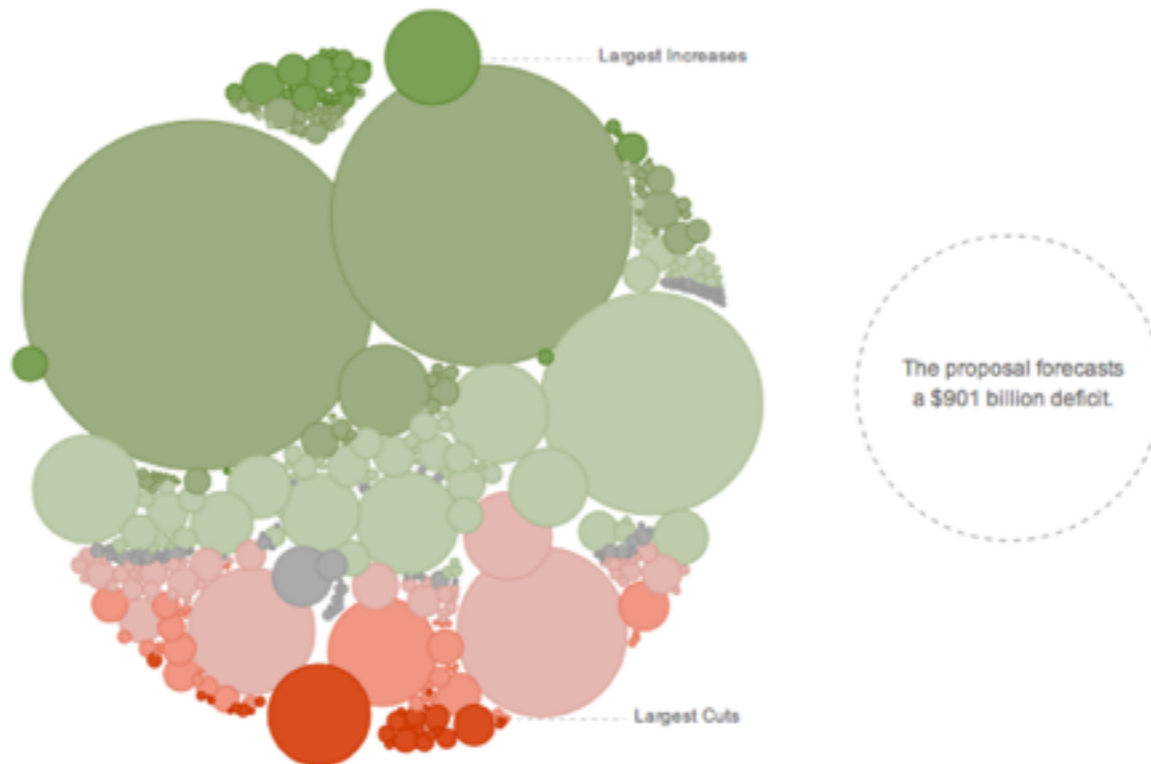
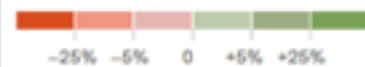
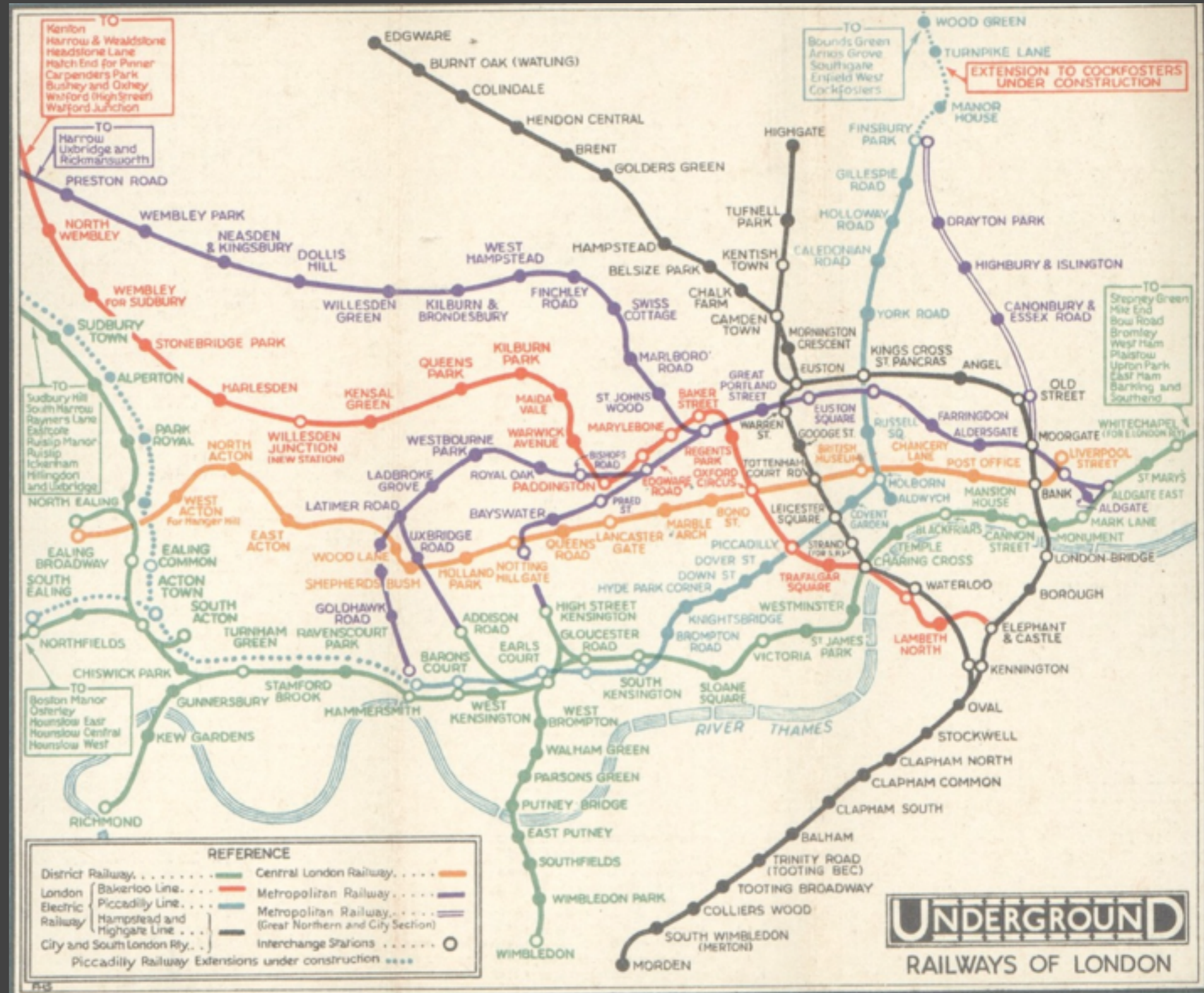


Chart shows \$3.7 trillion authorized to be spent in 2013. (Total spending is estimated to be \$3.8 trillion, including funds authorized in other years). Negative budget authority, which results from fees or other collections, is shown only on the department totals tab, but is included in other totals.

