Usability and its definitions

The concept of affordance is strictly connected with the concept of usability.
This concept concerns the easiness of use of any “tool” (or technological device) created by humans.

The document ISO 9241-11 of 1998 defines usability in the following terms:
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.

Notice that the most recurrent word is “specified”, which send to the contextual value of the concept of usability.

Usability and its definitions

- The definition of usability given by ISO 9241-11 is thus quite generical, being ISO 9000 an international certification which guarantees the use of “standard”.

Usability is the degree to which something - software, hardware or anything else - is easy to use and has a good fit for the people who use it.

It is a quality or characteristic of a product.

It is whether a product is efficient, effective and satisfying for those who use it.

It is the name for a group of techniques developed by usability professionals to help create usable products.

And, it is a shorthand term for a process or approach to creating those products, also called user-centered design.

http://www.upassoc.org/usability_resources/about_usability/

“Usability is about human behavior. It recognizes that humans are lazy, get emotional, are not interested in putting a lot of effort into, say, getting a credit card and generally prefer things that are easy to do vs. those that are hard to do.”

David McQuillen (2003). "Taking Usability Offline", Darwin Magazine.

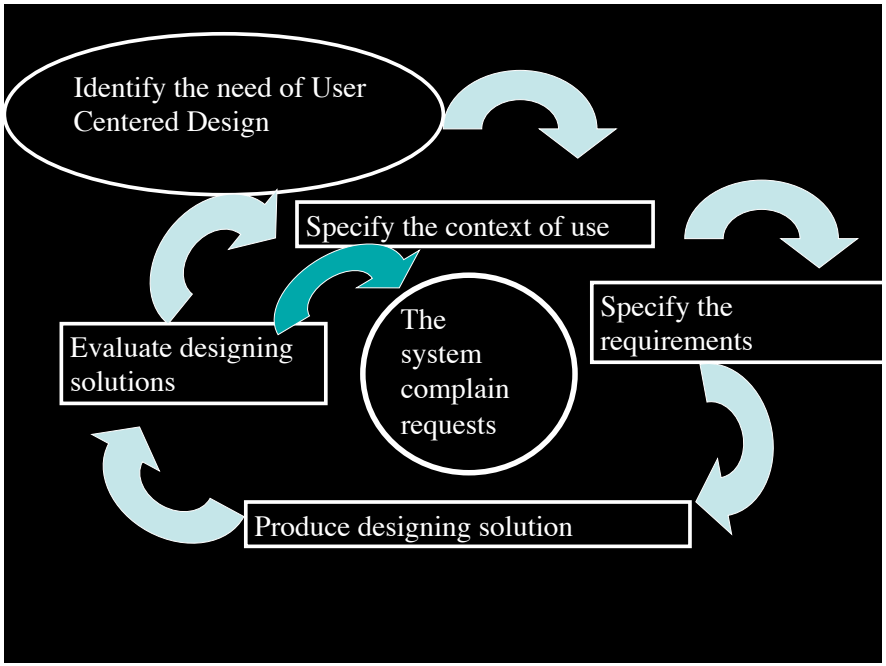
Usability means that the people who use the product can do so quickly and easily to accomplish their own tasks. This definition rests on four points: (1) Usability means focusing on users; (2) people use products to be productive; (3) users are busy people trying to accomplish tasks; and (4) users decide when a product is easy to use.
J. Redish and J. Dumas, A Practical Guide to Usability Testing, 1999.

It is important to realize that usability is not a single, one-dimensional property of a user interface. Usability has multiple components and is traditionally associated with these five usability attributes: learnability, efficiency, memorability, errors, satisfaction.

Jakob Nielsen, Usability Engineering, 1993, p. 26

The essential points in these definitions are:

1) Usability should be put in context
2) Is a quality, a process and a group of tecniques that ensure efficacy, efficiency and satisfaction and that are based on user centered design
3) Is based on human behaviour (easiness of use)
4) Being user centered means think to the user as productive/ busy and as the one who will decide whether a product is ease to be used.
5) Is not unidimensional, but it is related with 5 features, which move the focus of the definition from user centered design to user experience.



