Comp 341/441 - HCI

Spring Semester 2019 - Week 7 - Slides

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Reducing Cognitive Load

flow states and software

- unusual for beginners to be able to gain a sense of **flow**
  - *normally requires some level of comfort or familiarity*
  - *ease with the general operation and control of the application*
- acquiring a state of **flow** is quite difficult
  - *focused concentration is often not enough*
  - *reducing cognitive load in apps can aid in the process*
- interruptions in the real world can break a user's sense of **flow**
  - *visual clutter and noise in interfaces can have the same effect*
  - *interface distractions can also break a user's sense of **flow***

Reducing Cognitive Load

interface suggestions for flow

- reduce interruptions in the interface unless intentional for warnings, errors...
  - *non-important modal popups, notifications should be avoided*
- keep visual presentation simple
  - *bright, loud colours and images are jarring to the user's eye*
  - *unnecessary, prolonged or repetitive animations are distracting*
- sequential navigation should be obvious
  - *do not require the user to search the interface for **next**...*
- avoid switching between tabs, windows, pages for related information
- saving a document, work etc should be easy and intuitive for a user
- output and display progress reports for ongoing activities
  - *progress bars, spinning wheels, timers...*
- offer feedback in a prompt and consistent manner within the interface
- multi-tasking for users is difficult
  - *don't ask your users to perform too many interface tasks at once...*

Incentives, offers, and games

motivating our users

- consider motivation, persuasion, or helpful *nudging* in our designs
- design our interfaces to encourage and help increase productivity
- particularly useful for certain types of applications and sectors
  - *user participation apps*
  - *productivity tools*
  - *community related apps*
- compare this type of application to gaming
  - *often adept at engaging and keeping a user's attention*
- consider how and where games are compelling and addictive
  - *adapt applicable concepts for our own design*

Incentives, offers, and games

compelling and addictive nature of gaming

- current trend in design to apply addictive qualities of gaming to application design
  - *known as **gamification***
- most games have some goals and rewards, which encourage and incentivise a user
  - *often a built-in incentive to reach the next level, a sense of satisfaction*
- games may include elaborate systems of player rankings
  - *rankings act as system of validation, offers easily quantified feedback to users*
- multiplayer games offer an element of direct competition
  - *user's sense of skills, standing, and validation enhanced by opportunity to compete and win*
  - ***high scores** on a leaderboard help this sense of competition*
- multiplayer games also offer sense of **social** connection and community
  - *head-to-head gaming, group playing, or simply ability to share, compare, discuss...*
- online role-plaing games a good example of social awareness and collaboration

Incentives, offers, and games

examples of gamification

1. Good examples of the use of gamification within social context

   Source - Yu-Kai Chou & Gamification

2. Khan Academy Knowledge Map

   Source - Khan Academy

3. Play to Learn with Khan Academy

   Source - GCO

4. Scratch Programming Language

   Source - MIT

changing the brain game...

> *The immense amount of time spent with games during a child's formative years has led them to be literally 'hardwired' in a different way than those who came before.*

Carstens, A., and Beck, J. *Get ready for the gamer generation.* Tech Trends 49. PP.22-25. 2005.

> *Immense changes in technology over the past thirty years, of which video games are a major part, have dramatically and discontinuously changed the way those people raised in this time period think, learn, and process information...The change has been so enormous that today's younger people have, in their intellectual style and preferences, very different minds from their parents and, in fact, all preceding generations.*

Prensky, M. *Digital game-based learning.* McGraw-Hill. P.17. 2001.

Games and Simulations

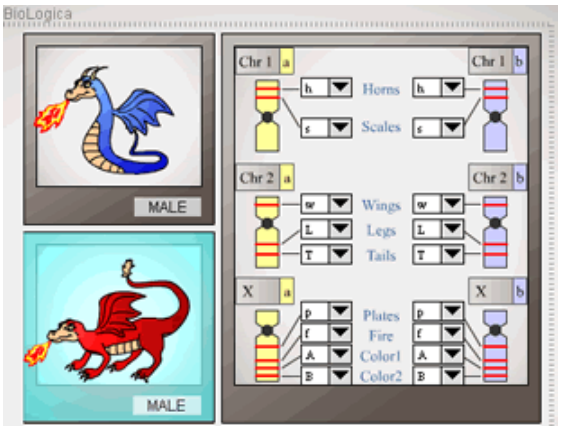
what are simulations?

