

Designing visual interfaces

Unit 5

Zeno Menestrina, MSc

zeno.menestrina@unitn.it

Prof. Antonella De Angeli, PhD

antonella.deangeli@unitn.it

Learning outcomes

- Principles of user interface design
- Introduction to information visualization

"To design is much more than simply to assemble, to order, or even to edit; it is to add value and meaning, to illuminate, to simplify, to clarify, to modify, to dignify, to dramatize, to persuade, and perhaps even to amuse."

– Paul Rand



Elegance & Simplicity

- Elegance = carefully select elements in a design with conscious decision
 - often involves taste
- Simplicity = solving a design problem in a clear and economical manner
- Best design is the result of a continuous simplification process
 - learnability
 - recognisability
 - immediacy
 - usability

Simplicity

“The easiest way to simplify a system is to remove functionality. [...] The fundamental question is, where's the balance between simplicity and complexity?”

- John Maeda



Simplicity

“The easiest way to simplify a system is to remove functionality. [...] The fundamental question is, where's the balance between simplicity and complexity?”

- John Maeda



Simplicity principles

- Unity: The elements in the design must be unified to produce a coherent whole
- Refinement: The parts (& the whole) must be refined to focus the viewer's attention on their essential aspects
- Fitness: The appropriateness of a specific design

Simplicity

10-Day Weather Forecast






Graph | Table | Descriptive | Daily | Hourly | Customize







Tue 01/19	Wed 01/20	Thu 01/21	Fri 01/22	Sat 01/23	Sun 01/24	Mon 01/25	Tue 01/26	Wed 01/27	Thu 01/28
16° 13°	23° 16°	29° 23°	31° 24°	31° 23°	37° 29°	35° 25°	30° 21°	27° 20°	31° 24°
0 in	0 in	0 in	< 1 in	0 in	0 in	< 1 in	0 in	0.03 in	< 1 in







5 Day Forecast Expand Daily Details ↓










DAY	HIGH/LOW	DESCRIPTION	PRECIP	WIND	HUMIDITY
TODAY Jan 19	16°F/14°	Partly Cloudy	0%	S 4 mph	48%
WED Jan 20	22°/17°	AM Clouds/PM Sun	20%	W 2 mph	66%
THU Jan 21	29°/24°	Mostly Cloudy	0%	ESE 2 mph	67%
FRI Jan 22	31°/25°	Cloudy	20%	NE 15 mph	71%
SAT Jan 23	30°/23°	Partly Cloudy	10%	NE 7 mph	69%
SUN Jan 24	37°/29°	Mostly Cloudy	10%	SSW 11 mph	66%

Simplicity

Today	Tomorrow	Thu	Fri	Sat
				
Partly Cloudy	Sunny	Partly Cloudy	Partly Cloudy	Scattered Thunderstorms
High: 28 Low: 13	High: 23 Low: 11	High: 25 Low: 13	High: 25 Low: 15	High: 25 Low: 13

Printable Forecast			Daytime High / Overnight Low (°)	Precip. %
Today Sep 10		PM Showers	N/A°/57°	30 %
Wed Sep 11		Sunny	75°/52°	0 %
Thu Sep 12		Partly Cloudy	78°/57°	0 %
Fri Sep 13		Partly Cloudy	77°/59°	20 %
Sat Sep 14		Scattered T-Storms	77°/57°	40 %
Sun Sep 15		Mostly Cloudy	76°/55°	10 %

Current Conditions	Forecast				
Updated 11:12 PM local, 0412 GMT	TUES	WED	THURS	FRI	SAT
cloudy 					
Temp: 69 F, 21 C	HIGH	HIGH	HIGH	HIGH	HIGH
Rel. Humidity: 62%	89 F	75 F	77 F	81 F	76 F
Wind: N at 19 mph (31 kph)	32 C	24 C	25 C	27 C	24 C
Sunrise: 06:27 AM	LOW	LOW	LOW	LOW	LOW
Sunset: 07:08 PM	62 F	57 F	60 F	60 F	58 F
	17 C	14 C	16 C	16 C	14 C

