



User interface design (C1U)

Class 3

Basic principles of user interface design

Usability

ISO-9241 International standard defines Usability as:

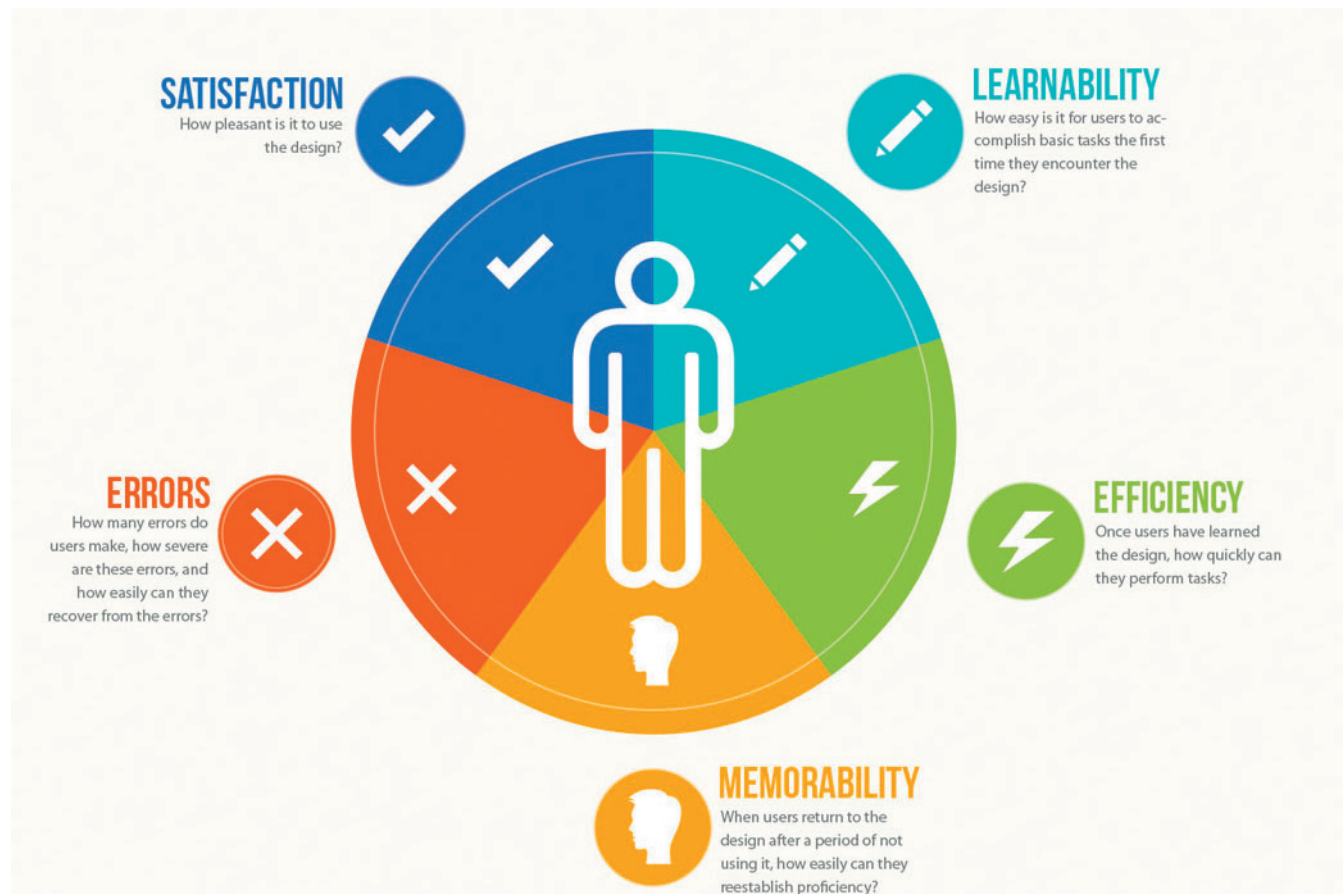
«The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use».

Usability is part of the *user experience (UX)* which is referring to the ease of use of an interface.

By itself, it is irrelevant to consider an interface as good or bad. An interface features needs to be evaluated in relation with the context of use and what tasks users want to complete.

To improve usability, it is important to emphasize the following three aspects :

1. The interface should rapidly become familiar to the users.
2. Users should be able to complete their tasks easily and as fast as possible.
3. The way the interface works should be easy to remember upon revisiting the web site.



Characteristics of a great interface

Utility

Utility is the result of the value-effort ratio. Users need a certain level of motivation in a certain context with certain expectations in order to use and interface to complete various tasks.

