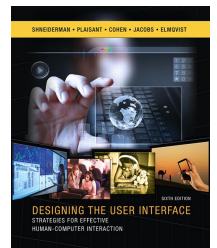Unit 09

Design Considerations – part 3

- Design for human experience
- Issues of time in user experience

Shneiderman, 6th Edition,
chapters 12,13

Design for the human experience

Topics

1. Display Design
2. Window Management
3. Animation
4. Web Page Design
5. Color
6. Non-anthropomorphic Design
7. Error Messages
8. Handling system response time

Introduction

- Interface design involves art, trendiness, and techniques taught in design schools

- In recent times competition over design has intensified, look at the design of smartphones, tablets, laptops, and wearables.

- So many design matters involve issues within the user experience aspects

1. Display Design

Display design

- Display design is an early topic of HCI (see control rooms and life critical applications).

- Then high resolution graphical color displays became available that necessitated new guidelines.

- Web-based markup languages and user-generated content requested for new guidelines

- Need to accommodate older adults and provide universal usability presented new challenges.

- Today small, wall-, mall-sized displays open further possibilities.

Display design
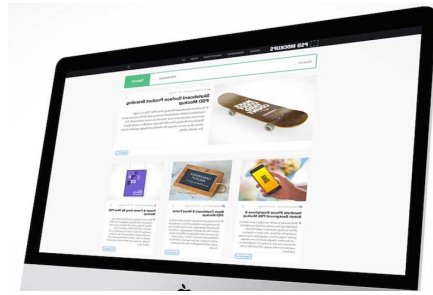
- For most interactive systems, the displays are a key component of successful designs

- Dense or cluttered displays can provoke anger, and inconsistent formats can inhibit performance.

- The complexity of this issue is suggested by the 162 classic data display guidelines offered by Smith and Mosier (1986).

- Display design will always have elements of art and require invention, but perceptual principles are becoming clearer, and theoretical foundations have emerged (Galitz, 2007; Johnson, 2014).

- Award winning displays https://www.webbyawards.com/ and https://www.awwwards.com/

Display design example

Display design guidelines (Smith and Mosier, 1986)

1. Ensure that any data that a user needs, at any step in a transaction sequence, are available for display.

2. Display data to users in directly usable forms; do not require that users convert displayed data.

3. Maintain a consistent format for any particular type of data display from one display to another.

4. Use short, simple sentences.

5. Use affirmative statements rather than negative statements.

6. Adopt a logical principle by which to order lists; where no other principle applies, order lists alphabetically.

7. Ensure that labels are sufficiently close to their data fields to indicate association yet are separated from their data fields by at least one space.

8. Left-justify columns of alphabetic data to permit rapid scanning.

9. Label each page in multi-paged displays to show its relation to the others.

10. Begin every display with a title or header, describing briefly the contents or purpose of the display; leave at least one blank line between the title and the body of the display.

11. For size coding, make larger symbols be at least 1.5 times the height of the next-smaller symbol.

12. Consider color-coding for applications in which users must distinguish rapidly among several categories of data, particularly when the data items are dispersed on the display.

13. For a large table that exceeds the capacity of one display frame, ensure that users can see column headings and row labels in all displayed sections of the table.

14. Provide a means for users (a system administrator) to make necessary changes to display.

Displays in control rooms

U.S. Navy air traffic control work environment, with multiple specialized data-intensive displays and highly coded fields

Mullet and Sano's design principles (1995):

- **Elegance and simplicity:** unity, refinement and fitness

- **Scale, contrast, and proportion:** clarity, harmony, activity, and restraint

- **Organization and visual structure:** grouping, hierarchy, relationship, and balance

- **Module and program:** focus, flexibility, and consistent application

- **Image and representation:** immediacy, generality, cohesiveness, and characterization

- **Style:** distinctiveness, integrity, comprehensiveness, and appropriateness

Display design: field layout

- Blank spaces and separate lines can distinguish fields.

- Names in chronological order, alignment of dates, familiar date separators.

- Labels are helpful for all but frequent users.

- Distinguish labels from data with case, boldfacing, etc.

- If boxes are available they can be used to make a more appealing display, but they consume screen space.

- Specify the date format for international audiences

- Other coding categories - background shading, color, and graphic icons

field layout example

Employee information display, including data about spouse and children

```
TAYLOR,SUSAN          34787331              WILLIAM TAYLOR
THOMAS                10292014
ANN                   08212015
ALEXANDRA             09082012
```

List children's' names in chronological order and display dates with separators

```
TAYLOR,SUSAN          34787331              WILLIAM TAYLOR
ALEXANDRA             09-08-2012
THOMAS                10-29-2014
ANN                   08-21-2015
```

field layout example

labels may help not frequent users and first name, second name may be more appropriate

```
Employee:    SUSAN TAYLOR   ID Number: 34787331
Spouse:      WILLIAM TAYLOR
Children:    Names            Birthdates
             ALEXANDRA        09-08-2012
             THOMAS           10-29-2014
             ANN              08-21-2015
```

boldface and lower-case letters improve readability

```
Employee:    Susan Taylor   ID Number: 34787331
Spouse:      William Taylor
Children:    Names            Birthdates
             Alexandra        09-08-2012
             Thomas           10-29-2014
             Ann              08-21-2015
```

field layout example

logical grouping may increase readability

Employee: Susan Taylor ID Number: 34787331
Spouse: William Taylor

Children: Names   Birthdates
            Alexandra   09-08-2012
            Thomas   10-29-2014
            Ann   08-21-2015

think of other improvements

Display design: Sequence of displays

- Sequences of displays should be similar throughout the system for similar tasks

- Within a sequence, users should be offered some sense of how far they have come and how far they have to go to reach the end

- It should be possible to go backwards in a sequence to correct errors, to review decisions, or to try alternatives

Display sequence example

This page from the US Post Office website allows users to change their address. The numbers at the top shows the five steps required to complete the process, and the highlighted number '2' gives users a sense of how far they have gone