- linear interactive tutorial versus a simulation
- model of a real world system
  - *respond in dynamic and rule-based ways to user responses*
- two basic types of simulation
  - *operational and conceptual*
- operational primarily used to teach procedural skills
- conceptual simulations

Games and Simulations

what are games?

- online games include a broad array of formats and features
- common elements such as
  - *competitive activity with a challenge and goal*
  - *set of rules and constraints*
  - *specific context*



Source - BioLogica

Games and Simulations

match game to learning goal

> *Jeopardy-style games, a staple of games in the classroom, are likely to be best for promoting the learning of verbal information (facts, labels, and propositions) and concrete concepts. Arcade-style games...are likely to be best at promoting speed of response, automaticity, and visual processing. Adventure games are likely to be best for promoting hypothesis testing and problem solving. It is critical, therefore, that we understand not just how games work, but how different types of games work and how game taxonomies align with learning taxonomies..*

Van Eck, R.N. "Digital game-based learning." Educause Review 41. PP.17-30. 2006.

- a game can often take over a tutorial
  - *Hays, R.T. 2005.*
- medical simulations
  - *Issenberg, S.B. et al. 2005.*

Processing Visual Information

intro

- how do users actually process a page or screen within an application?
  - *designers and developers interested in working out how to guide a user*
  - *optimise viewing experience for user's focal point*
- graphical artists use emphasis and position to draw attention
- cartoonists carefully compose and sketch out cartoons
  - *draw attention to speech-bubbles etc in correct order...*
- we can compose our visual page elements to influence a user's viewing order
- by knowing common patterns for user viewing
  - *we can design our apps to accommodate such usage patterns*
  - *putting relevant information where users actually look*

Image - Processing Visual Information

humour

Speech Bubbles

Source - The Curious Dog Log

Processing Visual Information

how do users read a page?

- Western readers follow a pattern for reading
  - *look at first word in the top left corner of a page*
  - *then scan across the line from left to right*
  - *read the words*
  - *skip to the beginning of the next line*
- reader's eyes scan across the line of text
  - *not a smooth action*
  - *user's focus jumps rapidly between given spots on the page*
  - *known as **fixation points***
  - *jumps from point to point known as **saccades***
  - *brain does not receive visual information during **saccades***
  - *brain capable of combining images received at each **fixation point***
  - *brain **sees in a line***

Processing Visual Information

perceiving more complicated pages...

- consider page layouts with a more complex design and pattern
  - *slightly harder to discern exactly how a user's eyes move across the page*
- some generalisations we can consider and transfer
  - *users get an initial impression of a page or document*
  - *z-shaped pattern*
  - *upper left, read title, then scan from upper right*
  - *diagonal to lower left, then scan to lower right*
  - *return focal point to areas of interest*
- uncertain how flashy, loud images etc will impact this pattern
  - *tend to break or interrupt a user's pattern of scanning the page*
- user searching a page for something specific will often follow a different pattern

Processing Visual Information

studies

- researchers have conducted eye-tracking studies
  - *using specialised cameras and software*
- capable of identifying where and what a user views on screen
- software can replay a user's **scanpath**
  - *a series of **fixations** and **saccades***
- replay tells us the areas of interest and how long each user viewed
- aggregate **scanpaths** to form a **heatmap** diagram
  - *shows predominant areas of interest to our users*

Video - Processing Visual Information

eye tracking advert

Google Chrome Japan
Source - YouTube

Processing Visual Information

Eyetracking Web Usability - part 1

- websites present a different pattern for users
- user's tend to follow an **F** pattern
  - *read across the top*
  - *continue down the screen*
  - *read lines, at least partial, of text*
  - *tend to read paragraphs nearer the top of the screen*
  - *only scan text near the bottom of the screen*
- at the bottom of the screen
  - *users tend to make an additional quick scan down the left side of the screen*
  - *left sidebar with links draws particular attention*

Source - Nielsen, J. and Pernice, K. *Eyetracking web usability.* New Riders. 2009.

