CS325
USER INTERFACE AND USER EXPERIENCE DESIGN
Week 12

Dr Frank Guan

Agenda

- Timely user experience
- Data visualization
- Future of UI

Timely User Experience

Does this happen around you?

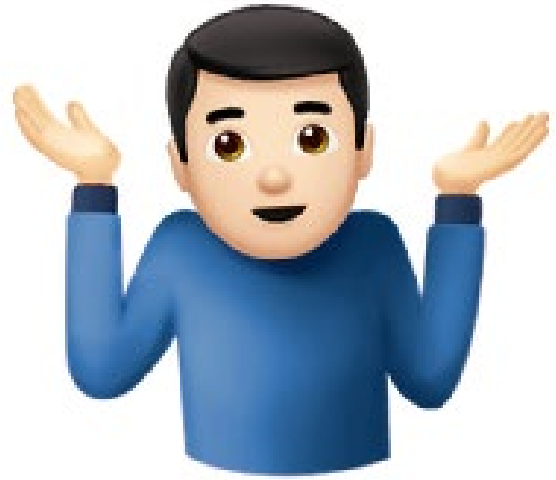
https://www.youtube.com/watch?v=1GNW6wsMb6c

Time is precious

- When externally imposed delays impede progress on a task, many people become frustrated, annoyed, and eventually angry.

Direct consequences

- Apps may be abandoned within minutes if performance is inadequate.
- Customers will leave the website and order the same product from a competitor if they suspect the user experience will be better.
- Some users accept the situation with a shrug of their shoulders, but most users prefer to work as quickly as the software and connection allow.
- Many more…



Reasons for user frustrations

- Delays
- System crashes and data is destroyed
- Software bugs
- Poor designs that lead to user confusion
- …

Balance between rapidness and low error rates

- However, …
  - If users work too quickly, they may learn less, read with lower comprehension, commit more data-entry errors, and make more incorrect decisions.
  - Stress can build in these situations, particularly in life-critical systems.
- Therefore, balancing rapid performance with low error rates is important.

What UI designers can do

- Make design decisions that dramatically influence the user experience.

- For example,
  - To optimize webpages to reduce byte counts and numbers of files
  - To provide previews (e.g., thumbnails or coverage maps) of materials available in digital libraries
  - To archives to help reduce the number of queries and accesses to the network
  - …

People’s reaction to Time

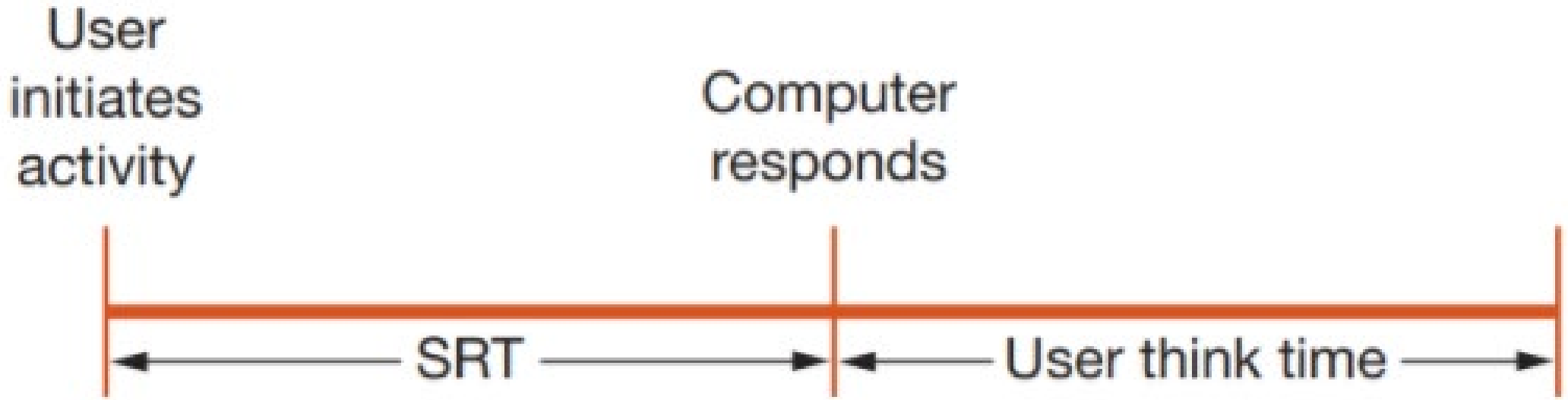
- People cannot perceive any difference in event times less than 25 milliseconds and have trouble perceiving them until those times approach 100 milliseconds.

- Human reaction time is another factor.

- Reaction time varies for each user (e.g., age difference, situation, operating an application in a stressed or life-critical environment versus a more casual one).

System Response Time (SRT)

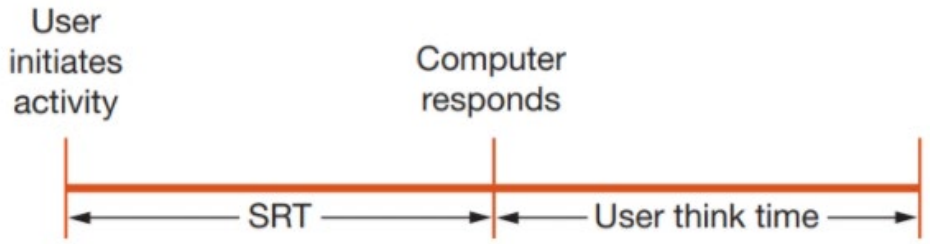
- The number of seconds it takes from the moment a user initiates an action—usually by touching an icon, pressing the “Enter” key, or clicking a mouse—until the computer begins to present feedback.



User Think Time (UTT)

- The User Think Time is the number of seconds that elapse between the computer's response and the user's initiation of the next action.

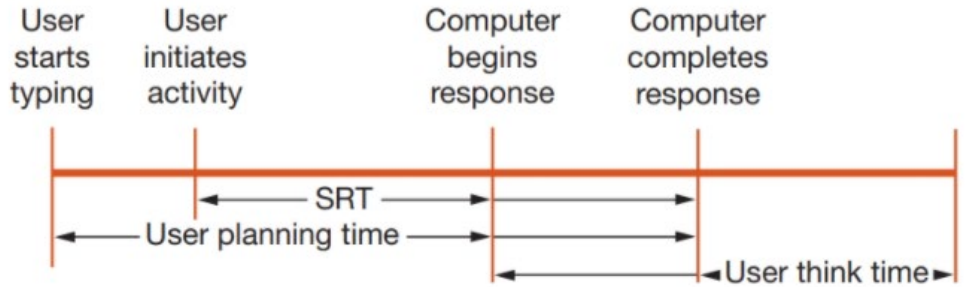
- A typical cycle for a user:
  - (1) initiate,
  - (2) wait for the computer to respond,
  - (3) watch while the results appear,
  - (4) scroll through results,
  - (5) think for a while, and then initiate again.



A more realistic model

- Some interfaces respond with distracting messages, informative feedback, or a simple prompt immediately after an action is initiated, but actual results may not appear for a few seconds.