2. Window management

Window management guidelines
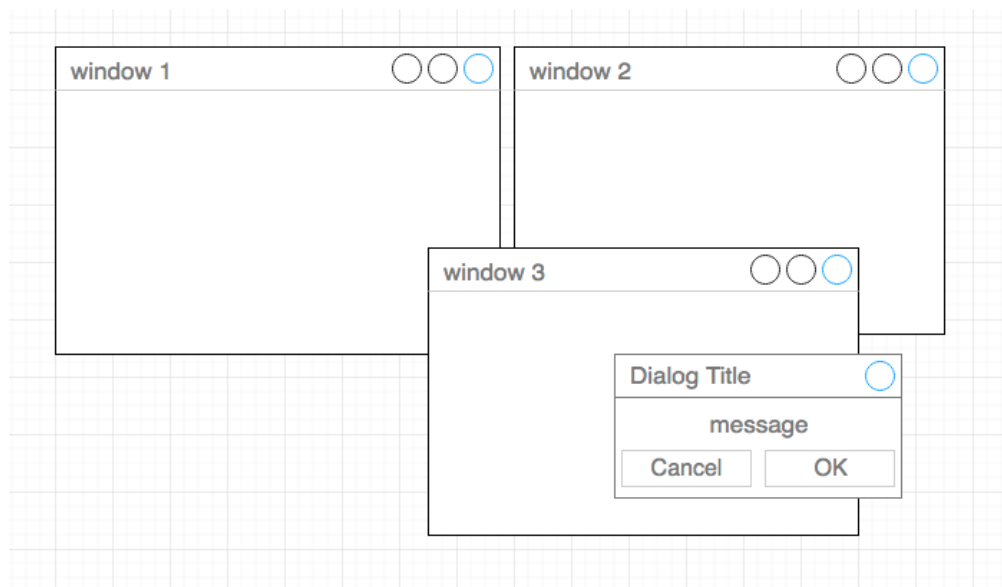
View (Window) Management

- If users' tasks are well understood and regular, an effective multiple-window display strategy can be developed.

- Overlapping, draggable, resizable windows on a broad desktop have become the standard for most users.

- Advanced users who work on multiple tasks can switch among collections of windows called "workspaces" or "rooms", each holding several windows whose states are saved, allowing easy resumption of activity.

View (Window) Management guidelines

- Users need to consult multiple sources rapidly

- Minimally disrupt user's task

- With large displays, eye-head movement and visibility are problems

- With small displays, windows are too small to be effective

- Need to offer users sufficient information and flexibility to accomplish task, while reducing window housekeeping actions, distracting clutter, eye-head movement
  - opening, closing, moving, changing size
  - time spent manipulating windows instead of on task

- Rooms - a form of window macro that enables users to specify actions on several windows at once

Coordinating multiple windows

- Designers may develop coordinated windows, in which windows appear, change contents, and close as a direct result of user actions in the task domain. A careful study of user tasks can lead to task-specific coordination

Example: Job-hunting users should be able to select the four most interesting position-description links and open them all with a single click. Then it should be possible to explore all of them synchronously to compare the job details (description, location, salary, etc.) using one scrolling action.
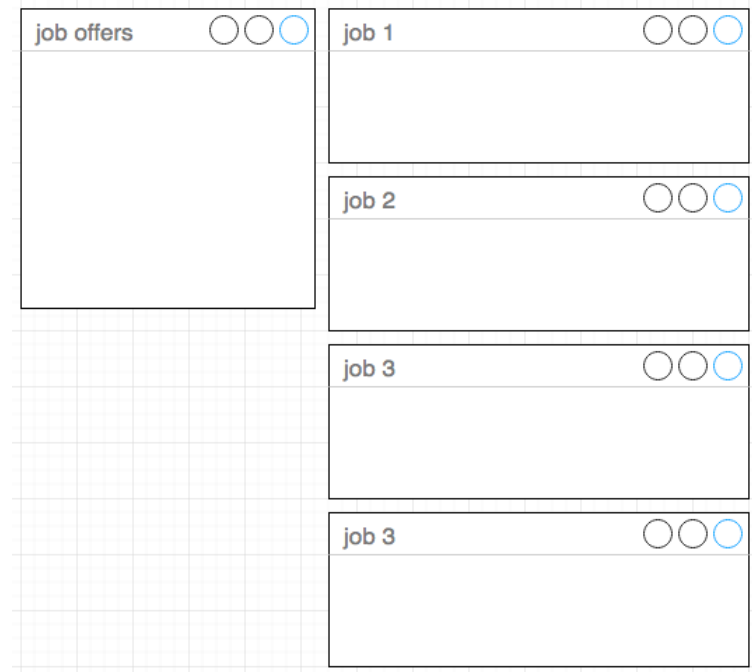
Coordinating multiple windows

- **Synchronized scrolling**: the scroll bar of one window is coupled to another scroll bar, and action on one scroll bar causes the other window's contents to scroll in parallel.

- **Hierarchical browsing**, e.g. Windows File Explorer allows users to browse hierarchical directories

- **Opening/closing of dependent windows**, opening a window simultaneously opens dependent windows in a nearby and convenient location.

- **Saving/opening of window state**, save the current state of the display with all the windows and their contents.

- **Tabbed windows**, like in most modern browsers

Hierarchical browsing example

ShareLaTeX allows users to edit a structured LaTeX document and see the resulting formatted document.

- On the left is the hierarchical list of document sections.

- The "1. Introduction" section is selected and highlighted in red, and its text can be edited in the middle The preview of the output is shown on the right.