Processing Visual Information

Eyetracking Web Usability - part 2

- images and graphics attract a user's attention
  - *tends to be a strong response and reaction when they are relevant and integral to the content*
  - *users seem able to quickly discern relevant imagery from stock photos*
  - *stock photos quickly overlooked and ignored*
- banner ads now tend to be ignored by users
  - *users start their **F** pattern beneath these adverts*
  - *users begin viewing site beneath these adverts*
- users tend to ignore repetitive elements on multiple pages
  - *eg: logo, navigation bars...*
  - *only look again if they need something...*

Source - Nielsen, J. and Pernice, K. *Eyetracking web usability.* New Riders. 2009.

Video - Processing Visual Information

eye tracking

Google Chrome Japan
Source - YouTube

Gestalt Laws of Perception

Intro

- Gestalt concept allows us to explain how humans perceive and comprehend visual information
- as interface designers such laws can be exploited
  - *create visual layouts and representations to improve communications, concepts, relationships...*
- Gestalt: **form**, **shape**...
  - *refers to the notion of a whole, a body, more than the mere sum of its parts...*
- Gestalt in psychology
  - *notion that humans seek sense of the world by imposing concepts of structure, order...*
- **Gestalt effect** suggests that our mind will naturally attempt to recognise coherent, whole forms...
  - *instead of perceiving individually smaller constituent parts that form the whole*

Image - Gestalt Laws of Perception

Gestalt Principles

Source - Gestalt Principles

Image - Gestalt Laws of Perception

WWF Logo

Source - World Wildlife Fund

Gestalt Laws of Perception

Max Wertheimer

- 1923, Max Wertheimer's paper *Laws of Organisation in Perceptual Forms*
- suggested a number of principles or laws that describe how the mind tends to perceive visual information
- for example, there are certain laws useful for consideration relative to design
  - *Law of Prägnanz*
    - Law of Proximity
    - Law of Similarity
    - Law of Closure
    - Law of Common Fate/Region
    - Law of Continuation
    - Law of Good Gestalt (or Good Continuation)

Gestalt Laws of Perception

Law of Prägnanz

- basic law proposed by Wertheimer
  - *the other laws are derived from this basic law*
- Prägnanz can be roughly translated as **concise** in nature, or a sense of **simplicity**
- when we perceive a visual scene we try to interpret it,
  - *in the simplest, most concise, and easily recognisable form*
- the mind tries to perceive the scene as a whole
  - *rather than the sum of its constituent parts*
- consider an image of a square or rectangle
  - *not four sides*
  - *two horizontal and two vertical*

Gestalt Laws of Perception

Law of proximity

- items located in close proximity will be perceived as a single entity or group
- items in a group will also be perceived as distinct and different from other items
  - *eg: an electronic board with individual lights, bulbs...*
- close proximity causes the interpretation in our vision and brain
- change the proximity, and our perception will change as well
- interface design
  - *separate and isolate similar elements and user's perception of the whole will change*
  - *eg: keep form elements together to avoid isolation and false perception*
  - *coherent presentation of like elements to form the required whole*

Image - Gestalt Laws of Perception

Proximity

Source - Web Designer Depot

Gestalt Laws of Perception

Law of Similarity

- visual elements that share properties or attributes are perceived as belonging together
- conversely, visual elements with differing properties or attributes will be perceived as belonging to different groups
- eg: jumble elements together - squares, circles, triangles, rectangles...
  - *our vision and brain will try to organise and sort these shapes*
  - *colour will also act as a varying factor*
  - *we will try to group based upon multiple attributes - shape, colour...*
- file managers are a good example of this principle in interface design
- highlighting and other sort options naturally help our users

