Mapping, Visibility, Feedback

Mapping: It guarantees a perceptual, logical or semantical correspondence between commands and actions

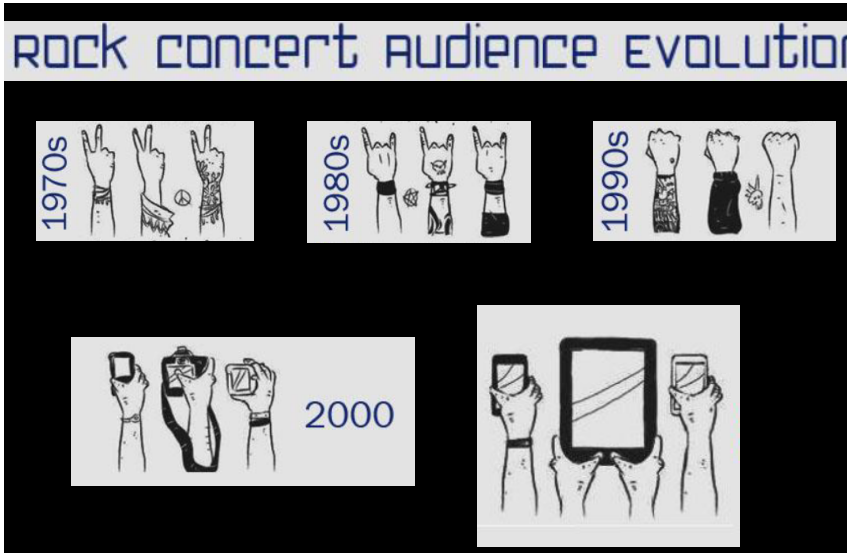
Visibility: Make it visible relevant connections (despite its name, it works also with sounds and touch)

Feedback: Gives to each action an obviouos and immediate effect.

The concept of usability should be considered together with that of feasibility. One of the aims of technology is to make our life more easy, feasible, comfortable.
If we take as example mobile phone, at the beginning they were quite heavy, and to bring them in a pocket or a bag could be a physical effort.



After that technology became more sophisticated, each component could be designed in very small proportion, allowing the creation of mobile extremely small.
But too small mobile could have usability problems…what about nowadays?

The concept of feasibility feasibility is on its turn linked to the concepts of flexibility and ductility, where these words denote, among other things, the possibility to use the system in different contexts.

IBM portable computer

The concept of flexibility is linked to that of accessibility, where this word denote the possibility to access system's functionality in a simple way, also by people with some kind of disability (virtually any).

The access to Malpensa Express

Accessibility concerns removing the barriers that would otherwise exclude some people from using the system at all.

Usability refers to the quality of the interaction in terms of parameters such as time taken to perform a task, number of errors made and the time to become a competent user. Clearly a system must be accessible before it is usable. A system may be assessed as highly usable according to some usability evaluation criteria, but may still fail to be adopted or to satisfy people.

Acceptability refers to fitness for purpose in the context of use. It also covers personal preferences that contribute to users "taking to" an artefact, or not.

Goal design cannot be summed up in a simple way and nor can the activities of the interactive system designer, particularly one who takes a human centred approach to design.

1. One view might say that the interactive systems designer aims to produce systems and products that are accessible, usable, socially and economically acceptable.

2. Another view might say that the interactive systems designers aims to produce systems that are learnable, effecting and accomodating.

3. A third view could be that the aim of interactive systems designers is to balance the PACT elements (Persons, Actvities, Context and Technologies) with respect to a domain.

These views are all valid.

To explore this complementary view, we should start by analyzing ACCESSIBILITY

And

ACCEPTABILITY

Accessibility

Access to physical space for people with disabilties has long been an important legal and ethical requirement and this is now becoming increasingly so for information spaces.

In Italy we have specific laws to guarantee the access to software technologies to people with any form of disability (legge 9 del gennaio 2004 n.4; Decreto del Presidente della Repubblica 1 marzo 2005, n. 75; Decreto Ministeriale 8 luglio 2005).