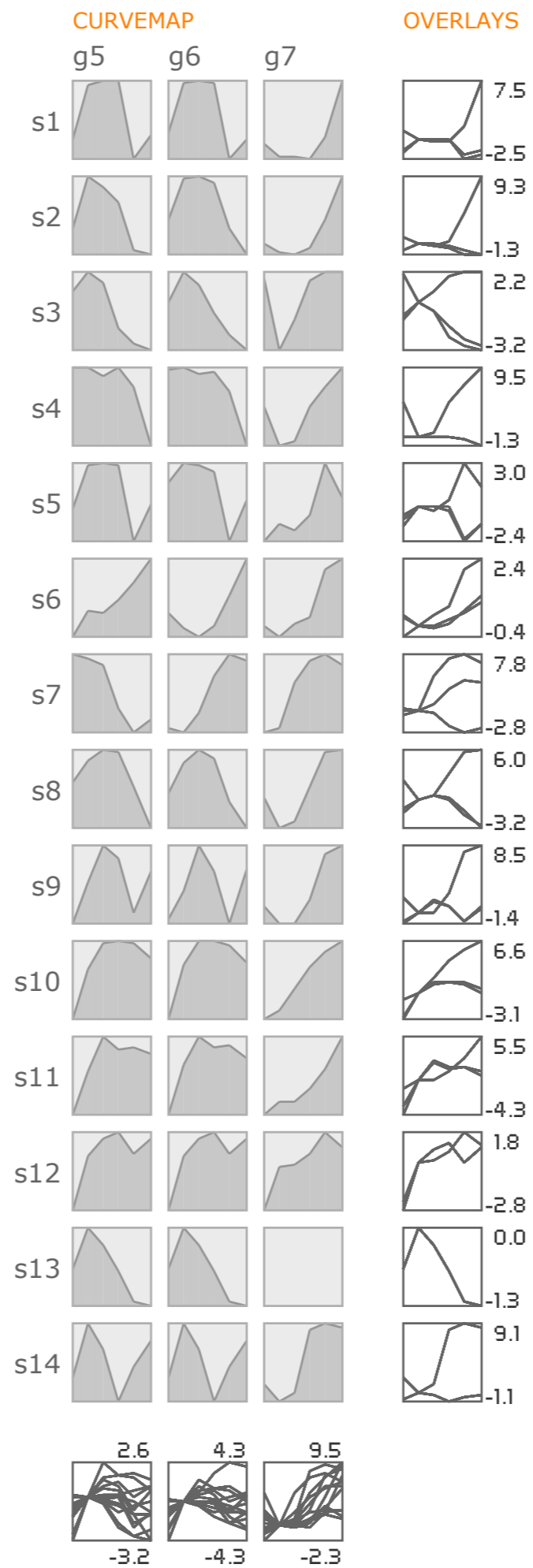
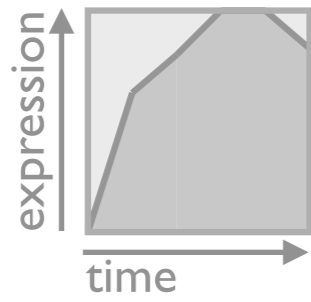
ABSTRACT

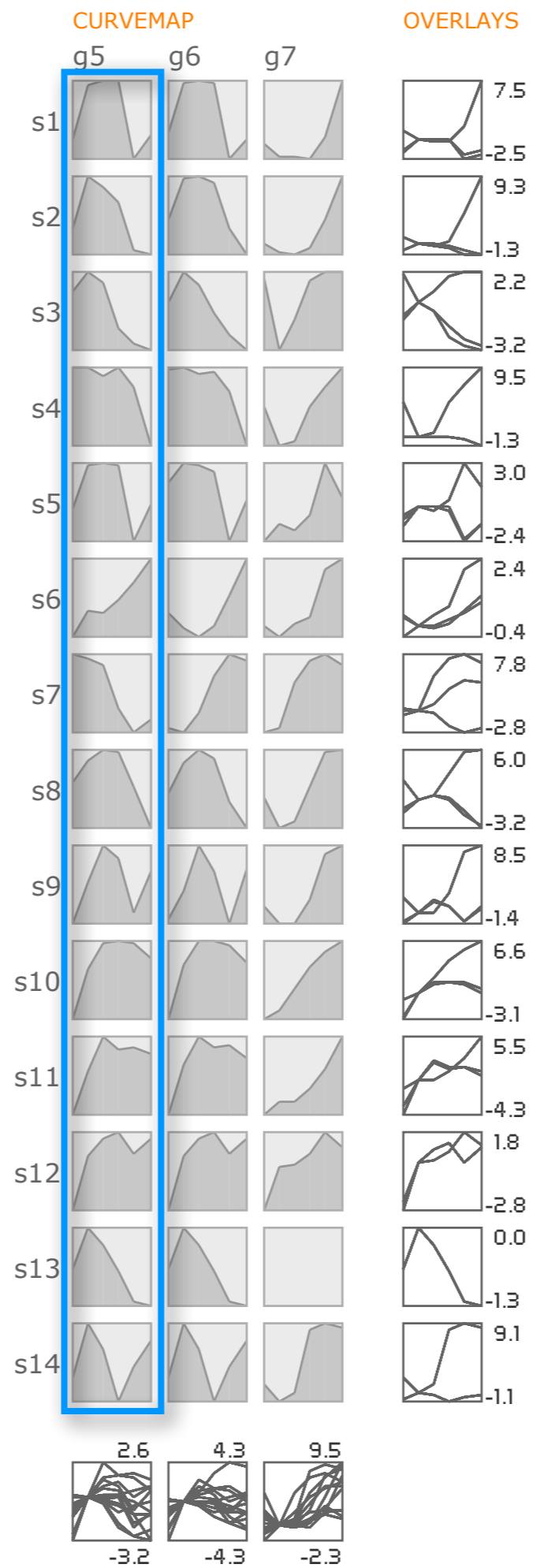
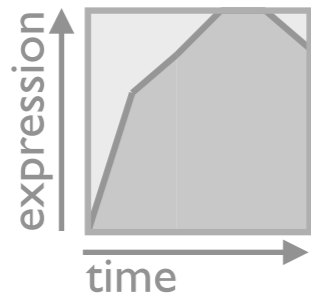


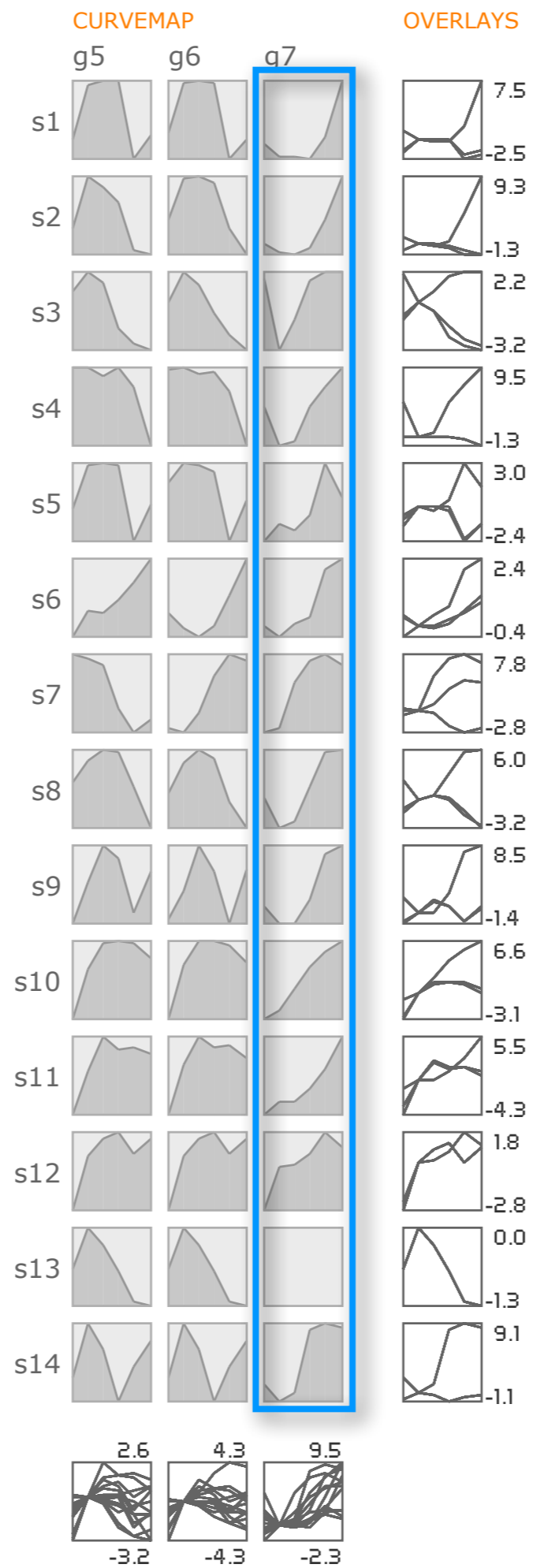
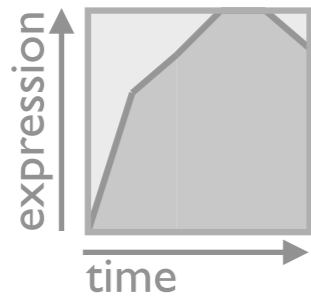
ABSTRACT