Image - Gestalt Laws of Perception

Similarity

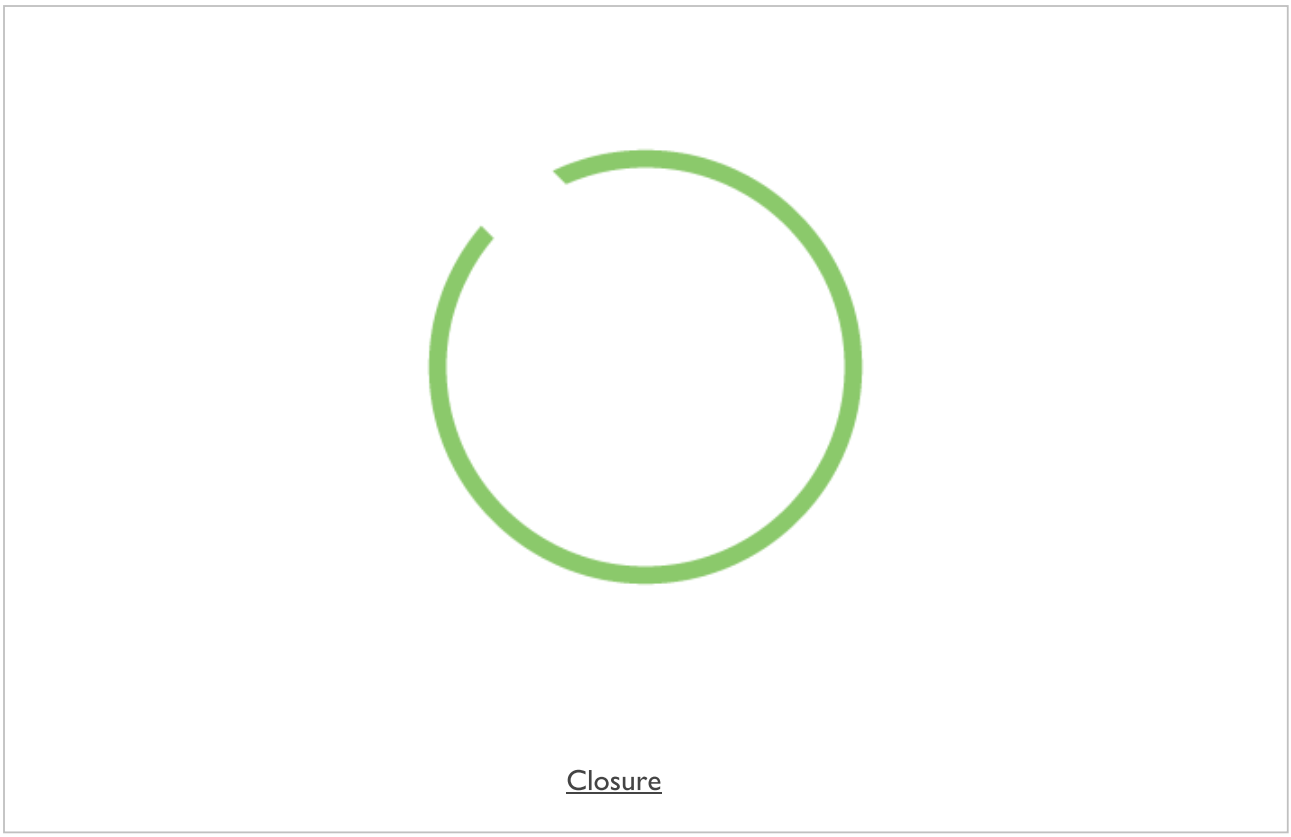
Source - Web Designer Depot

Gestalt Laws of Perception

Law of Closure

- lines, or similar representative grouped elements
  - *more likely to be perceived as a common group if they appear to form*
    - the outline or *closure* of a given shape or surface
- still considered true if that outline is not complete
- our mind will fill in any gaps in these incomplete shapes
  - *eg: an incomplete circle*
  - *simpler to see as a circle than an arc of 330 degrees...*
- logos and other visualisations often use this trick

Image - Gestalt Laws of Perception



Closure

Source - APRK Topics

Gestalt Laws of Perception

Law of Common Fate

- motion, and elements, moving in the same direction simultaneously
  - *still perceived as a similar grouping*
- drag and drop in interfaces
  - *uses this perception of grouping*
  - *act of dragging disparate elements imparts concept of group*
- the trail of the motion imparts a sense of unity to these interface elements