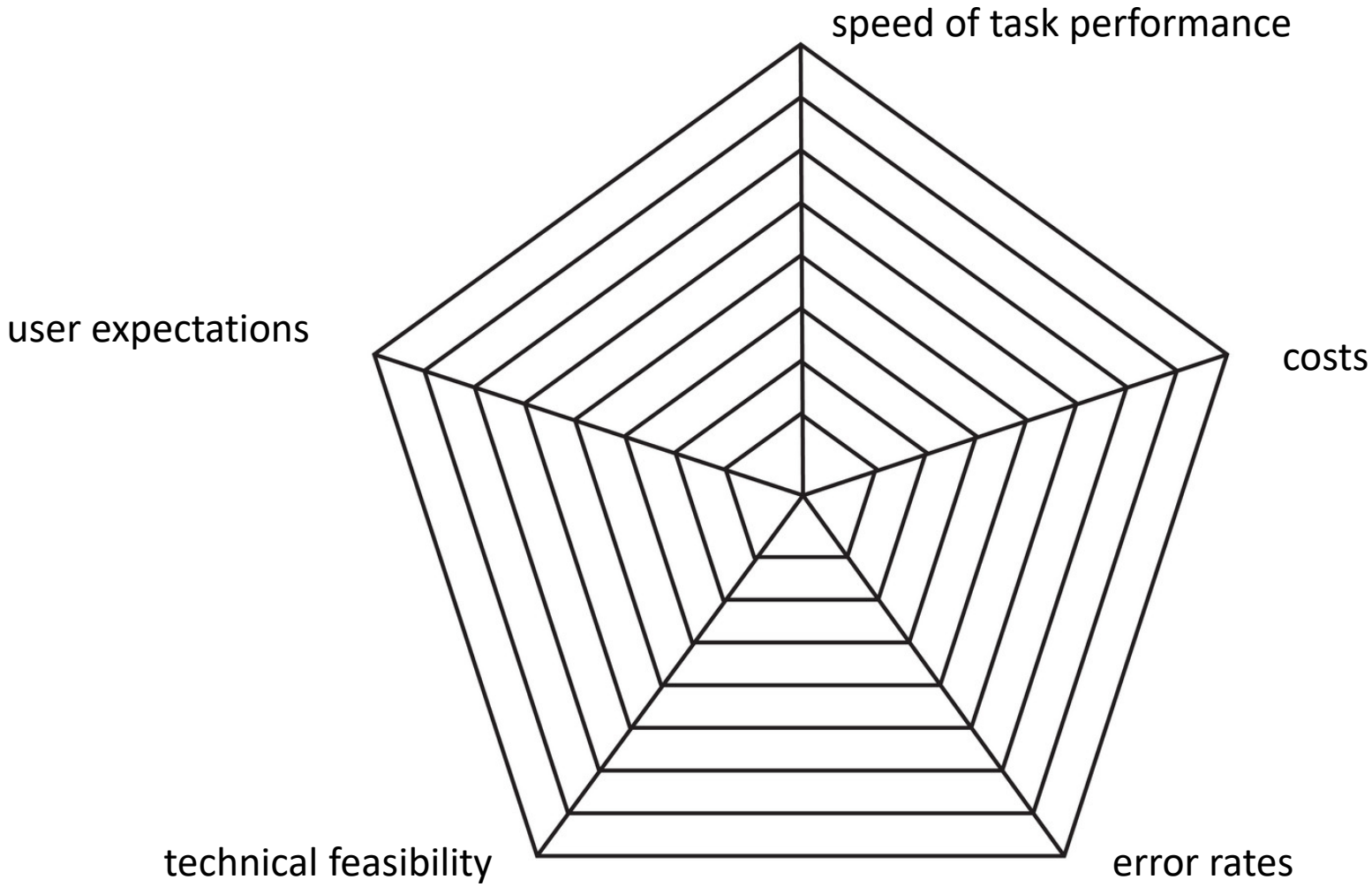
- Users prefer to have minimal, if any, delays for responses from networked devices
  - Most people will use whatever time they have to plan ahead; thus, precise measurements of user think time are difficult to obtain (e.g., print status).



Factors to consider for UI designers

- Overall productivity depends not only on the speed of the interface but also on the rate of human error and the ease of recovery from those errors.
- Lengthy (longer than 5 seconds) response times are generally detrimental to productivity and decrease satisfaction.
- More rapid (less than 1 second) interactions are generally preferred and can increase productivity, but they may also increase error rates for complex tasks.
- Other factors, e.g. the high cost of providing rapid response times and the loss from increased errors, must be evaluated.

Factors to consider for UI designers

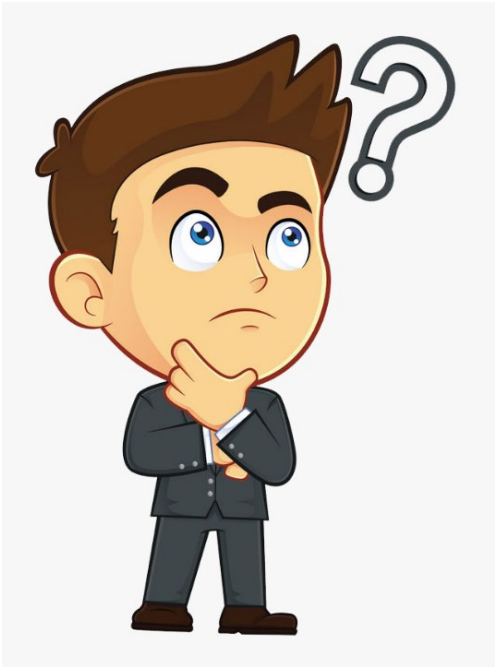


Users’ expectations and attitudes

- How long will users wait for the computer to respond before they become annoyed?

1st factor – past experience

- People have established expectations based on their past experiences of the time required to complete a given task.
- If a task is completed more quickly than expected, people will be pleased
- However, if the task is completed much more quickly than expected, they may become concerned that something is wrong
- Similarly, if a task is completed much more slowly than expected, users are likely to become concerned or frustrated



2nd factor – individual's tolerance for delays

- Large variations among individuals
  - Some may enjoy chatting with friends while pages load
  - Some may start banging on his or her desk, device, or keyboard in a vain attempt to push the computer along.

- Influenced by many factors, such as:
  - personality, cost, age, mood, cultural context, time of day, noise, and perceived pressure to complete work.

Other factors

- Users are highly adaptive and can change their working styles to accommodate different response times.

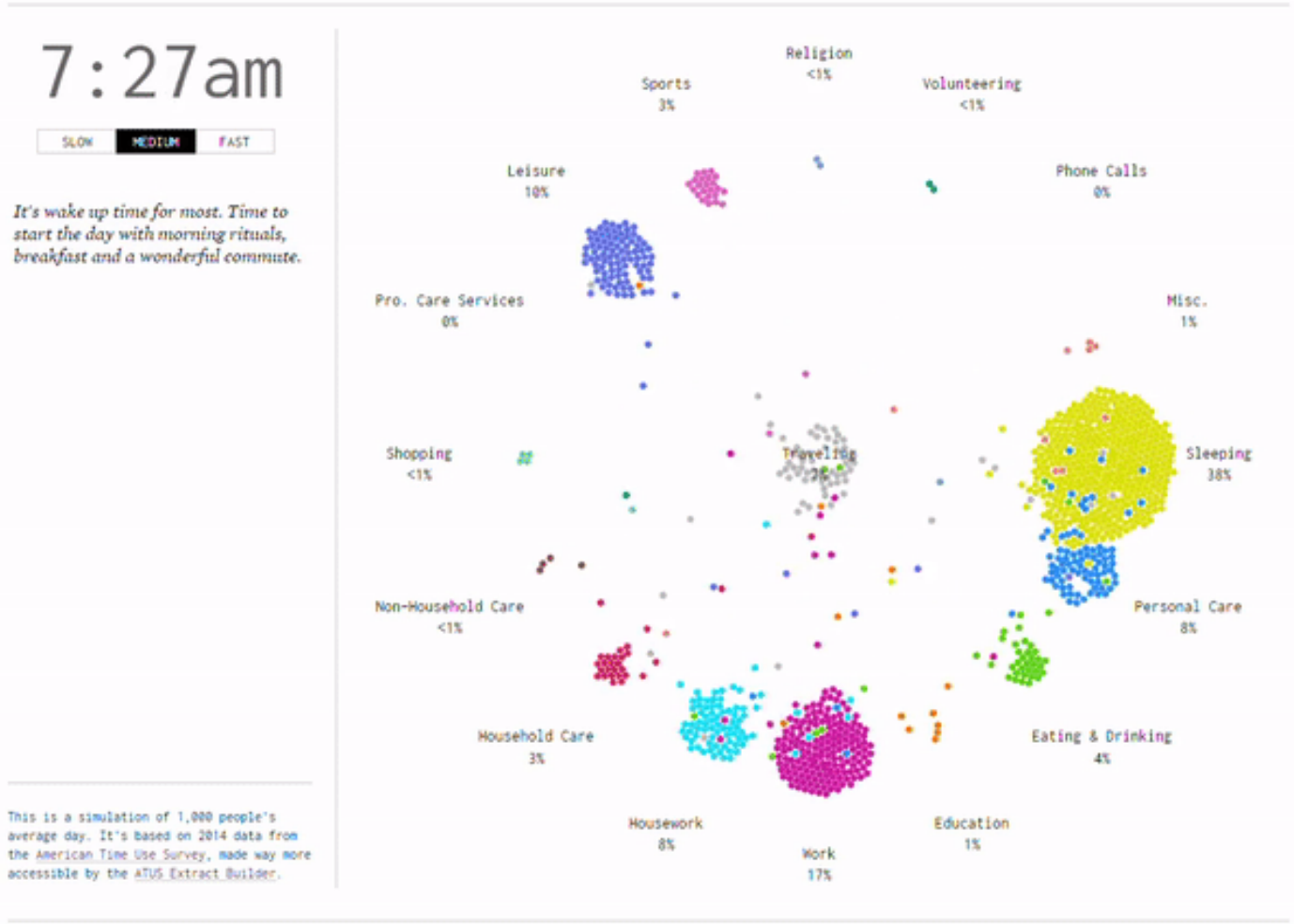
- The task complexity and the users' familiarity with the task
  - For simple tasks that require little problem solving, users want to perform rapidly and are annoyed by delays.
  - For complex problems, users will typically perform well even as SRT grows, as they can use the delays to plan ahead.