- After selecting a passage in one view the corresponding location on the other view is highlighted

Coordinated window views: Visual studio
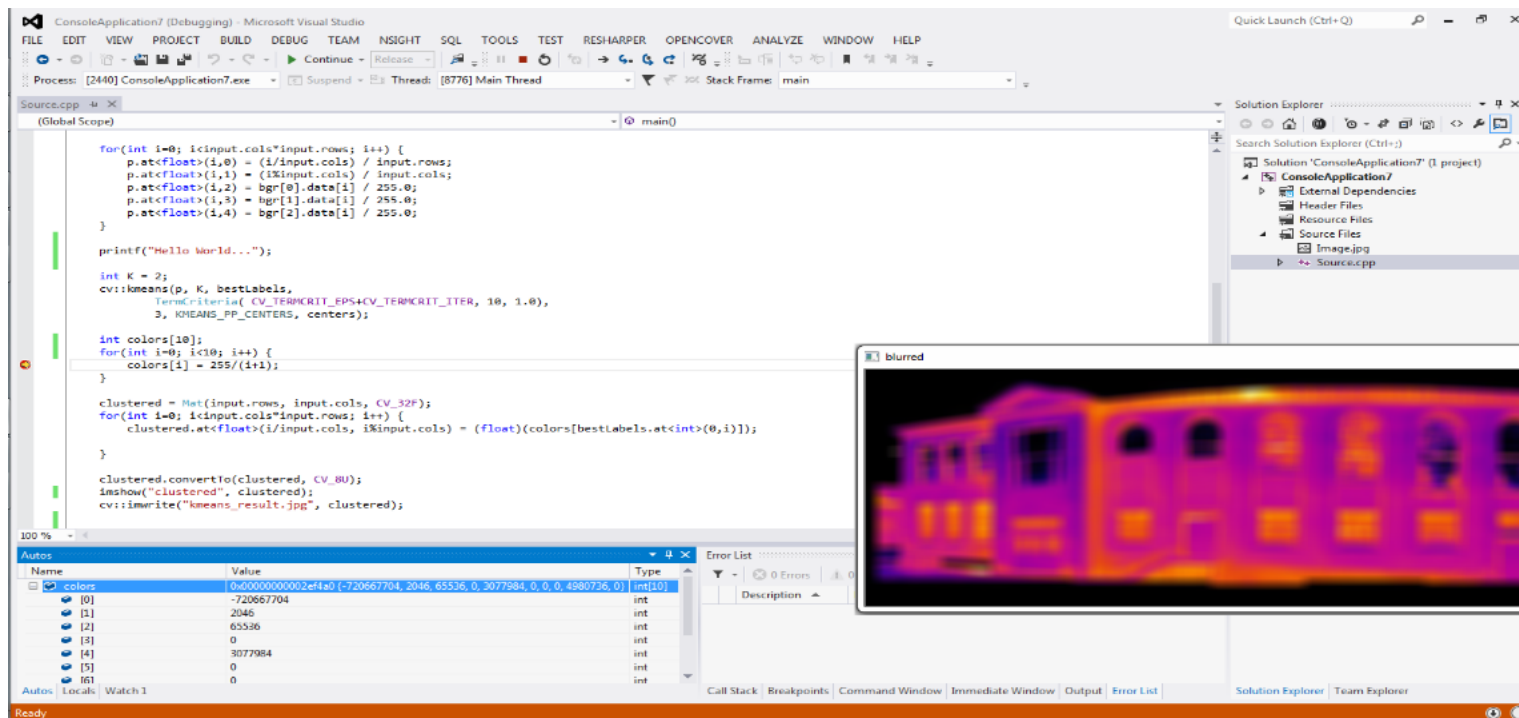
- The project files are listed on the right, in a hierarchical browser
- The selected file (i.e. "source .cpp") is highlighted in the list and displayed on the left
- A breakpoint was set in the code (red dot) at the line starting with "color[i]" so the bottom left window shows the values of the color array of the break point
- All windows are titled, except for the output window (the colorful image of heat sensor data) which overlaps all the other windows

