

Human Computer Interaction – A Systematic Approach on Interactive Web UI

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Abstract - Human-Computer Interaction also known as (HCI) is a multidisciplinary field of study focusing on the look of engineering and particularly the interaction between humans (the users) and computers. It is initially concerned with Computers and Users. The Humans interact with computers in some ways the interface or design between the humans and computers is crucial to facilitate this interaction. The desktop applications, internet browsers, computers makes a use of widespread graphical user interfaces of today. The Web Development and User Interface (UI) must consider a good design to satisfy the need of user interaction with websites. However, for a number of users, the interfaces of Web applications are still difficult and irritating to use. Irritation may end up in personal disappointment and unsuitable use but in addition it will have the worst effect within the workplace. If a person or user, experience a problem with misleading data or unexpected results it will reduce the person's willingness to use an application for an extended time. Good knowledge of Human-Computer Interaction (HCI) supports developers in designing useful, usable, and pleasant computing technologies and User Interface Designs for users which will help a lot while interacting with the website.

Key Words: HCI, UI, Web Applications, Web Development.

1. INTRODUCTION

Human Computer Interaction (HCI) is the study in which engineering influences human work and activities. The term "computer technology" now-a-days includes most technology from obvious computers with screens and keyboards to mobile phones, in-car navigation systems and even embedded sensors. HCI also has a corresponding design discipline also called as User Interaction Design or User-Centered Design which is focused on the way to design engineering so it is as easy and pleasant to use as possible and also as a perspective for user interaction between websites. A key aspect of the planning discipline is that the notion of "usability," which is usually defined in terms of efficiency, effectiveness and satisfaction. However, equally or more important in systems designed for private use. The computer program (UI) is that the point of human-computer interaction and communication in a very device this may include display screens, keyboards, a mouse and also the appearance of a desktop. It is also the way through which a

user interacts with an application or an internet site. There is a growing dependence of many businesses and companies on web applications and also for mobile applications which has led many companies to position their increased priority on UI in an attempt to boost the user's overall experience. The UI is usually talked together with user experience (UX), which includes the aesthetic appearance of the device, latency and also the content that is presented to the user within the context of the computer program. Both terms apply for the concept of human-computer interaction (HCI), which is that the field of study that specialize in the creation of engineering and also the interaction between humans and every one varieties of IT design. Specifically, HCI studies areas like UCD, UI design and UX design. An increasing demand on creating an optimized user experience has led some to carve out careers as UI designers and UX experts. Human Computer Interaction is the study about how people interact with computers and to what extent computers are or don't seem to be developed for successful interaction with human beings. Basically HCI consists of three parts such as: the user, the computer itself, and the ways they work together.

User - By a "User" I can be a personal user, a group of users that are working together. An appreciation of the way people's sensory systems (sight, hearing, touch) relay information is significant. Also, different users form different conceptions or mental models about their interactions and produce other ways of learning and keeping knowledge.

Computer - When we talk about the PC or Desktop, we are pertaining to any technology starting from desktop computers, to large scale computer systems. For instance, if we were discussing for the planning of a web site, then the web site itself would be stated as "the computer". Devices like mobile phones can also be considered as "computers".

Interaction - There are various differences between humans and machines. HCI tries to make sure that they both get on with one another and interact successfully. So as to achieve a usable system, you would like to use what you recognize about humans and computers, and work with likely users throughout the design process. In real systems, the schedule and budget are important, and it is vital to look out for a balance between what would be ideal for the users and what is feasible for them in actual.

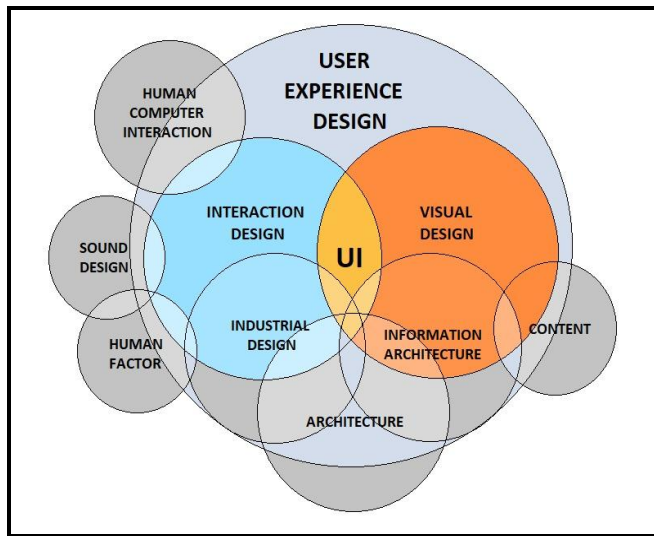


Image with reference from Adobe blog.