Suggestions

- For users to achieve rapid task performance, low error rates and high satisfaction:
  - Prepare the users to have adequate knowledge of the tasks
  - Eliminate distractions
  - Lower the users' anxiety
  - Provide accurate feedback about progress toward the completion
  - Avoid error. If errors occur, make sure that they can be handled easily.

Data Visualization (Enrichments)

A picture is worth a thousand words!



7 weeks of Data Visualization- A Day in the Life of Americans

https://medium.com/@hr23232323/7-weeks-of-data-visualization-a-day-in-the-life-of-americans-ddbfd387756d

Data visualization

- Definition: the graphical representation of data to amplify cognition (Card, 2012; Ware, 2013)

- Computer-based visualization has the added benefit of being interactive, which opens up vast opportunities beyond the static representations printed on paper

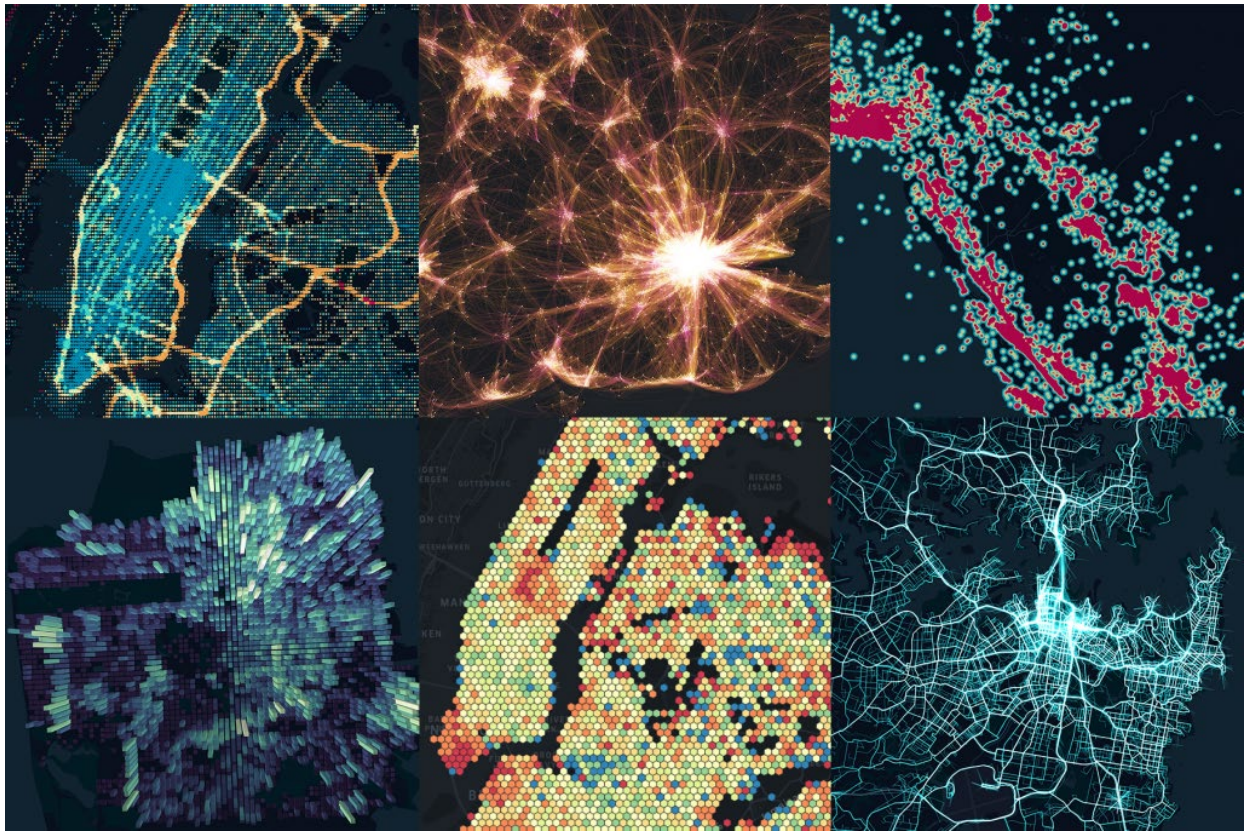
- Minimizes the gulf of evaluation because a well-designed graphical representation is optimized for many perceptual tasks

Data types

- 1-D linear data.

2-D space data

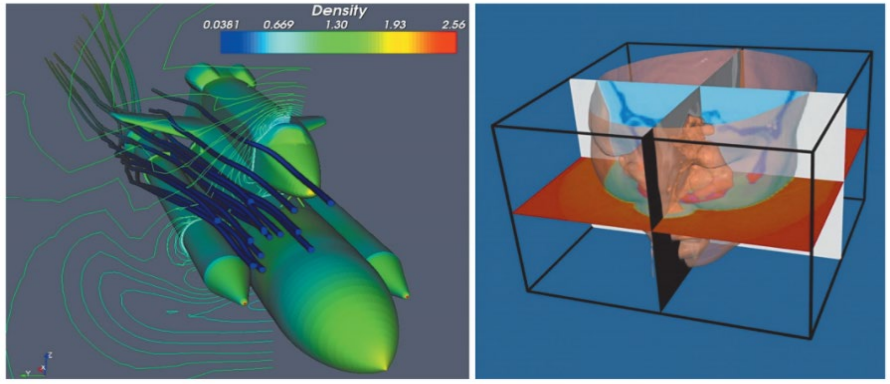
- Planar data include geographic maps, floor plans, and newspaper layouts.

