
use of **GESTALT LAWS** in HCI

special project by

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Approval sheet

Special Project

USE OF GESTALT LAWS IN HCI

Nirav Shah

99613006

Guide

Prof. Anirudha Joshi

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Approved for the partial fulfillment of the requirements for
degree of **Master of Design in Industrial Design**

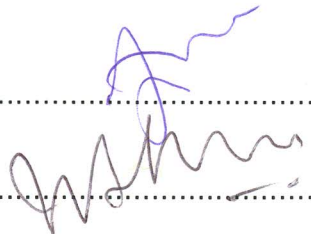
at

Industrial Design Centre,
Indian Institute of Technology, Bombay.

Guide

Internal Examiner

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Abstract

Gestalt laws of perceptual organization provide principles that help us to organize the given information so that we can perceive and make sense of these patterns. The project looks into the aspects of these grouping principles in relation to the field of human computer interaction.

The report consists of the three phases of the study done in the project:

- basic understanding of the relation between human perception and interface design
- document few interfaces that reflect the grouping principles
- state the key benefits introduced by gestalt laws of perception for HCI

The comments on the interfaces is mainly based on issues like human perception, structure and organization, and methods of grouping.

Keywords: gestalt laws, human perception, interface design, visual structure and organization

Introduction

Computer experts are already talking about technology to conform to humans rather than humans adapting to technology, where human perception plays an important role in defining the needs and constraints of the user. Researchers are now studying the 'human' factor in human computer interaction and formulate principles where a system must adapt to the user and guidelines which would help the designer to achieve these goals.

Human perception plays an important role in producing visual forms. But still under question are issues like visual design being rated very low in matrices compared to functional issues. The project was initiated with an inquiry into few issues still not fully understood by interface designers.

- how does human psychology affect graphical user interface?
- how is gestalt related to hci and interface design?
- what is the role of grouping in design of interfaces?

"use of gestalt laws in human computer interaction"

To start with, **Gestalt** ('Gestalt' - german for 'form') is an approach, particularly to perception and cognitive problems developed from 1912 onwards by Max Wertheimer (1880-1943), Kurt Koffka (1886-1941), and Wolfgang Köhler (1887-1967). Their principal claim was that the structural laws of wholes determine what occurs in their parts rather than vice versa.

Their empirical work, which centered on problem-solving and visual illusions, showed that the mind imposes on its surroundings interpretations that it is constantly trying to simplify an idea or observation¹.

1 ref : www.xrefer.com on gestalt psychology

Objective

The main objective of the project are as follows :

- to **understand the relation** between human perception and interface design.
- **document and analyze** few interfaces that reflects good or bad grouping examples.
- study the **role of gestalt laws** of perception as the basis of visual organization.
- to state the **key benefits** introduced by gestalt laws for HCI.
- to **benchmark** good examples of gestalt grouping as a guideline for an HCI designer to refer.

Human Computer Interaction

Human Computer Interaction has been defined as a discipline that studies the relationships between the human and the computer. The role of Human Computer Interaction is to provide people with a design that allows them to 'carry out their activities productively and safely'.

The discipline is concerned with achieving goals¹ such as :

- **learnability**
- **ease of use**
- **speed of use**
- **error-free use**
- **memory retention**
- **subjective satisfaction**

Additionally, many other factors are studied to analyze the implementation of new designs and to measure productivity changes due to design changes.

The interface between the user and the computer is a critical factor for both man and machine to do a job. *'An interface is a contact surface between two systems that dictates the nature of the interaction between those systems'*.

The individual users have different perceptions of computers and how to use them. Similarly, people have different memories and, therefore, call upon different factors in memory when going through any learning processes. This is where the issues on cognitive psychology come in the picture.

¹ ref : don norman's hci goals, www.useit.com

HCI and Psychology

User interfaces are designed to support the user to accomplish his tasks by using the system through the interface.

In order to make interface that is easy to learn, easy to remember and easy to apply to new problems, one must understand something about **learning, memory and problem solving**. These are topics which come under the cognitive psychology field while making the products that are efficient and effective is the central concern of engineering. Thus a study of both the fields is necessary to have an understanding of the users' needs (from psychology) and an understanding of potential solutions (from engineering).

1.4.1 Psychology issues related to HCI

a) Human Information Processing

The HIP model is the process involved in decision making which has mainly four stages of processing - encoding of the stimuli, comparing with memorized representation, formulating a response and taking an action.

b) Perception

The basic characteristics of human vision are highly important to computer graphics, because the ultimate goal of graphics is creating a visual stimulus sufficient for human observers to see a coherent and meaningful display.