2. LITERATURE REVIEW

A Bad website design do not follow any particular rule or formula. While a number of the business websites may need great elements mixed with inferior parts, while others suffer from the “good ideas, bad execution” problem. Another users experience both bad ideas and bad execution.

Too much Clutter – A number of the websites have an excessive amount of content which actually isn't needed. What does your homepage appear as if initially glance for users? An expert looking website contains a concise statement, a watch catching photo, a decent call to action – which is about it. Homepages or usually called as index pages which is that the most significant a part of an internet site are designed to present users with the companies most beneficial information, during a good and visually attractive way. Overcrowded sites don't seem to be only displeasing to the attention, but they also look less credible. Crowded sites often violate the golden rule of white spaces, which is crucial for maintaining user attention. Our brains looks for order and ease, and an excessive amount of content in one page will just increase the likelihood that a user will navigate far from your page and cannot waste much time thereon.

It Has Content Problems - Content that is of both top quality and useful is one in every of the foremost important driving factors for both SEO and boosting conversion rates. A business blog that makes actionable content could be a must, both for solidifying your reputation and securing your place on the coveted first page of search engine results pages (SERPs). The corporate blog is non-existent or not frequently updated. If you simply update a blog every few months, it's as if you're not trying hard enough to achieve attention of users for your company. Aim to post content a pair of times every week, as this drives SEO and lets your users know you're actively involved within the industry. If the content is

irrelevant. There's no point in blogging only for the sake of content. If you're visiting have a corporation blog, fill it with useful tips on your industry. Giving some information via posts, lists, and various tutorials give your readers something valuable. If you are doing just format the content correctly otherwise it will result in content problem issues. Businesses still be the trap of keyword stuffing, thinking it will improve their SEO when after all it does the other. You will even be failing to the correct sources that would improve your website's reputation. Over time, these little mistakes add up.

It doesn't Meet User Expectations - Your website's users have high hopes when it involves usability. Users expect the website to adapt seamlessly to every screen, contain relevant information which is easy to access. The foremost important characteristic of a website is its easy use. Usable websites have a competitive advantage and stand to form more money. Less usable websites can lose you plenty customers and clients attempting to find business which will cost you money. To see if your site is meeting user expectations, take a proper feedback from your established and potential customers and partners.

It uses an excessive amount of Flashy Animation or Videos - When done well, animations can serve knowledgeable purpose on your website. Large files (videos, animations and huge pictures) can slow the speed of your site. As per a study of website such as Adobe a number of individuals will navigate faraway from a site if its images take too long to load. The same applies to “splash pages,” which do little over raising your page's bounce rate. When people cannot find what they need straight away, they're more likely to go away. On the opposite hand, functional animation and pictures can make your website more productive. For instance, a Marketing survey found that over a third of individuals click your company's logo thinking it'll link back to your homepage. If yours doesn't, they may believe that it's because the link is broken.

Some of the critical reasons how a Bad Website Design affects your Business?

- Damages the credibility of your firm: If you're in a serious business, but your website is crowded with animation, excessive photos, and other clutter, then you are not sending a professional message to the users or clients.
- Makes your look and feel out of touch: A website if you do not update frequently does quite hurt your SEO. A dated website tells your customers you are behind the technological times, or worse that you just don't care enough to stay updated.
- Costs you customers: each time when a customer navigates away in frustration because of issues such as broken links, complex forms, or an excessive amount of navigation it is unlikely that you will see them again. If your competitor offers the identical services in an intuitive

website design t will be your loss and your competitor will take advantage and gain profit.