So, in other words, did the effort put by the user worths the value of the results? Did it meet the user's expectations?

Clarity

It is very important to make web site's content very clear, to avoid ambiguity that can cause confusion. Hierarchy and flow must feel natural and logical. Use titles, subtitles and captions in a consistent way.

Navigation must be easy and natural to use and to understand. It must be intuitive which means users should find the features without have to search for them. Be careful to select navigational terms correctly and use icons (visual metaphors) whenever possible.

Concision

We are often scared not to be clear enough and that makes some of us give too many details. That should absolutely be avoided.

Keep texts short and don't label everything. An interface must be light, not over clustered.

Too many elements or too much informations leads to confusion and adds to mental load. The fact is that if there is too much text, users won't read any of it. The real challenge when producing a user interface is to be concise and clear.

User-friendliness

User-friendliness has to do with the level of user comfort and satisfaction associated with the use of an interface (user experience). It is closely related to familiarity.

Familiarity

As mentioned earlier, the users need to feel concerned, that the web site has been designed for them. Make them feel at home. Everything needs to feel natural and based on common sense. Avoid shocking the users and make them feel disoriented. Metaphors used in everyday life can be put to profit. Using standards and cognitive ergonomics is the best bet.

Responsiveness

It is important for the interface to give feedbacks to the user at all times. For instance, if the user clicks on a module that can take some time to load, think of using a spinning pointer, a progress bar or a feature of some sort that let the users know that the feature is processing.

But this goes for very simple processes as well. For instance, when a user clicks on a link saying «products», it is expected for the products page to show (positive responsiveness). But if the text changes, but the title identifies the new page of content, the user has no way to know if the good content is showing, if the responsiveness is positive or not.

Using breadcrumbs is an efficient way to solve this potential problem.

Reliability

A reliable interface is one minimizing the risk of any type of errors to occur, and one making it easy to correct any of these errors.

Consistency

Cohesion is another important factor. The design must be coherent within navigation and layout. Every feature should have a constant location and text of different natures should be of similar style and be located in dedicated zones throughout the web site. In a consistent interface, users recognize where they are instead of being recalled.

Aesthetics

Although aesthetics can be perceived as secondary, it is actually very important. It contributes to the user experience by bringing satisfaction. The theory of uses and gratifications has proven with no doubts that the user experience is one major factor for popularity.

Also, aesthetic choices can help other characteristics and features. For instance, color coding can help the users knowing where they are in the site. Researches shown that minimalistic designs are much more efficient than overcrowded interfaces. So, the KISS rule of design applies here as well (Keep It Short and Simple).

Efficiency

The interface design should focus on saving as much time as possible for the users who should complete their tasks easily.

Work to diminish the number of clicks necessary to reach content and provide shortcuts whenever possible. Avoid forcing users to move from one extreme of the interface to the other and also avoid using technology that aren't universally used (such as Flash).

Control

An interface is a tool at the service of the users, not the other way around. Users must feel in control, that nothing is imposed to them.

Don't get the users trapped in your web site : give them control! Anticipate typical users need and create defaults. For instance, you can use pre-filled forms or use the most common language for the homepage. If necessary, supply help and documentation.

Even in applying responsiveness with alerts and such, make it feel like suggestions instead of commands, that can make all the difference. Some web sites and applications even use positive reinforcement, cheering the users so they feel in control of the system.

Forgiveness / reversibility

Most of possible users mistakes should be anticipated and easy solutions should be given to them to correct any error (e.g. back arrow, continue shopping, etc.).

This is an important aspect of user interface design as users will dare trying different functionalities if they trust their choices may easily be changed or void. For instance, entering full-screen mode can create insecurity if nothing insures the users to easily be able to come back to standard view.

Cognitive ergonomics

Cognitive ergonomics is commonly described as *the science of fitting the system to the human*. It consists of adapting systems, interfaces and processes to fit human abilities and limitations.

We are used to physical ergonomics where space, tools and tasks are adapted to suit human needs. For instance, the handle of some tools has been adapted to avoid wounds or to optimize strength, chairs have evolved in order for office workers not to develop back pain, QWERTY keyboard has made it faster and more natural to type, etc.

Cognitive ergonomics, on its part, tries to adapt systems and tasks to the human way of perceiving and understanding their environments taking into account its specificities.

Cognitive ergonomics made it possible to establish universal standards such as nuclear power plant's systems taking into consideration humans can make mistakes, universalized the use of red lights for cars to stop, or of the stop sign that anyone will understand even though it is written in a different language. Also, isn't CTRL-P for printing more intuitive and logical than F-4?