Example of coordinated view: image browsing

GLOBAL VIEW — INTERMEDIATE VIEWS — DETAIL VIEW
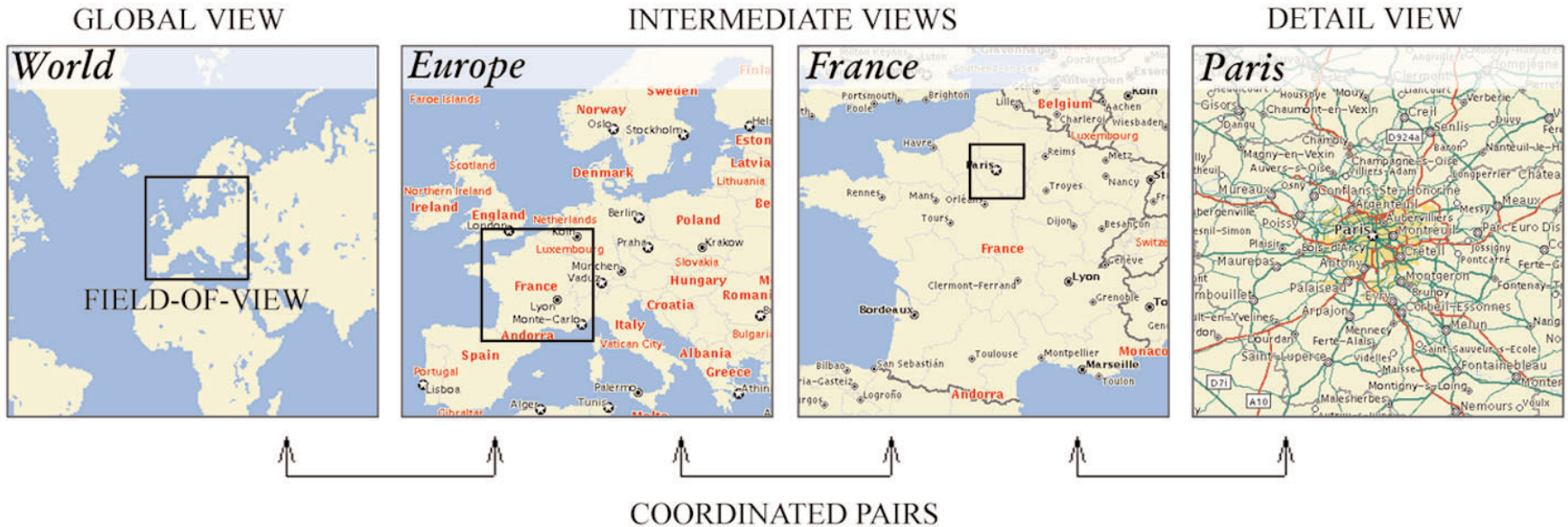
COORDINATED PAIRS

- For zoom factors: 5-30 coordinated overview and detail view are effective

- For higher zoom, an intermediate view is needed

Coordinated view: fisheye view

Mac OSX dock

In this case the focus area is magnified. This provides detail view (focus) and overviews (context) , without obscuring anything (Sarkar and Brown, 1994; Bartram et al., 1995; Baudisch et al., 2004),.
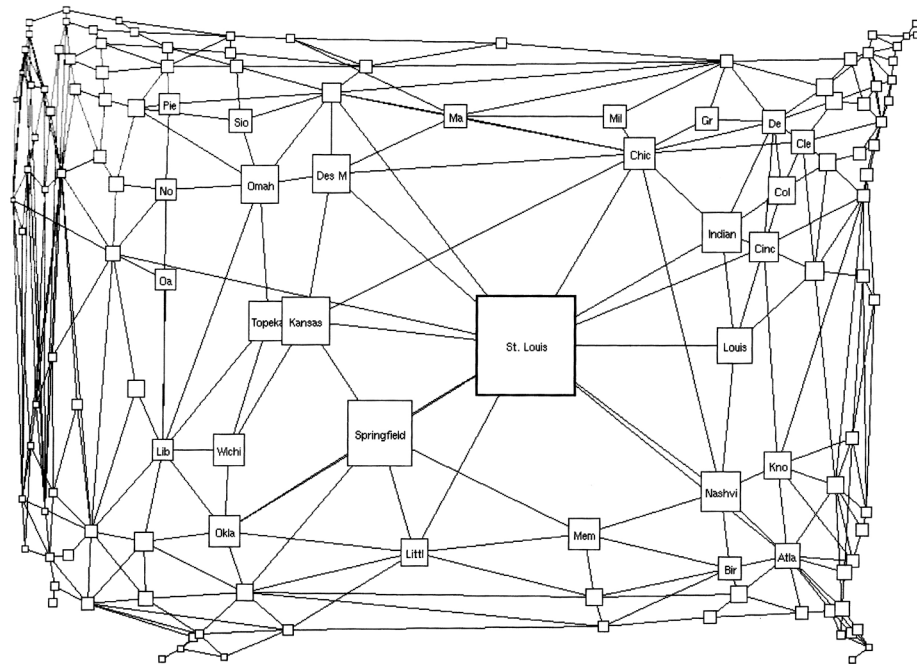
Fisheye view of U.S. cities, with the focus on St. Louis. The context is preserved, although the distortions can be disorienting (Sarkar and Brown, 1994).

3. Animations

Animations

- Perceiving and interpreting motion is a fundamental element of human perception.

- Our eyes are attracted to moving objects in the real world, and items moving in the same direction are interpreted as a group.

- Done well, animation is compelling.

- Done poorly, it can distract, irritate, and and waste time.

Animation

- The use of animation has grown significantly

- Examples include:
  - Keeping user oriented during transition
  - Indicating an affordance, inviting interaction
  - Entertaining
  - Indicating background activity (e.g. progress bar)
  - Storytelling
  - Alerting
  - Providing a virtual tour (e.g. for architectural designs)
  - Explaining a process

Animation
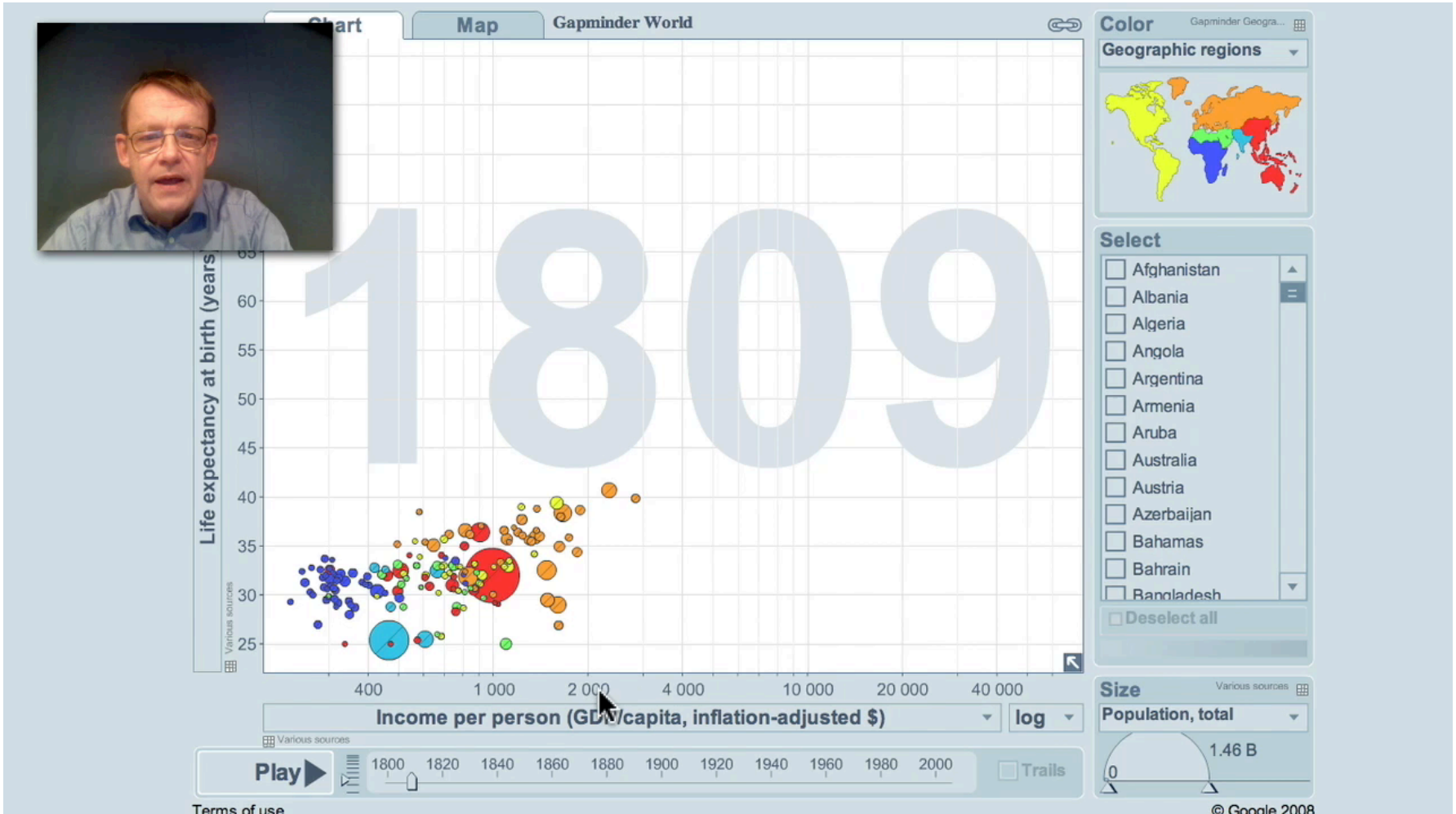
- Gapminder uses animation to compare the income of different countries as it changed over time. (Gapminder.org)