3. ANALYSIS AND IMPLEMENTATION

In analysis phase of a good interactive web UI we have come up with a solution and methods that can be used or inherited and keep some things in mind while developing a website and UI. The various methods that can be used as follows:

- The organization of the website should be logically organized.
- Proper Content Utility should be provided for the website. Whether the information provided is useful or interesting to the particular user.
- Navigation of the website should be easy to navigate. Memorable elements should be used to facilitate returning users to navigate the site effectively for example by using layout or graphics in the website.
- The use of Graphical Representation in a website. It should contain items such as Icons, Contrast Colours and Multimedia Content etc. to catch the user’s attention.
- The main purpose of the website should be specified clearly. For which purpose the website is created or being created such as (Personal, Commercial, Educational) use.
- The website should provide valid links to the particular content if specified. It should redirect the user to the particular source or the content. It should not be broken or invalid.
- The design of the website should be simple to interact with users. It should follow simple approach.
- The website should check for the Impartiality content means the information provided by the website is fair and objective. And also the information provided is credible and accurate.
- The website should be consistent and reliable i.e. is the website consistently designed (no changes should be done in page layout throughout the site).
- The website should not take longer time to load. If it takes usually longer time then we can make use of preloaders to load the site so that user can be kept engaged till the page loads.
- The website should possess the main functionalities such as security and privacy. The website should be able to securely transmit, store and display personal information or data.
- Make the website interactive so that the user can interact with it properly and also keep posting comments or receive recommendations for similar purchases.
- The website should possess strong user control capabilities. It means that does the website allows

individuals to customize their experiences (such as the order of information they access and speed at which they browse the website).

- The website should have main feature of Readability. Is the website easy to read and understand (Ex: No grammatical mistakes and spelling errors etc.).
- The website should be efficient enough. Is the information presented in such a way that the users can find the information they need.
- The website should have scan ability function. It gives the users the choice to pick out relevant information quickly as per their demands.

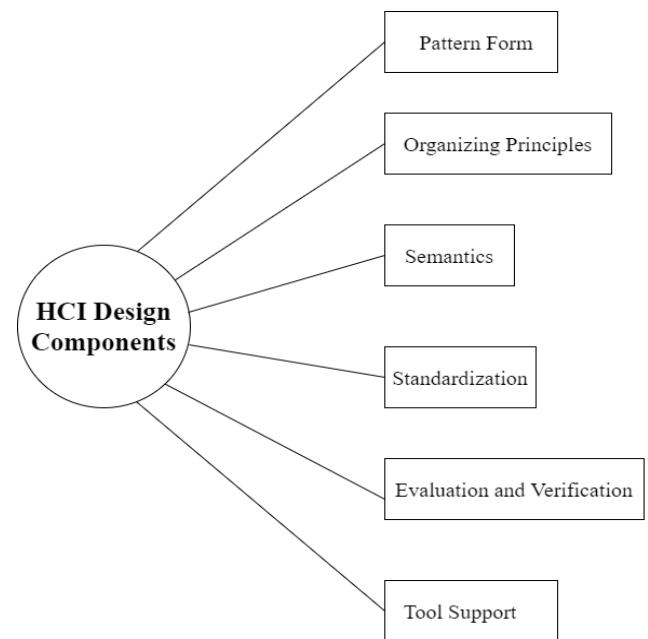


Fig: Some of the Components used in HCI Web Design

There are also various web development tools used nowadays to increase the interactivity and design of the website which can increase the user interactivity with the website. There is a tool called as Bootstrap which can be used to increase the responsiveness of the webpages which are being created for the website. Bootstrap is a Front End Framework for faster and easier web development process. It provides the ability to easily create responsive designs. The main purpose of responsive web design is that it helps in creating the websites which can automatically adjust themselves to look good on all devices for example from small phones to large desktops. Currently Bootstrap 4 is the latest version of Bootstrap, It consists of features such as new components, faster stylesheet and more responsiveness of website. Bootstrap has various advantages such as it is easy to use, having responsive features, mobile first approach and browser compatibility.

Another thing that can be used in making websites interactive is the use of Front End language such as HTML5 and CSS3. HTML is an abbreviation for Hyper Text Markup Language and CSS is an abbreviation for Cascading Style Sheets. HTML5 is a standard markup language used for creating webpages. It is mostly used for describing the structure of the webpage and consists of series of elements in it. CSS3 is used for describing the style of an HTML document. CSS is mainly used for styling a webpage and format the content structure. Some of the key modules that can be used in CSS are Text effects, Selectors, Backgrounds and borders, Animations, Multiple column layouts, 2D/3D Transformations etc. While building a highly interactive web pages CSS3 is highly recommended because it provides wider options for designing. It allows the web designer to create websites that are rich in content and low in code.