Gestalt laws of perceptual organization (further explained in the next chapter) provide principles that help us to organize patterns of stimuli so that we can perceive and make sense of these patterns of stimuli.

c) Attention and Memory

Focussing attention and memory constraints are the key issues while dealing with interface design. Focused attention will let the user interact more effectively, guiding their attention to the relevant information on screen. To minimize information loss and influence remembering, grouping of information is employed to overcome the limitations of short term and long term memory.

d) Reasoning

There are two types of reasoning techniques -

Deductive: reasoning which attempts to draw necessary conclusions from a specific set of assumptions or premise. In general, it is a logical operation which proceeds from the general to the particular.

Inductive: reasoning in which general principles are inferred from the specific cases. In general, what is assumed true of elements from a class is assumed true of the whole class.

e) Problem-solving

Problem-solving happens by mapping knowledge relating to a similar known domain to the new problem. Solutions are achieved mentally or by manipulation by examining the perimeters, experimenting and working through the problem.

Studies into problem-solving were carried out by Gestalt psychologists, who emphasized the difference between solving a problem by understanding its structure and finding the solution by a blind application of known rules.

Gestalt laws

3.1 The psychology of perception

Several general principles of perceptual organization were first described in the 1920's by psychologists of the Gestalt school. The gestalt psychologists were interested in describing the processes by which individual elements were grouped into gestalts (wholes) during early visual perception studies (Wertheimer, 1958). By describing how the global structure of the whole emerges from the finer-grained local structure of the parts, the Gestalt principles can explain the success of many visual design techniques.

The close association between Gestalt psychology and the physiology of the sense organs forms a vital part of its early history and is still apparent.

3.2 The laws of perception

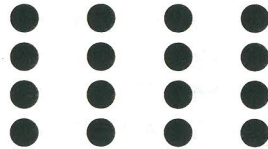
The grouping principles help artists and designers understand how humans perceive the visual field of view. Though each principle looks at the parts of an image, the overriding idea is that the whole is greater than the sum of the parts.

Following laws essentially govern the visual organization:

- 3.2.1 Law of Proximity**
- 3.2.2 Law of Similarity**
- 3.2.3 Law of Continuity (good contour or common destiny)**
- 3.2.4 Law of Closure**
- 3.2.5 Law of Common movement**

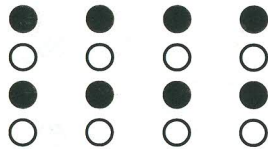
Two more factors are also associated with the above rules:

- 3.2.6 SYMMETRY**
- 3.2.7 FIGURE AND GROUND**



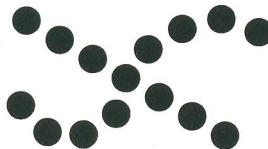
3.2.1 Law of Proximity

There is a tendency of individual elements to be associated more strongly with nearby elements than with those that are farther away. The eye organizes the dots first into four vertical columns because the horizontal separation is much greater than the vertical separation.



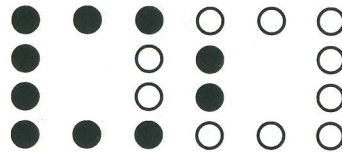
3.2.2 Law of Similarity

The elements will be associated more strongly when they share basic visual characteristics (such as visual variables of shapes, size, colour, texture, value and orientation) than when they differ along these dimensions. Or in other words, when more than one kind of element is present, those which are similar tend to form groups.



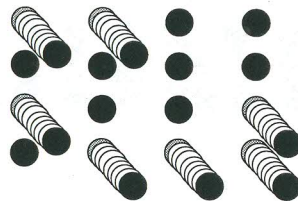
3.2.3 Law of Continuity ("good contour" or "common destiny")

The principle of continuity describes the preference for continuous, unbroken contours with the simplest possible physical explanation, rather than more complex but equally plausible combinations of more irregular figures. It is an instinctive trait of humans to follow a visual path. Continuation is the principle of leading the eye on its focus path.



3.2.4 Law of Closure

The principle of closure describes the powerful human tendency to interpret visual stimuli as complete, closed figures, even when some of the necessary contour information is absent. Other things when equal in characteristics, lines which enclose a surface tend to be seen as a unit.



3.2.5 Law of Common movement

Elements are grouped when they move simultaneously and in a similar manner. This is an important factor in interfaces having moving images or other elements like text or background.



3.2.6 Symmetry

The principle of symmetry describes grouping based on the emergent properties of the form instead of the characteristics of its constituent parts. The greater the symmetry of a possible figure, the more likely we are to use it as our interpretation of the gestalt.

