Human-Centred Design: sustainable ideas and scenarios for the development of projects and products based on knowledge and human abilities

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Summary

Human-Centred Design is defined as the discipline relating to products and services that, in different ways, takes into account the psycho-physical wellness of human beings, and is formulated according to an approach based on User-Centred Design (UCD). The User-Centred Design approach considers the relationships and the interactions users have with products while using them, and is developed within disciplines not properly belonging to the field of design. At the beginning of last century, with studies in psychology (1899) and semiotics (1913-16) the way was opened for the analysis of everyday objects from a systemic point of view. Within the production scenario, modern industry transforms any materials into working and functional objects, but later on, having crossed the absorption threshold, and with production surpluses, the trend will be to reconsider the objects, endowing them with deeper psychological meaning. Together with the psychological there is the semiotic analysis, which, with de Saussure, establishes the existence of a link between words and things, in such a way that human activities are structured like languages and the analysis sees the Linguistics as the basis of a general science of signs, whose purpose is to deepen the social use and the functionality of the objects. The semiotic theorization of Barthes and then Baudrillard, relating to the analysis of objects, follows Saussure's lead in thinking of the object as a sign or message. Within this area of

semiotic analysis, divergent positions from different thought' schools follow one after the other. Among these, we find Jean Baudrillard's (1968) and Charles Sanders Pierce's (2001); both, however, agree on various points: on the determination of the systemic and therefore relational character of the objects, and on the understanding of the mechanisms which are the basis of perceptive judgments, as well as the related elaborations which structure our consciousness (C.S. Pierce), and which come together as a frame of reference in the User-Centred Design approach. Psychology has recently found in Donald A. Norman - the director of the Cognitive Science Society at the University of California, a psychologist with an international reputation for his studies on "short term memory" and contemporary cognitive psychology - a supporter of the analysis of the learning processes. Moreover, his research on memory has a particular bearing on the creation and function of artificial intelligence, highlighted in a theory on the processes of elaboration of data by the brain known as "human information processing". He orients his studies within the area of "cognitive science" and hypothesizes on the errors due to the appearance incompatibility conditions between man and the environment. In addition to this, cognitive psychology, which has dealt with this subject for more than fifty years, has contributed decisively to the current ergonomic study on the man-machine relationship in terms of User-Centred Design.

Keywords: usability, pleasure in use, iterative design, user evaluation, user's needs

1 The objects at the core of the daily scene

The nature of the interaction between humans and the world of objects which surround them has been widely investigated. The main characteristics on which research and planning seem to be based concern the mechanisms related to perception, judgment and knowledge. The semiotic analysis by Pierce establishes that objects are not just perceived, but also used, and therefore are part of interactive processes that derive from knowledge and action.

These interactive processes are the result of cognitive interpretation produced over various stages: from sensation, perceived by the brain the moment an object is touched, through the mechanisms related to interpretation, which derive from everyone's personal outlook on world and culture. It is obvious that our interpretation causes us to ignore some things and favour others.

Here an important transaction takes place in the perception and in the successive cognitive interpretation of objects, which Baudrillard, in his formulation of the "functional system of objects" ("The system of objects", 1968) analyzes through the interpretation of different dimensions which coexist in the object and seem to be consistent with the "infinite interpretations" discussed by Pierce. Meanwhile, a symbolic relationship exists between the function of needs and their fulfilment which represents the characteristic in agreement with the

origins of the pre-modern "traditional system of objects".

With the advent of industrial production, "the coherence of the functional system" comes into question, with the loss of the inner value of the object, and the assumption of signs as the expression of "universal functions".

The renewed functionality acts as a system of "universal signs", causing, at the same time, the disappearance of the symbolic relationship between form, function and needs, since what comes to the surface through the signs, is a nature continuously elaborated, abstract; a "culturalized nature", thanks to the signs, and organized in a sort of "naturality" or culturality" (Baudrillard).