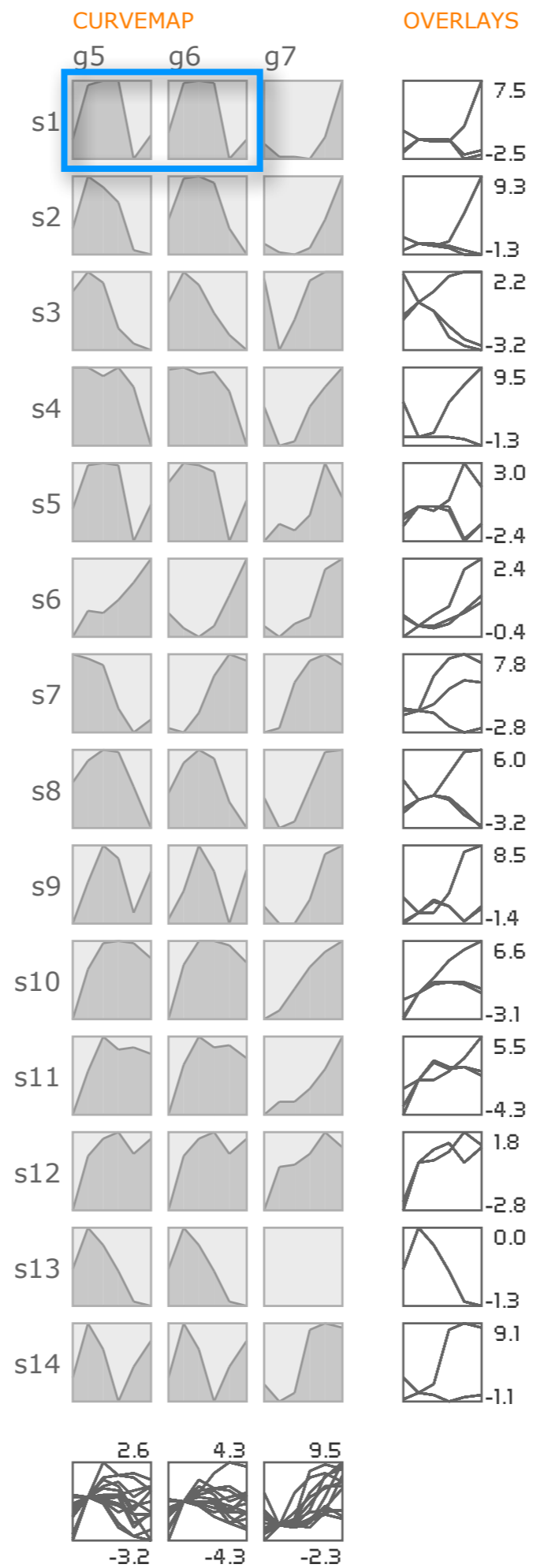
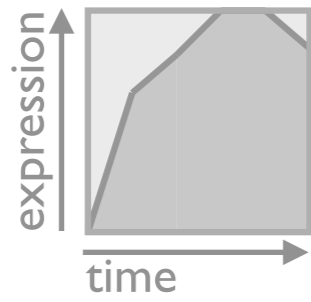


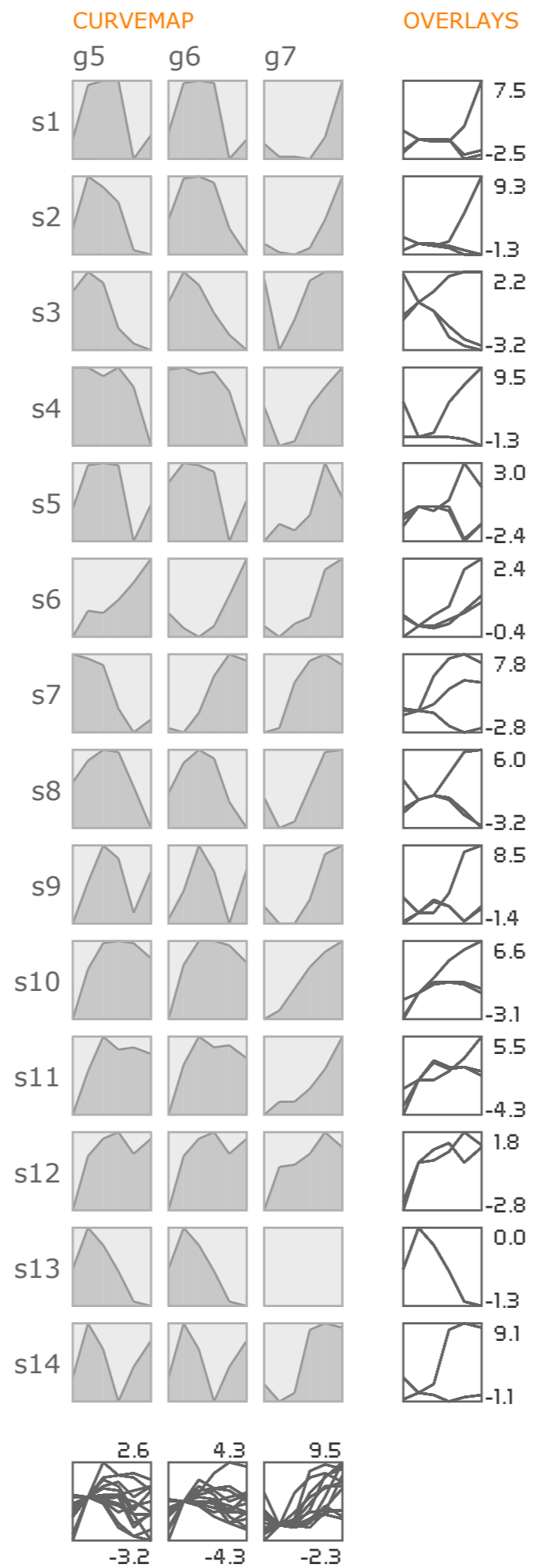
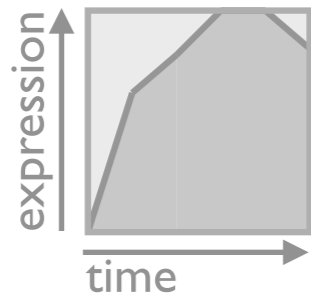
CONFIRM HYPOTHESES