Specify the context of use means to identify:

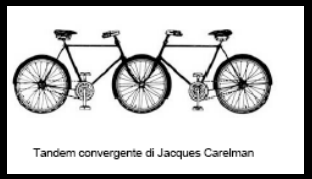
a) possible users,
b) the aim (goal) of the use and
c) the conditions in which a product will be used.

Specify requirements to take into account both client requirements and users requirements. To have a successful product both requirements should be implemented.

Produce designing solutions: this could be done in different phases.

Evaluate designing solutions: is extremely important, even if often this phase is not well considered by private companies.

The definition of "usability" does not refer to a given feature of an industrial product, but instead to the interaction between the user and the product in light of a given goal.


Tandem convergente di Jacques Carelman

We know that this bicycle is not working because we form a conceptual model of it e we could simulate the actions needed to make it work.
This simulation is possible because parts are visible and implications are clear.

We have cues on the functioning of things from affordances, invitations and constrains, and also from spatial correlations (mapping).

What is the main difference between scissors and a digital watch?

Perception, attention and memory: studies on the memory for everyday objects

Some authors studied the quality of memory when the task is to remember particulars of objects that we daily see or use.

What do you think: In such cases our memory is very good (object with which we have a daily interaction) or very bad?

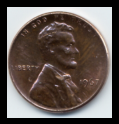
20 cents to remember

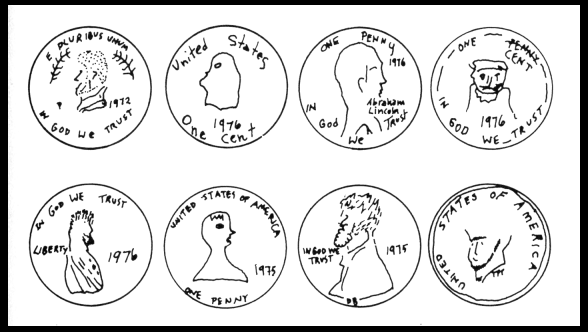
- Try to remember what is represented on the two sides of a 20 cents Italian coin
- Try to recover all the elements that comes to your mind
- Try to describe or reproduce the two sides of the coin on paper

Comparison with the original

One cent

The adventure of one cent





Nickerson, R. S., Adams, M. J. (1979). Long-term memory for a common object. *Cognitive Psychology*, 11, 287-307.

Forgotten cent

- On average participants remember only three out of eight important elements of the coin. Furthermore, even the reported elements were not in the right place.
- What does this experiement say to cognitive ergonomics?

Once again, is a matter of MEMORY.

We always try to SPARE ENERGY (reduce fatigue) : a good way to do this is by looking for information in the world.

Everytime we need information to execute a task, and this info is easily accessible in the world, we do not need to learn it.
For example, we do not have a precise knowledge on coins, even though we could easily (and efficently) use them.

Other examples?

When we should find the way in a city (wayfinding), an object in our house, when we should operate with a machine, and we KNOW THAT THE INFORMATION IS ACCESSIBLE IN THE EXTERNAL ENVIRONMENT, then the information coded in our mind could be as precise as is enough for allowing the requested behaviour.

Usually, knowledge coming from the outside is easy to assimilate, and this explain why people work good in their familiar environment but are usually unable to explain how they ca do it (how the can orient in a city, use a machine, procedural knowledge).

What are the effect of context on memory?

- Perception and memory are cognitive processes which are very closely related: it is often impossible to know whether a person has a bad memory of what she has seen correctly or has a good memory of what she has seen wrongly...

