Comp 341/441 - HCI

Spring Semester 2020 - Week 9

Dr Nick Hayward

Games and Simulations

learning to play a game - part 1

- provision of instruction in using and playing a game
- game or simulation requires cognitive effort
  - *to master the mechanics of the environment*
  - *not always available for learning goals or outcomes*
- we know this happens...
  - *may need to modify game and its general play*
  - *helps maintain a balance between learning and enjoying the game*
- one explicit option that often helps
  - *try to free such mental resources for learning the instructional goals*
  - *free by explicitly teaching how a game or simulation works*
- focus of this suggestion is on the mechanics of the interface
  - *not necessarily the detailed strategic decisions required by the game itself*
- computer generated agent can start the game or simulation
  - *e.g. a tour or example*
  - *how goals are achieved by manipulation of various interface elements*
- could actually be as simple as
  - *summarising keyboard controls for movement*
  - *or navigation elements of the interface*

Games and Simulations

learning to play a game - part 2

- also consider providing memory support
- many problem solving or strategy games
  - *take place over a period of time*
  - *participant accumulates data*
  - *participant may draw required conclusions from experience*
- records can also help learners
  - *help derive conclusions based on tests, experiments, or examples*
- might also consider including process guidance
- as a player progresses through the game
  - *actions may be recorded so they can view their progress*
  - *view upon completion of a game or segment*