Image - Gestalt Laws of Perception

Common Fate/Region

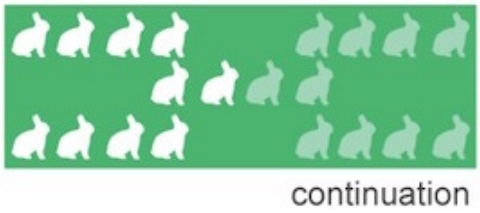
Source - [Web Designer Depot]

Gestalt Laws of Perception

Law of Continuation

- elements within an interface that appear to be a continuation
  - *perceived by users as belonging together*
- a user's focal point will continue along this line or sequence
  - *until the end or if broken by something else*
- peripheral vision will inform focal point...

Image - Gestalt Laws of Perception



Continuation

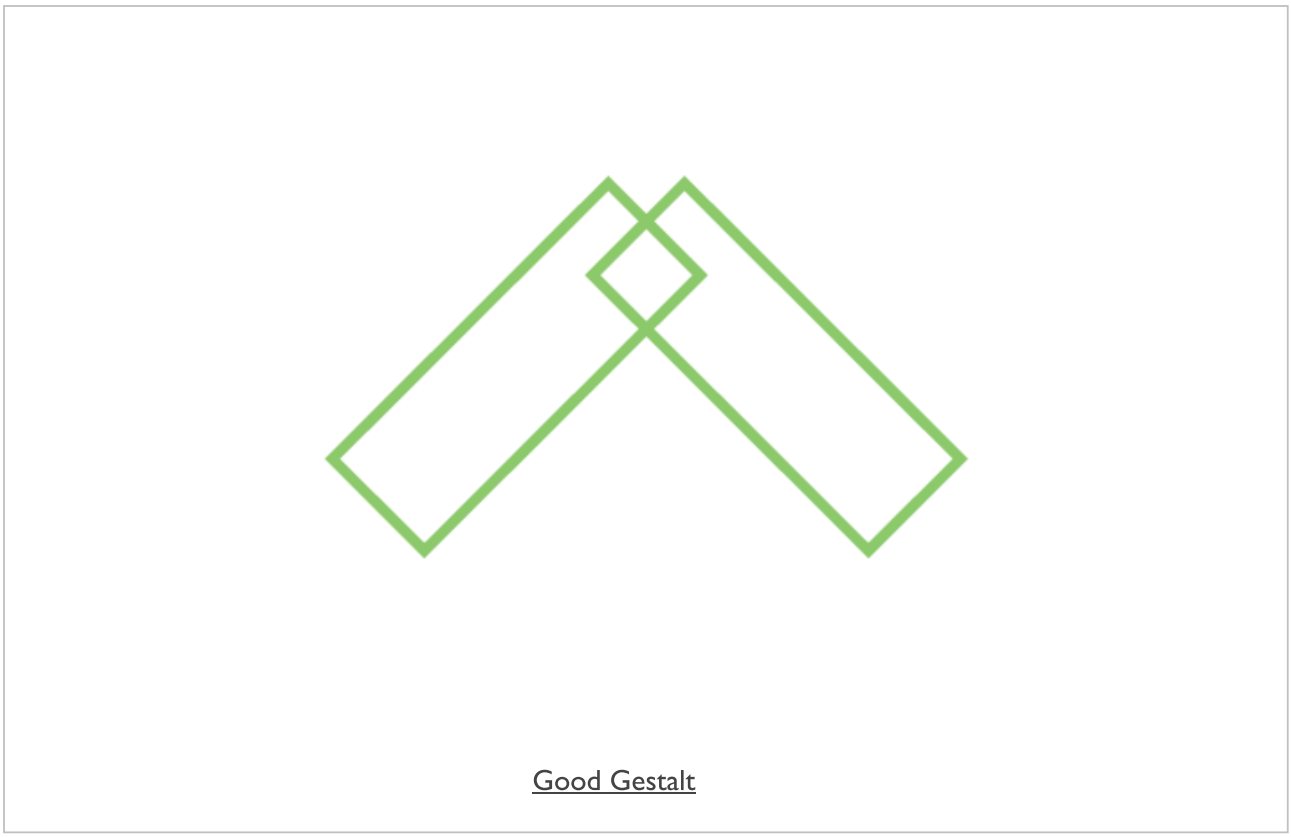
Source - Web Designer Depot

Gestalt Laws of Perception

Law of Good Gestalt (or Good Continuation)