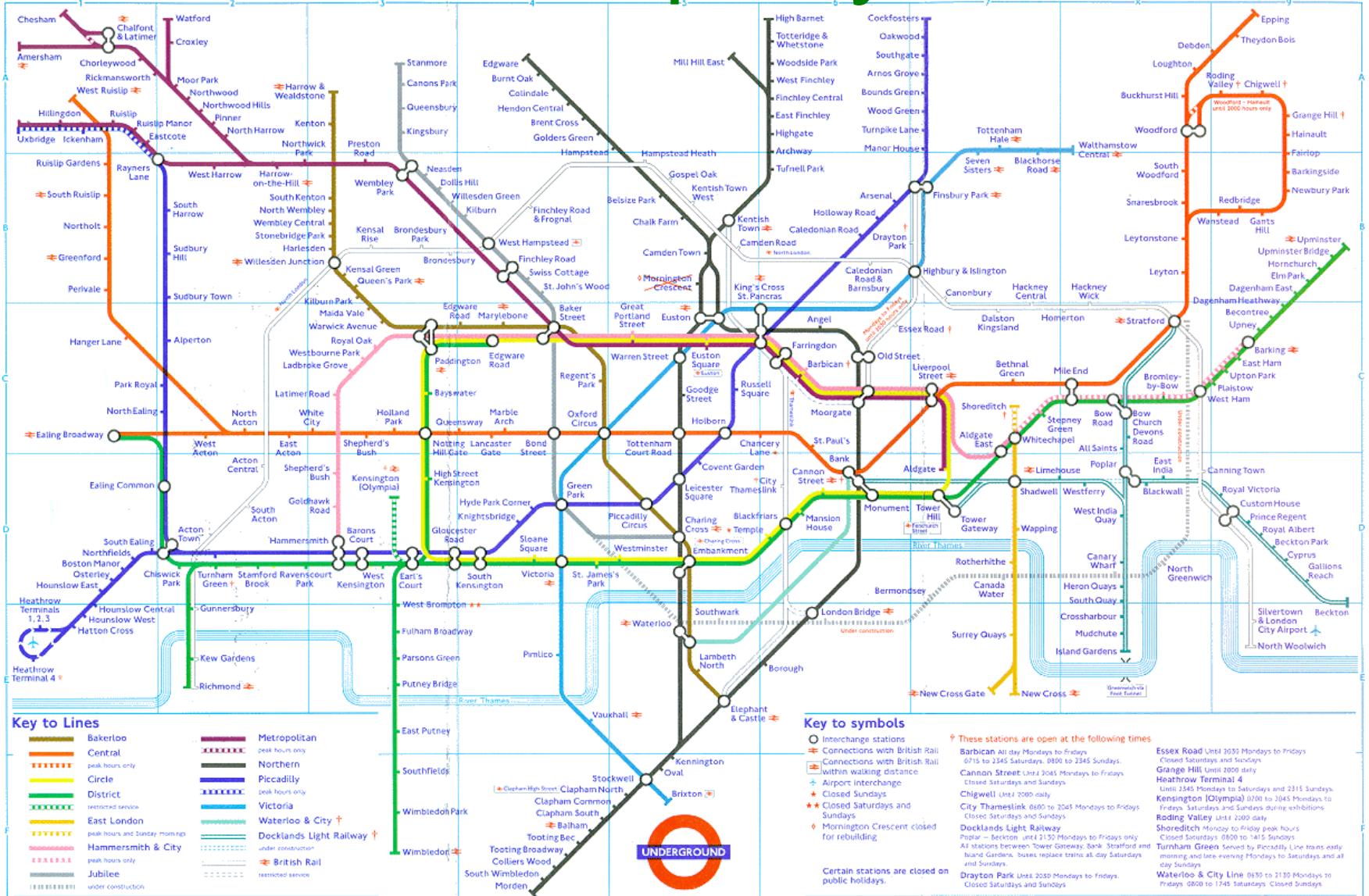
Forecast at a Glance								
TONIGHT	WEDNESDAY	WEDNESDAY NIGHT	THURSDAY	THURSDAY NIGHT	FRIDAY	FRIDAY NIGHT	SATURDAY	SUNDAY
								
Clearing	Sunny	Clear	Mostly Sunny	Mostly Clear	Partly Sunny	Chance T-storms	Chance T-storms	Mostly Clear
Lo 58°F	Hi 75°F	Lo 60°F	Hi 75°F	Lo 55°F	Hi 75°F	Lo 60°F	Hi 72°F	Hi 70°F Lo 55°F

Simplicity

The screenshot shows the Amarok 2 music player interface. The window title is "Blind Divine - Find The Cure :: Amarok 2". The menu bar includes "Amarok", "Playlist", "Tools", "Settings", and "Help". The playback controls at the top show a play button, a progress bar at 0:37, and a volume slider at 15%. The main interface is divided into several sections:

- Collection:** A sidebar on the left with search terms "Enter search terms here". It lists sources like Ampache (kollide), BBC, Cool Streams, Jamendo.com, Last.fm, Librivox.org, Magnatune.com, NPR, and Podcast Directory.
- Current Track:** Displays "Find The Cure" by Blind Divine on the album "Desire to Destroy". It includes a play count of 0, a score of 0, and a "Last Played" status of "Never".
- Albums by Blind Divine:** A list of albums including "Devouring The Beautiful (2007)", "Music for Unmade Movies - Volume 1 (2007)", and "Desire to Destroy (2007)".
- Wikipedia:** A section providing information about Blind Divine, stating they are an American band from Tucson, Arizona, and listing their genres as ambient or trance.
- Members:** A section for listing members of the band.
- Search playlist:** A search bar and a list of tracks from the "Desire to Destroy" album. The current track "Find The Cure" is highlighted, showing a play count of 5 and a duration of 5:10.
- Bottom Bar:** Shows the current track "Find The Cure" by Blind Divine on the album "Desire to Destroy" (5:10) and indicates 21 tracks in the playlist with a total duration of 1:06:00.