The United Nations and World Wide Web Consortium (W3C) have declarations and guidelines on ensuring that everyone can get access to information that is delivered through software technology.

Accessibility

With an increasingly wider range of possible users, designers should focus on personal abilities requesteb by the system they design.

For example, they should design with people with very different needs, such as elderly and children.

Besides, problems that we have to face during an extraordinary situation (such as in a stressfull one, with limited time, etc) are often the same problems od people with disabilites in everyday life.

People can be excluded from accessing interactive system for any of a number of reasons.

Can you say some?

1) Physically people can be excluded because of inappropriate siting of equipment or through input and output device making eccessive demands on their abilities. For example, an ATM may be positioned to high for a person in a wheelchair to reach, a mouse may be too big for a child's hand or a mobile phone may be too fiddly for someone with arthritis to use.

2) Conceptually people may be excluded because they cannot understand complicated instructions or obscure commands or they cannot form a clear mental model of the system.

3) Economically people are excluded if they cannot afford some essential technology.
4) Cultural exclusion results from designers making inappropriate assumptions about how people work and organize their lives. For example, using a metaphor based on football would exclude thos who do not understand the game.
5) Social exclusion can occur if equipment in unavailable at an appropriate time and place or if people are not members of a particular social group and cannot understand particular social mores or messages.

Overcoming these barriers is a key design consideration. Two main approaches to design for accessibility are:

1) Design for all (aka universal design);

2) Inclusive design

Design for all

Design for all goes beyond the design of interactive system and applies to all design endeavours. It is based on four premises:

1) Varying ability is not a special condition of the few but a common characteristic of being human and we change physically and intellectually through our lives
2) If a design works well for people with disabilities, it works better for everyone.

Design for all

3) At any point in our lives, personal self-esteem, identity and well being are deeply affected by our ability to function in our physical surroundings with a sense of comfort, independence and control.

4) Usability and aesthetics are mutually compatible.

Design for all

Design for all goes is grounded in a certain philosophical approach to design encapsulated by an international design community:

THE PRINCIPLES OF UNIVERSAL DESIGN

Design for all

Principles of Universal Design are:

1) Equitable use: the desing does not disadvantage or stigmatize any group of users.
2) Flexibility in use: The design accomodates a wide range of individual preferences and abilites.
3) Simple, Intuitive use: Use of the design is easy to understand, regardless of the user's experience, knowledge, languagre skills, or current concentration level.

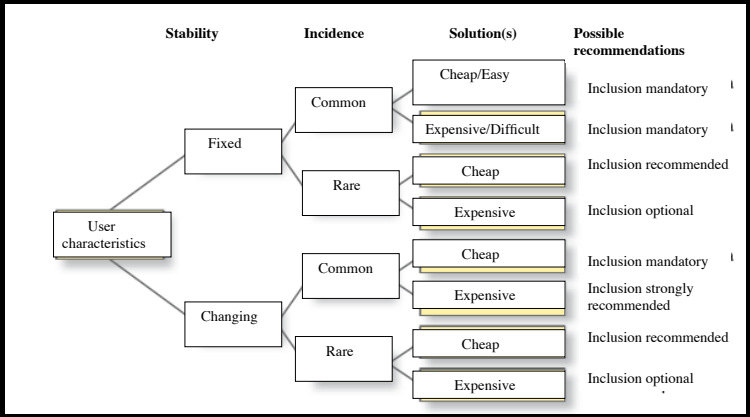
4) Perceptible information: the design communicate necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities
5) Tolerance for error: The design minimize hazards and the adverse consequences of accidental or unintended actions.
6) Low Physical Effort: The design can be used efficiently and confortably, and with a minimum of fatigue.
7) Size and Space for approach and Use: Appropriate size and space are provided for approach, reach, manipulation, and use, regardless of the usesr's body size, posture or mobility.

Inclusive design

Inclusive design is a more pragmtical approach that argues tath there will always be reasons (e.g. technical or financial) why total inclusion is unattainable.