Games and Simulations

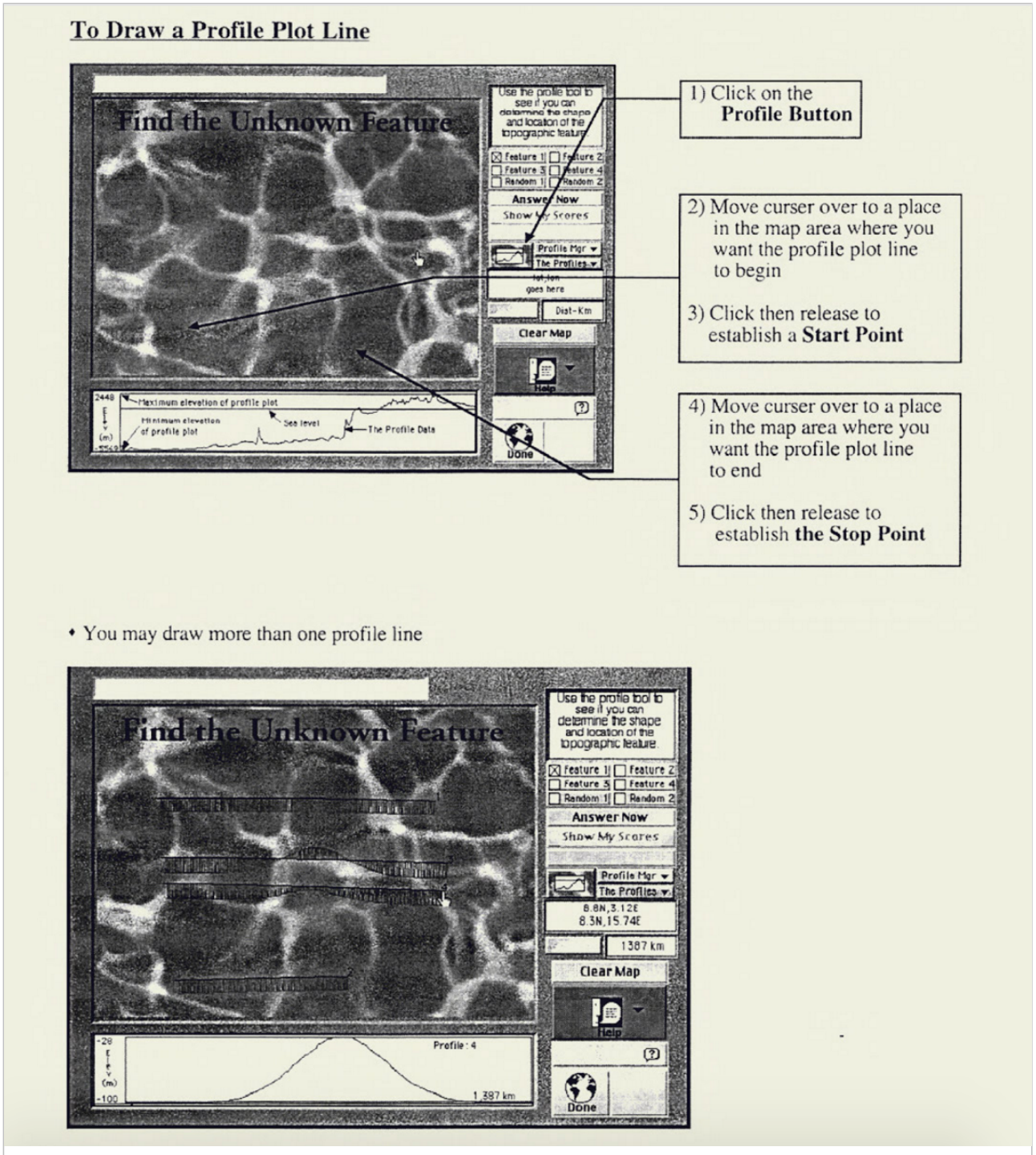
learning to play a game - part 3

> *"students need support in how to interact with geology simulations, particularly support in building and using spatial representations" P.181.*

Mayer, R.E., Mautone, P., and Prothero, W. 2002. "Pictorial aids for learning by doing in a multimedia geology simulation game." Journal of Educational Psychology 94. PP.171-185.

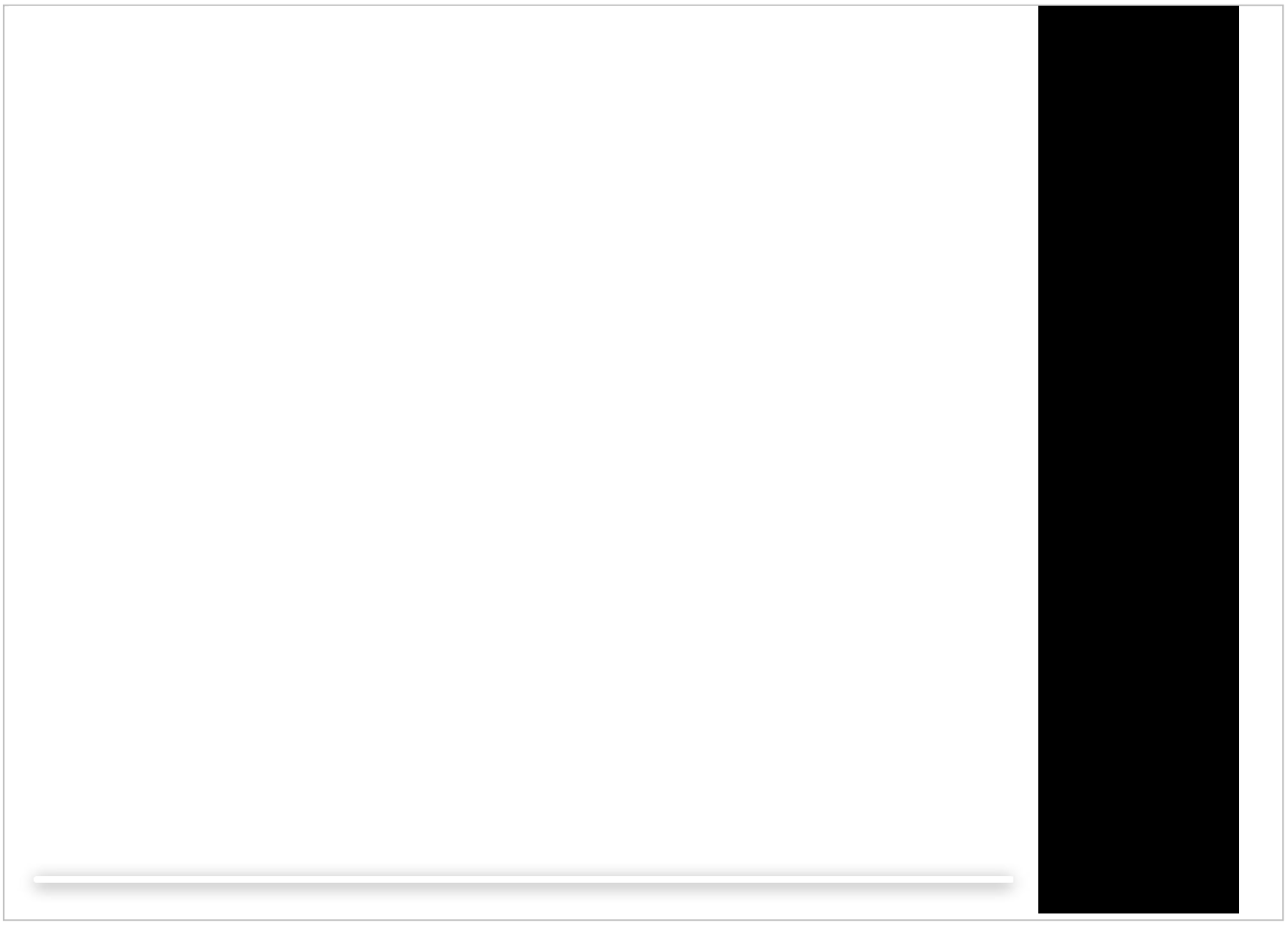
- another option is visualisation support
- *The Profile Game*
  - *players collect data from a planet whose surface is obscured by clouds*
  - *players draw a line and the computer shows a profile line*
  - *line indicates how far above and below sea level the surface is at a given point*
  - *by drawing many lines players learn*
    - whether a section contains a mountain, trough, island…
  - *players were provided with various aids*
    - strategy aids in text
    - visual aids diagramming various features,
    - or no aids
- the best game result
  - *players with the visual aids produced the best game performance*