Studies on memory concern cognitive context in particular…

The curve of serial learning

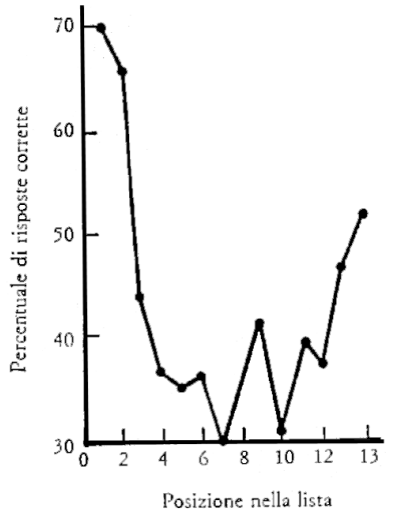
- Before going on, a little experiment…

The curve of serial learning

1. SADDLE
2. NERVE
3. DANCE
4. BEARD
5. GLASS
6. HARM
7. FUN
8. SONG
9. BANK
10. MUD
11. GOODS
12. SOCK
13. TOOTH

Primacy and Recency effect

Items which are in the first (primacy) or in the last (recency) positions in a list are more probably remembered.



Patterns and memory: a room entirely for you

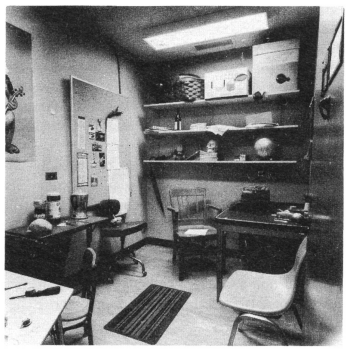


Figura 5.10. *La stanza sperimentale usata nell'esperimento di Brewer e Treyens sulla memoria (1981).*

Brewer, W. F., Treyens, J. C. (1981). Role of schemata in memory for places. *Cognitive Psychology*, 13, 207-230.

Memory inferences: something more, something less

Brewer e Treyens' Experiment

- 30 participants were individually brought in the room you've just seen. They've been said that the romm was the experiemnter's office.
- They've been asked to wait in the office for the experimenter, who said he would go in the lab to be sure that the previous participant had gone.

After 35 seconds …

… the experimenter came back and brought the participant into another room, asking him to write down every item he remebered of the room where we was kept waiting.

Would memory be influenced by the pattern representing what is normally present in a researcher's office?

Results

- 29 participants out of 30 correctly rememberd that a desk and a chair were present in the room (those objects are part of a conventional "researcher office" patten).
- Only 8 participants remembered that there were a skull and a scoreboard.
- 9 participants remembered books (actually NOT present).

Something more …

- Which are the effect of cognitive context on memory?

Again, another easy exercise on memory…

Read this list of words…

sour
candy
sugar
bitter
good
taste
tooth
nice

honey
soda
chocolate
heart
cake
tart
pie

And now…

- Write down all the words you remember form the list you've just saw.
- You have a couple of minutes.

Two minutes…

Try to remember if these words were in the list:

- *Taste*
- *Point*
- *Sweet*

Think carefully before answering; think whether you really see each of these three words and evaluate your degree of certainity about your memory for each word.

Now check the original list

sour
candy
sugar
bitter
good
→ taste
tooth
nice

honey
soda
chocolate
heart
cake
tart
pie

Strange Results

- The majority of participants (between 80 and 90%) i not only says that "sweet" was in the list, but they are also fully sure of their memory.

Roediger H. L, McDermott, K. (1995). Creating false memories. Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 21, 803-814.

Why this error?

- The false memory of "sweet" is due to both the quick activation in our memory, when we read the list, of the cathegory associated to sweets, and to our capacity to quickly recognize the core (or general meaning) of the whole list of words.

- Basically, code processes could introduce a degree of distortion in our memory and modify it.
- Previous knowledge, usually helpful in coding new information (the so-called elaborative coding) could, sometime, alter our memory.

According to Norman we could have a precise behaviour even with an imprecise knowledge, and this happens for 4 reasons:

1) Information in the world. Our behaviour is determined by the combination of the information in memory (in our head) with the information in the world (as affordances)

2) No high precision is requested. For a perfect behaviour it is enough to have the knowledge that describes the information or the behaviour just enough to distinguish the correct alternative.