4. Web page design

Web page design

- Web-based designs are different than desktop because the broader consumer-oriented audience appreciates colorful graphics and many site designers use eye-catching photos.

- The race is on to create cool designs, enticing images, and attention-grabbing layouts.

- User preferences become crucial.

- In addition, webpage designs have to accommodate tablets, smartphone displays, and other touchscreen interaction. Responsive design refers to developing websites that provide an optimal viewing and interaction experience .

Web page design top mistakes (Tullis, 2005)

1. Burying information too deep in a website

2 . Overloading pages with too much material

3. Providing awkward or confusing navigation

4. Putting information in unexpected places on the page

5. Not making links obvious and clear

6. Presenting information in bad tables

7. Making text so small that many users cannot read it

8. Using color combinations for text that many users cannot read

9 . Using bad forms

10. Hiding (or not providing) features that could help users

Web page design top mistakes (Norman, Nielsen, 2011)

#1 Bad Search

Overly literal search engines reduce usability in that they're unable to handle typos, plurals, hyphens, and other variants of the query terms.

#2 PDF Files for Online Reading

Users do not like coming across a PDF file while browsing, because it breaks their flow.

Even simple things like printing or saving documents are difficult, pdf layouts are often optimized for a sheet of paper, which rarely matches the size of the user's browser window.

#3. Not Changing the Color of Visited Links

- Past navigation helps users understand their current location, makes it easier to decide where to go next.

- Links are a key factor in this navigation process.

- Knowing which pages they've already visited frees users from unintentionally revisiting the same pages again.

Web page design top mistakes (Norman, Nielsen, 2011)

#4. Non-Scannable Text

A wall of text is deadly for an interactive experience. Intimidating. Boring. Painful to read.Write for online, not print.

#5. Fixed font size

- Respect the user's preferences and let them resize text as needed.

- CSS style sheets unfortunately give websites the power to disable a Web browser's "change font size" button and specify a fixed font size.

- About 95% of the time, this fixed size is tiny , reducing readability significantly for most people over the age of 40.

#6. Page Titles With Low Search Engine Visibility

- For the homepage, begin with the company name, followed by a brief description of the site. Don't start with words like "The" or "Welcome to" unless you want to be alphabetized under "T" or "W."

- For other pages than the homepage, start the title with a few of the most salient information-carrying words that describe the specifics of what users will find on that page.

#7. Avoid design that looks Like an advertisement

- Selective attention is very powerful, and Web users have learned to stop paying attention to any ads that get in the way of their goal-driven navigation.

- So, users also ignore legitimate design elements that look like prevalent forms of advertising.

- Therefore, it is best to avoid any designs that look like advertisements.

#8. Violating Design Conventions

- Consistency is one of the most powerful usability principles: when things always behave the same, users don't have to worry about what will happen.

- Instead, they know what will happen based on earlier experience. Every time you release an apple over Sir Isaac Newton, it will drop on his head. That's good.

- Deviation from conventions, the site will be harder to use

#9. Opening New Browser Windows

- Designers open new browser windows on the theory that it keeps users on their site.

- The strategy is self-defeating since it disables the Back button which is the normal way users return to previous sites.

- Users often don't notice that a new window has opened, so they will be confused by a grayed out Back button.

#10. Not Answering Users' Questions

- Users are highly goal-driven on the Web. They visit sites because there's something they want to accomplish — maybe even buy a product.

- The ultimate failure of a website is to fail to provide the information users are looking for (e.g. the price).

Web page design guidelines

- **Numerous guidelines for web designers** are available on the Web and can be incorporated into your design process to ensure consistency and adherence to emerging standards

- Examples include:

  - The Java Look and Feel Design Guidelines, (Oracle, 2015)

  - Research-Based Web Design & Usability Guidelines (Usability, 2015)

  - World Wide Web Consortium's Web Accessibility Initiative (WAI, 2015)

  - The Web Style Guide (Lynch and Horton, 2008)

  There are numerous web sites that address web design, some of which were created as companions to relevant books:

  - Web 2.0 How-To Design Guide (Hunt, 2015)

  - Web Bloopers (Johnson, 2003 --- updated 2008 online)

  - Building Scalable Web Sites: Building, Scaling, and Optimizing the Next Generation of Web Applications (Henderson, 2006)

5. Color

Color

- Color can:
  - Soothe or strike the eye
  - Add accents to an uninteresting display
  - Facilitate subtle discriminations in complex displays
  - **Emphasize** the logical organization of information
  - Draw attention to **warnings**
  - Evoke strong emotional reactions of joy, excitement, fear, or anger