This makes clear how Baudrillard's and Pierce's theories agree, especially concerning the system of signs, both abstract and changeable and therefore subject to various interpretations of natural culture (naturality). To Baudrillard, "naturality" is the corollary to every kind of functionality, which represents the modern connotation of the environmental system that surrounds us.

To sum up, our biological basis allows us to be aware of things, stimulating in us the mechanism of sensation, transforming it subsequently, into conscious perception, through which cultural superstructures work to make us choose, thanks to a perceptive selection, according to perceptive judgements. After observation and judgment, there is the "doing" stage, that is to say, the phase of "judgments in terms of things that we can observe and use".

Here quality and form are considered in order to make judgments of value and usability. This stage involves the definition of perception and use; understanding the difference between them is crucial. The microwave oven is a good example: electromagnetic waves warm the food. You cannot see them, but you can see their effects.

The effect makes the meaning of the term use clear. When you use an object you interact with it in order to get a specific purpose or result. Interaction is considered as a process in which the users, according to what they know about the object, act on it, get a result and repeat a process in a continuous cycle.

What identifies the object of use is its being at the centre of the interactive process of knowledge and actions, a process aided by the object itself either by offering help or defining limits deriving from its own composition and configuration.

In this way the object is characterized by a wide range of possible interactions, a feature defined by Pierce as "indicative" insofar as its relation to its "factuality" (materiality related to function). Perceptive qualities are independent, while the "indicative" ones exist in an object only if it relates to the others.

This theory agrees with Baudrillard's, in which he brings to light a fundamental concept which is the basis of the meaning the objects assume in the different contexts in which they are used, that is to say the dimension of "functionality". Apparently, it is a dimension objects exercise in relation to the function they carry out in virtue of their "existence" according to which their

destiny is accomplished in accordance to "a precise relationship with the real world and human needs".

Baudrillard demolishes this assumption by stating that the term "functionality" does not signify that something has been "adapted" to a purpose, but rather that "has been adapted to an order or a system". Therefore, functionality is the "ability to integrate into a whole", in a context of action. In this way the object goes beyond its primary function (fulfilling a need), in order to support a "secondary function", projecting it into another dimension, becoming "an element of play, of combination, of calculation in a universal system of signs" ("The system of objects", 1968).

Moreover, the "indicative" characteristics are not always so clear. Sometimes they can only be seen after "a conscious or factual inference"; that is to say, after there has been a shift from one judgment to another.

In this case, from the selective perception, which allows us to focus on that and only that object, we pass, thanks to a perceptive judgment, to a judgment phase expressed in terms of observed things that can be used. "Indicative" characteristics are at the core of a dynamic process that explores the object from the point of view of the productive circumstances (past), the current configuration (present), and the possibilities for use (future).

In addition to this, "factual inference" helps us understand how that specific object can be used, and who is going to use it, creating the image of an "ideal user". Materials, form, weight, dimension, refer to the physical features of the final user; therefore the object carries the inscription of the user.

This takes place according to an organization of the activities which occur between objects and users in a closed system; that is, structured in terms of performances and optimal use. At this point it would be useful to retrace Baudrillard's thought concerning the main themes relative to techniques and automatisms which are dealt with in the User-Centred Design (UCD) approach.

According to Baudrillard, you can basically distinguish between two connotations of the object, the formal one and the technical one. For the latter you can use the term "automatism", which determines a "special function" of the object that enables it to be considered as "absolute" and consequently a role "model".

In this way it is established that this object, with its "special function", will be known and assimilated as the "technical model". Everything begins with the replacement of manual operations by automatic mechanisms, which represent an abstraction of the previous mechanisms and make the functional system more difficult.

Automatism has in itself the concept of "functional transcendence", due to the belief that the degree of perfection of an object is proportional to the automatism that animates it. According to Baudrillard, this impoverishes the range of "functions" of the object itself.

In fact, in order to configure a practical object in an automatism, you must reduce it to a

"stereotype" of the given function, with the inevitable consequence of diminishing it and making it "fragile".