3.27.7 Figure and Ground

The elements demonstrates a figure/ground relationship in equilibrium that creates an ambiguous focus. We cannot see both the figures at the same time, but have to switch between them. The classic example of the vase and two faces can be interpreted in a more useful concept with the use of figures or text along with their backgrounds.

Gestalt examples in HCI

1. Proximity

a) the links on the top of yahoo homepage are different in character, however, due to its closeness with each other they form a group.

b) the words are grouped vertically by distancing the space between two columns

The screenshot displays the Yahoo! homepage layout. At the top, there are several promotional banners: 'Yahoo! Careers' with the text 'find a job, post your resume', 'cool cell phones' with 'up to \$80 cash back!', and 'Yahoo! Travel' with 'plan your holiday travel'. Below these is a search bar with a 'Search' button and a link to 'advanced search'. A horizontal menu of links follows: 'Shopping', 'Computers', 'Videos', 'DVDs', 'CDs', 'Toys', 'Electronics', 'Video Games and more'. Below this menu is another row of links: 'Auctions', 'Autos', 'Classifieds', 'Shopping', 'Travel', 'Yellow Pgs', 'Maps', 'Media', 'Finance/Quotes', 'News', 'Sports', 'Weather', 'Connect', 'Careers', 'Chat', 'Clubs', 'GeoCities', 'Greetings', 'Mail', 'Members', 'Messenger', 'Mobile', 'Personals', 'People Search', 'Photos', 'Personal', 'AddrBook', 'Briefcase', 'Calendar', 'My Yahoo!', 'PayDirect', 'Fun Games', 'Kids', 'Movies', 'Music', 'Radio', 'TV', and 'more...'. Below the links is a section titled 'Make a Connection with Yahoo! Personals' with a form for 'I'm a' (Man) and 'seeking a' (Woman). To the right is a 'In the News' section with a headline: 'Anti-Taliban forces claim to take key city of Mazar-e-Sharif'. Below the main navigation area is a 'Just 4 You!' section with a grid of links: 'Rediff Bol', 'E-Cards', 'Astrology', 'Movies', 'Women', 'Romance', 'Chat', 'Health', 'Home & Decor', 'Matrimonial', 'Auctions', 'Contests', 'Homepages', 'IT Education', and 'Tech Jobs'. Below this is a 'Exchange Recipes and Food Tips' section with a link to 'Daily Newsletters'. To the right of the 'Just 4 You!' section is a 'Rediff Finance' section with a 'GET QUOTE' button, stock market data (BSE 3079, NSE 1004), and links to 'Insurance', 'Affordable Health Cover', 'Special Offers', 'Easy Banking', 'Stocks / Trading', 'Mutual Funds', 'Credit Card / Loans', 'Non Life Insurance', 'Life Insurance', 'Portfolio Tracker', 'Market Report', and 'Money News'. Below the 'Rediff Finance' section is a 'Rediff Guide to The Net' section with a 'SPECIAL: A Guide to Top Holiday Destinations' link, a 'What are you searching for?' section with links to 'Anthrax?', 'Bin Laden?', 'Taliban?', 'US Military?', 'Actresses?', 'Actors?', 'Games?', 'Education?', 'Bollywood?', and 'Ecards?', and a 'SITE TOUR' section with links to 'Seven Sites' and 'Great Cartoonists'. Below the 'SITE TOUR' section is a 'FEATURE' section with a link to 'Sampling the World by Degrees'.

- your search results
- references
- behaviourism
The Macmillan Encyclopedia
2001
- psychology
The Macmillan Encyclopedia
2001
- language
The Penguin Dictionary of
Psychology
- memory
The Penguin Dictionary of
Psychology
- psychology
The Penguin Dictionary of
Psychology
- view all references (55)

cognitive psychology

The branch of psychology dealing with the higher mental faculties: perception, memory, language, and thought. Cognitive psychologists are interested in how humans take in information through the senses (particularly in reading and speech), store it in memory, and manipulate it during thinking and reasoning. Cognitive psychology has been one of two major developments in psychology since World War II (the other being social psychology). Its concern with internal mental life and human development contrasts with the weakness of behaviourism in such areas. Child psychology and cognitive development are areas of major concern. It includes the study of attention as an executive controller of mental activity. The computer has provided cognitive psychologists with a metaphor for looking at mental processes, using the language of computer programming and the concepts of information input, storage, retrieval, and processing to describe the brain as an information-processing machine. Cognitive psychology includes research in artificial intelligence and the brain sciences, in particular neuropsychology. Recently the computer metaphor has been abandoned by some scientists, since the brain utilizes fundamentally different principles of computation. They suggest that modelling the electrical activity of large networks of nerve cells in the brain allows a more direct understanding of the brain's possibly unique methods of information-processing.