Color guidelines

1. Use color conservatively: Limit the number and amount of colors <=4
2. Recognize the power of color to speed tasks
3. Color coding should support the task
4. Color coding should appear with minimal user effort
5. Color coding should be under user control
6. Design for monochrome first
7. Consider the needs of color-deficient users (8% of males)
8. Color can help in formatting (group related items)
9. Be consistent in color coding
10. Be alert to common expectations about color codes (red=danger)
11. Be alert to problems with color pairings (e.g. red with blue)
12. Use color changes to indicate status changes
13. Use color in graphic displays for greater information density

Color Brewer

- ColorBrewer helps designers select color schemes for maps and other graphics (Brewer et al, 2015)

- Controls also allow users to narrow down the choices to colors that are visible to users with color impairments

ColorBrewer color schemes

ColorBrewer Color Schemes (brewermap.m)

Non-anthropomorphic design

- Concerns
  - attributions of intelligence, autonomy, free will, etc. can deceive, confuse, and mislead users
  - important to clarify differences between people and computers
  - users and designers must accept responsibility for misuse of computers
  - although attractive to some people, an anthropomorphic interface can produce anxiety in others
    - computers can make people feel dumb
    - computers should be transparent and support concentrating on the task in hand
  - mature technology should avoid Mumford's obstacle of animism
  - anthropomorphic interfaces may distract users
    - Microsoft's ill-fated Clippy character was intended to provide help suggestions
      - Amused some, but annoyed many
      - Disruptive interference
      - Lacked appropriate emotional expressions

6. Anthropomorphic design

Non-anthropomorphic design

- Attributions of intelligence, autonomy, free will, or knowledge to computers are appealing to some people. There are persistent advocates of creating anthropomorphic interfaces, often called virtual humans, lifelike autonomous agents, "chatbots," or embodied conversational agents (Cassell et al., 2000; Gratch et al., 2002; D'Mello et al., 2007).

- But to others such characterizations may be seen as deceptive, confusing, and misleading. The suggestion that computers can think, know, or understand may give users an erroneous model of how computers work and what the machines' capacities are.

Non-anthropomorphic design guidelines

- Be cautious in presenting computers as people.

- Design comprehensible, predictable, and controllable interfaces.

- Use appropriate humans for introductions or guides.

- Use cartoon characters in games or children's software, but usually not elsewhere

- Provide user - centered overviews for orientation and closure.

- Do not use 'I' pronouns when the computer responds to human actions.

- Use "you" to guide users, or just state facts.

7. Error messages

Pearson

Design for 'error handling'

- Increase attention to **message design**.

- Establish **quality control**.

- Develop and **enforce guidelines** .

- Carry out **usability tests**.

- Consider conducting **"error handling" reviews**.

- Record the frequency of occurrence for each message .

Error messages design guidelines

• Be as **specific and precise** as possible. Determine necessary, relevant error messages.

• Be **constructive**. Indicate what the user needs to do.

• Use a **positive tone**. Avoid condemnation. Be courteous.

• Choose **user-centered phrasing**. State the problem, cause, and solution.

• Consider **multiple levels of messages**. State brief, sufficient information to assist with the corrective action .

• Maintain **consistent grammatical** forms, terminology, and abbreviations.

• Maintain **consistent visual** format and placement.

Error messages guidelines

- Unnecessarily hostile messages using violent terminology can disturb non-technical users:

  - FATAL ERROR, RUN ABORTED

  - CATASTROPHIC ERROR: LOGGED WITH OPERATOR

  - Negative terms such as ILLEGAL, ERROR, INVALID, BAD should be eliminated or used infrequently

Error message examples

- **Poor:** SYNTAX ERROR.
  Better: Unmatched left parenthesis

- **Poor:** INVALID DATA
  Better: Days range from 1 to 31

- **Poor:** BAD FILE NAME
  Better: The file C:\demo\data.txt was not found

- **Poor:** ???
  Better: Touch icon twice to start app

Error messages examples

Poor: I will begin the lesson when you press RETURN.
Better: You can begin the lesson by pressing RETURN.
Better yet: To begin the lesson, press RETURN.

Poor: Invalid date.
Better: Arrival date must come after departure date.

8. Issues of Time in User Experience

Pearson

Improving system response

- System Response Time (SRT) is a concern for designers. There are steps they can take to improve the timely user experience

- Designers can optimize web pages to reduce byte counts and numbers of files or provide previews (e.g. thumbnails or coverage maps) to help reduce the number of queries and accesses to the network or provide data