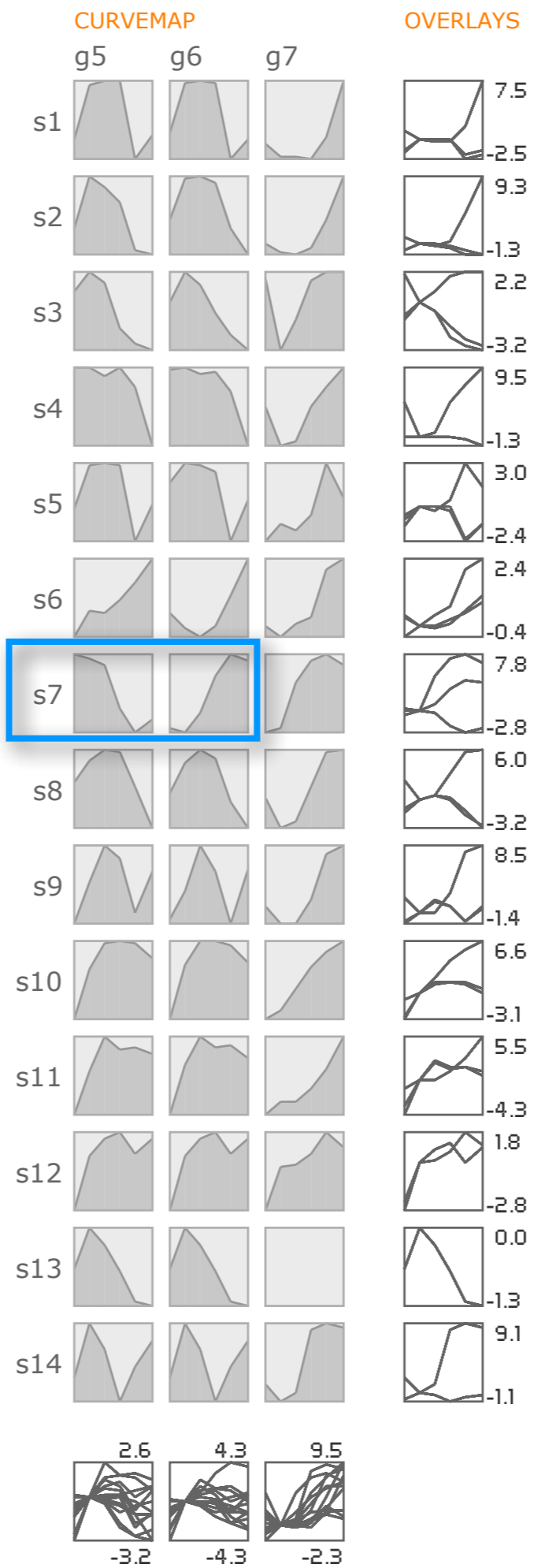
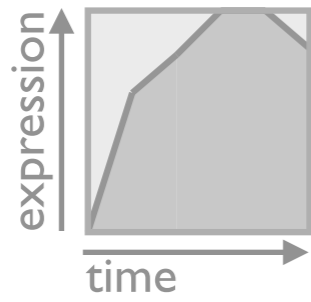








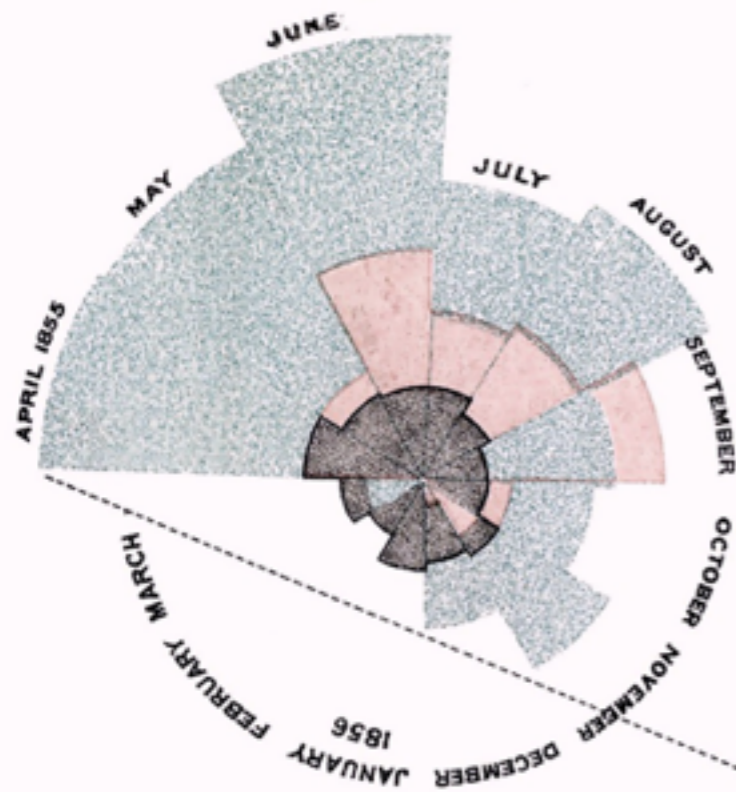




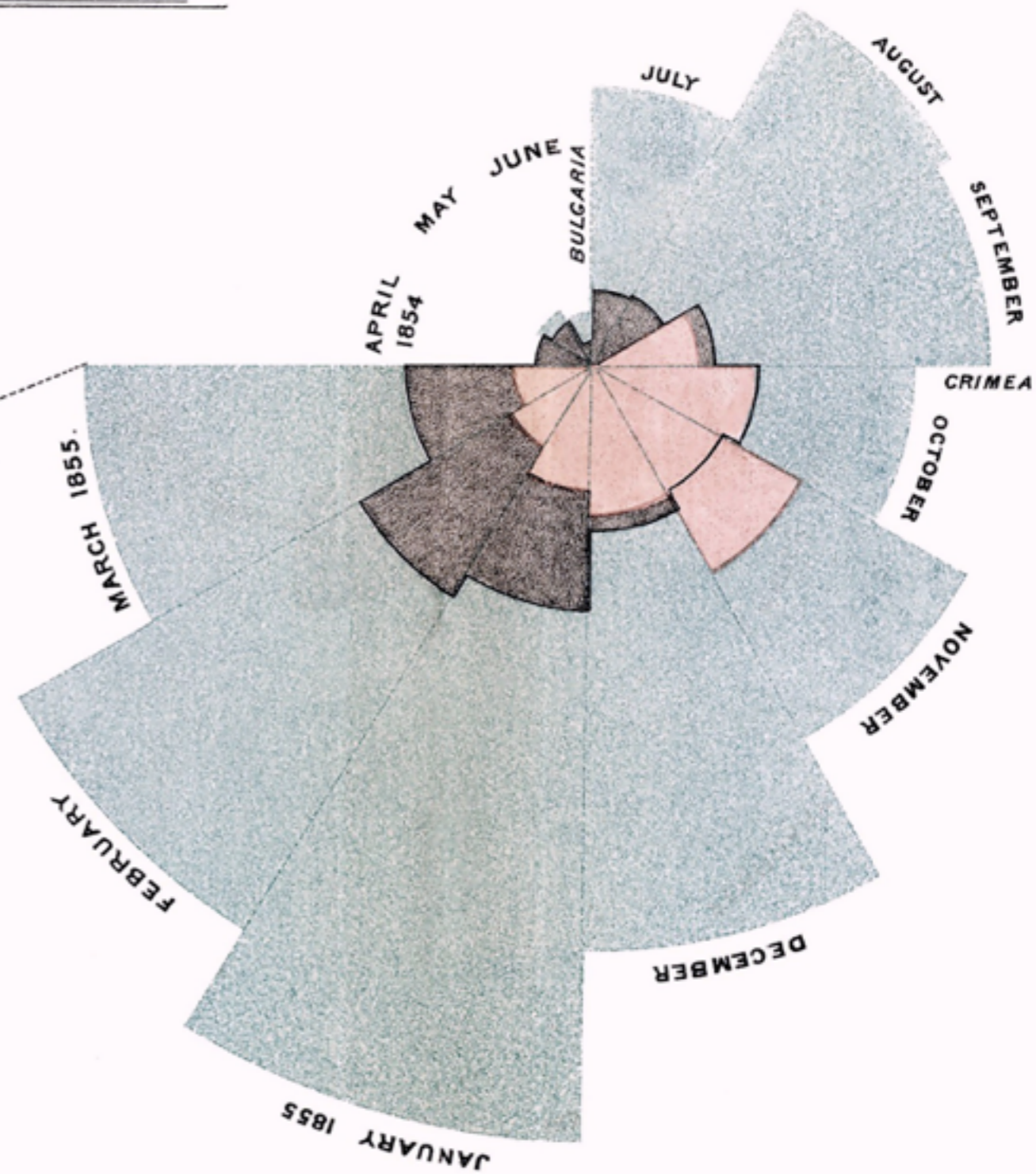
COMMUNICATE IDEAS

DIAGRAM OF THE CAUSES OF MORTALITY IN THE ARMY IN THE EAST.