Moreover, the automatism reduces the level of efficiency of the object, since you risk technical failure. One only has to consider that a non-automated object must be continuously adjusted and moved in a broader functional group. If the object is automated, its function is carried out and concluded in the exact moment in which it materializes, because it is exclusive.

Furthermore, in terms of the human–object relationship, automatism is perceived as a closure, a functional redundancy, that induces humans to behave like spectators free of any responsibility. Following this path, Baudrillard interprets the contemporary technological thought, which goes in the opposite direction. Nowadays, the degree of perfection of a machine or object is not measured by the performance of some given automatism, but instead on a certain margin of "indetermination", which allows the machine to be sensitive to information that comes from outside". This assertion recasts the man-machine interaction as a relation in which humans become the "living interpreters" of a machine at a very high technical level, because it is conceived as an open structure. But, if the high level of technicality implies the organizational intervention of the humans, this trend leads, in the long run, to a total abstraction of the objects.

This abstraction fascinates us, because it is not perceived as "technical rationality", but as "basic desire, as the imaginary truth of the object", which leads to the lack of interest in the structure and in the function. Baudrillard's "imaginary truth" represents the human wish that "everything functions by itself", without any effort. This contradiction resides in the limit that every type of automation contains in itself and in its "materiality", which defines a form.

Formal completeness does not predict the open structuring of technologies and their corresponding needs, and if the myth of automation is anchored in a certain formalization it possesses, it existed prior to every other specific characteristic of the object, because it impresses the reflection of the image of the humans on the objects themselves. On the other hand, the automated object in order to work by itself must necessarily resemble the humans.

Commonplace objects (a table, chair, bed, etc…) clearly evidence the presence of the man, since they satisfy his primary needs.

Symmetrically, in highly technical objects, you can see the so called "super-structural functions". They refer to what the "man projects on them", that is to say "the autonomy of his conscience, his power to control, his individuality, and the image of himself". Therefore, automatism, the "transcendence of function", transfers the super-functionality of the human conscience to the equivalent "formal transcendence of the man".

According to Baudrillard, super-functionality is the representation of the autonomy of the individualistic conscience of the modern man, who is not interested in "naive animism or too human meanings" of the objects anymore. This super-functionality is close to the technical essence of the objects, by which the "modern man" is inspired in order to "change his life".

In reality, humans, instead of pursuing this desire, trying to get fluid structures and open operational experience, consider their own finiteness within a society founded on technology, as "the most beautiful general object" and give it the importance of an original instrumental model (prototype).

In conformity with this vision, automatism and personalization are not completely contradictory, automatism being the personification of the man's desire at object level.

For Baudrillard it represents the best example," the "most complete form, the most sublime of the inessential, of the marginal differentiation through which the personalized relationship between the man and his objects works".

1.1 The objects speak and act

From what has been said, in order to make the technical object have a purpose and a function, it must be part of a system of objects, based on the same logic, and it must provide capable users with instructions on how to use it.

This constitutes the relational system in which the technical object states the different kinds and degrees of inter-relations between object-object/s and object-user/s. Provided that this is true, we must verify it by increasing the quantity and the typologies of new objects which depend on different productive and design logics and which include the technical objects.

The technological innovation has brought about changes such as to influence the nature of the materials themselves.

The so called "silent revolution" of new materials, which are determined by the technical invention of the composite-materials, modifies the perception of the world, especially with respect to its material composition. This material aspect is independent of technical–functional supports, and sets up a landscape of forms and surfaces that are separated from their content.

Naturally, this transfers to the objects, where this new condition is interpreted in terms of greater efficiencies or services, which tend to become behaviours, creating levels of interaction and relations previously unimaginable.

Thanks to the materials that become lighter and more transparent, - in both visibility and functionality - the surfaces, the textures, that idea tends more and more toward dematerialization and comes out in the conception of interfaces.

These interfaces open up to virtual worlds, where images that transmit content and information in real time prevail over the support material which generated them. A non-material density of information appears, which owes nothing more to form but its complex technological content.