Simplicity



Techniques

- **Reducing** a design to its essence
- **Regularising** the elements of the design
- Combining elements for **maximum leverage**

Reduction

Reduce the interface elements to the absolute minimum

- Check
 - Are all the elements needed?
 - Are all the control necessary?
 - Is it there any form of repetition? Redundancy?
- Reduction through successive refinement is the only path to simplicity

Reduction

- **Determine the essential qualities** (typically a short list of adjectives) that should be conveyed by the design, along with any fixed formal elements (label, an essential control, an image, a logo, a colour)
 - Critically examine each element in your design and **ask yourself why is it needed**, how it relates to the essence of the design, and how the design would suffer without it. If you can't answer any of these questions, remove the element.
 - **Try to remove the element** from the design anyway. What happens? If the design collapses, either functionally or aesthetically, the elements must be replaced. Otherwise, consider omitting it from the final solution.
-

Reduction



Regularisation

- When further reduction is no more possible, the **remaining elements can be regularised** to further simplify the design
- Regularity can be achieved by aligning or reflecting elements along common axes, by standardising or repeating sizes and spacing of components, or by reducing components to basic geometric shapes

Regularisation

- Use regular geometric forms, simplified contours, and muted colours wherever possible
- If multiple similar forms are required, make them identical, if possible in size, shape, colour, texture, lineweight, orientation, alignment, or spacing
- Limit variation in typography to a few sizes to one or two families
- Make sure critical elements intended to stand out in the display are not regularised

Regularisation

5 Day Forecast

Expand Daily Details ↓

DAY	HIGH/LOW	DESCRIPTION	PRECIP	WIND	HUMIDITY
TODAY Jan 19	16°F/14°	Partly Cloudy	0%	S 4 mph	48%
WED Jan 20	22°/17°	AM Clouds/PM Sun	20%	W 2 mph	66%
THU Jan 21	29°/24°	Mostly Cloudy	0%	ESE 2 mph	67%
FRI Jan 22	31°/25°	Cloudy	20%	NE 15 mph	71%
SAT Jan 23	30°/23°	Partly Cloudy	10%	NE 7 mph	69%
SUN Jan 24	37°/29°	Mostly Cloudy	10%	SSW 11 mph	66%

Current Conditions

Updated 11:12 PM local, 0412 GMT

cloudy



Temp: 69 F, 21 C
 Rel. Humidity: 62%
 Wind: N at 19 mph (31 kph)
 Sunrise: 06:27 AM
 Sunset: 07:08 PM

Forecast

TUES	WED	THURS	FRI	SAT
t-storms	sunny	sunny	p/cloudy	t-storms
HIGH 89 F 32 C	HIGH 75 F 24 C	HIGH 77 F 25 C	HIGH 81 F 27 C	HIGH 76 F 24 C
LOW 62 F 17 C	LOW 57 F 14 C	LOW 60 F 16 C	LOW 60 F 16 C	LOW 58 F 14 C

Leverage

- The most challenging means of simplification is finding point of leverage at which design elements play multiple roles
- It requires insight into the user task
- Effective design utilizes every component to its fullest

Leverage

- Review the functional role played by each element in the design
- Look for situations where multiple elements are filling (or partially filling) the same role
- Question whether an elements role could be filled as well by an adjacent component, possibly after minor modifications
- Combine redundant elements into a single, simpler unit or replace the lot with a common higher-level unit.
- Careful with modes!!!!