Example of preview of data availability
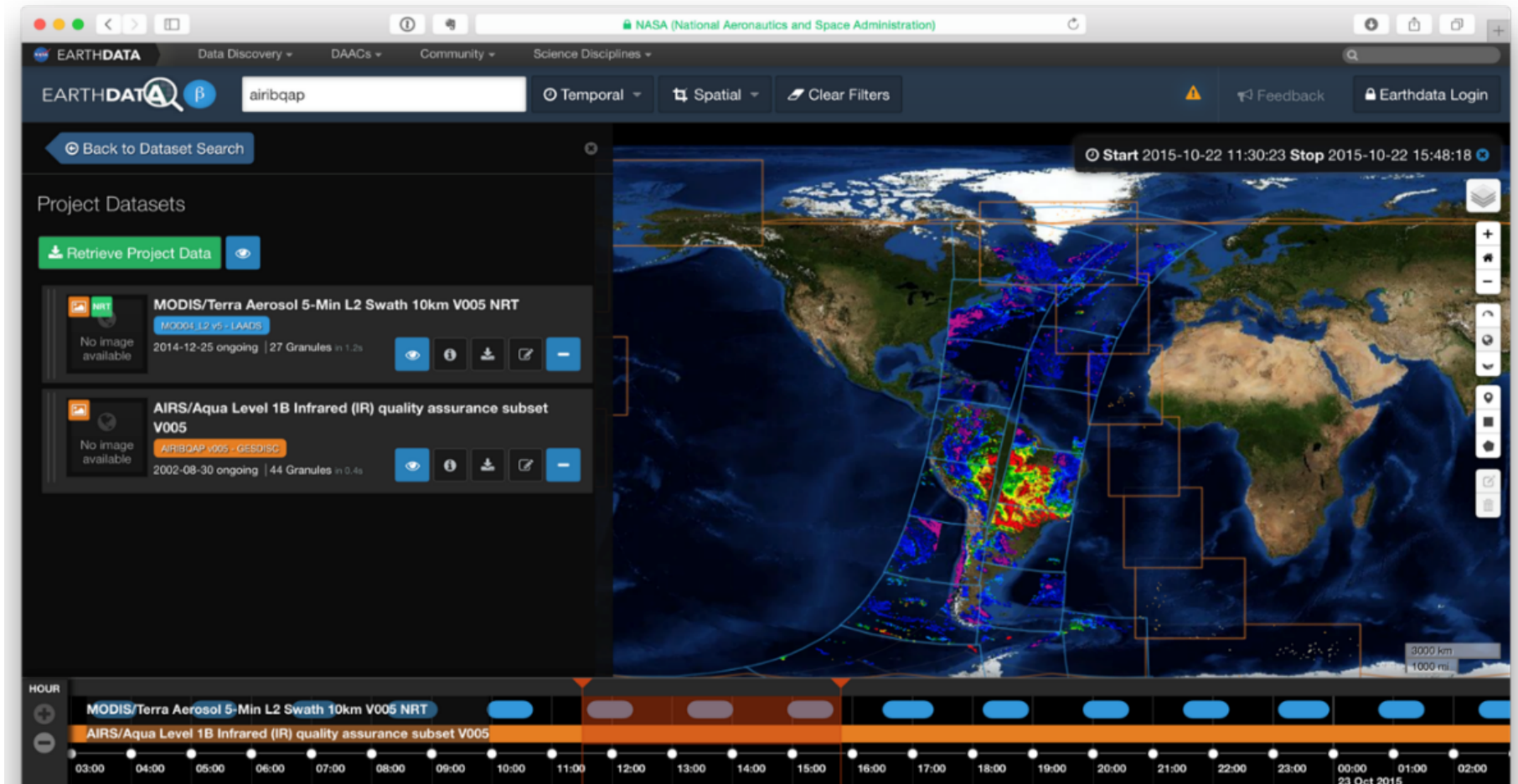
- The Earthdata Search (search.earthdata.nasa.gov) indicates the geographic and temporal coverage of datasets before the data is downloaded. Here the user has selected two datasets. The one dataset is tagged with the color blue and the other orange

- Those colors are used on the timelines and on the map revealing where and when the two datasets overlap

Models of system response impacts

- **System response (SRT)** is the time from the moment users initiate a (computer) activity until the computer presents results on the display

- **User think time** is the time during which the user thinks before entering the next action
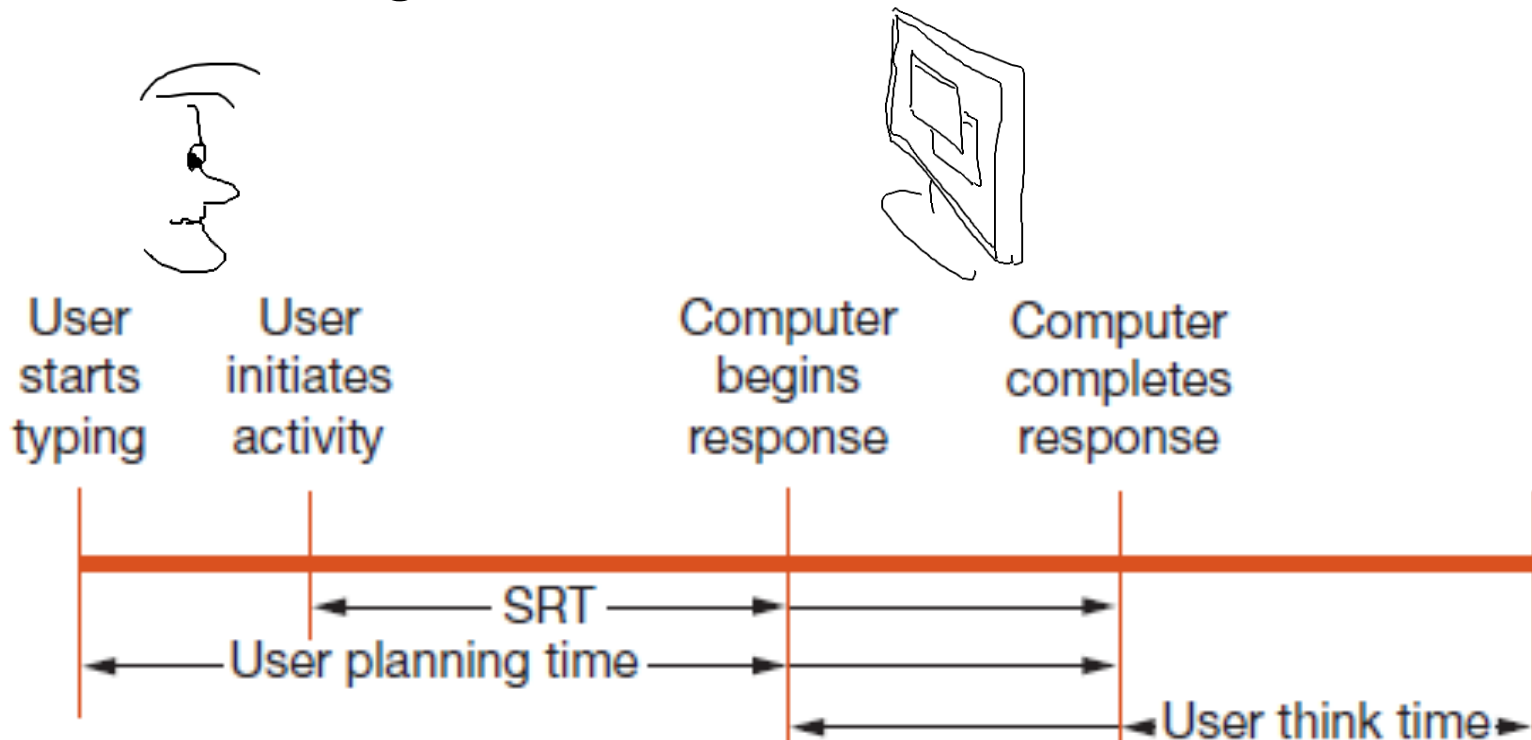
Expectations and Attitudes

- Three primary factors that influence user expectations and attitudes regarding SRT is **user's previous experiences**

- The first factor influencing acceptable SRT is that 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, but 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.