Identification and understanding of interface elements

For an interface to be efficient, users must be able to understand the features and functions of the interface's elements. If the users don't know what to do or if they don't understand the interface rapidly, they won't be able to use it easily.

in some sort of temporary memory, a buffer that's independent from short and long term memories.

So, perceived information first goes through perceptual memory to then be stocked briefly in the *short term memory*. A good interface will make it possible for this information to be moved to long term memory, otherwise it is deleted.

The law of least effort

A user, for different reasons, doesn't want to lose time nor energy (physical and cognitive). So, users have a tendency not to learn nor remember functionalities if they don't seem useful.

For instance, it is well known that a user can only recognize rapidly a maximum of seven elements (5 to 9, actually) which can be memorized for a maximum of fifteen to thirty seconds. More elements cause too much of a mental load and if those elements aren't transferred to *long-term memory*, the data is lost.

A good design will consider cognitive ergonomics based on the tasks that can be completed to allow new users to complete its tasks easily, rapidly, and in an as intuitive as possible way.

The ease to remember information is related to their familiarity and their volume. It is much more easier to remember five words of a known language than ten of an unknown language.

Humanizing the information treatment

This has to do with what is commonly called the mental load which takes into account the user's senses and mnemonic limits, the limits and ways a user perceives, learns, remembers and thinks.

It is important to limit the mental load and structure information in a way that will simplify user's tasks on a web site.

Long term memory stocks data on the long term, but it is more difficult to access. The only way to use long term memory is to organize correctly information so users can remember more easily. Therefore, cohesion and consistency are very important.

Optimizing perceptual memory

Perceptual memory is a part of the memory which manages information perceived with our five senses. It stocks the data

Reading speed and distance

Reading text on screen is between 20% and 30% slower than reading printed material. It is important to fragment informations in smaller chunks and use captions to encourage users to read the contents.

Reading on screen occurs at a distance between 60 and 90 cm (35 cm for books). It is therefore important to compose texts using a good font and correct size and leading.

External cohesion

The symbols used must be logical and efficiently represent the feature or function it is related to. For instance, both MAC and PC uses a trash can related to the delete function.

The same principle applies when comes the time of choosing navigational terms. Avoid trying to be original and extravagant here and prefer using commonly used terms so users understand well.

Also, colors and various effects can help differentiate interface elements from normal content.

Internal cohesion (consistency)

It is important to make recurrent use the symbols, terms, elements positions, methodology, etc. Consistency will make it easier and faster for the users to complete their tasks.

Metaphors

A metaphor create a conceptual space users will find familiar and of which they will intuitively know the rules. For instance, if a hotel corridor is used as an interface, the users will intuitively know that the doors must probably be used.

Pragmatism

Cohesion and metaphors link the interface to the physical world like some comparison. For instance, video controls in a web page are the same as those used on a DVD player.

A pragmatic approach helps the users by suggesting them actions to be made. For instance, when opening a photograph on a web site, left and right arrows tell the user they can view

the following or the preceding photographs and an X icon reassures them that they can come back to where they were before viewing the images.

Considering users physical limitations

Many physical limitations of various nature should be taken in considerations when designing an interface : hearing, motor impairments, visual limitations, etc.

For audio and video, think of supplying verbatim (transcriptions). For people with motor impairments such as Parkinson disease, create links that doesn't require precise positioning of the pointer. For visually impaired users, use the alt attribute, make font size big enough, etc. Use correct color schemes and contrast to facilitate reading thinking of people having problem differentiating some colors (daltonism).

The 10 principles of cognitive ergonomics

Standardize

In every domain including interface design, there are widely common way of doing things. For instance, electricity wires are identified using colors the same way everywhere.

In an interface, everybody will understand that an X placed on the up-right corner of a window will close it or that a magnifier next to a text field is used to make a search. Use these standards!

Users learn from usage. The more they use a function, the more they develop reflexes which helps prevent errors and make using an interface fast and easy.

Use of stereotypes

The stereotype is a concept very closed to the use of standards. In facts, good standards generally follow a stereotype.

Let's take the example of wall mount a light switch. It is installed vertically and it is on when in up position and off when in down position. If you decide to install it horizontally, chances are the user will be confused. Also, we increase volume turning right or we increase the power of a machine by levelling up an handle, not by levelling it down.

Controls matching equipment layout

Whenever possible, configure elements in a way that the usage becomes obvious. For instance, on a stove, the best practice is to position the power knobs using the same configuration as the burners.