3.2 similarity

- a) all the further reference links, though far apart from each other in the whole paragraph, are of same colour forming a group through its similarity.
- b) similarly, keywords and reference links are differentiated by use of different colour to easily make out the links and the search keyword.

Search results 1 to 10 of 183 for search term reasoning

- reasoning
reasoning Suppose you have (in mind) **reasons** for believing you have been lied to, or **reasons** against visiting the dentist, or **reasons** to...
The Oxford Companion to Philosophy
- practical reason
...function as universal law? The scope of practical **reason**, however, is much wider than this: practical **reasoning** must (for example) include the critical comparison and sifting of alleged human goods and...
The Oxford Companion to Philosophy
- logic n.
2 a chain of **reasoning**; **reasoned** argument (I don't follow your logic ; is not governed by logic). b the correct or...
The Oxford English Reference Dictionary

Netscape Mail Cal

CNN.com Editions: Europe Asia

Updated: 03:15 a.m. EST (0815 GMT) -- 10 Novemb

WAR AGAINST TERROR



Taliban: Key city has fallen

- The Taliban and the opposition say that the strategic northern Afghan city Mazar-e Sharif has been taken by the Northern Alliance.
- President increasing by 25 percent number of troops available at airports
- Indian Prime Minister Vajpayee expresses "solidarity" in meeting with Bush

FULL STORY »

Why is Mazar-e Sharif significant?
TIME.com: [Rebels: Mazar-e Sharif is ours](#)

Bush calls up more reserves
Military Desk Briefing | War Room
Afghanistan: [Info](#) | [Strikes map](#)
Voices: [Message board](#) and [chats](#)

ON THE SCENE [more»](#)

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Kelly Wallace: [Anti-terrorism strategy](#)
Wolf Blitzer: [New war, new commander](#)
Map: [Go On the Scene with CNN](#)

THE MASTER FIGURE SK
Coming on November 29th

Google™ [Advanced Search](#) [Preferences](#)

modular furniture

[Web](#) [Images](#) [Groups](#) [Directory](#)

Searched the web for **modular furniture**.

Category: [Business > Industries > Manufacturing > Consumer Product](#)

[USM Möbelbausysteme](#) - [[Translate this page](#)]

USM Möbelbausysteme, perfekte Funktion und Qualität in zeitlosem Design. Haller gehören dazu ...

[www.usm.com/](#) - 3k - [Cached](#) - [Similar pages](#)

USM Modular Furniture- Configuration Assistant

The usm.com site requires the following, one of which (or more) could not be established. ...

[www.usm.com/italienisch/](#) - 7k - [Cached](#) - [Similar pages](#)

[[More results from www.usm.com](#)]

Decunhas Modular Furniture, knockdown furniture for home

... Decunhas are providers of **Modular** concepts in furniture making. Our goal is to provide full justice to the conceptualization of our clients and ...

Description: **Modular** knockdown furniture for offices and homes, with a wide range of options.

Category: [Business > Industries > Manufacturing > Consumer Products](#)

[www.decunhas.com/](#) - 65k - [Cached](#) - [Similar pages](#)

Northwest Modular Furniture Systems--Used Office Furniture

Northwest **Modular** Systems Furniture was founded in 1987. No pre-owned office furniture from small businesses, large corporations.

[www.nwmodular.com/main.htm](#) - 3k - [Cached](#) - [Similar pages](#)

[[More results from www.nwmodular.com](#)]

modular furniture, modular office furniture

... Whether you're in need of an ergonomic task chair or a complete modular office plan, spriggsinc.com can fulfill your every need. Our complete line of ...

[www.spriggsinc.com/furniture.htm](#) - 11k - [Cached](#) - [Similar pages](#)

GMDC Arts and Industry Center - Modular Furniture

About GMDC ... Wood Carving. Contact Us. **Modular Furniture**.

[sm_tables.jpg](#) (12239 bytes) SPACECRAFT.

[www.gmdconline.org/index/mod_furniture.html](#) - 7k - [Cached](#) - [Similar pages](#)

3.3 continuity

a) the main tabular menu on the left is broken down by advertisement, still

good contour is followed and the blue menu bar can be seen as a group.

b) the offsets in the search results indicate that they are sublinks of the above mentioned search result, one can clearly perceive the sublinks as secondary and this helps in providing good continuation to the main links.