The substance mixes with the electronic and computer micro-technologies and conquers unexpected dimensions leading to considerable new properties. The miniaturization of the components, the circuits, the energetic streams, is not immediately perceivable and consequently not immediately understandable.

Moreover, the components have not been through the process of "naturality" discussed by Baudrillard, and since they are carriers of other meanings, they cause the objects to lose their identities, simply because underneath the surface there is nothing to understand.

From a psychological point of view, virtuality only relates to the cognitive phase, with the result that it skips the lower phases of perception and interpretation besides those of valuation and selection. Recent technological developments favour an approach to the artificial as complex as the organic world to which it aspires.

The world-machine metaphor of modernity substitutes the living world-organism, which is based on information and its processes.

So, we have machines that create a dialogue between subjects and objects based on a net configuration, where the objects themselves are both the connections and the centres of activity. As a result of this scenario, it is clear that the choices relative to the use of logic, relational strategies, and managerial strategies of users' nets become more consistent.

This revolution involves also traditional objects of daily use, still linked to mechanical technologies, but revamped with electricity (e.g. electrical household appliances). These objects are made intelligent, thanks to the introduction of automated and computerized managerial programs. At the same time, new typologies and especially new concepts of objects are on the market with all their innovative power, which feature greater autonomy for the user, and the promise of constant interaction. They are not just intelligent, but are also "sensitive".

All they react to the environmental stimuli and are above all designed for dialogue with the user. They are Information and Communication Technology (ITC) oriented objects; their main characteristic is the communicative interface where the information exchange (which acts as an actual space of action) takes place.

On the one hand, this leads to the introduction, in the consolidated typology of objects (electrical household appliances) of new use functions. On the other hand, a new concept of objects spreads: objects which perform many diverse functions.

The distance between multi-use and multi-function objects becomes ever clearer. In fact, if the multi-use object, even with its finiteness, can be continuously reinterpreted and adapted to unforeseen uses, the multi-function object has different functions working on the same level, integrated in the same object, among them those connected to interaction.

Therefore, they are not only objects that carry out more diverse functions, but an interaction with the user as well. Here we reconnect to what Baudrillard asserts regarding objects conceived as "open structures" based on a certain margin of indetermination, and therefore of interpretation, allowing the objects to be sensitive to information coming from the environment.

Of course, the intervention of man was based on an idea of organization that later on turned into the ability of programming the so called hi-tech machines.

But the idea remains of "open structure" with "open technologies" that reconnects to the configuration of the objects as a concept, and which, even in their formal finiteness, is not completely defined by their use and content. Baudrillard's states that objects express their functionality not by carrying out their task in the best or worst way possible, but by being an integral part of a system that "considers them part of a combination or of a play…", even if in the semiotic meaning of adherence to a system of universal signs.

Even in the progressive loss of the function's adhesion to form, and of the definitive passage of objects to an interpretative system of signs (universal functions) which demolishes the coherence of the previous system (Baudrillard). For Pierce, the object is infinitely interpretable (even if through infinite signs), thanks to a culture that keeps renewing the contents of the naturality which has taken the place of nature.

Today, as the signs do not make clear the certainty and the substance hidden in the objects, because they are with difficulty ascribable to a particular category, what we have defined as concept takes over: open communicative structures that function on the basis of processes that appropriate the unexpectedly appearing variable.

If the surface is the repository of the senses, since there is no more correspondence between the inside and the outside, this is the place where the greatest innovation tends to recover the sensorial characteristics that are the main feature of the system of pre-modern objects.

2. New paradigms. The New Human Factors

The new interpretative paradigms of reality give rise to systems of thought and action able to reconfigure and reorient themselves in a strategic way. The previous economic model was characterized by possession, keeping and conservation of goods, but contemporary modernity makes space for immediacy, understood as acquisition, that is the use and the immediate understanding of things and processes that are behind them.

Actions overlap and mix. They are carried out with the purpose of boosting the satisfaction of individual needs in close connection with collective ones. In this way, new planning references are generated: rational technological systems, behaviour flexibility and recognisability of artefacts.