- our perception of smooth continued lines
  - *even if they are broken by an intersection or crossing*
- eg: multiple lines crossing still perceived as separate single lines
  - *we see individual lines*
  - *we rarely see the meeting of two angles*
- our mind has been taught to perceive the crossing of two lines as simpler
- data visualisation is a good example
  - *allows us to present multiple lines and expect our users to differentiate*
  - *multiple data results crossing...*

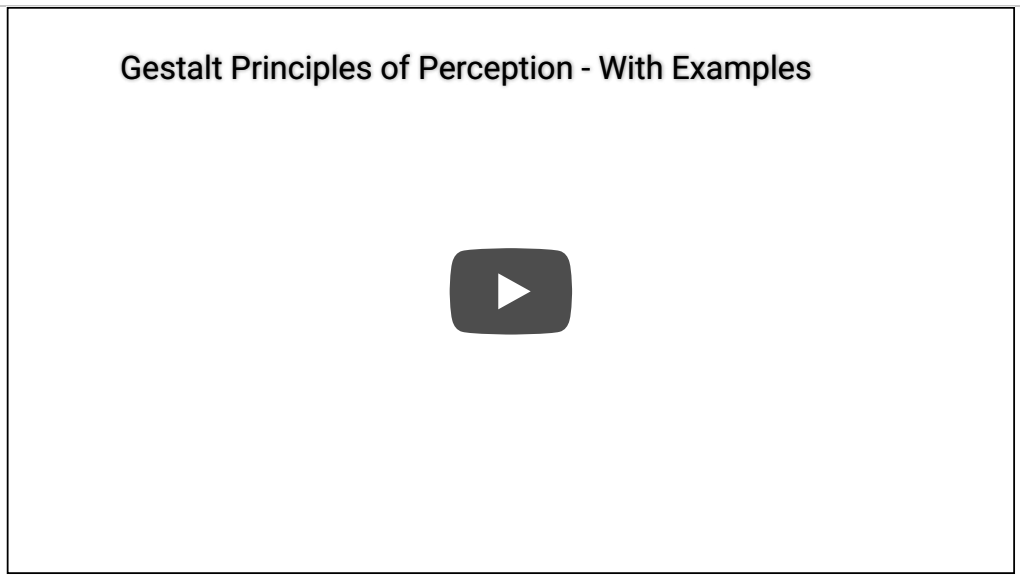
Image - Gestalt Laws of Perception



Good Gestalt

Source - APRK Topics

Video - Gestalt Laws of Perception



Visual Attributes

contrast

- elements used as components to build a graphical interface
  - *might include buttons, icons, drop-down lists, menus, checkboxes...*
- attributes are properties of these visual elements
  - *attributes as styling for a page's visual elements*
- patterns in design and layout aid a user
  - *reduces cognitive load, creates an aid to vision, perception, recognition...*
- elements with similar function should be style in a similar manner
- **contrast** presents itself as an intentional and easily recognisable difference
  - *eye-catching, attention grabber for a user...*
  - *can provide users with clues to elements, content...*

Visual Attributes

size

- **size** is another way we can create differentiation in our designs
  - *generally easy for a user to discern and understand*
- size has been used for centuries in print design
  - *Lombardic capitals in mediaeval manuscripts and books*
- size is often perceived as visual dominance
  - *a sense of greater importance*
  - *size can make a difference within certain aspects of interface design*
- size has been applied in the use and development of grid layouts in web design
  - *allow us to easily define relative sizes for content, blocks...*
  - *larger centre panels often perceived as more important than headers, sidebars...*
- data visualisation uses this principle for differentiation
  - *quickly and effectively communicate larger data values*
  - *relative weights of data*
- assigning size attributes needs to consider relative weighting of importance
  - *relative value of elements to task at hand...*

Visual Attributes

colour

- **colour** can play a vital role in the presentation of an interface
  - *also plays important role in user perception*
- after size, colour is perceived as next important attribute
  - *aids user differentiation*
- colour can help guide a user to certain aspects of an interface
- elements that share identical colours often perceived as in the same group
  - *contrasting colours present a useful juxtaposition of elements*
- cultural pre-conceptions aside
  - *certain colours have perceived inherent meaning*
  - *red for danger, errors...*

Visual Attributes

shape, direction, and angularity...