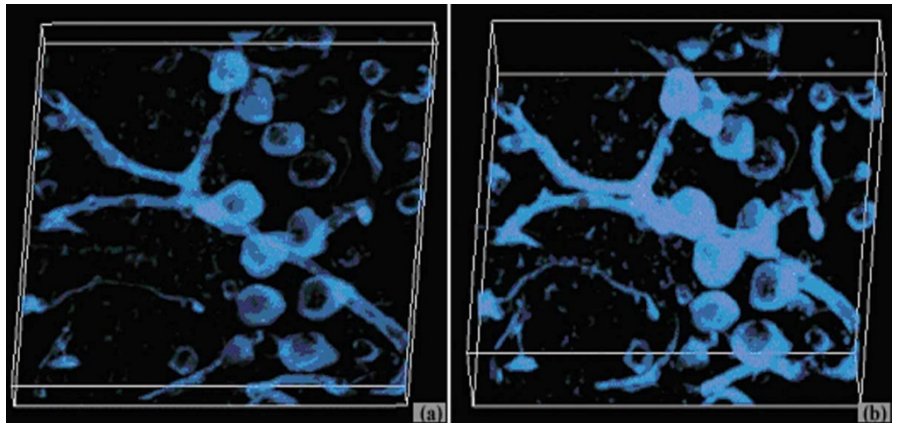


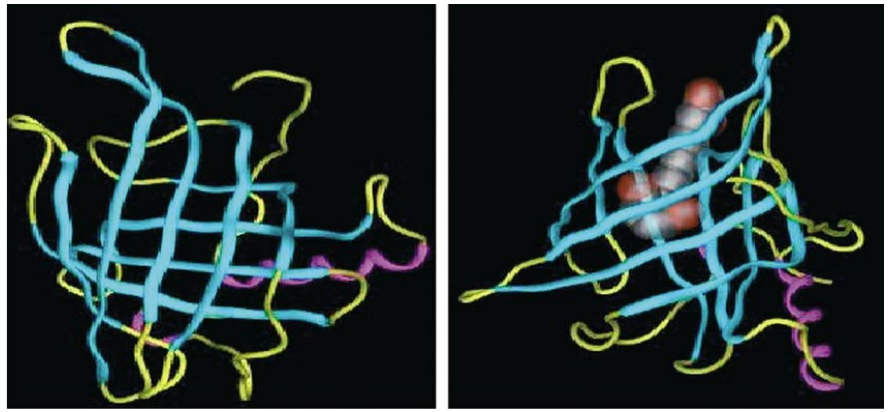
https://eng.uber.com/keplergl/

3-D volume data

- Real-world objects, such as molecules, the human body, and buildings, have volume and complex relationships with other items.
  - Computer-assisted medical imaging
  - Architectural drawing
  - Mechanical design
  - Chemical structure modeling
  - Scientific simulations
  - …



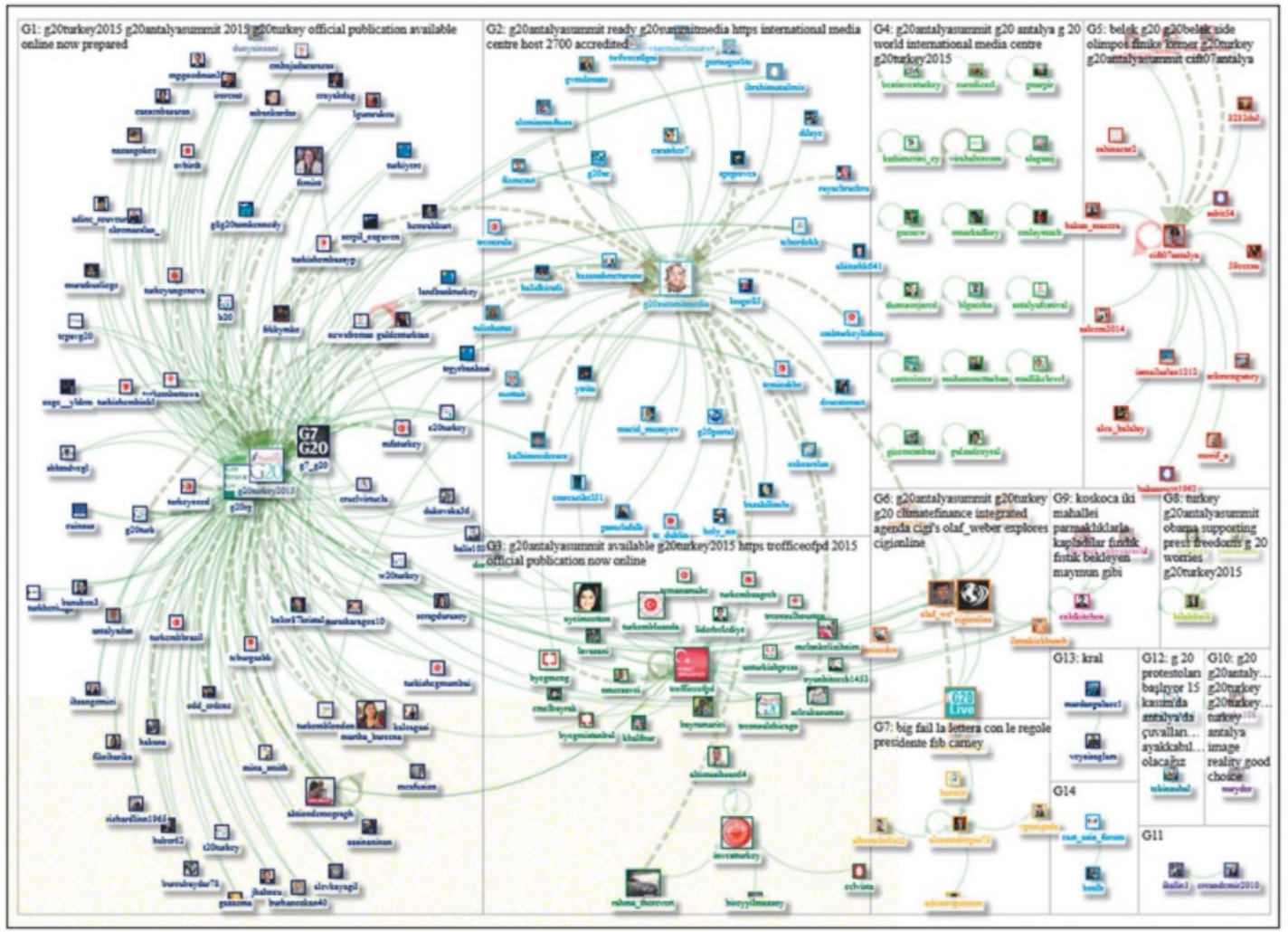




Temporal data

Google Finance line graph showing the year-to-date performance of three stock market indices: the Dow Jones Industrial Average (.DJI, blue), the NASDAQ Composite (.IXIC, red), and the S&P 500 (.INX, yellow). The overview window at the bottom shows several years from 2011 to 2015; grabbing the window allows for panning and resizing the detail view (top).

Network data



Task categories

- 1. Data and view specification
- 2. View manipulation
- 3. Process and provenance