2.
APRIL 1855 TO MARCH 1856.



1.
APRIL 1854 TO MARCH 1855.



The Areas of the blue, red, & black wedges are each measured from the centre as the common vertex.

The blue wedges measured from the centre of the circle represent area for area the deaths from Preventible or Mitigable Zymotic diseases; the red wedges measured from the centre the deaths from wounds; & the black wedges measured from the centre the deaths from all other causes.

The black line across the red triangle in Nov^r 1854 marks the boundary of the deaths from all other causes during the month.

In October 1854, & April 1855; the black area coincides with the red; in January & February 1856, the blue coincides with the black.

The entire areas may be compared by following the blue, the red & the black lines enclosing them.

Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui ont été en Russie; le noir ceux qui en sont sortis. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M. M. Chiers, de Léger, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre.

Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davout qui avaient été détachés sur Minsk et Mohilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

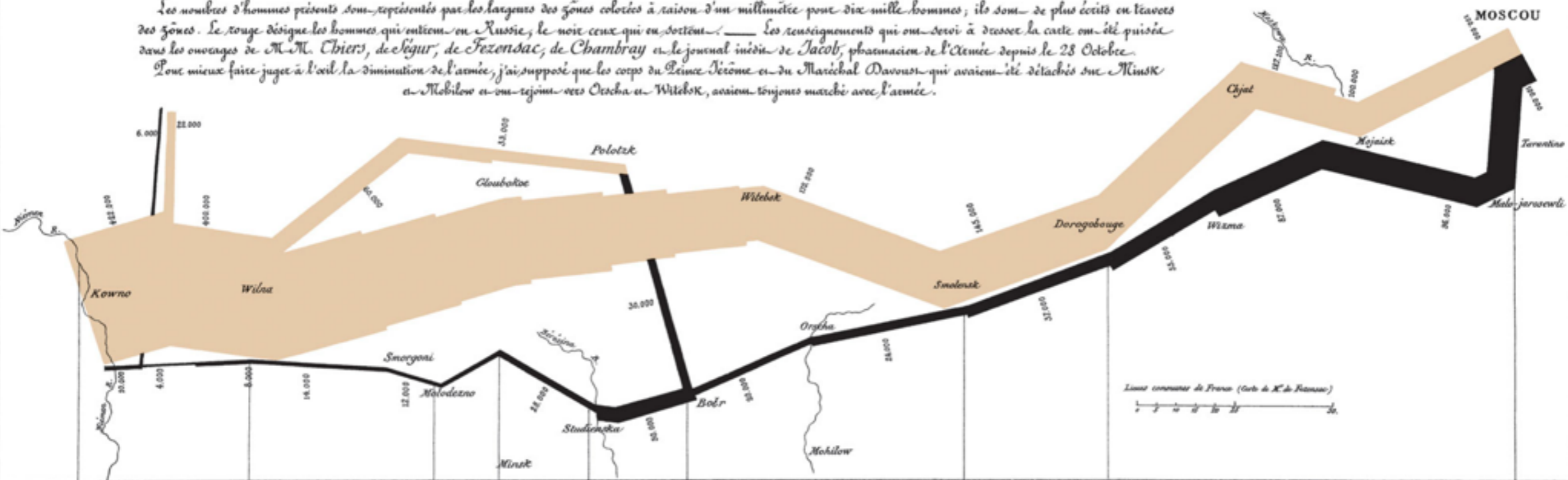
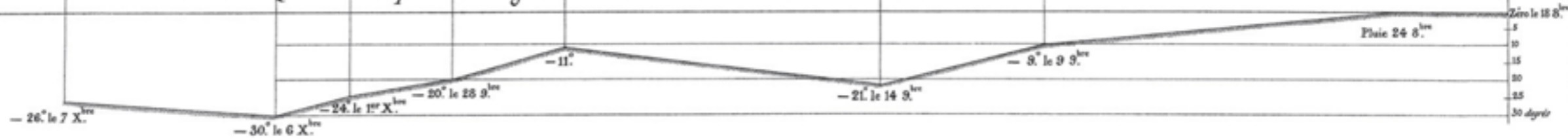


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.



Autog. par Régnier, 1. Par. 37° Paris 52 60° à Paris.

Imp. Lit. Régnier et Desrot.

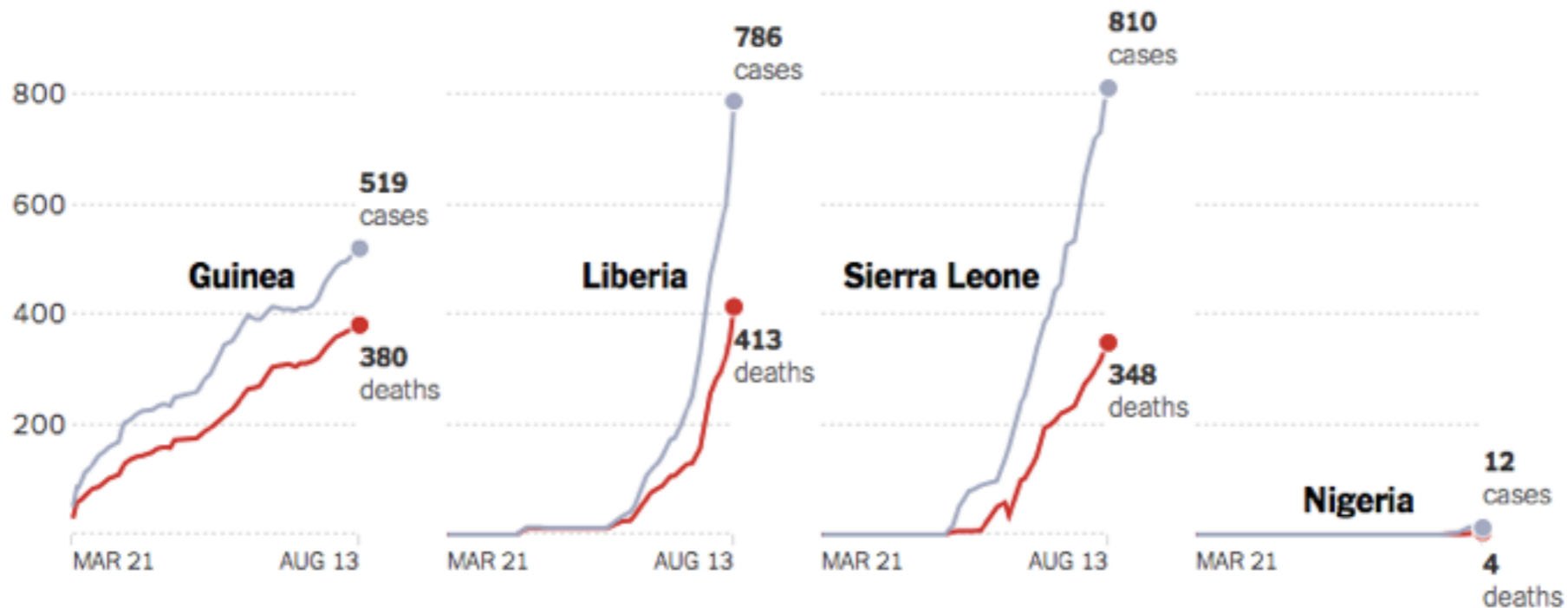
Q&A

What You Need to Know About the Ebola Outbreak

UPDATED AUGUST 13, 2014

How many people have been infected?

More than 2,100 people in Guinea, Liberia, Nigeria and Sierra Leone have contracted Ebola since March, according to the World Health Organization, making this the biggest outbreak on record. More than 1,100 people have died. Two American aid workers infected with Ebola while working in West Africa were taken to a containment unit in Atlanta for treatment.