- users are often able to quickly and easily differentiate shapes and patterns
  - *Gestalt principles in practice*
  - *easily differentiating squares from circles and triangles*
- easily differentiate content and elements
  - *apply shapes as outlines, borders, content differentiation...*
- elements placed at an angle to one another perceived as jarring and mis-matched
- grid design and layouts further heighten this issue of angles
- angles perceived as creating a sense of **visual tension**
  - *often distracting for a user*
- angles can, however, be used to highlight and contrast elements

Visual Attributes

weight, text styling, texture...

- weight in interface design
  - *refers to the thickness of a line, font...*
  - *its relative presentation within a design*
- can be a quick and easy differentiating factor within our designs
- a variation on the concept of **contrast**
- text styling can be a very useful and practical difference in designs
- texture can also play a useful role in our designs
- texture has a broad use in graphic design
  - *often perceived relative to the overall visual look and feel of a block of text*
  - *its overall visual effect*

Usability

Intro

- may consider an application, product, software as usable if it fulfills
  - *can be efficiently operated*
  - *provides an overall pleasant usage experience*
  - *can be easily learned*
- often difficult to judge the usability of a product etc
  - *rules are often subjective in nature relative to usability*
- each rule may vary greatly from user to user due to
  - *different skill sets*
  - *existing knowledge*
  - *previous experience*
- user's expectations, opinions, general preferences affect perception of usability
- some users are naturally more curious, patient, and persistent
- user experience may also be influenced by
  - *attitudes and experiences of friends, contemporaries...*
  - *general moods*
  - *stress levels, fatigue, distractions*

Image - Usability

Scissors

Scissors

Source - RightLeftRightWrong

Video - Usability

Left-handed in a right-handed world

What it's like to be left-handed in a right-handed world...
Source - YouTube

Usability

end of learning

- clear functionality and general operations with appropriate visible controls, labels...
- clear navigation options and paths, plus user's current location
- minimum memorisation and recall for sequences, commands, actions
  - *easy to remember and recall*
- product, application encourages exploration and experimentation
- mistakes are easily recoverable, and operations can be retried if necessary
- assistance and help is easily accessed, clear, correct, and relevant
- consistent interaction behaviour, visual layout, terminology
  - *helps encourage correct user mental model*
- limited surprises for application behaviour and usage
  - *less for the user to learn...*
- where possible, a user is guided through steps to complete complex tasks...
- clear feedback is provided when a user performs an action
- current status of the system is clearly presented and labelled
- application, system, or product should form a coherent whole