Benyon, Crerar e Wilkinson (2001) recommended undertaking an inclusivity analysis that ensure that inadverted exclusion will be minimized and common characteristics that cause exclusion and which are relatively cheap to fix will be identified.

Distinguishing between fixed and changing user's characteristics, they presented a decision tree. We all suffer from disabilities from time to time (e.g. a broken arm) that effect our abilities to use interactive systems.



Inclusive design

As a way of ensuring an accessible syte, designers should:

1) Include people with special needs in requirements analysis and testing of existing systems;
2) Consider whether new features affect users with special needs (positively or negatively) and note this in the specification;
3) Take account of guidelines – include evaluation against guidelines;
4) Include special need user in usability testing and beta test.

To a large extent, "design for all" is just a good design.

The aim is to design to cater for the widest range of human abilities.

By considering access issues early in the design process, the overall design will be better for everyone.

Thinking on design for all and inclusive design brought to important innovations….

Could you think to some examples?

There is still a lot to do….

Any ideas?

Acceptability

Acceptability is about fitting technologies into people lives. For examples, some railway trains have "quiet" carriages where it is unacceptable to use mobile phones, and cinemas remind people to turn their phone off before the film starts: in these cases the use of phone is UNACCEPTABLE.

An essential difference between usability and acceptability is that acceptability can only be understood in the context of use.

Usability can be evaluated in a laboratory (though such evaluations will always be limited). Acceptability cannot.

The key features of acceptability are:

1) Political. Is the design politically acceptable? Do people trust the new technology? In many organizations new technologies have been introduced for simple economic reasons, irrespective of what people may feel about them and the ways that people's jobs and lives might change. In the broader environment human rights might be threatened by changes in technology.

2) Convenience. Design that are awkward or that force people to do things may prove unacceptable. Design should fit effortlessy into the situation. Many people printed e-mail because it was more convenient to carry and read…

Other examples?

3) Cultural and social habits. If political accessibility is concerned with power sttructure and principles, Cultural and social habits are concerned with the way people like to live. It is rude to disturb other people, for example. Spam email is become such an unacceptable aspect of life that some companies have given up on e-mail altogether

4) Usefulness. This goes beyond the notion of efficiency and effectiveness and concerns usefulness in context. For example, many people have found the "dairy" functions on first PDAs perfectly usable, but not sufficiently useful in the context of everyday living.

5) Economic. There are many economic issues that render some technology acceptable or not. Price is the obvious one and whether the technology offers value for money. But the economic issues go further than that as the introduction of new technology may completely change the way business work and how they make money. A new "business model" is often a part of economical acceptability.

Accessible, Acceptable

ACCESSIBILITY	ACCEPTABILITY
Physical	Political
Conceptual	Convenient
Economic	Economic
Cultural	Cultural & Social
Social	Useful

The Tecnology Acceptance Model (TAM)

Is a way of looking at technologies and whether they will be accepted by communities.

It has its origins in business studies rather than in computing or psychology.

TAM looks at technology acceptance from two perspectives: ease of use and effectiveness (each of these further broken down into more specific characteristics of technology, which bring to different variants of TAM).

Recently, another aspect has been put in light to the acceptance: trust.

The Italian Government is considering introducing electronic access to a variey of social benefits (such as unenmployment benefits, housing benefit, etc).

What are some of the acess issues involved with this?

Usability

A system with a high degree of usability will have the following characteristics:

1) It will be efficient in that people will be able to do things using an appropriate amount of effort;
2) It will be effective in that it contains the appropriate functions and information content, organized in an appropriate manner;

Usability

3) It will be easy to learn how to do things and remember how to do them after a while;

4) It will be safe to operate in the variety of contexts in which it will be used;

5) It will have high utility in that it does the things that people want to get done.

Usability

Achieving usability requires us to take a human-centred approach to design and to adopt a design approach in which evaluation is central.

However, this view brought to the proposal of different principles, not universally shared.