Applied research, to make innovative technologies immediately available for industry, has filled the world of human activity with cross-reference sophisticated relational visions. Solutions like bus networks allow for a new type of technology and control of installations.

Computer and communicative systems become ever more necessary for organization needs in action contexts, conferring a degree of external connection and access to services once not imaginable. Fertile territory, like the area of household activities, is pervaded by technology and high connectivity with domotics (home automation), which spreads very easily.

This sets the user free from the tasks of organizing, planning, carrying out and understanding

household activities, delegating these tasks to a central computer system, which, of course, can be programmed and managed at a distance thanks to the network of services provided by the enterprise. In this scenario, the goal consists in making the processes that are behind the activities of the environment more transparent. Up to now, these processes had only had the aim of satisfying in an average, neutral way, the needs they are meant to fulfil.

But by directly involving users in choices, by making them willing to understand and spot the processes between outgoing and ingoing actions in the system, better results can be obtained, both on an emotional and a strictly functional level.

Active involvement has a double meaning, "educational" and "playful" (Gilmore & Pine, 2000), in reference to managerial choices regarding the surrounding environment. It leads to the complete modification of the role of the users, no longer doomed to be passive, lacking interest in the processes and activities that surround them, largely self-generated to fulfil or foresee their requests. Starting with these considerations, the object is to focus on the use of the product by the user, in order to analyze the user's performance, rather than that of the product itself. The quality of the industrial products has, up to now, taken into account safety, durability, reliability, design of the object, and, when it is put on the market, the right price/quality ratio. All these qualities mainly refer to the services provided by a given product to the people who buy it. The main feature is founded on objective parameters that are valuable for everyone, not offering specific services requested by individual users.

The characteristics taken into account in order to assure the above mentioned qualities derive from the Human Factors (which originally were the basis of ergonomics).

They are founded on the interaction human-system and include physical, social, cognitive, organizational and environmental characteristics. Later on, because of markets saturation, consumers' movements and environmental awareness, the marketing re-orients its strategies.

It focuses on the consumer and creates the so called "silent designer". Meanwhile the consumers request changes; from passive users, they become active and aware users, like silent designers.

The usability of a product corresponds to the kind of interaction that the person establishes with it and its context. It depends on the kind and degree of relationship that the user creates with the product and the system of activities.

Once the users have acquired knowledge on characteristics, ways and terms of use, they move to the following stage, the stage of the perception of the product and its wide and shared use.

The features of the usability of a product are, above all, connected to the performances provided, and consequently to the ones typical of the cognitive usage: effectiveness, efficiency and satisfaction related to use and usability perception - traits of the psychological perception.

Usability is defined by ISO regulation 9241-11, as "(…) the possibility that a specific user uses a specific tool in order to meet specific targets in terms of effectiveness, efficiency, satisfaction, in

a specific use context". Effectiveness means accuracy and completeness through which the user meets specific targets. Efficacy means resources related to accuracy and completeness through which the user gets a specific target. Satisfaction means a use context which is easy and acceptable to the users.

The User-Centred Design approach, a recent development of ergonomics that relates to the design approach, takes into account the relationships and the interactions that the users create with the products while they use them, according to the following criteria: usability of the system (effectiveness, efficacy and user satisfaction), understandability of the information available (including the language used), easiness of the programming and operativity of command and dialogue procedures, possibility of interactive dialogue after each and every procedure.

The overcoming of usability as functionality, use and performances, takes place when you think of the more individual and subjective features of the user-product relationship, especially in relation to the pleasure in use, which deals with psychological-emotional features of the relationship user-product. These features gather in the research and experimentation of the New Human Factors. Users' intentions and expectations are the basis of this research. Obviously, the system must be easy to spot and understand, so that it can highlight the results in the communicative-interactive space of the relationships that stretch out from one user to the whole system of users.