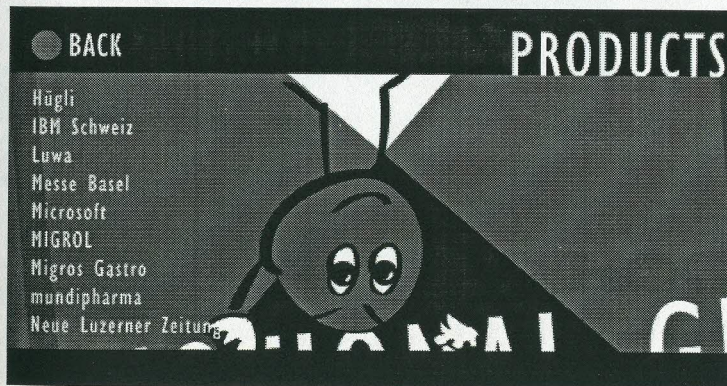
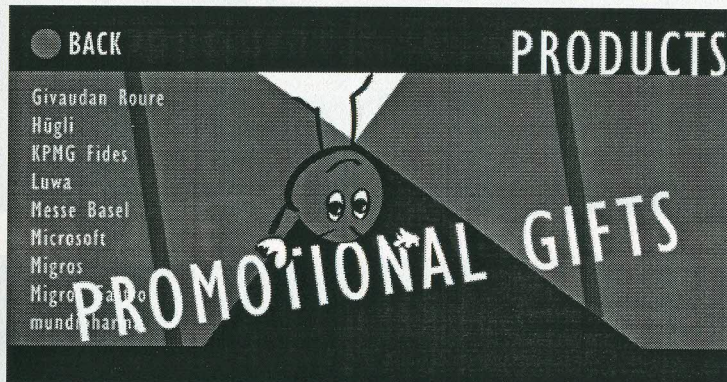
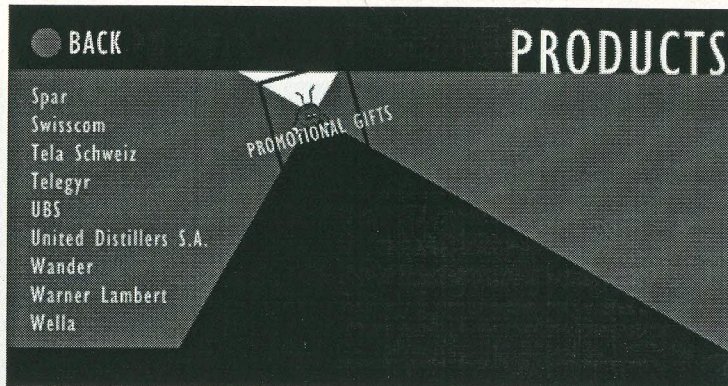
Take a Tour of Yahoo! Personals - where millions of singles meet!

Arts & Humanities Literature, Photography...	News & Media Full Coverage, Newspapers, TV...
Business & Economy B2B, Finance, Shopping, Jobs...	Recreation & Sports Sports, Travel, Autos, Outdoors...
Computers & Internet Internet, WWW, Software, Games...	Reference Libraries, Dictionaries, Quotations...
Education College and University, K-12...	Regional Countries, Regions, US States...
Entertainment Cool Links, Movies, Humor, Music...	Science Animals, Astronomy, Engineering...
Government Elections, Military, Law, Taxes...	Social Science Archaeology, Economics, Languages...
Health Medicine, Diseases, Drugs, Fitness...	Society & Culture People, Environment, Religion...

- [Eng](#)
- [anr](#)
- [Xhr](#)
- [Shc](#)
- [Am](#)
- [trip](#)
- [Bid](#)
- [nev](#)
- [use](#)
- [Fin](#)
- [cov](#)
- [Tra](#)
- [Pol](#)
- [Mo](#)
- [Mo](#)
- [YLI](#)
- [YLI](#)
- [che](#)
- [Asi](#)

3.4 closure

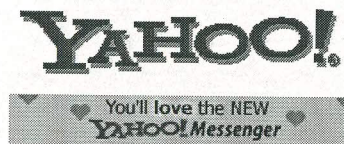
a) Eventhough no borders are used, by the presence of surrounding elements and by forming a closed group of similar elements it follows closure.