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TALKS

Hans Rosling shows the best stats you've ever seen

TED2006, Filmed Feb 2006; Posted Jun 2006



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INTERACTIVE TRANSCRIPT

ABOUT THE SPEAKER

ABOUT THIS TALK

You've never seen data presented like this. With the drama and urgency of a sportscaster, statistics guru Hans Rosling debunks myths about the so-called "developing world."



THE ROLEX ARTS INITIATIVE PAIRS ESTABLISHED MENTORS WITH EMERGING PROTÉGÉS FOR A YEAR OF CREATIVE COLLABORATION

WHAT TO WATCH NEXT



Hans Rosling's new insights on poverty

18:57 Posted: Jun 2007

Views 1,616,080 | Comments 193



00:17 | 19:53

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RECOMMENDED READING

**A survey of powerful visualization techniques,
from the obvious to the obscure.**

BY JEFFREY HEER, MICHAEL BOSTOCK, AND VADIM OGIEVETSKY

A Tour Through the Visualization Zoo

THANKS TO ADVANCES in sensing, networking, and data management, our society is producing digital information at an astonishing rate. According to one estimate, in 2010 alone we will generate 1,200 exabytes—60 million times the content of the Library

The Value of Visualization

Jarke J. van Wijk*

Dept. Mathematics and Computer Science
Technische Universiteit Eindhoven

ABSTRACT

The field of Visualization is getting mature. Many problems have been solved, and new directions are sought for. In order to make good choices, an understanding of the purpose and meaning of visualization is needed. Especially, it would be nice if we could assess what a good visualization is. In this paper an attempt is made to determine the value of visualization. A technological viewpoint is adopted, where the value of visualization is measured based on effectiveness and efficiency. An economic model of visualization is presented, and benefits and costs are established. Next, consequences for and limitations of visualization are discussed (including the use of alternative methods, high initial costs, subjectiveness, and the role of interaction), as well as examples of the use of the model for the judgement of existing classes of methods and understanding why they are or are not used in practice. Furthermore, two alternative views on visualization are presented and discussed: viewing visualization as an art or as a scientific discipline. Implications and future directions are identified.

CR Categories: H.5.2 [Information Interfaces and Presentation]: User Interfaces; I.3.6 [Computer Graphics]: Methodology and Techniques I.3.8 [Computer Graphics]: Applications

Keywords: Visualization, evaluation

1 INTRODUCTION

Modern society is confronted with a data explosion. Acquisition devices like MRI-scanners, large scale simulations on supercomputers, but also stock trading at stock exchanges produce very large amounts of data. Visualization of data makes it possible for researchers, analysts, engineers, and the lay audience to obtain insight

In this paper I want to give a contribution to the discussion on the status and possible directions of our field. Rather than to pinpoint specific topics and activities, my aim is to detect overall patterns, and to find a way to understand and qualify visualization in general. This is an ambitious and vague plan, although the basic ground for this is highly practical.

I have to make decisions on visualization in many roles. As a researcher, decisions have to be made ranging from which area to spend time on to which particular solution to implement; as a supervisor, guidance to students must be provided; as a reviewer, new results and proposals for new research must be judged, and opinions are expected if they are worth publishing or funding; as advisor in a start-up company, novel and profitable directions must be spotted. All these cases imply judgement of the value of visualization in varying senses.

How to assess the value of visualization? Visualization itself is an ambiguous term. It can refer to the research discipline, to a technology, to a specific technique, or to the visual result. If visualization is considered as a technology, i.e., as a collection of methods, techniques, and tools developed and applied to satisfy a need, then standard measures apply: Visualization has to be *effective* and *efficient*. In other words, visualization should do what it is supposed to do, and has to do this using a minimal amount of resources. One immediate and obvious implication is that we cannot judge visualization on its own, but have to take into account the context in which it is used.

In section 2 a short overview is given of the background of the topic discussed here. In section 3 an economic model of visualization is proposed. The basic elements are identified first, the associated costs and gains are added next. Various implications of the model are discussed in section 4. In section 5 this model is applied to several cases. In section 6 the model is discussed and alternative views are considered, followed by conclusions in section 7.