Expectations and Attitudes

- Other factors influencing SRT expectations are the **task complexity** and the **users' familiarity with the task**.

- For simple, repetitive 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.

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

Expectations and Attitudes

These conjectures may play a role in choosing the optimum interaction speed:

- Novices may exhibit better performance with somewhat slower response times.

- Novices prefer to work at speeds slower than those chosen by knowledgeable, frequent users.

- When there is little penalty for an error, users prefer to work more quickly.

- When the task is familiar and easily comprehended, users prefer more rapid action.

- If users have experienced rapid performance previously, they will expect and demand it in future situations.

User Productivity and Variability in SRT

- Repetitive tasks
  - Nature of the task has a strong influence on whether changes in response time alter user productivity
  - Shorter response time means users responds more quickly, but decisions may not be optimal

- Problem solving tasks
  - Users will adapt their work style to the response time
  - Users will change their work habits as the response time changes

User Productivity and Variability in SRT
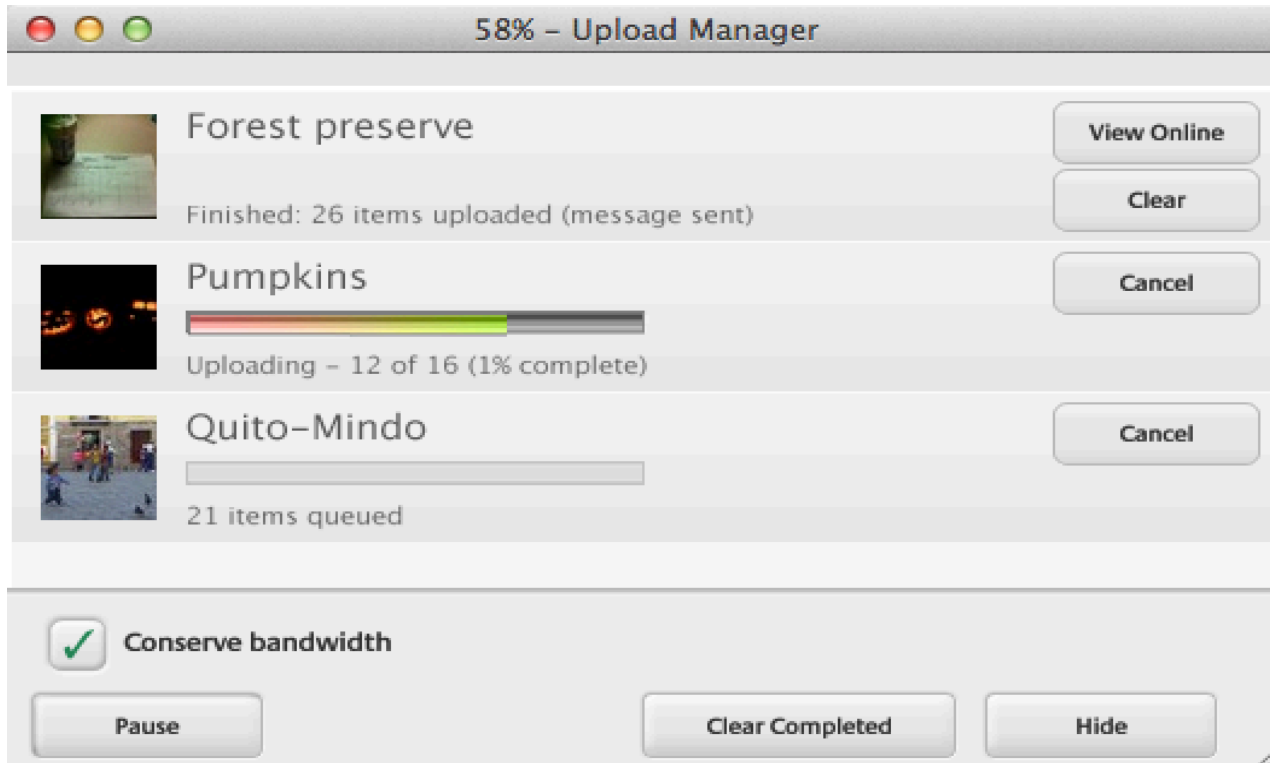
- Progress indicators reassure users that the process of uploading photos from Picasa to the web is underway, and how far it has gone already

- They also allow users to see the results or to cancel uploads

Response Time Guidelines

- Users prefer shorter response times
- Longer response times (> 15 seconds) are disruptive
- Users' usage profiles change as a function of response time
- Shorter response time leads to shorter **user think time**
- A faster pace may increase productivity, but it may also increase error rates
- Error-recovery ease and time influence optimal response time.
- Response time should be appropriate to the task:
  - Typing, cursor motion, mouse selection: 50 -150 milliseconds
  - Simple, frequent tasks: 1 second
  - Common tasks: 2 - 4 seconds
  - Complex tasks: 8 - 12 seconds

Response Time Guidelines

- Users should be advised of long delays

- Strive to have rapid start-ups

- Modest variability in response time is acceptable

- Unexpected delays may be disruptive

- Offer users a choice in the pace of interaction

- Empirical tests can help to set suitable response times

In summary, topics covered for design for the human experience

1. Display Design
2. Window Management
3. Animation
4. Web Page Design
5. Color
6. Non-anthropomorphic Design
7. Error Messages
8. Handling system response time