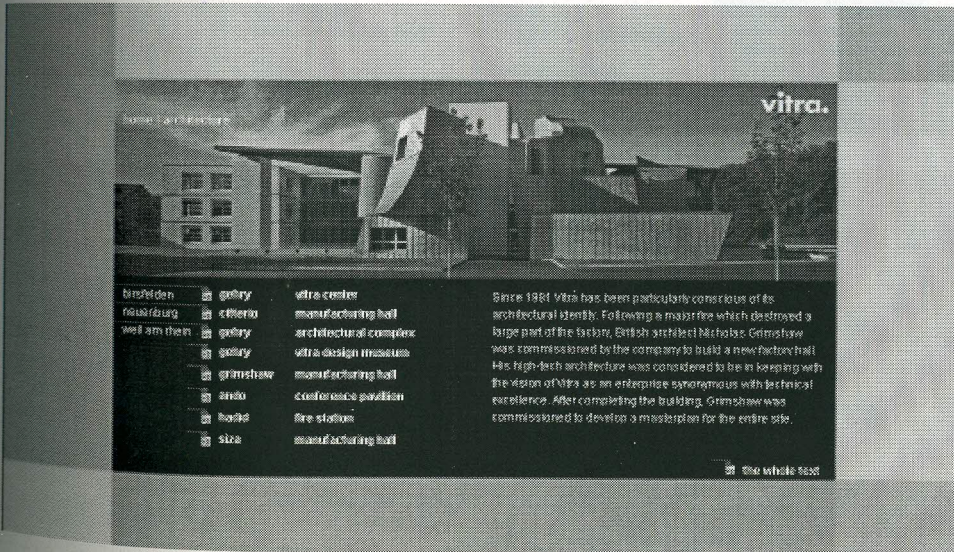
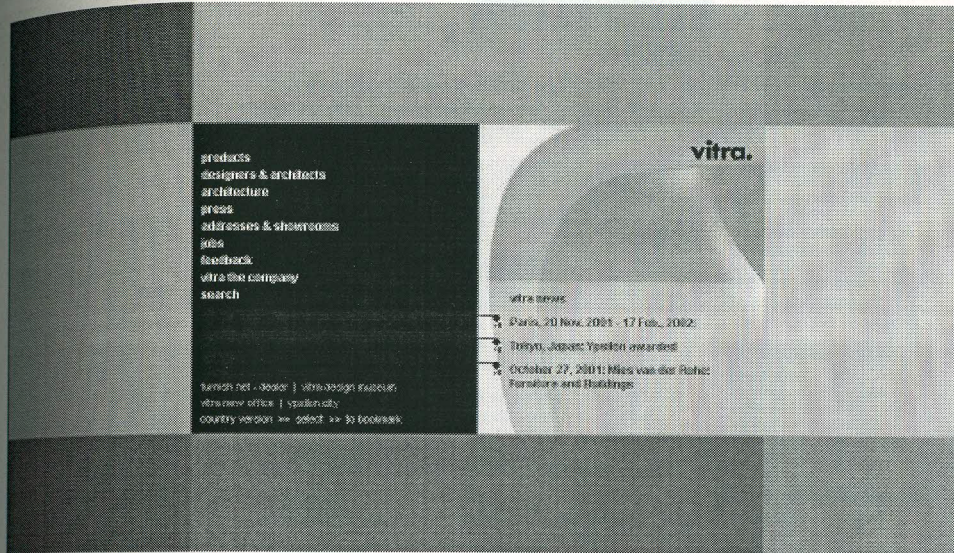


3.5 common movement

a) Moving images, text or symbols following a similar path group together. This is specially seen in websites and other web applications.

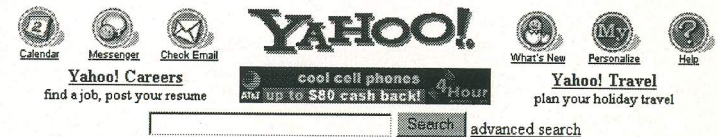
b) the small advertisement uses moving images as the best method to draw attention of the viewer. The same effects are featured in the messenger application.





3.6 symmetry

- The site uses symmetry as the basis of visual organization making it simple to use and attractive by the use of colours. Both vertical and horizontal symmetry is used quite effectively.
- Yahoo has exploited the benefits of symmetry by using it on top of the site to create interest on the main page. Both the logo and icons (navigation links) gives a balanced feel to the homepage.



[Y! Shopping](#) · [Computers](#) · [Videos](#) · [DVDs](#) · [CDs](#) · [Toys](#) · [Electronics](#) · [Video Games](#) and more
[Shop Auctions](#) · [Autos](#) · [Classifieds](#) · [Shopping](#) · [Travel](#) · [Yellow Pgs](#) · [Maps](#) · [Media](#) · [Finance/Quotes](#) · [News](#) · [Sports](#) · [Weather](#)
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[Personal](#) · [AddrBook](#) · [Briefcase](#) · [Calendar](#) · [My Yahoo!](#) · [PayDirect](#) · [Fun Games](#) · [Kids](#) · [Movies](#) · [Music](#) · [Radio](#) · [TV](#) · [more...](#)

Make a Connection with Yahoo! Personals

I'm a seeking a

Enter City, State or ZIP:

[Take a Tour of Yahoo! Personals](#) - where millions of singles meet!