Leverage



Information visualization

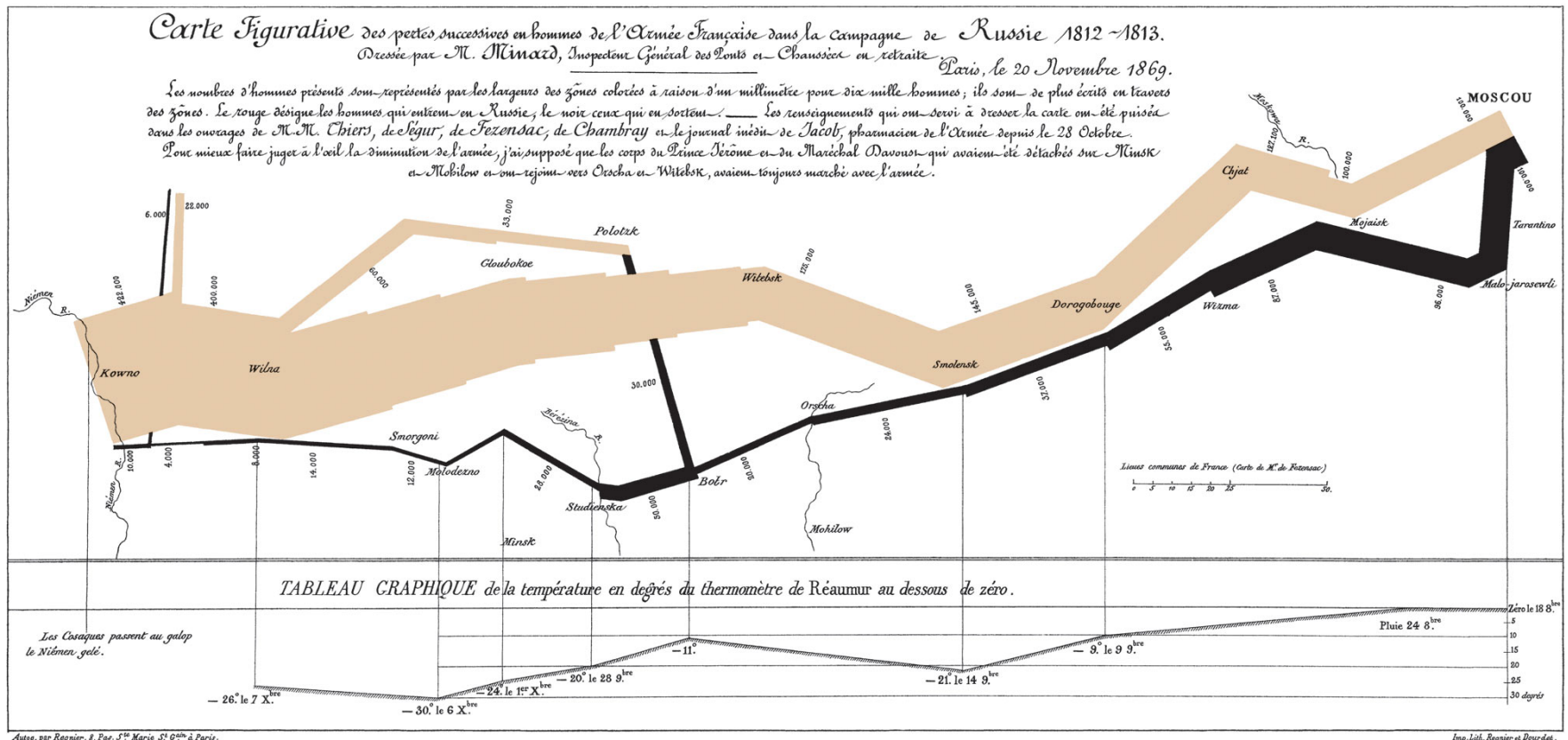
- Information visualization (InfoVis) produces (interactive) visual representations of abstract data to reinforce human cognition
- visualisation is an activity in which humans are engaged, as an internal construct of the mind

WHY - Presentation

Graphics are a mean to display facts about the data in a way that others can see and understand the underlying structure and the hypothesis about the data (Rober, 2000).

WHY - Presentation

Graphics are a mean to display facts about the data in a way that others can see and understand the underlying structure and the hypothesis about the data (Rober, 2000).