-WHAT

-WHY

-WHO

-HOW

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Miriah Meyer

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born in Martinsville, VA

year 0

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dad buys a Commodore64

born in Martinsville, VA

year 0

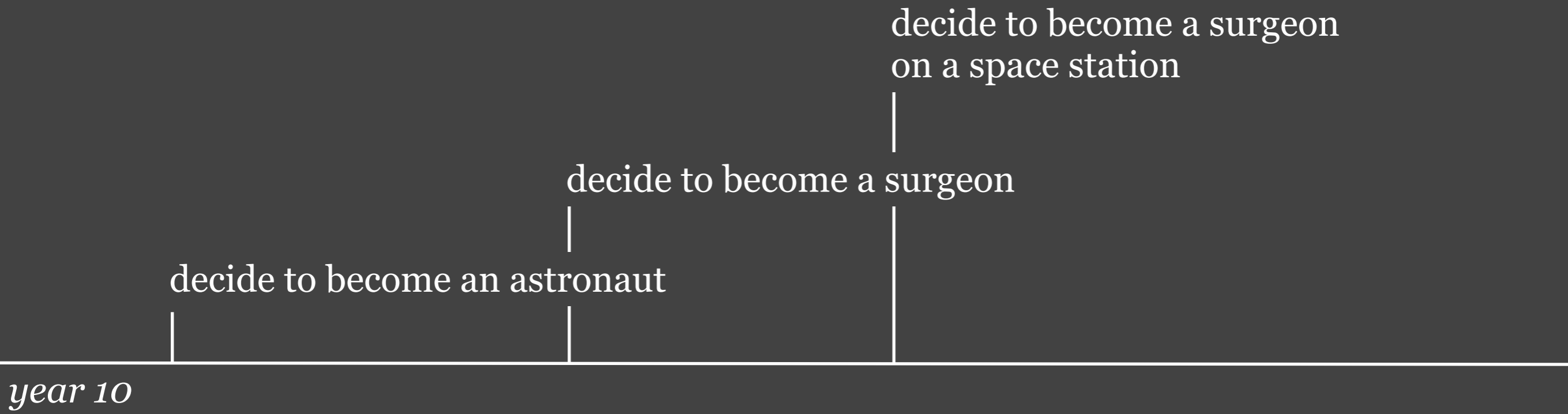
decide to become an astronaut

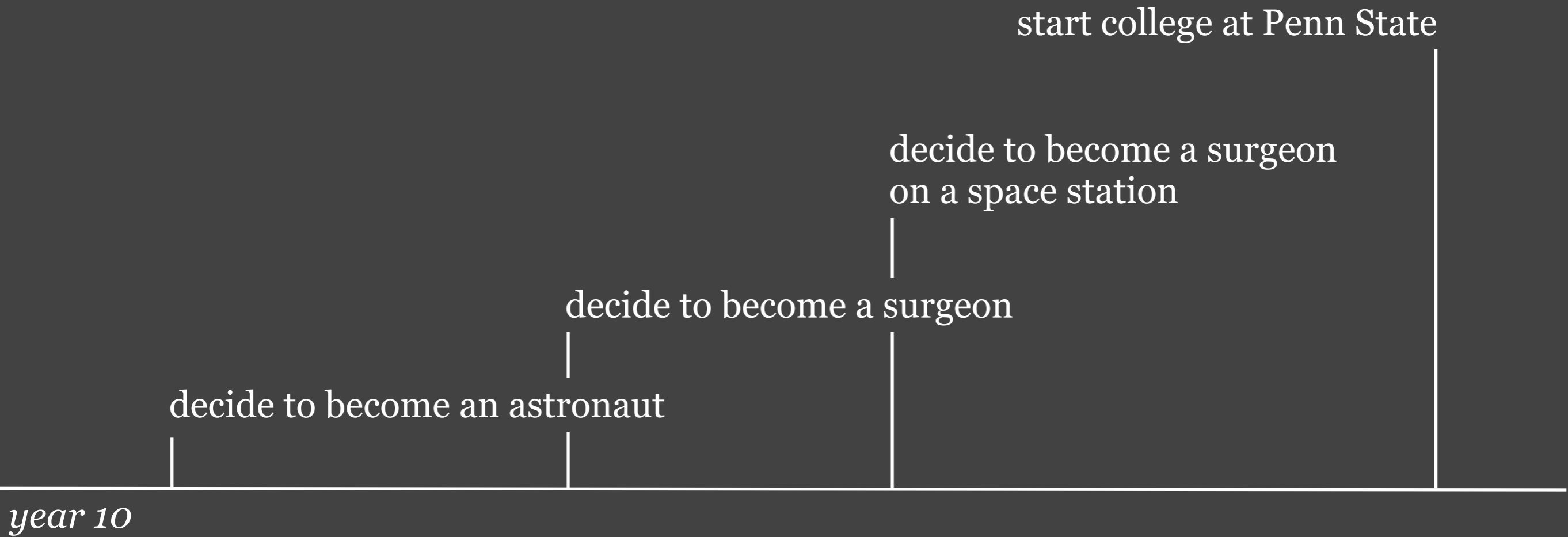
year 10

year 10

decide to become an astronaut

decide to become a surgeon





finish BS in astronomy

year 20

software engineer at Raytheon

finish BS in astronomy

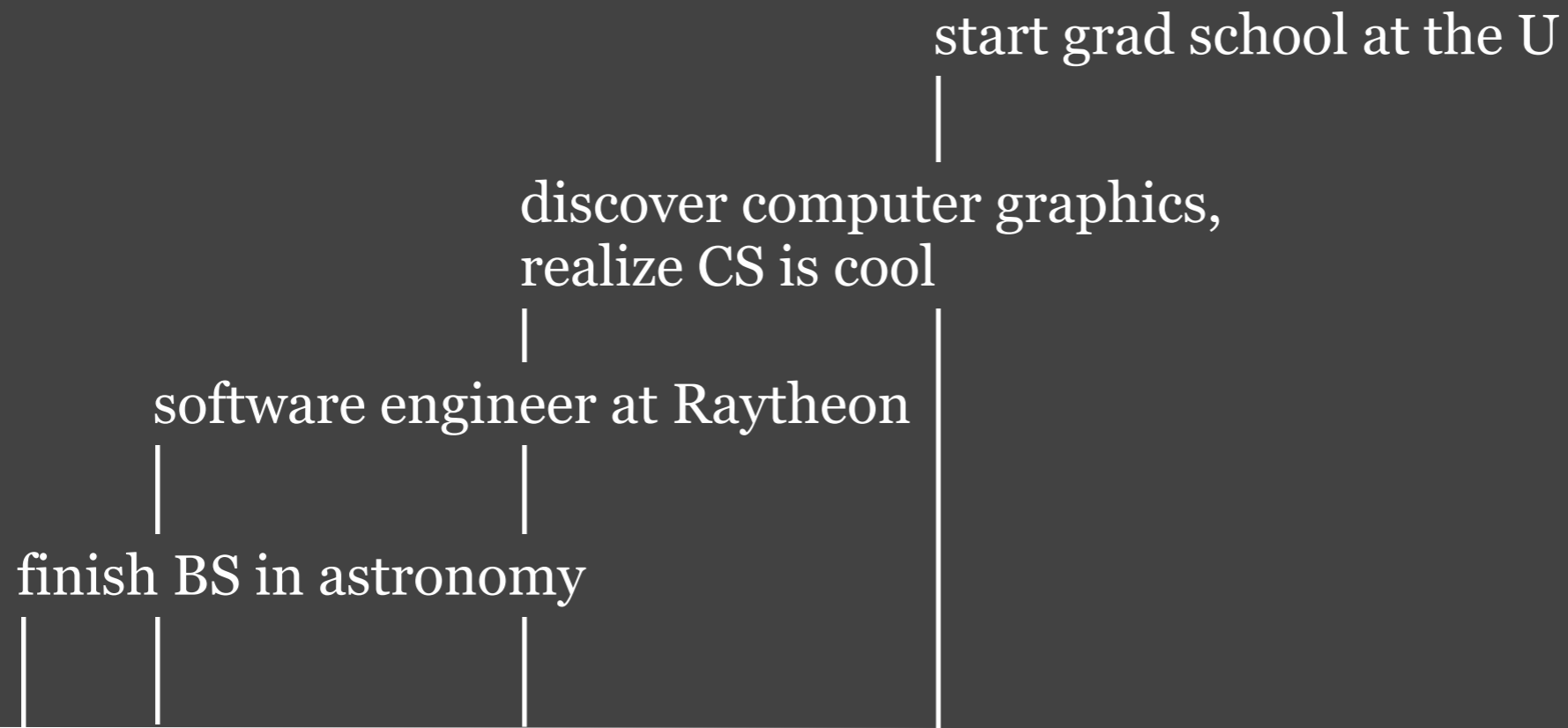
year 20

discover computer graphics,
realize CS is cool

software engineer at Raytheon

finish BS in astronomy

year 20



year 20

finish PhD in computer science



year 30

postdoc at Harvard University

|

finish PhD in computer science

||

year 30

assistant professor at the U in
School of Computing and SCI

postdoc at Harvard University

finish PhD in computer science

year 30

assistant professor at the U in
School of Computing and SCI

postdoc at Harvard University

finish PhD in computer science

year 30



WE ARE HERE

YOU

-WHAT

-WHY

-WHO

-HOW

The **goal of this course** is to introduce students to the principles, methods, and techniques for effective visual analysis of data.

We will discuss visualization techniques for a **broad range of data types**: from spatial data (simulations, sensors, etc) to non spatial data (graphs, tables, text, etc).

You will **gain experience** in using cutting-edge visual analysis tools, as well as in **developing your own** interactive visualization tools.

CONTENT

FOUNDATIONS

- design
- perception
- data and tasks
- visual encoding
- interaction
- multiple views
- filtering and aggregation

TECHNIQUES

- tabular data
- graphs and trees
- text
- sets
- maps
- scalar fields
- vector fields
- tensor fields

NUTS & BOLTS

SCIVIS vs INFOVIS

CS-5630/6630 | Visualization | Fall 2014

INSTRUCTOR: Miriah Meyer

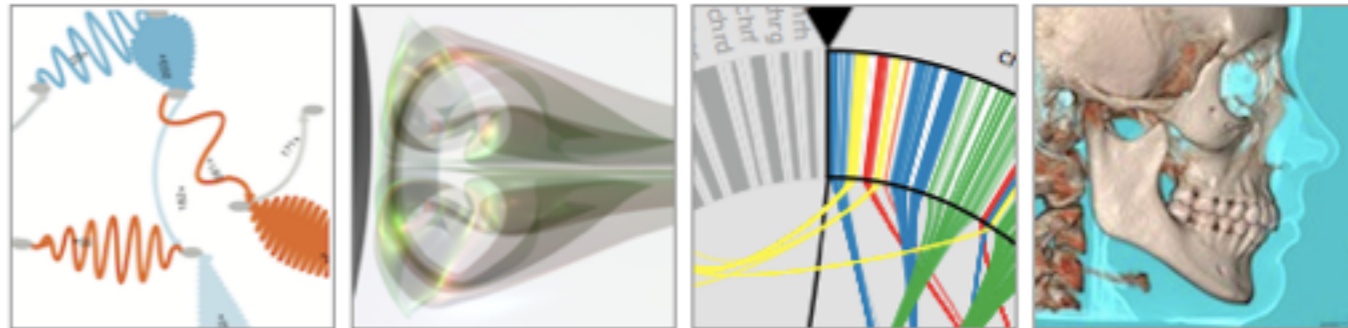
TIME: T/Th 9:10-10:30am

PLACE: L101 WEB

OFFICE HRS: TBD, WEB 4887

TA: Alex Bigelow

OFFICE HRS: TBD



[SCHEDULE](#) | [SYLLABUS](#) | [ASSIGNMENTS](#) | [EXAMS](#) | [LECTURES](#) | [RESOURCES](#)

The goal of this course is to introduce students to the principles, methods, and techniques for effective visual analysis of data. Students will explore many aspects of visualization, including techniques for both spatial (eg. gridded data from simulations and scanning devices) and nonspatial data (eg. graphs, text, high-dimensional tabular data). The course begins with an overview of principles from perception and design, continues with a framework for discussing, critiquing, and analyzing visualizations, and then focuses on visualization techniques and methods for a broad range of data types. Students will acquire hands-on experience using cutting edge visualization systems as well as programming interactive visual analysis tools.