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[Xbox Exclusive](#) - Only at Yahoo! Shopping - ships Nov. 19th
[American Airlines Sale](#) - round trip flights starting at \$198
[Bid on Pamela Anderson's dress](#) - new! [Y! Warehouse](#) - buy and sell used products

Broadcast Events

[FinanceVision](#) - live market coverage M-F 9am-5pm ET
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[Y! Essentials](#) download it now!
[Y! Games](#) - [spades](#), [canasta](#), [chess](#), [dominoes](#), [euchre](#), [hearts](#)
[Astrology](#) - what's your sign?

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[Access Yahoo! via](#): [Pages](#), [PDAs](#), [Web-enabled Phones](#) and [Voice \(1-800-My-Yahoo\)](#)

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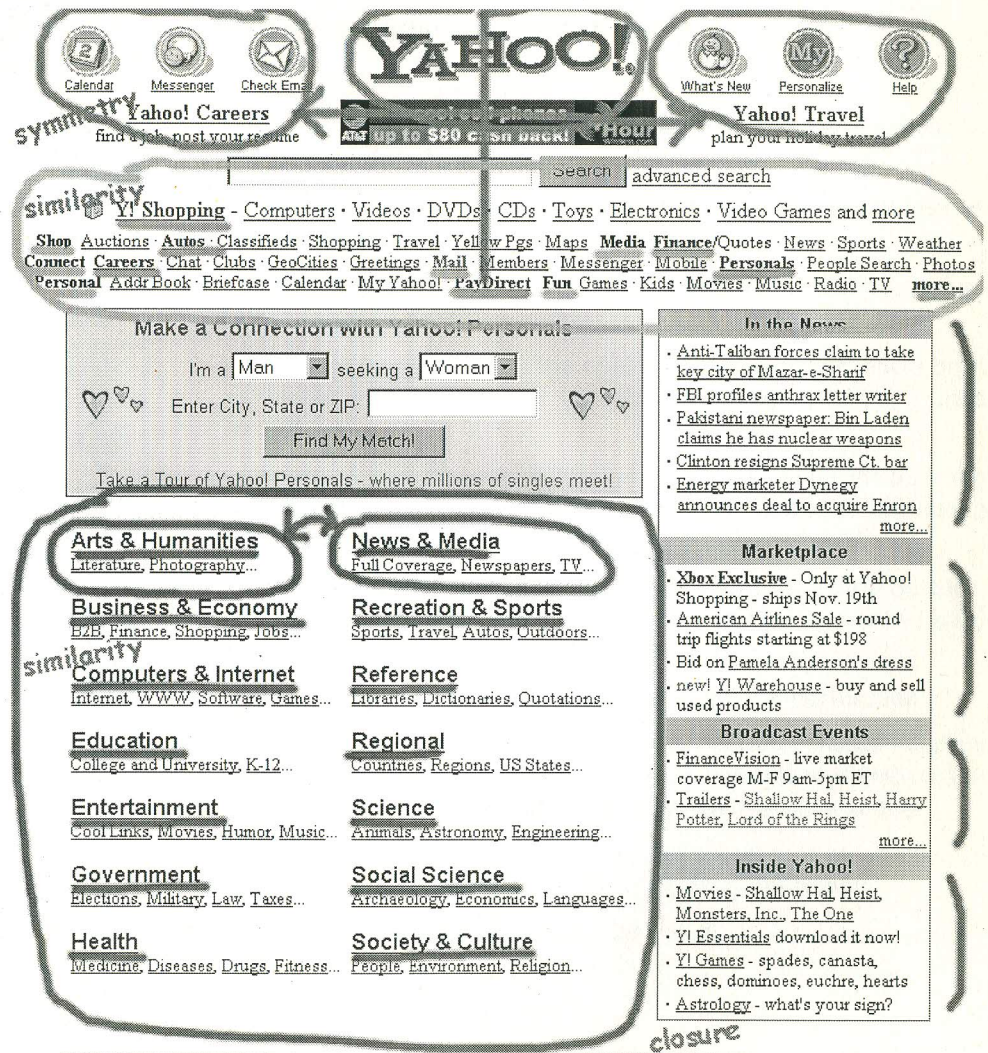
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4.1

Gestalt in YAHOO!