Simplify the presentation of informations

Well organized informations makes understanding easier and faster. Using design principles such as unity, proximity and alignment greatly improves the interface quality.

Whenever possible, use icons or images which replace a lot of text (an image worth a thousand words).

Present information in appropriate detail

Not all users and not all tasks require the same quantity of details. Learn to display just the necessary amount of information and use tool-tips instead of clustering the interface.

Present clear images

Using icons, metaphors or images, be careful to make it so the users is able to see and interpret them clearly.

Images must be visible. They must be of appropriate size, location and distance. There should be no obstruction and they should contrast with the background or their environment.

Images must be distinguishable from other surrounding signals and informations and there should be sufficient spacing between them. Similar signals should be different enough to avoid confusion.

Images must be easily interpretable. The user must be able to know if an image is navigation, decoration or informational. If the image is a metaphor, it should be understood at once.

Using redundancies

Redundancies have to do with consistency, standards and stereotypes. It means to repeat the message many times different ways to reduce the risk of errors to occur.

Let take for an example a stop sign. It is red (which is used for danger and obligations), it is octagonal (quite a rare shape to see) and it tells us to stop. The message is repeated three times. Even though STOP would be written in a language you don't understand, you would still know what the panel means.

Also, emergency vehicles use sirens and flashing lights so if you don't hear them coming, there are chances you will notice the lights.

Even the address writing pattern uses this approach as, with a zip code, the city name and the province aren't necessary, although, since errors may occur writing zip codes, the information reduces the risk of loosing mail.

Using patterns (pop-out effect)

Using a pattern makes information easier to understand and anything unusual sticks out very efficiently.

So, you can group elements by themes to simplify tasks, you can use graphs so number data become easier to understand or use charts to compare numbers or quantities.

Provide variable stimuli

Just like something unusual sticks out of patterns, anything new of a different aspect is easier to notice. That is actually why emergency vehicles sirens are changing pitch and rhythm in order to be more easily noticed.

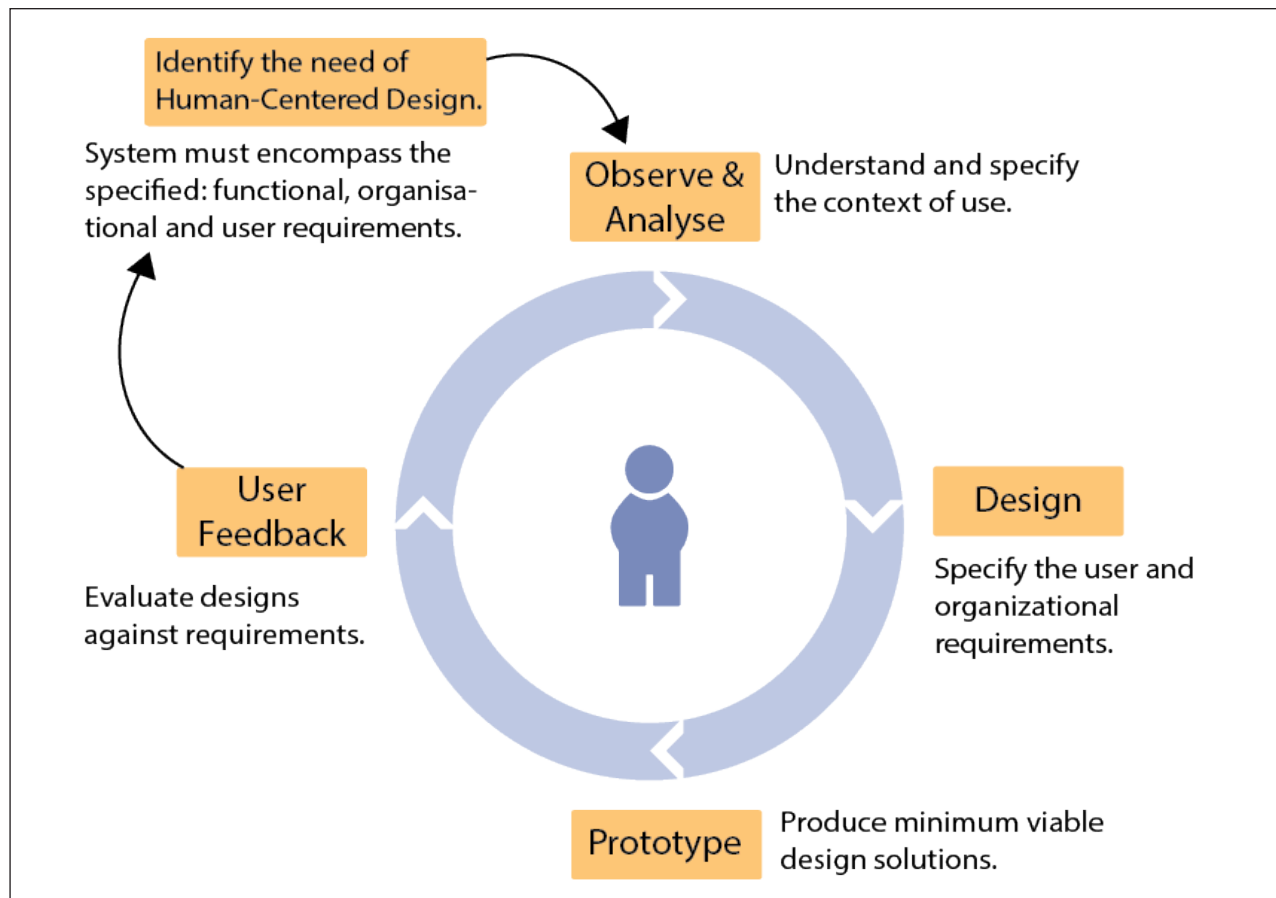
For instance, it is a good practice to have different presentations depending on the type of information or you can use an animated element that grabs attention very easily.