Usability

Some early pioneers of usability, Gould et al. (1987) developed the message kiosks for the 1984 Olympic Games. They based their approach on 3(4) key principles that Gould and Lewis had evolved over the previous three years. Their principles were:

1) Early focus on users and tasks. Designers must first understand who the users will be, in part by studying the nature of the expected work to be accomplished, and in part by making users part of the design team through participative design or as consultants.

2) Empirical measurement. Early in the development process, intended users' reactions to printed scenarios and user manuals should be observed and measured. Later on they should actually use simulations and prototypes to carry out real work, and their performance and reactions should be observed, recorded and analyzed.

3) Iterative Design. When problems are found in user testing, as they will be, they must be fixed.

This means design must be iterative: there must be a cicle of design, test and measure, and redesign, repeated as often as necessary. Empirical measurement and iterative design are necessary because designers, no matter how good they are, cannot get it right the first few times. (Gould et al. 1987, p. 758).

As a result of their experiences with that project they added a fourth principle, integrated usability:

"All usability factors must evolve together, and responsibility for all aspects of usability should be under one control".

Today, these classic principles are not advocated by everyone.

Cockton (2009), for example, argues that designers need to understand the values that their designs are aiming at and that the sort of advice offered by Gould e Lewis is dangerous and out of date.

Whilst not going as far as that, we would certainly agree that designers need to consider what worth their designs bring to the world.

One way to look at usability, expecially for interactive systems, is to see it as concerned with achieving a balance between the four principal factors of human-centred interactive systems design, PACT:

1) People
2) Activities people want to undertake
3) Contexts in which the interaction takes place
4) Technologies (hardware e software).

People

- Physical differences
- Psychological difference
  - Mental models
  - Social differences

For people, designers need to think about the physical, psychological and social differences and how those differences change in different circumstances and over time. It is most important that designers consider all the various stakeholders in a project.

Exercise: a metro ticket machine

- Think about a metro ticket machine. What are the physical aspects of people that need to be taken into account in the design?

- Now, think about the people who will use it. Identify the variety of characteristics, physically, psychologically (including different mental models people might have) and socially, in terms of usage of the system.

Activities

- Temporal aspects

- Cooperation

- Complexity

-Safety-critical

-The nature of the content

For activities, they need to think about the complexity of the activity (focused or vague, peaks and troughs, continuous or interruptable), cooperative features and the nature of the data.

Contexts

- Physical environment
- Social context
- Complexity
-Organizational context

For context they should think about the physical, social and organizational setting.

Technologies

- Input
- Output
- Communication
-Content

For technologies, they need to think about input, output, communication and content.

All these aspects should be considered together

People (with their physical and psychological differences) in their social/ physical/psychological/organizational context, aiming at a goal with an activity that goes together with other activities (identify the relevant ones) with their technologies + ours, their skills+what we expect⋯.

Scoping a problem with PACT

The aim of human-centred interactive systems design is to arrive at the best combination of the PACT elements with respect to a particular domain. Designers want to get the right mix of technologies to support the activities being undertaken by people in different contexts.

A PACT analysis is useful for both analysis and design activities: understanding the current situation, seeing where possible improvements can be made or envisioning future situations.

Scoping a problem with PACT

To do a PACT analysis the designer simply scopes out the variety of Ps, As, Cs, and Ts that are possible, or likely, in a domain.

This can be done using brainstorming and other envisionment techniques and by working with people through observations, interviews and workshops, personas and scenarios (we will work on it later). The designer should look for trade-offs between combinations of PACT and think about how this might affect design.

Scoping a problem with PACT

Let assume that we have been asked by a University department to consider developing a system controlling access to their laboratories.

We will do it with a a PACT analysis.

1) People. Students, lecturers and technicians are the main groups. These are well educated and understand things such as swipe cards, passwords and so on. People in wheelchairs need to be considered, as do other design issues such as colour blindness. There may be language differences. Both occasional and frequent visitors need to be considered. However, there are other stakeholders who need access to rooms, such as cleaning staff and security personnel. What are the motivation for management wanting to control access in the first place?