Image - The Profile Game



The Profile Game

Video - Bryan Alexander



- Bryan Alexander - Preparing Teachers and Students to Succeed in an Open-Ended Future

- gaming section starts at 2:50 for about 35 seconds...
  - *then example game usage from 4:37 to 6:20 minutes*

Game examples - President Elect &c.

- Microsoft's Space Simulator - 1994
- President Elect - 1988 Editions
- SimEarth - 1990
- SimLife - 1992

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

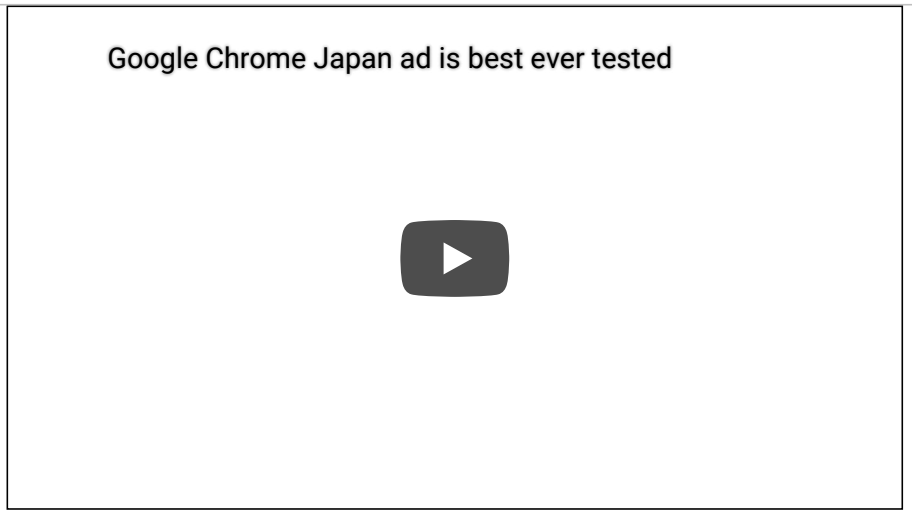
Processing Visual Information

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

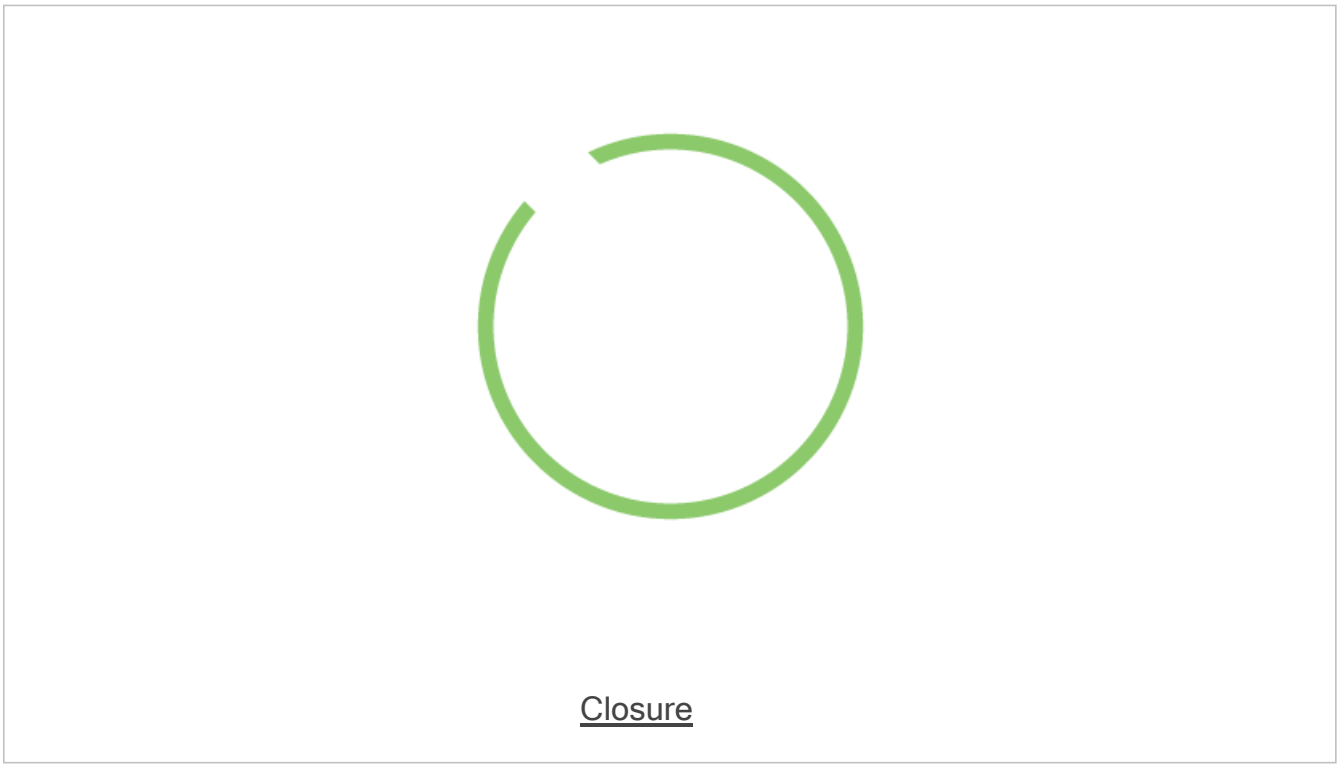
Source - Web Designer Depot

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

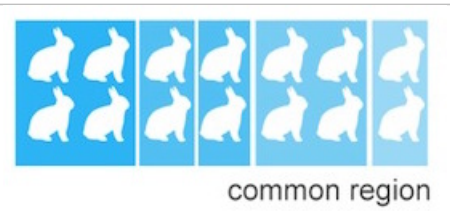
Source - APRK Topics

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)

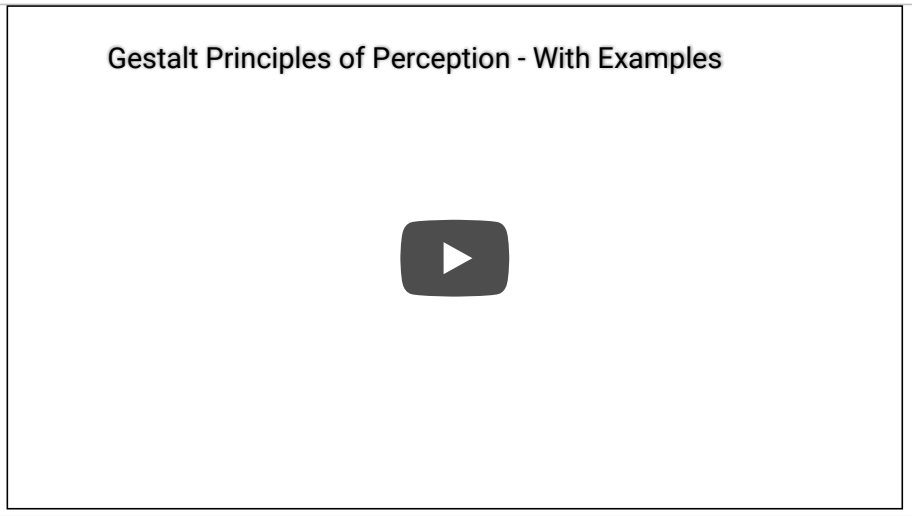
- our perception of smooth continued lines
  - *even if they are broken by an intersection or crossing*
- eg: multiple lines crossing still perceived as separate single lines
  - *we see individual lines*
  - *we rarely see the meeting of two angles*
- our mind has been taught to perceive the crossing 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



Resources

- Card, S.K., Moran, T.P. and Newell, A. *The psychology of human-computer interaction.* Lawrence Erlbaum Associates. 1983.
- Carstens, A., and Beck, J. *Get ready for the gamer generation.* Tech Trends 49. PP.22-25. 2005.
- Hays, R.T. *The effectiveness of instructional games: A literature review and discussion.* Technical Report 2005-004. Washington. 2005.
- Issenberg, S.B., McGaghie, W.C., Petrusa, E.R., Gordon, D.L., and Scalese, R.J. 2005. *Features and uses of high fidelity medical simulations that lead to effective learning.* Medical Teacher 27. PP. 10-29.
- Nielsen, J. and Pernice, K. *Eyetracking web usability.* New Riders. 2009.
- Prensky, M. *Digital game-based learning.* McGraw-Hill. P.17. 2001.
- Van Eck, R.N. *Digital game-based learning.* Educause Review 41. PP.17-30. 2006.