3) There are natural constraints

4) There are cultural constraints

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Visibility (information in the world)

It consists in making relevant functions immediately visible for the user

It becomes extremely complex (almost impossible…) when the number of functions is more than the number of commands.

Visibility: affordance

Physical affordances are the most relevant for product design: on a desktop, for example, a key role is played by perceived affordances, constraints and conventions.

We could put attention not only to the possibility for the user to perceive an affordance, but also to the possibility of perceiving an affordance where in fact there isn't.

Affordance perceived

	Perceived	Not Perceived
Affordance	*Perceiveble Affordance*	*Hidden Affordance*
No Affordance	*False Affordance*	*Correct Rejection*

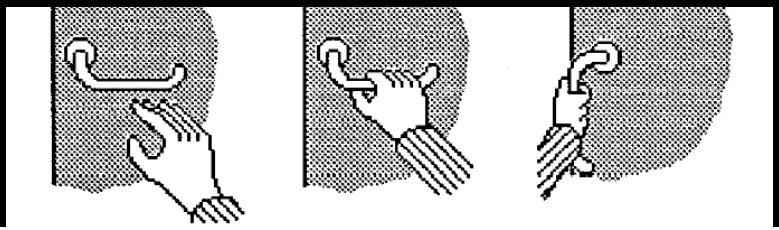
Nested Affordance

These are affordance spatially grouped, where the recognition of an affordance make it possible to recognize the following

Sequential Affordances

"…are situations where acting on a perceiveble affordance bring information about new affordances"

"Affordances are not passively perceived, they are explored… In this case we learn through attention and not through reasoning or inferences"



Multimodal Affordance

Constraints

Affordances are"invitations" to use, constraints are "limitations" to use

They are divided in:

1) Physical Constraints: physical limitations which limit the number of possible operations (atm card);

2) Semantical constraints: are based on the knowledge of the situation and the world (old telephone);

3) Cultural constraints: are connected both with symbols in general and to schema, scripts and social behaviour different in each culture.

4) Logical Constraints.

To increment usability by using constraints

Think about example of

1) Physical constraints
2) Semantical/logical constraints
3) Cultural constraints

Physical Constraints

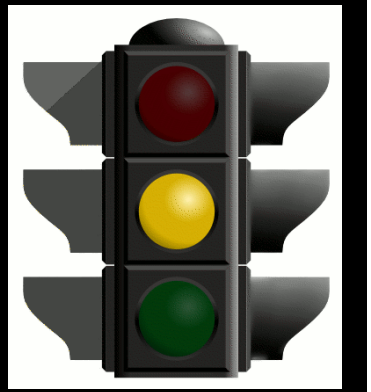
- They limit the possibility of actions and are strictly connected to affordances

Logical Constraints

- They induce to use reasoning to determine alternatives, and go together with a good conceptual model