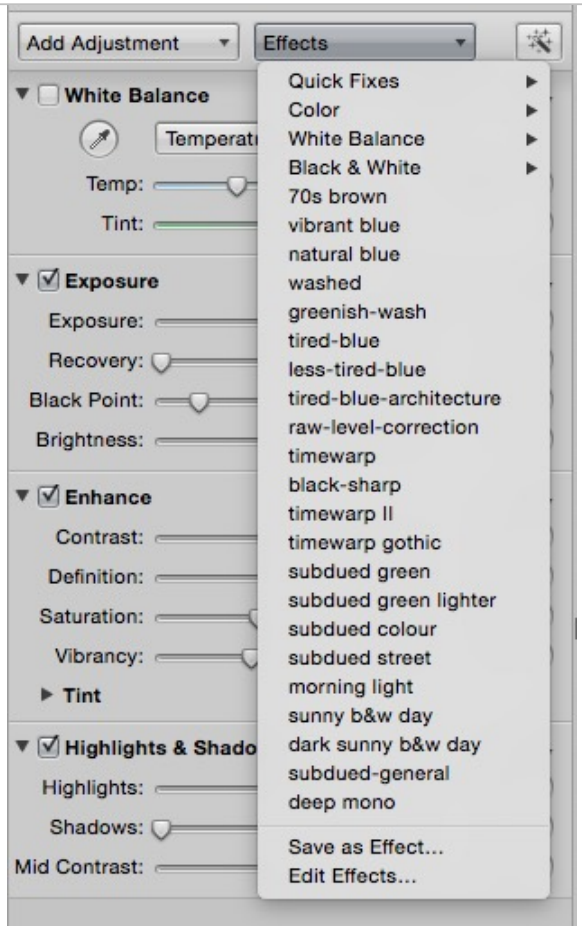
Usability

efficiency

- straightforward, easy for an experienced user to repeat actions or complete tasks
- minimal deliberate or strenuous thinking to perform routine application tasks
- enable and encourage a user to achieve a state of **flow**
- allow a skilled user to achieve a low error rate
  - *clear notification and detection of limited errors and mistakes*
- stable performance and reliability to prevent delays and hindrances
- minimal, if any, surprises and inconsistencies in interaction and design patterns

Image - Usability

preset effects



Aperture Effects

Source - Aperture

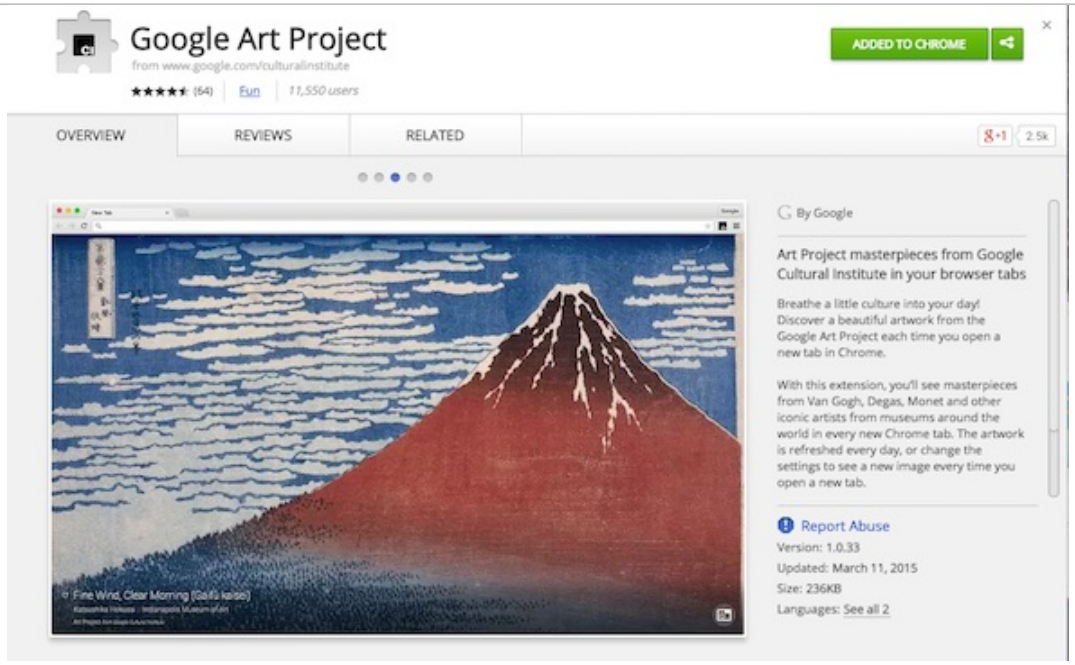
Usability

experience

- possible to consider a product or application relative to its experience
  - *whether it is a pleasant experience or not...*
- is the application's design and interface pleasant and appealing for its users
- does it promote and encourage positive productivity
- eg: if we consider games, does the application's experience
  - *provide enjoyment for its users*
  - *challenge them relative to their abilities*
  - *provide general entertainment and distraction*
- does the user feel rewarded and positive for tasks and actions completed
- again, is the product stable, reliable, and trusted by users
- likewise, are the delays sufficiently limited to avoid frustrations for users
- is the product free of unnecessary annoyances and frustrations
  - *help promote user satisfaction, reduce cognitive overload, and help achieve and maintain a sense of flow for users*

Image - Usability

pleasing concepts



Chrome Art

Source - Google Art Project

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