Where grouping works...

- Simple, neat and text based look gave yahoo the immense success and popularity
- Yahoo relies more on creating various categories by chunking of information in smaller units. This helps to divide the complexity it provides on the homepage into easily readable and usable information.
- Its hierarchy structure with categorized links and few direct links to other yahoo services helps to avoid clutter on homepage and gives the user maximum control.
- The homepage is devoid of any image-based gimmicks (except the small ad banner) thereby enabling faster download rate.
- All the text for links are blue in colour and non-emphasized text is black in colour clearly differentiating the two elements.
- Font size is consistent throughout the page and only headings offer variation in font size.
- Six icons (navigation images) in form of buttons are placed in symmetry to the logo for direct links.
- Minimal design and maximum functionality.



The grouping of information on yahoo homepage

Gestalt in mobile phones

Panasonic mobile phones

Mobile phones pose a challenge in interface design as the physical control panel and the display screen are closely placed and buttons are related to the icons on the screen. Shown here are three models of panasonic mobile phones displaying how grouping and differentiation guides the user for better control.

- The icons for phone book and menu are directly grouped with their physical operating buttons. Though in these models one cannot perceive the icons and the buttons as one group.
- The panel organization is also laid out according to gestalt grouping and differentiation is done by change in shape and symbols. The variation in buttons are done to chunk similar function keys together.
- Only other informative icons (battery life and volume) used on the main display are symmetrically arranged to have a sense of balance.



allure

promax

versio

Guidelines for designers

The first step in development of structure is the grouping of display elements into higher-order units. Without the integrity provided by a coherent visual structure, a design quickly becomes impossible to interpret and understand.

5.1 Benefits of Visual structure & Organization

Visual structure and organization provide the user with the visual pathways needed to experience a product in a systematic way. Structure affects the visual experience at its most primitive level because it is the first aspect of the display to be perceived as information is extracted and used to guide subsequent interaction.

Organized structure must be consciously induced by establishing relationships among the components of the design. Effective use of structure allows individual elements to work in concert without being diminished in their own right. The eye craves structure and will seek to impose its own organization onto a design whose structure is not readily apparent. This breakdown threatens communication, since the designer is no longer in control of the message.

Structure introduces four key benefits :

UNITY

Visual structure ties even highly disparate design elements together and allows them to work in concert toward a common communication goal.

INTEGRITY

A strong and coherent structure keeps the design focused on the communication goal by creating an emergent form that contributes to the meaning of the ensemble.

READABILITY

Structure enhances readability by dividing the information content of the entire display into manageable subsets that can be processed separately or parallel, according to the designer's wishes.

CONTROL

Structure allows users to predict areas of interest and eases their navigation through the composition. Control of structure allows the designer to influence this process of exploration and ensure that the information is delivered effectively.

Guidelines for designers

Listed are few guidelines related to grouping methods that can be referred by visual designers for the design of interfaces :

- **Alignment**

- identify the major boundaries in the existing layout, and look for the ways to enhance them by moving additional (or free standing) elements into the alignment with them.

- **Layering**

- group each item of information into a small number (generally taking the thumb rule of 7 plus/minus 2) of categories according to its origin or intended use.
- size and value within elements can establish clear perceptual hierarchies.

- **Symmetry**

- symmetry about the vertical axis is more prevalent in human perception and is generally more useful in visual displays.
- center the information on the axis of symmetry by carefully balancing the amount of information on the each side of the axis.

- **Space**

- review the organization of the information into a prioritized set of chunks of manageable size.
- 'white space is not a wasted space' - it can be used to direct user's attention to adjacent regions containing critical information.

- **Regularization**

- limit variation in typography to a few sizes from one or two families.
- use regular forms and simplified contours except where critical elements need to stand out in the display.

- **Integration**

- equalize the visual weight of figure and ground

- **Selection**

- avoid the mixing of purely textual, iconic, or symbolic signs within a single image set.

Conclusion

To be effective, design must be an integral part of the product development life-cycle. Design is valued for its fitness to a particular user and task.

The study gave me a wonderful insight into the field of human perception and its relevance to human computer interaction.

Gestalt laws of perception have provided important clues for forming rules for interface design, though with the complexity involved in interface design, I believe they cannot be used as quick formulas for design work. The laws provides understanding of the human capacities and these become the constraints to be followed while designing. It is seen from the examples studied that better grouping helps in achieving the HCI goals listed earlier in the report.

What next ? Study of Gestalt laws will help in compiling a set of rules or standards for the field of human interaction design. HCI researchers have already made a pathway, the matter is - how far can one go.

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