2) Activities. The overall purpose of the activity is to enter some form of security clearance and to open the door. This is a very well-defined activity that takes place in one step. It happens very frequently, with peaks at the start of each laboratory session. The data to be entered is a simple numeric or alpha-numeric code. It is an activity that does not require cooperation with others (though it may be done with others). It is not safety-critical, though security is an important aspect.

3) Contexts. Physically the activity takes place indoor, but people might be carrying books and other things that makes doing anything complicated quite difficult. Socially it might happen in a crowd, but also it might happen late at night when no-one else is about. Organizationally, the context is primarly about security and who has access to which rooms and when they can gain access. This is likely to be quite a politically charged setting.

4) Technologies. A small amount of data has to be entered quickly. It must be obvious how to do this in order to accomodate visitors and people unfamiliar with the system. It need to be accessible to people with special needs (which one?). The output from the technology needs to be clear: that the security data has been accepted or not and the door has to be opened if the process was successful. Comunication with a central database may be necessary to validate any data input, but there is a little other content in the application.

The combination of these elements are very different in, for example, a public kiosk, a shared diary system, an airline cockpit or a mobile phone; and it is this wide variety that makes achieving a balance so difficult. Designers must constantly evaluate different combinations in order to reach this balance.

There are two relationships that need to be optimized:

1) The interaction between people and the technologies that they are using. This focuses on the user interface.

2) The interaction between the people and the technologies considered as a whole (the people-technology system), the activities being undertaken, and the contexts of those activities.

The idea is that of a people technology system optimized for some activities, for example in the design of a writing system the different modalities of writing should be analyzed, as well as different contexts.

It is important to remember that the people-technology system may consist of many people and many devices working together to undertake some activities.

Think of the activity of writing and all the various contexts in which we undertake this activity.

Then think about the different technologies that we use for writing.

Which combinations are most usable in which circumstances? Why?

Norman and usability

Talking about usability Norman expecially focuses on the concept of error as connected with mental models, to finish with the concept of "gulfs" to be bridged.

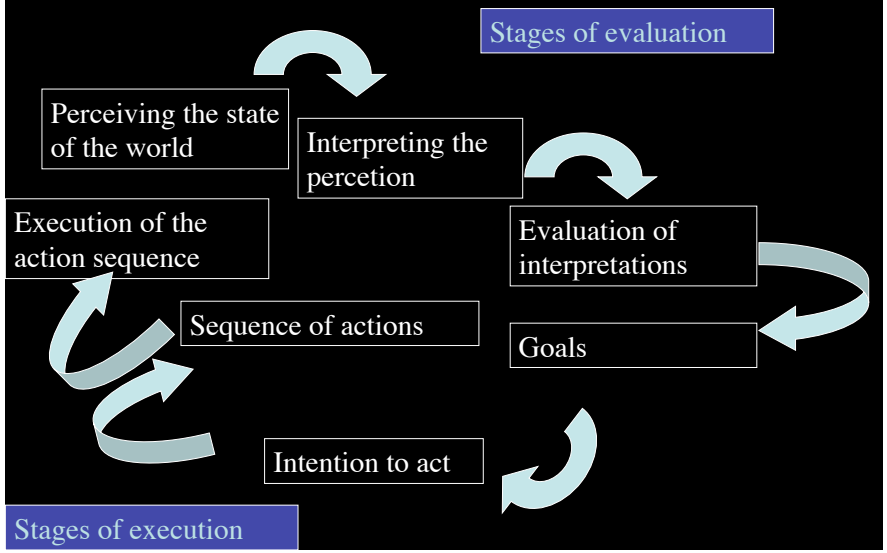
The concept of error

Human beings are subject to error.

Errors could be considered (and consequently classified) in different ways, according to different theories

Norman, being inspired by cognitive psychology of the' 80s, put forward a classification based on what he defines as "a seven-stage model of activity"

The seven stage model of activity by Norman



Example: Turn on a light

GOAL: To increase the light in the room

INTENTION: Turn on a lamp

SEQUENCE: Walk toward the lamp, press the switch

EXECUTION: [*Walk toward the lamp, press the switch*]

PERCEPTION: [*Hear "click", see light*]

INTERPRETATION: The lamp make click and start giving light

EVALUATION: The light in the room is increased.