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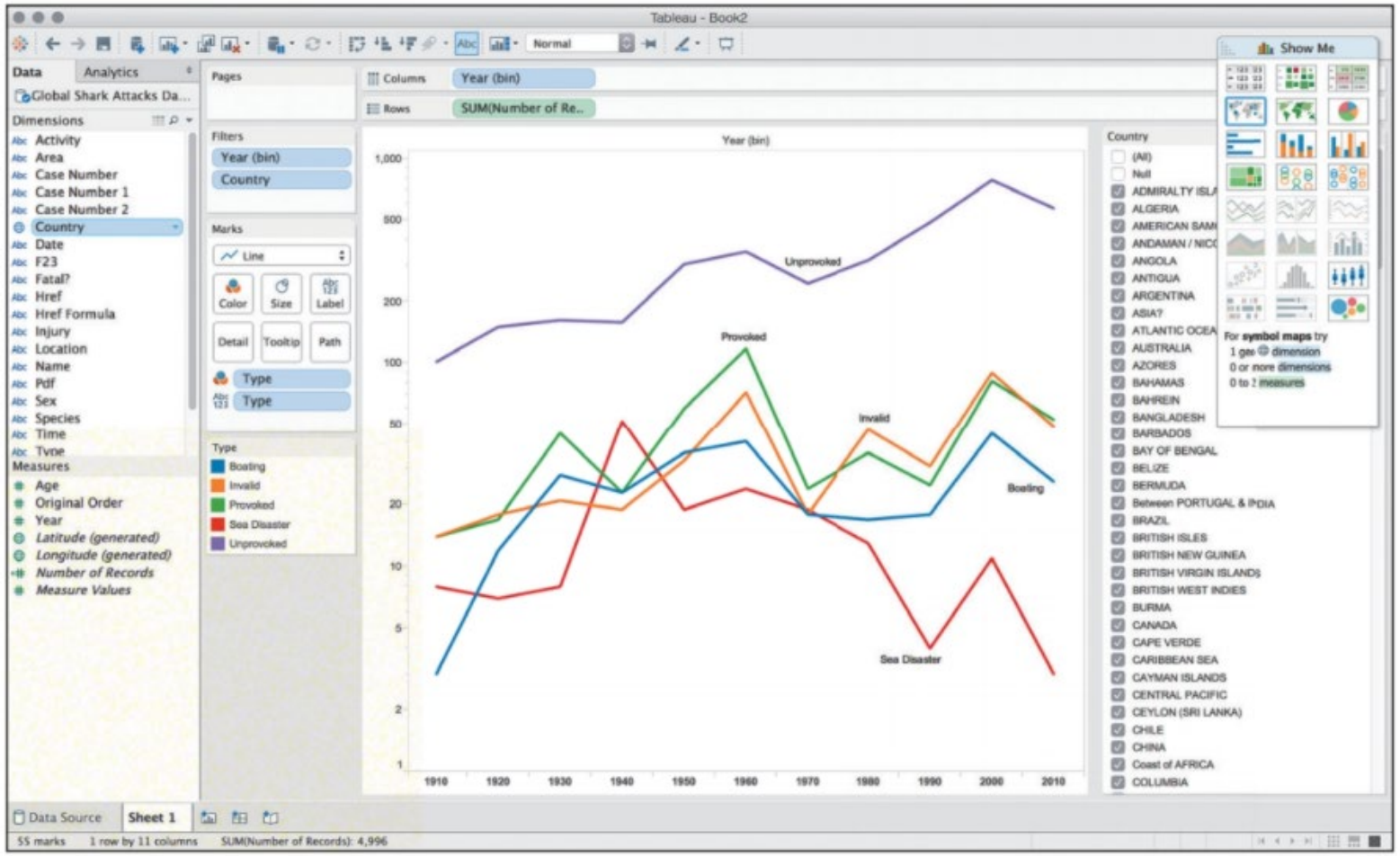
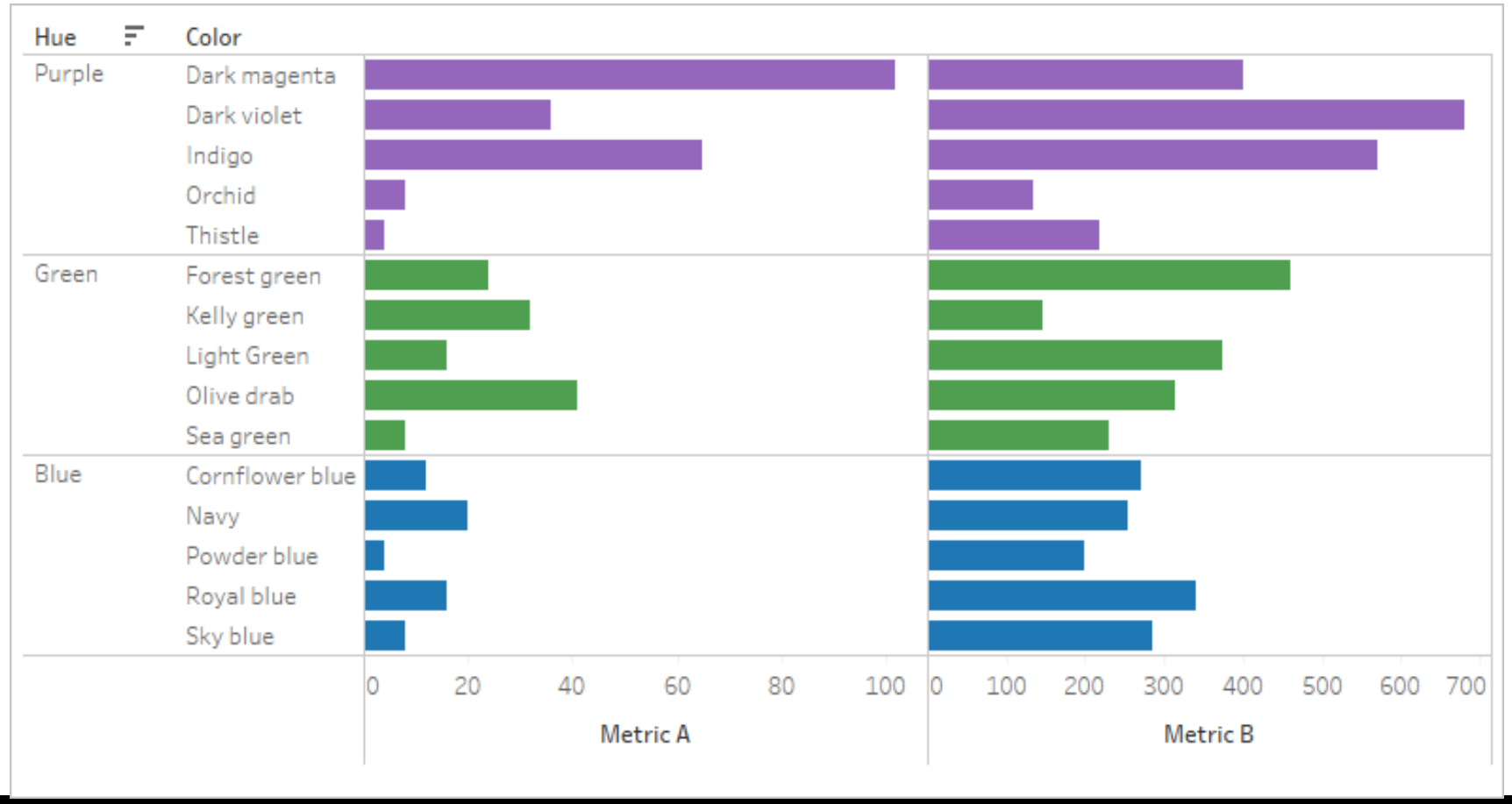
1.1: visualize data by choosing visual encodings

- Select a visual encoding for a particular dataset (Tableau©)



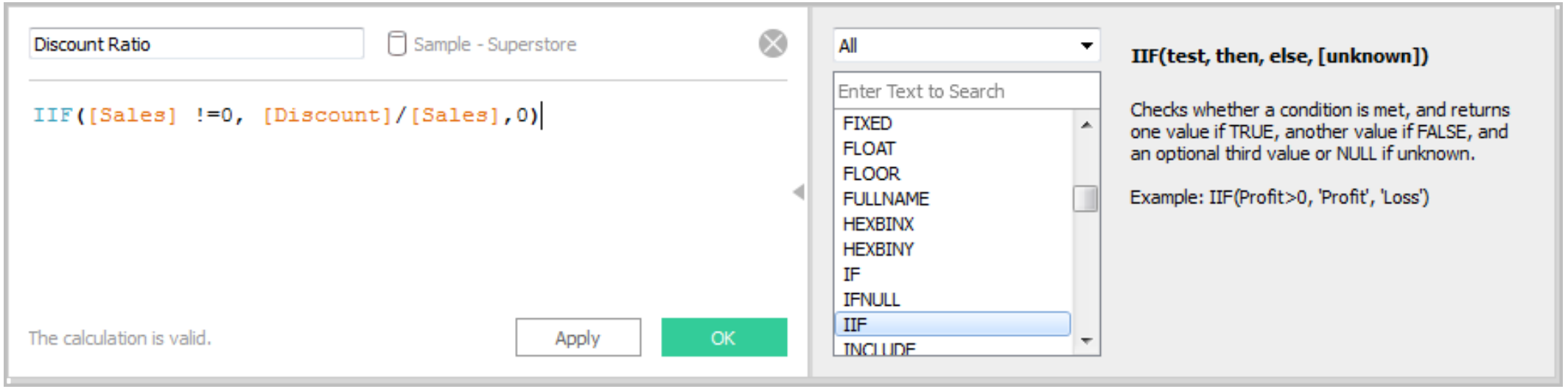
1.2: sort items to expose patterns

- Ordering data items according to some dimension, such as age, income, or price, is vital in exposing hidden patterns in the data.



1.3: derive values of models from source data

- Data computed from the original, such as statistics (e.g., mean, median), transformations, and even powerful data mining methods.