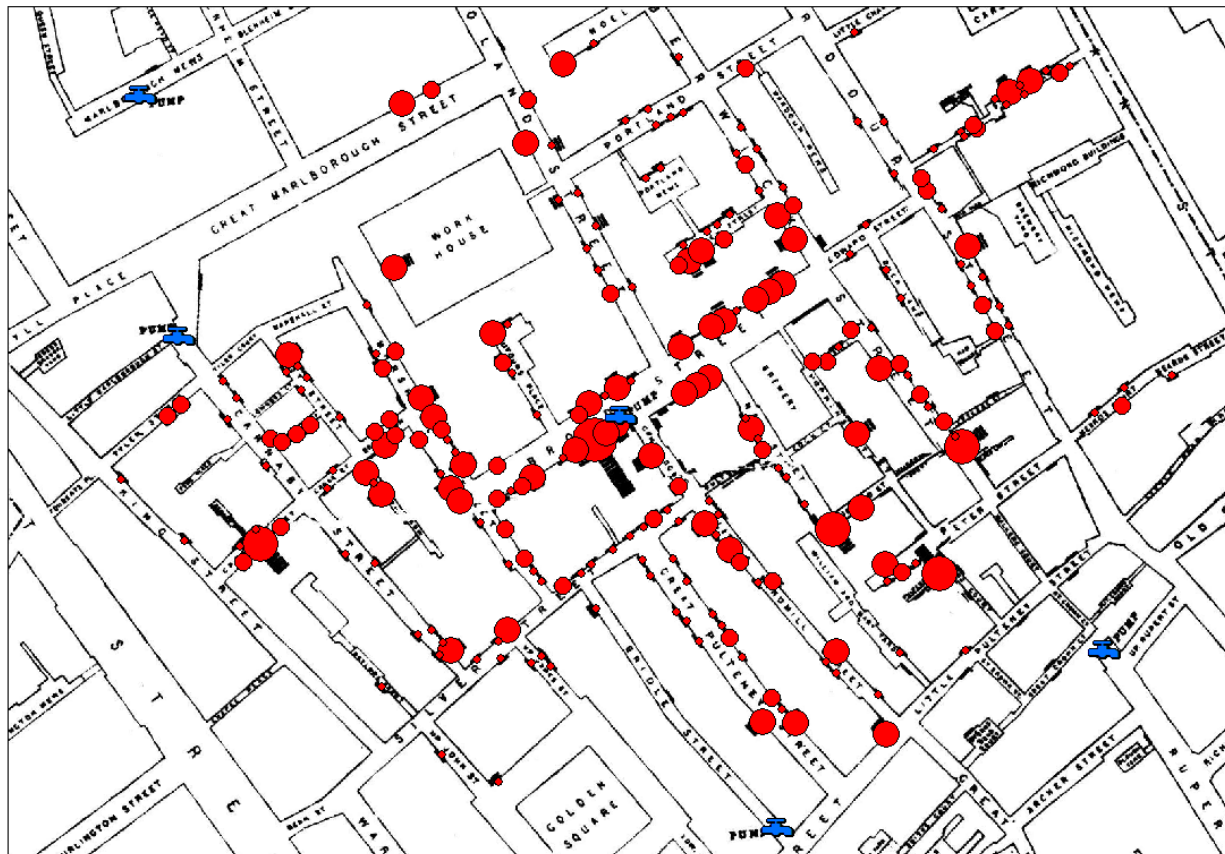


WHY - Explorative analysis

Graphics also are a mean for finding and identifying structures and properties in a given data set (Tufte, 1983).

WHY - Explorative analysis

Graphics also are a mean for finding and identifying structures and properties in a given data set (Tufte, 1983).

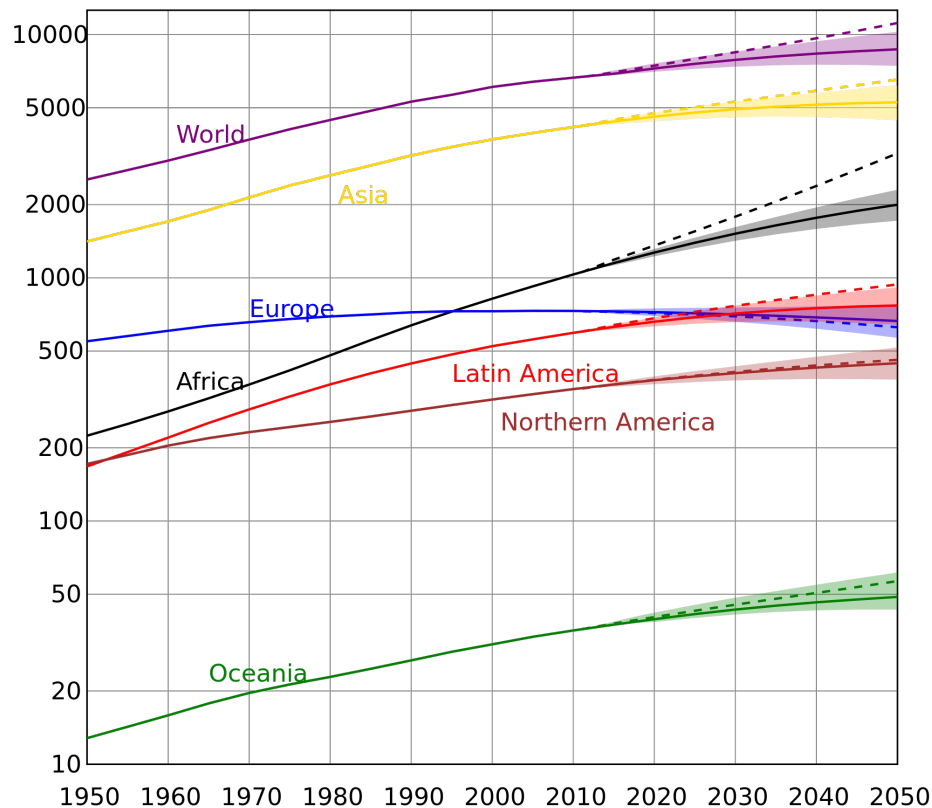


WHY – Confirmative analysis

Graphics are also the visual mean to confirm or reject some hypothesis about the data.

WHY – Confirmative analysis

Graphics are also the visual mean to confirm or reject some hypothesis about the data.





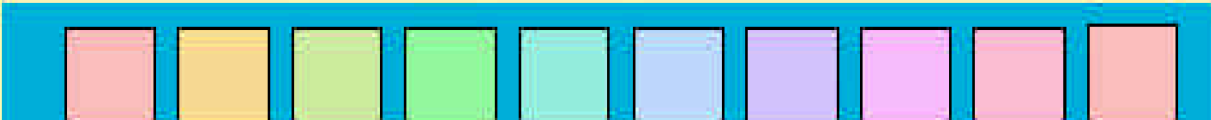




Visual better than textual?