Success!

At each step on the way we perceive the new state of the world, interpret what we see, and compare it against what we intended to change. We may have to repeat these actions if our goals were not met.

Thus, according to Norman, people have goals - things that they are trying to achieve in the world. But devices typically only deal with simple actions.

This means that two "gulfs" have to be bridged:

1) The gulf of execution

2) The gulf of evaluation

The Gulf of Execution

Is the difference between intentions (or goals) and actions, it refers to the problem of how an individual translates intentions into actions. Does the system present possibility of actions which correspond to people's intentions?

A measure of this gulf is obtained by considering how much the system allow an individual to execute the actions that he wants DIRECTLY and WITHOUT ANY SUPPLEMENTARY EFFORT.

The Gulf of Evaluation

Is the converse of the Gulf of Execution and refers to how an individual understand, or evaluates, the effect of actions and knows when his or her goals are satisfied. It is concerned with deciding whether the actions were successuful in moving the person towards his or her goal. It corresponds to the amount of effort one need to interpret the physical state of the system and to determine how it corresponds to expectations and intentions.

The Gulf of Evaluation

Does the system give a physical representation which could be directly perceived and directly interpreted in terms of user's intentions and expectations?

The gulf of evaluation is small when it offers information about its state in a form that is easy to receive, easy to interpret and corresponding to the idea the user has about the system.

The gulf of execution could lead people to start a sequence of actions which is impossible to finish, while the gulf of evaluation could lead to going on in the interaction in a wrong way or to quit it.

The gulfs have to be bridged both semantically (does the person understand what to do and what has happened?) and physically (can the person physically or perceptually find out what to do or what has happened?

A key issue for usability is that very often the technology gets in the way of people and the activities they want to do.

If we compare using an interactive devicec such as a remote control to using a hammer or driving a car, we can see the issue more clearly. Very often when using an interactive system we are conscious of the technology; we have to stop to press the buttons; we are conscious of bridging the gulfs.

When hammering or driving, we focus on the activity, not the technology. The technology is "present to hand".

Technological breakdown

When using a hammer, driving or writing with a pen we will usually focus on the activity itself: we are hammering, driving or writing. It is only when something happens to interfere with the smooth operation of these technologies that we become aware of them (e.g. hit your finger, avoid a hole in the street, the pen stops working) and then the unconscious use of the technology turns into a conscious interaction with the technology.

Technological breakdown

Winograd and Flores (1986) refers to this as a "breakdown".

One aim of interactive systems design is to avoid such breakdowns, to provide people with a way of undertaking activities without really being aware of the technologies that enable them to do what they are doing.

An errors classification based on the seven stage model of activity

The division of action in seven stages is a rough model of the several functions connected to human behaviour.

Indeed, the majority of our actions does not require all 7 stages (and, conversely, each stage could be divided in an infinite number of sub-stages).

An errors classification based on the seven stage model of activity

The possibility of error is present in any stage, but Norman suggest to focus on error at different stages.

Of course errors may be categorized in many different ways (as it is, in fact, see for example Reason).

Norman divide them into two main categories:

1) slips
2) errors "of thought".

Slips and lapsus are originated by automatisms, not consciously filtered. Usually there are not serious consequences. They happen when our attention is focused somewhere else while executing an action.

If you form a correct goal but then get wrong in the execution, you did a lapsus.

If you form a wrong goal, then you have a "thought error", which could also be severe and it is difficult to identify.

A slip is the error that occurs when a person does an action that is not intended.

According to Norman, the path from intention to action consist in the activation of the seven stage schema.
This action system allows slips to be organized into three major categories (and a number of subcategories).