Task categories

- 1. Data and view specification
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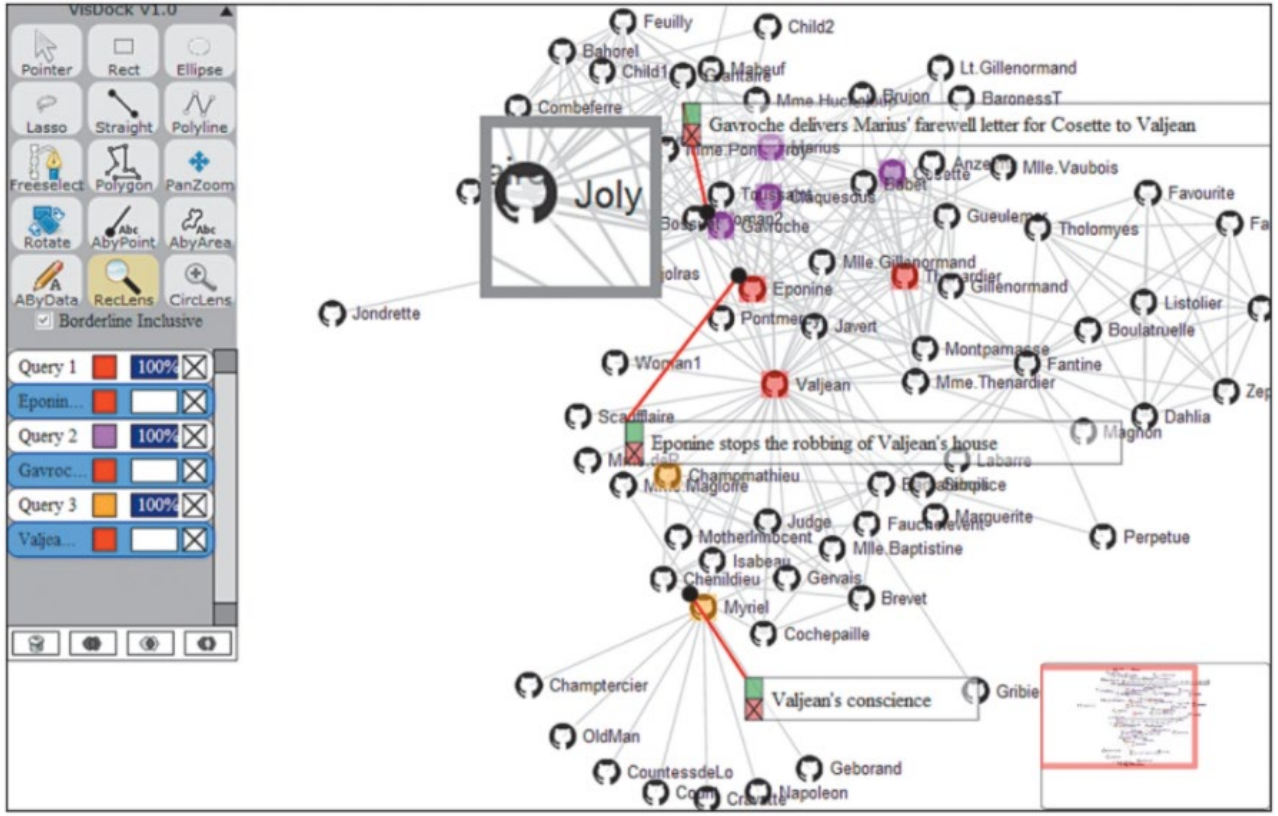
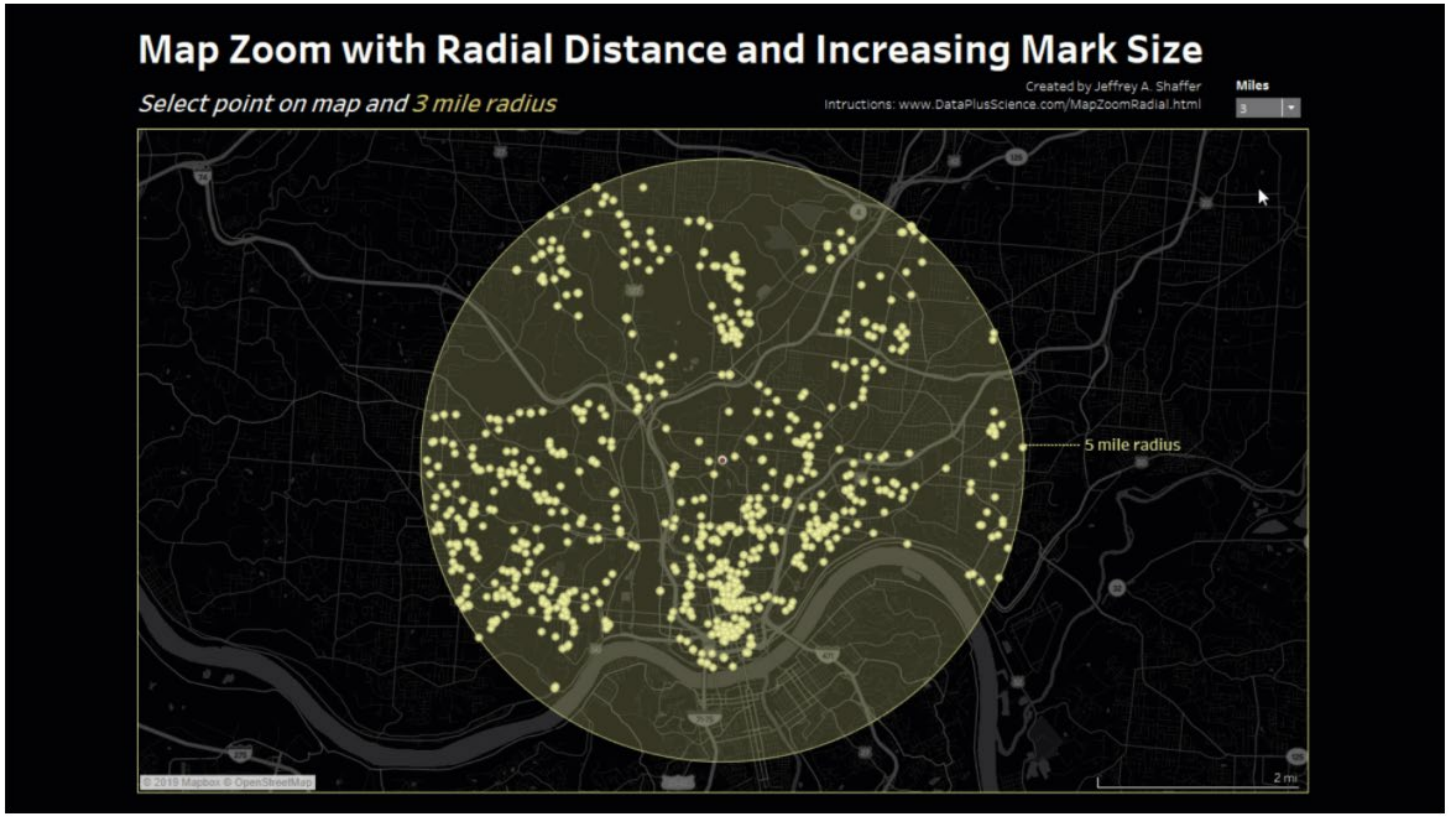
2.1: select items to highlight/filter/manipulate

- Pointing to an item or region of interest
- Common forms of selection include:
  - clicks
  - mouse hover
  - region selections



2.2: navigation

- Pan and zoom allow the user to control the size and position of the viewport on the visualization