SCHEDULE

| WEEK | DATE | TOPIC | DATE | TOPIC | HOMEWORK |
|------|-------|---------------------|-------|-------------------------------|--|
| 1 | 8/26 | Introduction | 8/28 | Design principles | Design critiques |
| 2 | 9/2 | Perception | 9/4 | Data types & Intro to Tableau | Data exploration out Th due in 1.5 weeks |
| 3 | 9/9 | Visual encodings | 9/11 | Color | |
| 4 | 9/16 | Intro to Processing | 9/18 | Processing lab day | Time series out T due in 2 weeks |
| 5 | 9/23 | Tasks | 9/25 | Interaction | |
| 6 | 9/30 | Views | 10/2 | Filtering & aggregation | |
| 7 | 10/7 | Exam 1: foundations | 10/9 | Tabular | Parallel coordinates out Th due in 3 weeks |
| 8 | 10/14 | <i>fall break</i> | 10/16 | <i>fall break</i> | |
| 9 | 10/21 | Trees & graphs | 10/23 | Text & Sets | |
| 10 | 10/28 | Maps | 10/30 | Grids | scalar data out Th due in 2.5 weeks |
| 11 | 11/4 | Isosurfaces | 11/6 | 3d graphics | |
| 12 | 11/11 | Volume rendering | 11/13 | Transfer functions | |

GROUND RULES

- be respectful of everyone's time
- come to class prepared
- critique ideas, not people
- discuss ideas together, do the assignments on your own
- be engaged!

L2: Design

REQUIRED READING

What's Vis, and Why Do It?

1.1 The Big Picture

This book is built around the following definition of visualization – **vis**, for short:

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. The design space of possible vis idioms is huge, and includes the considerations of both how to create and how to interact with visual representations. Vis design is full of tradeoffs, and most possibilities in the design space are ineffective for a particular task, so validating the effectiveness of a design is both necessary and difficult. Vis designers must take into account three very different kinds of resource limitations: those of computers, of humans, and of displays. Vis usage can be analyzed in terms of why the user needs it, what data is shown, and how the idiom is designed.

In the rest of this chapter, I'll discuss the rationale behind many aspects

6.10 Function First, Form Next

The best vis designs should shine in terms of both form and function; that is, they should be both beautiful and effective. Nevertheless, in this book, I focus on function.

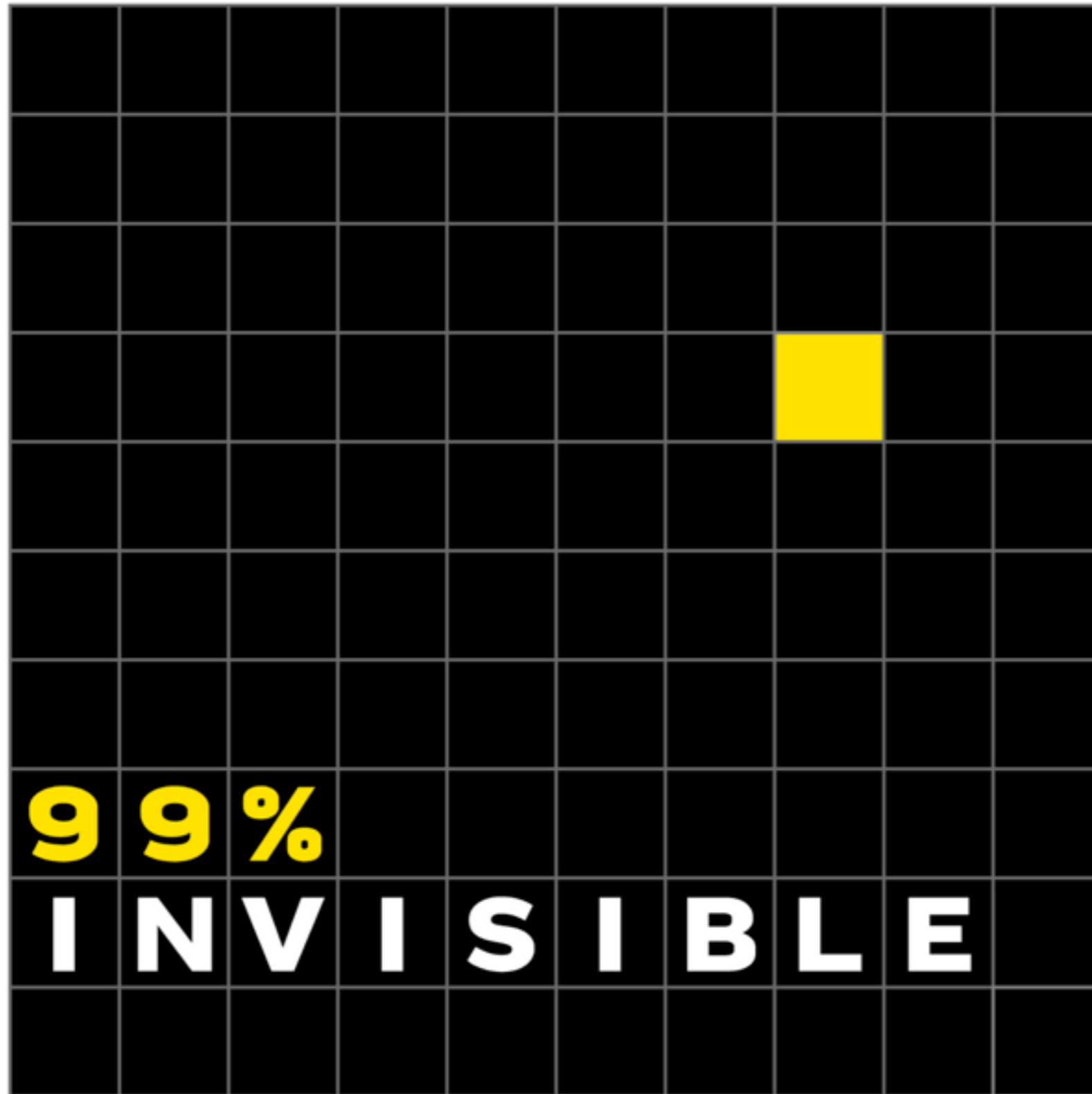
My rationale is that given an effective but ugly design, it's possible to refine the form to make it more beautiful while maintaining the base of effectiveness. Even if the original designer of the vis has no training in graphic design, collaboration is possible with people who do have that background.

In contrast, given a beautiful and ineffective design, you will probably need to toss it out and start from scratch. Thus, I don't advocate a "form first" approach, because progressive refinement is usually not possible. My argument mirrors the claims I made in the first chapter about the size of the vis design space and the fact that most designs are ineffective.

Equally important is the point that I don't advocate "form never": visual beauty does indeed matter, given that vis makes use of human visual perception. Given the choice of two equally effective systems, where one is beautiful and one is ugly, people will prefer the better form. Moreover, good visual form enhances the effectiveness of visual representations.

I don't focus on teaching the principles and practice of graphic design in this book because they are covered well by many other sources. I focus on the principles of vis effectiveness because of the lack of other resources.

6.11 Further Reading



99%

INVISIBLE

A TINY RADIO SHOW ABOUT DESIGN
WITH ROMAN MARS