- **Locality** - is enabled by grouping together information that is used together (e.g., demographical growth)
- **Minimising labelling** - is enabled by using location to group information about a single element, avoiding the need to match symbolic labels (e.g., maps)
- **Perceptual enhancement** - is enabled by supporting a large number of perceptual inferences which are easy for humans to perform (e.g., London cholera)

Visual variables

Bertin's Original Visual Variables

Position changes in the x, y location	
Size change in length, area or repetition	
Shape infinite number of shapes	
Value changes from light to dark	
Colour changes in hue at a given value	
Orientation changes in alignment	
Texture variation in 'grain'	

Colours

<https://webdesign.tutsplus.com/articles/an-introduction-to-color-theory-for-web-designers--webdesign-1437>

Shneiderman's InfoViz Tasks

- **Zoom:** see a smaller subset of the data
- **Filter:** see a subset based on values, etc.
- **Detailed on demand:** see values of objects when interactively selected
- **Relate:** see relationships, compare values
- **History:** keep track of actions and insights
- **Extract:** mark and capture data

Example - Navigation

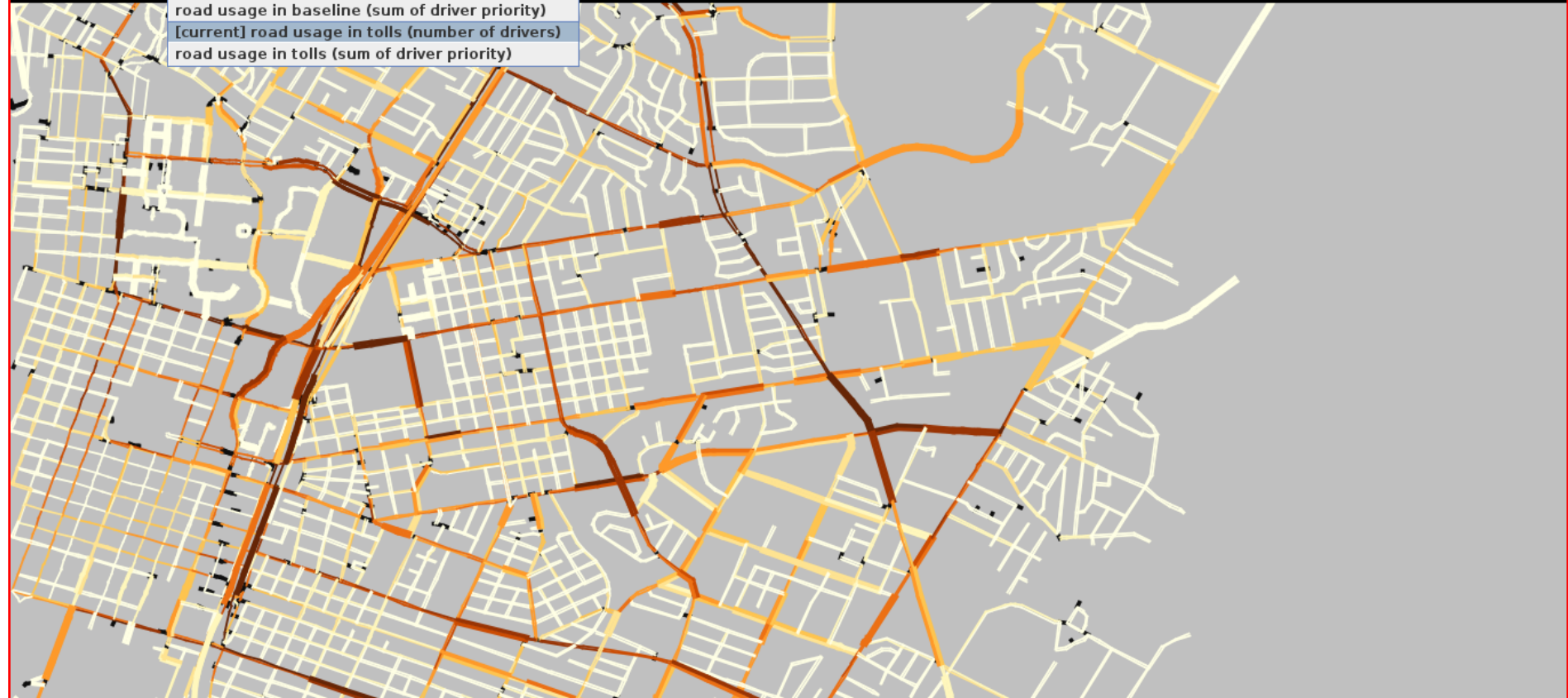
- **Zooming:** is the increasing magnification of a decreasing (or increasing) fraction of a two dimensional image
- **Panning:** is the smooth movement of a viewing frame over a two-dimensional image of greater size
- **Scrolling:** is the movement of data past a window able to contain only a part of it
- **Focus + context:** to illustrate at the same time the overall picture (the context) and to see details of immediate interests (the focus)