3.1 GESTALT PRINCIPLES USED IN UI

Gestalt Principles also called as Gestalt laws of grouping are used for account for the observation that humans naturally perceive objects as organized patterns and objects. The law describes that how the human eye perceives visual elements and also aims to show that how complex scenes can be reduced to more simple shapes. The law was developed by a group of psychologists in Germany and developed a series of theories of visual perception.

- 1) Proximity - The Gestalt law of proximity states that the objects or shapes that are close to each other appear to form groups. Even if the shapes, sizes, and objects are radically different, they're going to appear as a group if they are close. It refers to the way the smaller elements are "assembled" in a composition. It is also called as "grouping", the principle concerns the effect generated when the collective presence of the set of elements becomes more meaningful than their presence as separate elements. Grouping of the words changes the visual and psychological meaning of the composition in non-verbal ways unlike to their meaning. Elements which are grouped together create the illusion of shapes or planes in space, whether or not the elements are not touching.
- 2) Similarity - The Gestalt principle of similarity states that the perception lends itself to seeing stimuli that physically resemble one another as a component of the identical object. It is perception of relationships between object similar to each other i.e. grouping mechanism (Grouped by shape, colors, etc.). This allows the people to differentiate between adjacent and overlapping objects based on their visual texture and resemblance. Other stimuli that have different features are generally not perceived as a part of the object.

Therefore the laws of similarity and proximity often work together to form a Visual Hierarchy.

- 3) Closure - The Gestalt principle of closure refers to the mind's tendency to determine the complete figures or forms even if a picture is incomplete, partially hidden by other objects, or else a part of the knowledge needed to make an entire picture in our minds that is missing. Closure is additionally thought to have evolved from ancestral survival instincts in this if one was to partially see a predator their mind would automatically complete the image and know that it had been a time to react to potential danger even if not all the mandatory information was readily available.
- 4) Continuation - The Gestalt principle of continuation refers when there is an intersection between two or more objects, people tend to perceive each object as one uninterrupted object. This permits differentiation of stimuli even after they are available in visual overlap. Humans have a tendency to group and organize lines or curves that follow an established direction over those defined by sharp changes in the direction.
- 5) Common Fate - The Gestalt principle of common fate refers when visual elements are seen moving in the same direction at the same rate, perception associates the movement as a part of the same stimulus. This allows people to make out moving objects even when other details (such as the objects colour or outline) are obscured. The law of common fate is used extensively in user-interface design, for instance where the movement of a scrollbar is synchronised with the movement (i.e. cropping) of a window's content viewport; The movement of a physical mouse is synchronised with the movement of an on-screen arrow cursor, and so on.
- 6) Good Form - The Gestalt principle of good form refers to the tendency to group together forms of similar shape, pattern, colour, etc. Even in cases where two or more forms clearly overlap, the human brain interprets them in a way that permits people to differentiate different patterns and/or shapes. An example would be a pile of presents where a dozen packages of various size and shape are wrapped in precisely three or so patterns of paper, or the Olympic Rings.

4. KEY DESIGN ELEMENTS IN UI

- 1) Navigation of Website.

Navigation is one of the important factor while designing a website. It should have important factors such as:

- Salient menu bar.

- Consistency of navigation bar.
- Easy access to web pages (It should not have excessive backtracking/clicks and reach out through multiple pathways).
- Should contain proper search features and the users should feel in control and also ease of managing the website.

- Type of interaction.
- Organizational attractiveness.
- Information related to service policy.
- Contact and Organization information.
- The purpose of visiting and expectations.

2) Graphical Representation of Website.

Graphical Representation is very much important as the web application is much more of texts and information and it is also a medium for expressing creativity, data visualization, and presentation of information. It is providing factors such as:

- Inclusion of Images.
- Multimedia Content such as animation or audio.
- Visual attractiveness and layout.
- Use of various colors schemes, fonts and size of the text.
- Use of unique logos and icons.
- Making effective use of white spaces to avoid visual overload.

3) Organization of Website.

Proper organization of website is very much necessary to increase the user interactivity connected with the website. A website can be organized as per the requirements whether it will be used for personal, commercial or official use.

- Cognitive mapping and architecture of website.
- Should have understandable structure.
- Logical organization.
- Hierarchical and sequencing organization (Systematic arrangement and categorization).
- Meaningful labels, headings and keywords.

4) Content Utility of Website.

It is one of the important factors used for website design. It refers to the textual or visual content published in a website.