Remember that simple written warnings rapidly become ignored, they become part of the decor.

Provide instantaneous feedback

Use feedbacks at all possible time to confirm an action or a process. Let users know that their content is downloading or tell them what action should be taken. You can also use transition from page to page to let them know they are leaving a page to another.

For instance, there is a reason why your computer keyboard clicks. It is to let you know that you pushed the keys correctly so you don't need to look at it or constantly look at the screen.



Essential UI design laws

POLA principle

POLA stands for *Principle of least astonishment*. It states that if a necessary feature has a high astonishment factor, it may be necessary to redesign it.

According to this principle, design should be adapted to the user's experience, expectations, and mental models.

Human being only able to pay full attention to one thing at a time, it is important to reduce the mental load and, even more important, novelty should be minimized.

MAYA principle

MAYA stands for *Most advanced yet acceptable*. It states that since people are naturally resistant to change, novelty and innovations, it is important to rely on standards as much as possible.

Bringing novelties should be done gradually so users can get used to it. Since users have different levels of comfort, offer traditional fall-back options when novelties are integrated.

Baby duck syndrome

Linked to the MAYA principle, the baby duck syndrome define the users attitude using a new interface for the first time. The user then judges the new interface comparing it with similar features of the older version.

Very generally, users will be disturbed by modifications made to a known interface, by any type of changes. That makes interfaces updates quite challenging.

Habit formation

When an interface is used persistently, user develops habits. Using the interface becomes natural, easy. Be careful not to make bad assumption about users behaviours and ensure the users form good habits.

Hick's Law

Hick's law states that *the time it takes to make a decision increases with the number and complexity of choices*.

Knowing this, it is important to reduce the number of choices presented to users. Too many choices adds to their cognitive burden, their mental load. By giving too many choices, there are chances your users will run away to another web site.

Learn to identify essential and secondary contents, apply hierarchy, make navigations shorter and use contextual navigation (sub-navigation) if needed.

Banner blindness

Just like in newspapers and magazines, users on the Internet have developed a mechanism to avoid anything resembling advertising while searching for content.

For this reason, it is important to be careful, for instance, not to position navigational elements above an image or a logo grabbing a lot of attention. This would seem to much like an advertisement and the navigation would then probably be ignored.

Fitts's Law

Fitts's law is stating that *the time it takes to acquire a target is a function of the distance to and size of the target*. In other words, it means : the farther away a target is, the larger it needs to be in order for a user to be able to reach it easily.

It is important to keep this law in mind when creating buttons or any clickable elements. A large button acts like a call to action. Although, a button that would be too big can make users click inadvertently.

Miller's Law

Miller's law states that *the average person can only keep seven (plus or minus two) items in their working memory*. So, it is highly beneficial to fragment content within logically organized groups in order to ease complex tasks.

For instance, think of the phone numbers or credit cards numbers formats. Instead of a long series of numbers, it is fragmented into smaller chunks so it is easier to remember.

Zeigarnik effect

Zeigarnik effect states that people tend to remember better uncompleted or interrupted tasks than completed tasks and that it is very difficult for people to leave an uncompleted task.

For instance, students studying for an exam taking breaks to go do something else will remember much more details of their studies than those studying without interruption.

This is actually why long complex forms on the web use a progress bar. Knowing what is left to be done, users are more likely to complete the task.