Example - Navigation

- **Zooming:** is the increasing magnification of a decreasing (or increasing) fraction of a two dimensional image
- **Panning:** is the smooth movement of a viewing frame over a two-dimensional image of greater size
- **Scrolling:** is the movement of data past a window able to contain only a part of it
- **Focus + context:** to illustrate at the same time the overall picture (the context) and to see details of immediate interests (the focus)

Don't show any special layer
road usage in baseline (number of drivers)
road usage in baseline (sum of driver priority)
[current] road usage in tolls (number of drivers)
road usage in tolls (sum of driver priority)

Agents Active/Ready/Routing	Time	Sim Speed (Actual/Cap)
0 moved / 0 live / 0 ready	0.0	Paused / 1x



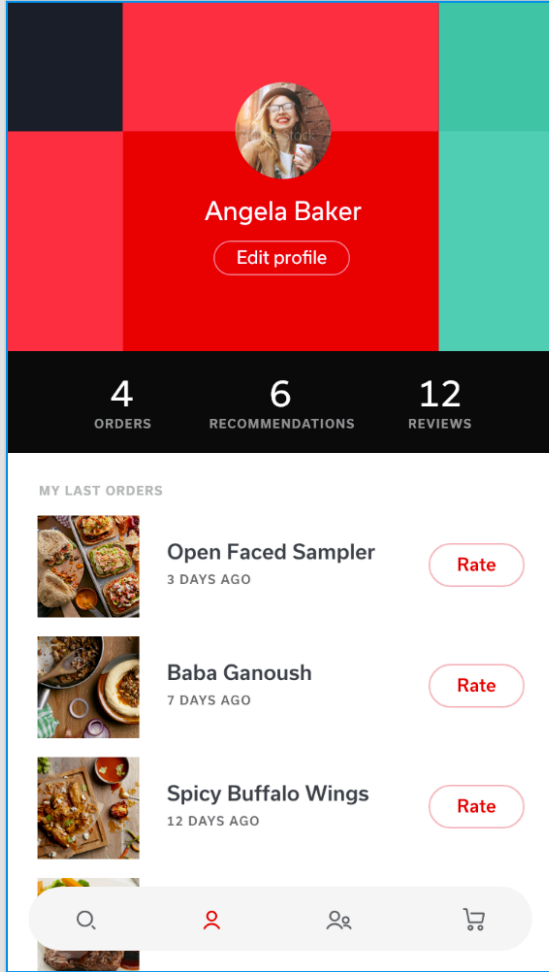
Example - Navigation

- **Zooming:** is the increasing magnification of a decreasing (or increasing) fraction of a two dimensional image
- **Panning:** is the smooth movement of a viewing frame over a two-dimensional image of greater size
- **Scrolling:** is the movement of data past a window able to contain only a part of it
- **Focus + context:** to illustrate at the same time the overall picture (the context) and to see details of immediate interests (the focus)

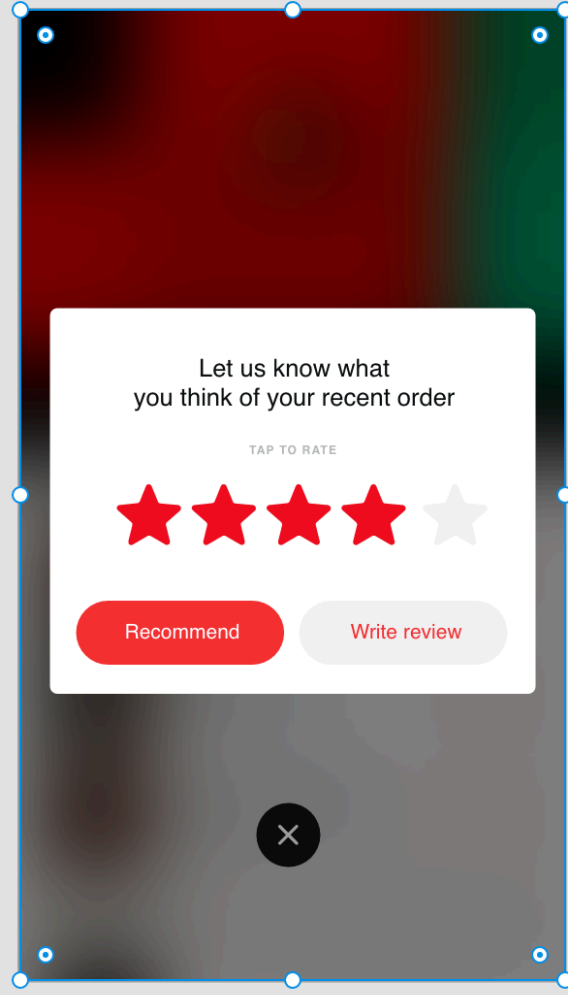
Example - Navigation

- **Zooming:** is the increasing magnification of a decreasing (or increasing) fraction of a two dimensional image
- **Panning:** is the smooth movement of a viewing frame over a two-dimensional image of greater size
- **Scrolling:** is the movement of data past a window able to contain only a part of it
- **Focus + context:** to illustrate at the same time the overall picture (the context) and to see details of immediate interests (the focus)