2.1 User-Centred Design (UCD), the Usability-based Approach

The User-Centred Design is defined as designing products (and services) which the users can use both for a specific purpose and to carry out other operations and the tasks they request, with very little effort and great efficiency (Rubin, 1994). In addition to this, the UCD represents all the theoretical and practical tools available in order to get information about the users' needs and requests in a systemic and structured way. The latter are taken into account from the design phase up to the making of the product itself. More specifically, all the choices made in the design phase try adapt the development and the realization of the product to the users and the use it is addressed to. Moreover, the UCD doesn't focus only on the user – putting him or her at the core of the design and production process – but also on the procedures, the methods and the processes that check products' and services' usability (usability defined by norm ISO 9241:1998, Appendix 1). According to this norm, usability is defined as "the effectiveness, the efficacy and the satisfaction of a certain user with the purpose of getting certain targets within a certain use context". This norm refers mainly to software use, but it can also generally refer to every context in which a user interacts with a product or service in order to get a specific target. The content of the norm ISO 9241 is the core of the UCD in terms of content and of analysis of usability.

The usability of products and services has recently opened up to the whole cycle of products, not being linked just to the specific use of the product anymore (norm ISO 13407, Appendix 6). The lifecycle of the product or service includes the following phases: design, pre-production, production, sale and supply, maintenance, dismantling and recycle.

The user is neither the only one who uses the product not the only one who the UCD process is addressed to. The UCD process includes the designer, the supplier of raw materials, the producer, the seller and supplier, the user and the ones who dismantle and recycle it (norm ISO/TR 16982:2002, Appendix 7).

In order to get the best results while interacting with the product, the UCD plans a cycling check of the theory and the choices made. This cycle helps both improve information and reorient the design process in every phase of the production and development of the product or service.

2.2 Methods and approaches in design working teams

Models of a UCD process help product and services designers offer advice with the purpose of sharing practice, including the users' needs in the designing process. In these models, user requirements are considered important since the very beginning and are included into the whole product life-cycle. Their main characteristics are the active participation of real users, and an iteration of design solutions.

The three main approaches of the UCD are based on well established schools.

- Since 1970, the Scandinavian tradition of IT design has developed the "Cooperative design: involving designers and users on an equal footing";

- Since 1990, the North American school has developed the "Participatory design (PD)" inspired by Cooperative Design, which focuses on the participation of users. In this approach, we have the users involved in the design working group, rather than gathering their feedback through observation and testing;

- "Contextual design or inquiry". A set of formal techniques to gather and analyze information from observation, developed in 1995/6. It is now widely adopted by the US software industry.

All these approaches follow the ISO standard Human-Centred Design processes for interactive systems included in the ISO 13407 Model, (1999), in the group of ISO 20282 (2006/07) and in the ISO/TR 16982 (2002) (Appendix: Standards and Regulations)

The UCD activities consist of four phases: Research and Analysis, Design Process, Implementation and Deployment. Each phase includes a wide range of activities.

Research and Analysis

This phase includes several stages. In the first stage the key stakeholders choose the action set that starts the project plan, which includes the usability tasks carried out by a multidisciplinary team of experts who spot the usability goals. The next phase focuses on determining the field studies, mainly by taking into account the products and by creating user profiles. The task analysis analyzes the user scenarios in order to document user performance requirements. The user scenarios show how people are likely to use (or misuse) new products and services.

This approach is useful to know practical, emotional and social aspects of use for final evaluation. One of its tools is the bodystorming that captures the intuitive responses coming out of interactions. The user performance requirements (user needs) are based on observation, as latent needs, but the users can also directly express their needs.

Design Process

Brainstorming design, concepts and metaphors are at the core of this phase. In order to find a range of published information about customers, competitor and political, social and economics trends, *Research and information* are used.

There are different research methods: the "Cultural probes" is a research technique which probes attitudes and inspirations among different cultural groups; the "Diary studies", are completed by user groups - usually according to a format - and cover topics specified by its usefulness to provide context for interviews and observation; the "Observation" is an immersive research, where the designer observe people carrying out tasks in their own environments and asks about their actions, thoughts and feeling; the "Ethnographic" is an observational research developed in a context of people and tasks targeted in a design project (the design concepts are improved by working with paper and pencil to get to the first step of the low-fidelity prototypes); and "Prototyping of simulations of design concepts" is a technique which moves from written scenarios through sketches, on-screen demonstrations or physical models, to fully interactive working simulations.