The three major categories of slips are:

1) Errors in the formation of the intentions
2) Faulty activation of schema
3) Faulty triggering

A. Errors in the formation of the intentions

This category includes:

1) Mode errors
2) Description errors

1. MODE ERRORS. Erroneous classification of the situation. When a situation is falsely classified, then the resulting action may be the one that was intended and appropriate for the analysis of the situation but inappropriate for the actual situation. The name results from the experience with computerized text editors that have explicit modes for entering text (text mode) and for giving commands (command mode).

Examples: Say "come in" at the telephone, try to take glasses off without wearing them

B. Faulty activation of schema

This category includes:

3) Capture errors,

4) Data driven activation

5) Associative activations,

6) Loss of intentions

7) Misordering of action components

2.DESCRIPTION ERRORS.Insufficient specificity. Some slips of selection occur either when all the relevant information needed to form the appropriate intention is not available or when an appropriate intention has been formulated, but the description of the desired act is insufficient. This situation give rise to an incomplete description, leading to ambiguity in the selection of information from memory.

Examples: throwing away the keys instead of garbage, "sending" some papers instead of the mail…

3. CAPTURE ERROR. A capture error occurs when a familiar habit substitutes itself for the intended action sequence.

Example: to count 1,2,3,4,5,6,7,8,9,10, Jack, Queen, King.

4. DATA-DRIVEN (External) ACTIVATION. In the class of slips called "data driven" the intrusions result from the analysis of external events: The environment forces an intrusion. This class is similar to other forms of activation errors, with the distinguishing feature being that there is some obvious environmental cause for the act.

The most prominent example is the Stroop phenomenon (other example: digiting the number of the room instead of the number of the department, put money in the coffee machine when we want to have water ⋯)

5. ASSOCIATIVE ACTIVATION. This class differs from capture activations in that there need not be any formal similarity between the action sequences involved, but simply a strong association between them. Thus, the intention activates a relevant set of schemas that, by association with other schemas in memory, cause those others to become activated. This is the mechanism of "being reminded of". However, once the reminded of schemas are activated, it may be that they control the resulting actions rather than the intended schemas. Errors of associative activations seems to occur most frequently in speech.

Examples: the classical "freudian lapsus", such as use the name of former boy/girlfriend to call the new one, to say that an abstract should be of 200 pages instead of words⋯

6. LOSS OF ACTIVATION (INTENTION). When the appropriate schemas for an action schema are activated some may lose activation as a result of a normal decay and interference properties of primary memory. The result shows up in several different ways, depending upon the exact schema that was lost and when in the temporal events of the action the schema was lost. One result can be that of losing the desired intention but allowing the behavioural repertoire to continue to its next logical conjunction.

Examples: To stand staring into the refrigerator wondering why we are there, to go in a room and to forget the reason⋯

A sub-class of 6. is

7. MISORDERING OF ACTION COMPONENTS. Sometimes the component of action are misordered. Examples? To give raisin instead of the rest (and to put coins in the mouth), or we leave out a step in a sequence (forget to put water in the coffee machine, studies on aircraft accident reveal that skipped steps are a frequent cause of accidents) or the repetition of a step in a sequence of the restarting of the sequence at some earlier stage (Examples?)

C. Faulty triggering

This category includes

1) Spoonerism (“You have tested the whole warm” instead that “You have wasted the whole term”)

2) Blends. (Blend the component of actions when two active schemas are triggered simoultaneously, merge tende to involve the anticipation components)

C. Faulty triggering

3) Intrusion of thoughts. A large class of errors occurs from false triggering of acts among the things currently active in mind (eat instead of meet)

4) Premature triggering. This sometimes lead to a lack of action rather than an intruded action.

Slips that results from failure to perform some action are more difficult to detect than error that result from a falsely executed action

Even if slips are easily detectable, we need feedback to notice them before is too late.

The problem arises of where feedback should be putted

All the levels of an action are simoultanously present, then the error could be at any level.
This make difficult to notice at which level the error is coming, which crucial to correct it and even more crucial to prevent it.

Now, let’s think of examples of slips in technology (or real life) and how to prevent it (possible solutions).