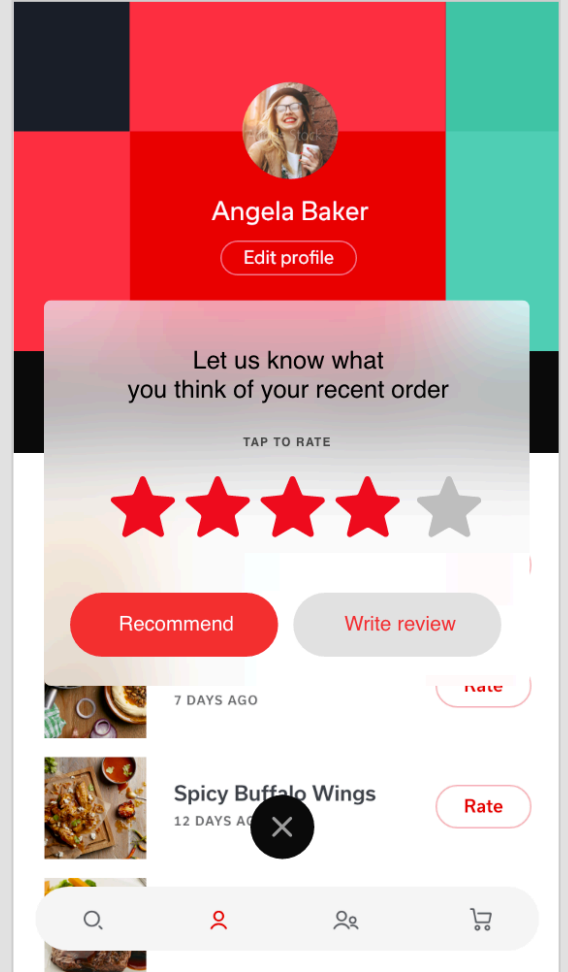
Rate



Rate - 1



Rate - 2



Usability

Usability is a **quality attribute** that assesses how easy user interfaces are, based on:

- **Learnability:** How easy is it for users to accomplish basic tasks the first time they encounter the design?
- **Efficiency:** Once users have learned the design, how quickly can they perform tasks?
- **Memorability:** When users return to the design after a period of not using it, how easily can they reestablish proficiency?
- **Errors:** How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
- **Satisfaction:** How pleasant is it to use the design?

PACT Analysis

User-centric framework for thinking about a design problem:

- Who the users are - **People**
- What activities are being carried out - **Activities**
- Where the interaction is taking place - **Context**
- What technologies are used - **Technologies**

Nielsen's heuristics (1)

Rules of thumb for user interface design:

1. **Visibility of system status:** Inform the users about what is going on (appropriate feedback within reasonable time)
 2. **Match between system and the real world:** Use the users' language, with familiar concepts (follow real-world conventions)
 3. **User control and freedom:** Users often choose system functions by mistake and will need a clearly marked "emergency exit"
 4. **Consistency and standards:** Users should not have to wonder whether different words or actions mean the same thing
 5. **Error prevention:** Even better than good error messages is a careful design which prevents a problem from occurring
-

Nielsen's heuristics (2)

Rules of thumb for user interface design:

6. **Recognition rather than recall:** Minimize the user's memory load by making objects, actions, and options visible
 7. **Flexibility and efficiency of use:** Allow users to tailor frequent actions (novice and expert users)
 8. **Aesthetic and minimalist design:** No information which is irrelevant or rarely needed
 9. **Help users recognize, diagnose, and recover from errors:** Error messages should be expressed in plain language (no codes)
 10. **Help and documentation:** It may be necessary to provide help and documentation.
-

Exercise

- Design a visual interface – **cameras online store**
 1. PACT analysis
 2. Usability issues of existing websites
 3. Design proposal

Key point

- Elegance and simplicity:
 - Reduction
 - Regularisation
 - Leverage
- Information visualization = visual representations of abstract data to reinforce human cognition

Recommended readings

- Elegance & Simplicity

<https://www.evl.uic.edu/aej/422/week06.html>

- Introduction to InfoViz

http://linux3.dti.supsi.ch/~mazza/infovis_introduction.pdf

Other readings

<http://lawsofsimplicity.com/2006/07/23/law-1-reduce/>

<http://www.nngroup.com/articles/recommended-books-visual-design/>

<http://webdesign.tutsplus.com/articles/design-theory/an-introduction-to-color-theory-for-web-designers/>

<http://bokardo.com/principles-of-user-interface-design/>

<http://dzineblog.com/2009/03/interface-design-inspiration-36-beautiful-login-pageform-designs.html>

<http://www.webdesignfromscratch.com/web-design/web-2-0-design-style-guide/>