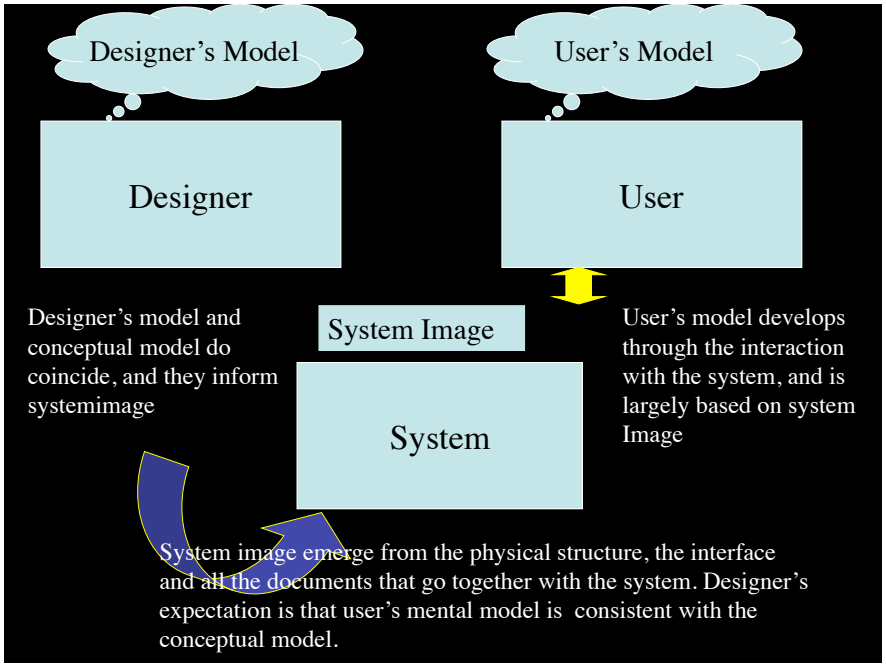
Cultural Constraints

- They are based on accepted cultural conventions: they evolve and request a good knowledge of the community we are referring to.



In the actual practice of ergonomical design usability is considered as determined by the gap between the mental model of the designer (ideas he has on how the system works) and the mental model of the user (the way in which he perceives the the product and its way of working).

- According to Philip Johnson-Laird, we continuously forms mental models, based on available information. These models are useful to "organize" reality and to give it a coherent (for us) meaning.
- In the interaction (with devices and technological systems), what give us the information for the way in which the system work is the visible part of the system together with instructions and past experience. If the system image is incoherent or unsuitable, the interaction would result (sooner or later) into errors.



Is always a matter of MEMORY.

The best way to remember (the most powerful memory) is TO UNDERSTAND, and that's why we have the tendency to build mental models, whose power is based on GIVING MEANS TO THINGS.

This is why designers should give to users suitable models, but also make the user able to use in the better way EXTERNAL MEMORY, which has the main role of being a sort of reminder.

A good way to do this is using MAPPING

Mapping

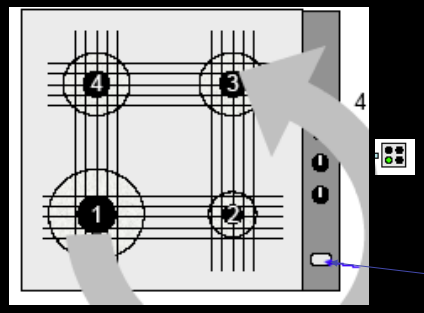
The designer has the possibility to use natural mapping in an interface between controls and the movements and actions that have an effect as outcome, in order to make his conceptual model more transparent.

The term mapping basically denote the direct relation between controls and effect, such as the relation between an action and another one (if you turn the wheel on the right the car turn on the right), or between the activation of a control and its effect on the device (such as in the stove tops).

Then with mapping we mean the relations between controls, movements to action controls and effects in the world.

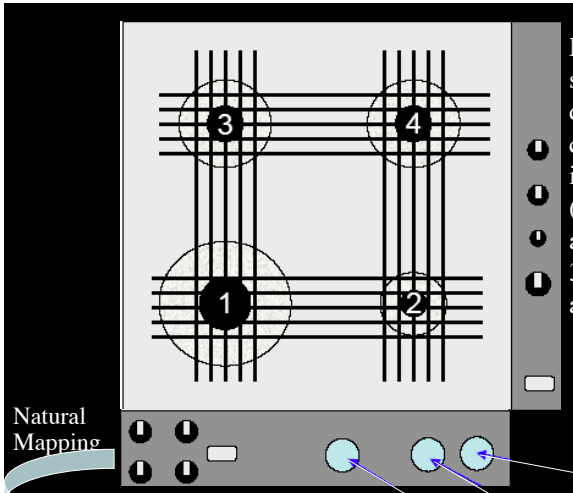
Natural mapping

Natural mapping take advantageof physical and cultural (such as red=stop) analogies, resulting in a immediate understanding. For example, to turn up the volume, you culd use arrows to go up (and to go down for turning down) instead of the knob, using in this way an analogy between the physical height and the "height" of acoustical volume.