- Sufficient amount of information and motivation to keep visitors interested and further explore the site.
- Content quality.
- Current and up-to-date information.
- Information that should be relevant to the purpose of the website.
- Users need and requirements and utility.

5) Purpose of the Website.

It represents the actual purpose of the website being created and the motive behind it. It should have some qualities such as:

6) Simplicity and Readability of Website.

The website should have simple and readable layout so that user can interact with it without any hesitation and confusion.

- Should have simple subject headings.
- Transparency in information that will reduce search time.
- Website design optimized for various screens.
- Uncluttered layout and consistency in design.
- Minimize unnecessary features.
- Easy to read and well-written.
- Should be understandable and grammatically correct.
- Appropriate amount of content in each page in readable blocks.
- Appropriate content at reading level.
- Ease of using the site (Including first time visitors).

5. USER ENGAGEMENT IN WEBSITES

Site engagement can be considered as an indicator of your website's or web application's success and here are some of the most common and important user engagement metrics used to check user engagement. In today's low-attention economy, site engagement are often considered an indicator of your website's success. Customer engagement is related with overall profitability, as engaged users are more likely to buy, become repeat customers, and share the product or service with other people.

1) Pageviews. - Pageviews, sessions, and users are the most common metrics that are used to indicate traffic on your website. Pageviews are the most basic of all user engagement metrics, measuring an instance of a user visiting a specific page on your web site. Measuring pageviews will assist you to know how often people visit your website. A higher range may be assumed to be an indicator of interest and/or sensible SEO practices, since search engines are often the most important drivers of traffic to websites. Pageviews show traffic but without tying within the context of different related metrics, they can't assist you to totally perceive the means behind these numbers.

How to Track Pageviews?

You can use Google Analytics to trace most user engagement metrics. It is perhaps the foremost comprehensive free analytics package tool accessible. You can view pageview metrics under Audience > overview, and choosing a relevant time period. Aside from pageviews showing what percentage people visited your website over a given amount of your time, pageview analysis may also be used to show whether website changes (i.e., a new layout, an internet ad campaign, etc.) are performing as expected. As a straightforward rule, once your pageviews increase, it implies the changes you enforced should be operating a minimum of in terms of driving traffic.

2) Time on Page. - Many websites are churning out content on a regular basis, gaining an understanding of how much time people actually spend on your content and it has become an important user engagement metric. There are two ways to look at time spent they are as follows:

Micro view: Time spent on the particular page.

Macro view: The average session duration or average time spent on the website.

What is Time Spent on Page?

The time spent on page is a user engagement metric that measures the time a user spends on a page on your website. This metric provides and shows an indication of interest. For instance, the average person reads at a rate of about 200-250 words per minute. If your website have articles that are 2,100 words long (the blog post length, as found by Medium) and a visitor only spent 10 seconds on that page, then you can be sure that they are not very much interested in the content of the page.

What is Average Session Duration?

The Average Session Duration (formerly also known as Average Time Spent on Site) measures the length of an average session duration, over a specific time period, divided by the total number of sessions over a specific time period. A Session refers to a group of user interactions with your website and Average Session Duration refers to the total time spent on your website. This is different from time spent on page because it tracks all the activity that a visitor has completed on your website versus tracking just the time spent on a certain page.

How to Track Time Spent?

For this you can use Google Analytics to track how much time people spend on your website. User can find the average session duration metrics under the 'Acquisition' tab. Google Analytics tracks the page activities using timestamps every time a page loads or when an activity triggers more events in the page. This is measured by looking at the difference between when the first event occurred compared to the next. For example: If the page was viewed at 11:00 am and also the next one was viewed at 11:03 am, then the time

spent on page for the first page is 3 minutes. The problem with using timestamps to trace activity is that it cannot track the time spent on the exit page. The exit page is probably the last page the visitor looks before they exit the website completely. So if someone only visited one page and exited it, Google Analytics records the session duration as 0 irrespective of what quantity time they really spent on your website. Therefore, the values of average session duration and time spent on page reported are normally lower than what they are actually and should not be taken at the face value. If you recognize that your average blog post is about 500 words, and your readers spend between 1-2 minutes reading them, then you're in a good range.

3) Bounce Rate. - The bounce rate is called as the percentage of visitors to a website that exits website after viewing only one page. The bounce rate gives an indication of how good your content is and if the people are leaving without taking action, then your content is not relevant as per their expectation. People may bounce the website for several reasons such as:

- a) Your content or offer isn't what they expected.
- b) They got bored.
- c) You're not offering something different.