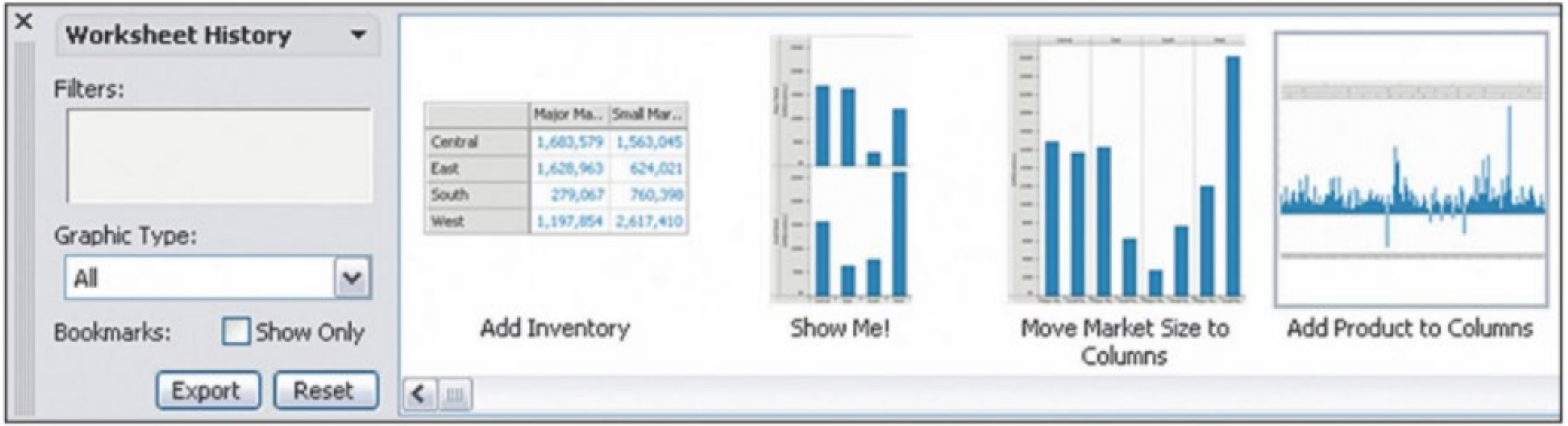
https://www.dataplusscience.com/MapZoomRadial.html

Task categories

- 1. Data and view specification
- 2. View manipulation
- 3. Process and provenance

3.1: record for revisit/review/sharing

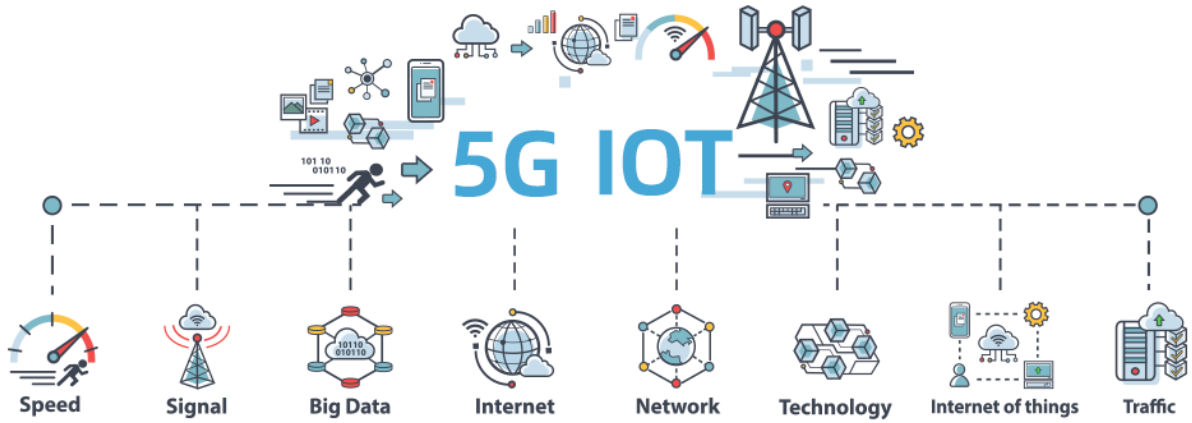
- Record the insights generated from data and the path leading up to them.
- One approach that several tools provide is an automatically recorded history of interactions, allowing the user to review and revisit the exploration and even share it with others

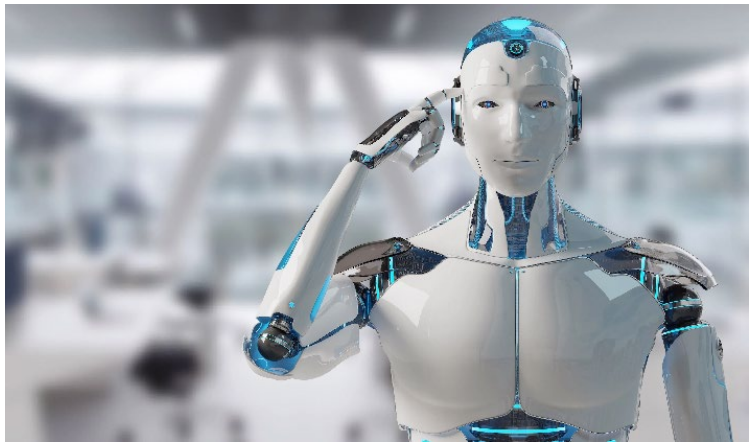


Future of UI

What are the next big things?

- New devices, especially those that are ubiquitous and pervasive
- New technologies, AI, VR, AR, block chain, …
- New connections, 5G/6G, IoT…

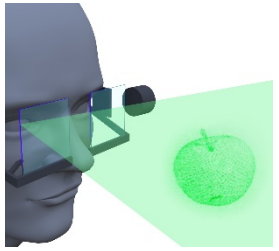


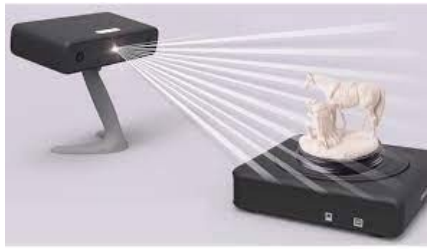


Future UI

- Design novel input and output devices
  - More shifts from keyboards to gestures, speech, and body movement
  - Expansion of tactile and tangible environments provides fresh possibilities

- Examples
  - 3D scanners
  - Haptic feedback devices
  - Large public displays
  - Transparent glasses
  - Immersive goggles
  - 3D printing and novel fabrication methods
  - …





Future UI

- Brain-computer interface

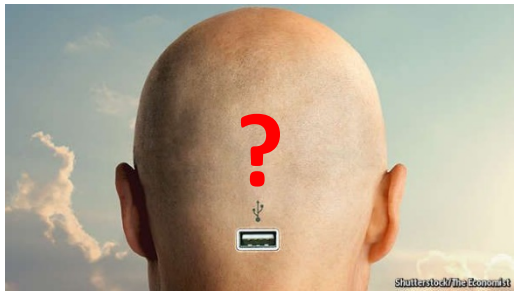
Personal Computer
e.g. Commodore PET 1983