To increment the functionality of this system it is necessary to put on keys an icon which make recognizible which stove is corresponding.

Designer's mental model in this case is the one of "reading direction": in western cultures we read from left to right. However, designer did not take into account natural tendency to group by proximity, similarity etc.



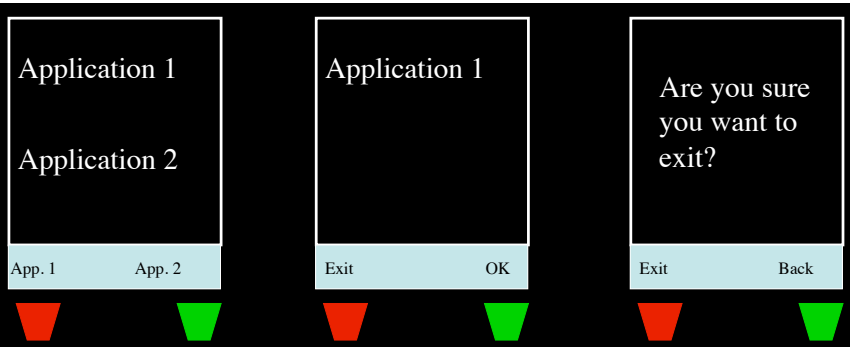
Mapping based on width similarity: the difference in dimensions of stoves correspond to the difference in dimensions of tops (keys). However, the ambiguity remains for tops 3 and 4. Then, again, icons are needed.

Mapping based on spatial similarity: the spatial disposition of tops is the same of stoves. This solution makes the correlation intuitive, reducing at the least the possibility of errors.

A good natural mapping do not need labels, instructions, icons and schmes.

Here is a design principle by Norman:

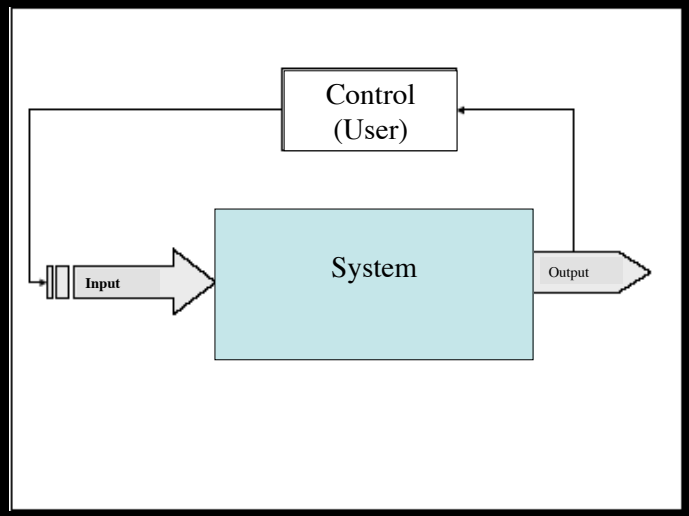
If a design depends upon labels, it may be faulty. Labels are important and often necessary, but the appropriate use of natural mappings can minimize the need for them. Wherever labels seem necessary, consider another design.



There are different codes that could induce to the choice of the correct command/key. For example, red for “stop” and green for “go”. Reading helps, but we often respond automatically on the base of associations by proximity (also proximity in actions).

To form a mental model, and consequently to effectively use a system, the retroactive information during the interaction are fundamental. Technically, this is called feedback, which inform us, for example, on which action we have done by operating a command.

A very useful feedback is the visual one, such as the number we see on the screen while we are digiting it. Also the sound for “busy” (or not)..what abouth the absence of sound?



Feedback is one of the most known principles of usability.

For complex systems feedback is necessary for evaluating risk of actions that could have crucial effects.

In the technological UCD it is essential to design series of mechanisms that allow the system to go back into the state precedent to any given user's action, and that allow the user to be informed on the state of the system after each action.