It is important to measure how your visitors are engaged to the website, it is also important to measure that how unengaged your visitors are. You might have high traffic but if you also have high bounce rates, this means your content is not engaging enough to make visitors stick around the website. How to Track Bounce Rate in Google Analytics is go to Behavior > Site Content > All Pages. You will see a column for Bounce Rate. To Improve the Bounce Rate take a look at your pages with high engagement of users and lower bounce rates. Try to determine what you did right on the page and that could be applied to other pages. Similar to Average Session Duration some ways that you can use to lower bounce rates are to produce great content and use internal linking to get people interested in navigation and clicking through to other related pages on your website. Deliver your content to be reliable and helpful. Also provide a good user experience such as no pop-up ads, audio, or automatic video playback.

4) Unique Visitors. - The Unique visitor is a term used to refer a person that visits a website at least once during the period. Google puts emphasis on tracking page views or visits but the unique visitors metric shows how many users or individuals actually reaches to your website.

Tracking Unique Visitors - Whenever you visit a website, Google Analytics assigns you a client ID that is stored in a cookie in your browser. This client ID is unique to each browser and not IP address, so if you visit a website using another browser, Google Analytics will recognize you as another unique user. This can address a problem or report

inaccurate results because of situations such as multiple people sharing one computer. There can be multiple visitors but only one is registered. A single person can visit your website from different computers or different web browsers. This will be counted as multiple visits, when they actually came from one person. In Google Analytics you can view the visitors by using go to Audience > Overview and look at the Users metric. This will tell you the number of unique visitors to your site. Tracking and comparing your statistics for unique visitors over a specific time period can say you whether any new visitors are discovering your website, or if your traffic comes from returning users. You can optimize or improve Unique Visitors by knowing your audience. If you have a good grasp of who your existing audience is, you can use this metric to take steps to find a new or related audience segment. Also promote your website taking care for looking towards the impact on different audience segments.

5) Conversion Rate. - The conversion rate is a term used to check the percentage of website visitors that complete desired actions. It is linked to overall profit and can lead to conversions, such as:

- a) Purchasing any of your products or services.
- b) Downloading your app, eBook, etc.
- c) Contacting your business and submitting a form.
- d) Engaging with your website in some way.

A high conversion rate tells you that your marketing skills are effective and they have resulted in your website visitors completing your end goal.

How to Track Conversion Rate - The good thing about conversion rates is that you just can tailor them to be broad or specific in terms of things like overall conversion rate, marketing channel conversion rate and Keyword conversion rate. Most of social media platforms like Facebook, Twitter, Instagram and Pinterest have their own built-in analytics tools that can be used to track conversion rates. Also for websites, you can use some tools such as Google Analytics or Google AdWords to track certain conversion rates. There is also a dedicated tab on Google Analytics for conversions, which is used to analyze data based on goals, attribution or multi-channel funnels.

6. CONCLUSIONS

Human-computer interaction also addresses human-centered and collaboration of cross-disciplinary fields to know users and contextual use of solutions. However, rapidly changing technology generates challenges to HCI practice like fail to introduce updated design for novel product. Design thinking process has been widely used as an innovative and user-oriented approach to unravel wicked problems with many diverse applications. Overall, HCI shares similar steps with iterative process such as understanding and observing users to figure out problems,

designing or ideation, prototyping and testing. However, each step has specific principles, determining the tools to use, and also the goals to realize. HCI requires understanding users to form requirements, applying design rules and principles for design, and focuses largely on designing software.

REFERENCES

- [1] Observing the User Experience, Second Edition: A Practitioner's Guide to User Research by Elizabeth Goodman, Mike Kuniavsky, Andrea Moed.
- [2] Interaction Design: Beyond Human - Computer Interaction (2011) by Yvonne Rogers, Helen Sharp, Jenny Preece.
- [3] Designing the User Interface: Strategies for Effective Human - Computer Interaction (5th Edition 2009) by Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs.
- [4] [Wikipedia.org/wiki/Principles of grouping](https://en.wikipedia.org/wiki/Principles_of_grouping).
- [5] [Searchenginejournal.com/user-engagement-metrics](https://searchenginejournal.com/user-engagement-metrics).
- [6] [Interaction-design.org/](https://interaction-design.org/) Design thinking the beginners guide.