Prototypes are essential for user feedback: people are allowed to reflect on their appropriateness or try them out so that their ease of use may be evaluated.

The usability testing on low-fidelity prototypes includes the "User evaluation or user testing". Prototypes of new products and services (or the products and services themselves) are tested by the people who will use them to check how much they fulfil the users' needs, and how usable they are. If good results are obtained, the next step is the creation of the high-fidelity detailed design and prototypes. In this case, the Iterative Design may be a User-Centred approach that iterates through prototyping and user evaluation (or testing) to deliver products and services that are tailored to the users' needs.

After usability testing, finally, a Standards and Guidelines Document including *the design specifications* is written.

Implementation Phase

This phase includes the ongoing heuristic evaluations, which are, the evaluation of a user interface by a set of expert evaluators who judge its compliance with an agreed set of usability principles or heuristics.

The last phase mainly relates to the delivery team as design is implemented. The conduct usability testing is carried out as soon as possible.

Deployment Phase

Surveys get users' feedback and field studies get info about the real use of the product. Finally, the real object's usability is tested.

3 Conclusions

The acquisition of the users' needs can be analyzed from two points of view: the objective point of view, by using only measurable parameters, and the UCD approach, by taking into account also the users' expectations, preferences, feeling and judgments. Needs are identified by their priority to human's needs, related to a scale of values. On top of it there are the basic needs linked to surviving, and down on the scale we find the needs linked to safety, socializing and pleasure or gratification. Naturally, the product or service must fulfil specific requests.

They must either be useful for specific purposes which are coherent with basic needs, or, if they take into account the feelings involved in using a product, create the "pleasure in use". This last hypothesis is still at an early stage, so, for now, the attention is paid only to the UCD.
Since the '80s – the birth of the UCD – it has become more and more important among the tools available for the designers and for research on users. In the past, these investigations were a kind of test to the design solutions in terms of product/service, and this phase was the final stage of the design process. Later on, the user research was used since the very beginning of the real design phase, in order to organize the whole process.

This gives the designers more tools, in order to enhance the awareness of the opinions about products and services. The recent development of the UCD provides the designers with effective research and development tools to search for enquiry techniques that suit best the design process. From the users' point of view, these enquiry techniques boost people to express their wishes, thoughts and feelings that, up to the birth of the UCD, hadn't been taken into any account by classic market researches.

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Appendix

Standards and Regulations

1. ISO 9241:1998 Ergonomic requirements for office work with visual display terminals (VDTs). Guidance on usability.

2. ISO 20282:2006 Ease of operation of everyday products

This new standard for product usability is currently being developed. It is currently a draft technical specification. Once it is finalised it will be tested as a technical specification for three years before being finalised as a standard.

ISO 20282-1 explains how to identify the aspects of the context of use that should be taken into account in the design and evaluation of daily products.

ISO 20282-1 provides requirements and recommendations for the design of easy-to-operate daily products, where ease of operation addresses a subset of the concept of usability concerned with the user's interface by taking account the main user's characteristics and the context of use.

ISO 20282-1 is intended to be used in the development of daily products, for which it defines ease of operation, explains which aspects of the context of use are relevant, and describes the characteristics of the intended user population that may influence usability.

The intended users of this part of ISO 20282-1:2006 are usability specialists, ergonomists, product designers, interaction designers, product manufacturers and others who are involved in the design and development of daily products.

ISO 20282-1 is applicable to mechanical and/or electrical products with an interface that a user can operate directly or remotely to gain access to the functions provided. These products fall into at least one of the following categories: consumer products intended for some or all of the general public which are bought, rented or used, and which may be owned by individuals, public organizations, or private companies; consumer products intended to be acquired and used by an individual for personal rather than professional use (e.g. alarm clocks, electric kettles, telephones, electric drills); walk-up-and-use products that provide a service to the general public (such as ticket-vending machines, photocopying machines, fitness equipment); products used in a work environment, but not as part of professional activities (e.g. a coffee machine in an office); products including software that supports the main goals of use of the product (e.g. a CD player).