Laptop
e.g. Apple MacBook

Smartphone
e.g. Google Pixel

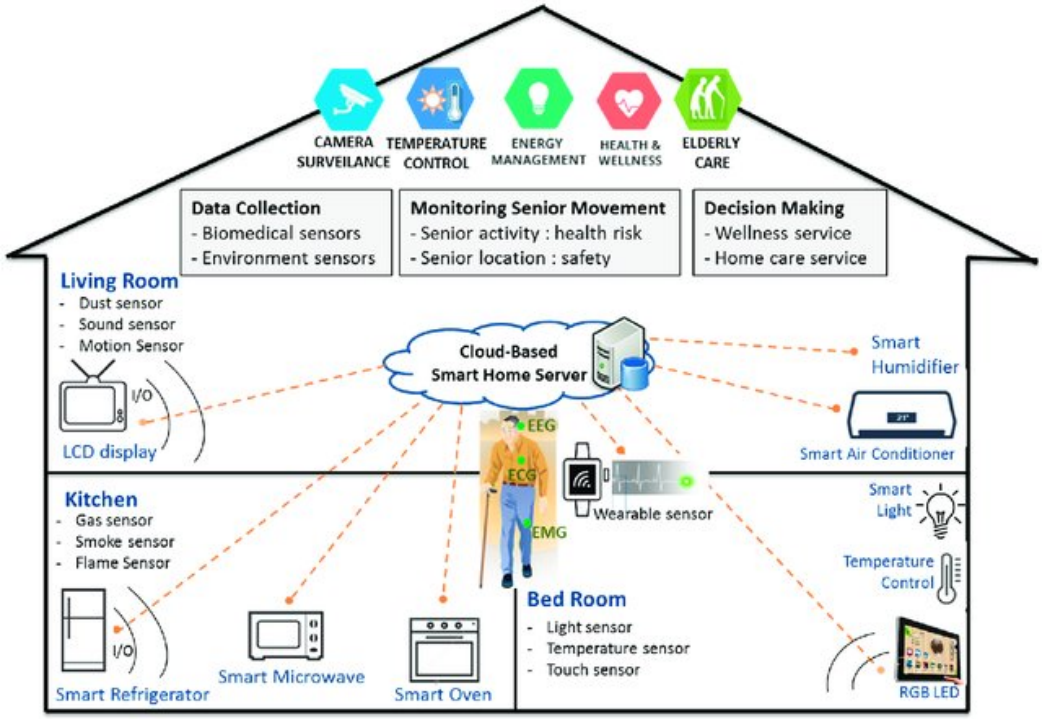
AR/VR

Glass-like AR platform



Future UI

- Support successful aging strategies
  - Growing population of older adults results in increasing needs of technologies and solutions towards ageing-in-place
  - Demands of interfaces that collect data from sensors, encourage healthy diet and exercise, promote social connectedness, and enable balanced involvement from caregivers



Future UI

- Promote life-long learning
  - Online learning (i.e. MOOCs)
  - Gamification
  - Immersive training
  - …

Future UI

- Secure cyberspace
  - Criminal activity and privacy violations threaten to undermine user participation in every form of transaction, participation, political engagement, and tool usage.
  - UI designing for usable privacy and security will help ensure that benefits are retained, intrusions minimized, and expectations of safety realized.

Future UI

- Shift from user experience to community experience
  - Shift to community experience design, social media participation, game theoretic mechanisms to engage growing communities in constructive ways.
  - Shift from emphasis on micro-HCI to macro-HCI
    - Micro-HCI
      - Focus on measurable performance (i.e., speed, errors) on multiple standard tasks taking seconds or minutes in lab environments
    - Macro-HCI
      - Focus on case studies of user experience over weeks and months, in realistic usage contexts with rich social engagement
      - Macro-HCI thinking and big data analytic tools could provide insights at every level, which could be shared with relevant stakeholders, but producing meaningful changes in such massive systems remains a challenge

Future UI

- Accelerate analytic clarity
  - Big data movement lead to better understanding of invisible processes in business, community growth/ decay, learning, or public health
  - Visual user interfaces can benefit decision-making process

- Engineer new business models
  - People are more closely connected with each other, i.e. LinkedIn, FB, …
  - User experience can be designed to promote trust, conflict resolution, and open feedback from consumer reviews

Challenges for UI

Alienation

- As people spend more time using computers and mobile devices, they may become less connected to other people.

- Can we build user interfaces that encourage more constructive human social interaction?

Complexity VS Speed

- The society is becoming more and more complex and fast-changing.
- It is extremely difficult for individuals to make informed choices.
- How to balance between simplicity and safety for UI?

Information-poor minority

- People with weak computer skills may have a new reason for not succeeding in school or not getting a job.
- Importance to bridge the gap in access to computer technologies by rich VS poor communities/countries
- Can user interfaces be developed to empower low-skilled workers to perform at the level of experts?

Invasion of privacy

- Violation of people's privacy is easier now

- How can UI be designed to reduce privacy threats from cyber-criminals, governments, or companies?

Lack of reliability

- The complexity of technology and organizations provides ample opportunities for employees to pass the blame on to others or to the computer: “Sorry, the computer won’t let us give you a mortgage.”
- Another example: driverless cars
- Improved UI designs should make users and designers accept credit and responsibility where they are due.

Other challenges

- Another side of fast development of intelligent interfaces
  - Make machines look like they have taken over human abilities.
  - Some jobs may become less valued or even eliminated, as automation spreads, productivity and overall employment may increase.
  - Anxieties from a group of people who experience computer shock, web worry, or network neurosis.

Strategies to Prevent Negative Impacts

Human-centered design

- Make users the center of attention, include them in the design process, and build feelings of competence, mastery, clarity, and predictability.
- Apply human-centered design strategies and elicit frequent evaluations and feedback from users.

Advanced research

- Individuals, organizations, and governments can support research to develop novel ideas, minimize the dangers of technology, and spread the advantages of interactive systems.
- Improved theories of cognitive behavior, individual differences, community evolution, and organizational change would be helpful in guiding designers and implementers.

Education

- Schools and colleges, as well as employers, all play a role in training.
- Special attention should be paid to continuing education and on-the-job training.

Public consciousness raising

- Informed consumers and users of information and communications technologies can benefit the entire community.
- Professional societies such as the ACM, IEEE, etc, and user groups can play a key role through public relations, consumer education, and professional standards of ethics.

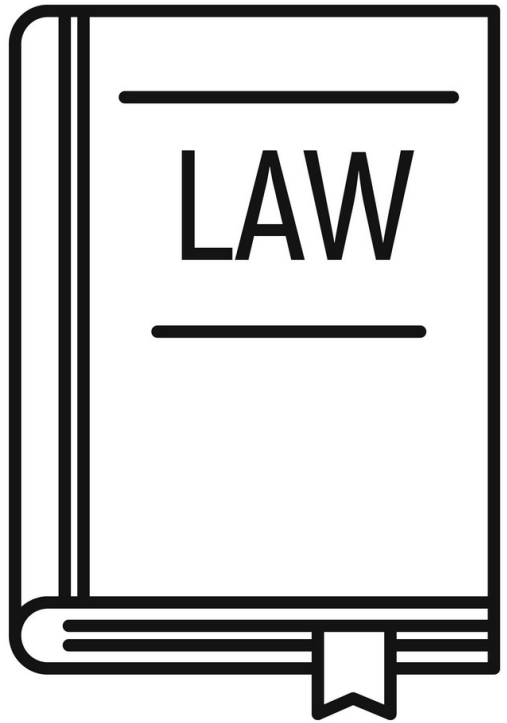
IEEE
Advancing Technology for Humanity

acm

Legislation

- Much progress has been made with legislation concerning privacy, right of access to information, and computer crime, but more work remains to be done.

- Cautious steps toward regulation, work rules, and standardization can be highly beneficial.



Administrative Matters

Group Project Demo

- Group Project demonstration
  - 1 Dec 2021 on MS Teams
  - 10-min for each team (be sharp)
  - 2-3 slides introducing your project and your team
  - Demo via MS Teams
  - Rehearse on MS Teams (in case screen sharing is not possible, prepare a video for demonstration)
  - No Q&A

Time Slots

CS325 GROUP PROJECT DEMONSTRATION TIME SLOT		
Date: 1 Dec 2021 (Wed) Venue: MS Teams		
START TIME	END TIME	TEAM #
1:30PM	1:40PM	1
1:40PM	1:50PM	2
1:50PM	2:00PM	3
2:00PM	2:10PM	4
2:10PM	2:20PM	5
2:20PM	2:30PM	6
2:30PM	2:40PM	7
2:40PM	2:50PM	8
2:50PM	3:00PM	9
3:00PM	3:10PM	10
3:10PM	3:20PM	11
3:20PM	3:30PM	12
3:30PM	3:40PM	13
3:40PM	3:50PM	14
3:50PM	4:00PM	15
4:00PM	4:10PM	16

Group Project Peer Evaluation

- Please double check by 11:59PM on 26 Nov 2021 (Friday)
  - Team members
  - Your name
  - Your email address
  - Your ID
- Peer evaluation will be done on TEAMMATES
  - You will receive an email notification
  - If no response is received, your credits will be evenly shared by other members
  - Be objective and fair to evaluate your teammates because they deserve that after one trimester's hard work
- Complete by 11:59PM on 3 Dec 2021 (Friday)

Final Exam

- Duration: 90 minutes
- Online and closed book exam
- MCQ + Open End Questions (just like mid-term exam)
- Safe Exam Browser is needed
- A “Trial Quiz” will be created for your test your computer settings on next Wednesday.