1-This part of ISO 20282 is not applicable to the following: purely physical products without an interactive user interface (such as a jug or a hammer); products where appearance or fashion is the main goal (such as a watch with no markings); products requiring specialist training, specific skills and/or professional knowledge (such as a musical instrument or a car); standalone software products; products intended to be used for professional activities only.

3. ISO/TS 20282-2:2006 Ease of operation of everyday products - Part 2: Test method for walk-up-and-use products

ISO 20282-2 specifies a test method for measuring the ease of operation of "walk-up-and-use" products. The purpose of the test is to provide a basis for predicting the ease of operation of a walk-up-and-use product, including measures of its effectiveness and efficiency of operation, and the satisfaction of the intended user population in its expected context of use.

The intended users of ISO 20282-2 are people with human factors expertise in the design and management of appropriate tests, including manufacturers, suppliers, purchasing organizations or third parties (such as consumer organizations).

4. ISO/PAS 20282-3:2007 Ease of operation of daily products - Part 3: Test method for consumer products

ISO/PAS 20282-3 specifies a *test method* for measuring the ease of operation of consumer products. The purpose of the test is to provide a basis for predicting the ease of operation of a consumer product, including measures of its effectiveness and efficiency of operation, and the satisfaction of the intended user population in the intended context of its use.

The intended users of ISO/PAS 20282-3 are people with human factors expertise in the design and management of appropriate tests, including manufacturers, suppliers, purchasing organizations and third parties such as consumer organizations.

5. ISO/PAS 20282-4:2007 specifies a *test method* for measuring the ease of installation of consumer products. The purpose of the test is to provide a basis for predicting the ease of installation of a consumer product, including measures of its effectiveness and efficiency of installation, and the satisfaction of the intended user population in the intended context of its use. The method could also be applied to maintenance tasks.

The intended users of ISO/PAS 20282-4 are people with human factors expertise in the design and management of appropriate tests, including manufacturers, suppliers, purchasing organizations and third parties such as consumer organizations.

6. ISO 13407:1999 Human-centred design process (for interactive systems)

There is an international standard that is the basis for many UCD methodologies. This standard defines a general process for including human-centred activities throughout a development life-cycle, but does not specify exact methods.

In this model, once the need to use a human-centred design process has been identified, four activities form the main cycle of work:

- Specify the context of use. Identify the people who will use the product, what they will use it for, and under what conditions they will use it.

- Specify requirements. Identify any business requirements or user goals that must be met for the product to be successful.

- Create design solutions. This part of the process may be done in stages, building from a rough concept to a complete design.

- Evaluate designs. The most important part of this process is that evaluation - ideally through usability testing with actual users - is as integral as quality testing is to good software development.

7. ISO/TR 16982:2002 Ergonomics of human-system interaction. Usability methods supporting human-centred design

This standard provides information on human-centred usability methods which can be used for design and evaluation. It details the advantages, disadvantages and other factors relevant to using each usability method. It explains the implications of the stage of the life cycle and the individual project characteristics for the selection of usability methods and provides examples of usability methods in context. The main users of ISO/TR 16982:2002 will be project managers. It therefore addresses technical human factors and ergonomics issues only to the extent necessary to allow managers to understand their relevance and importance in the design process as a whole. The guidance in ISO/TR 16982:2002 can be tailored for specific design situations by using the lists of issues characterizing the context of use of the product to be delivered. Selection of appropriate usability methods should also take account of the relevant *life-cycle process*. ISO/TR 16982:2002 is restricted to methods that are widely used by usability specialists and project managers. ISO/TR 16982:2002 does not specify the details of how to implement or carry out the

usability methods described.

Testing methods

Remote usability testing
Remote usability testing is a technique that exploits users' environment (e.g. home or office), turning it into a usability laboratory where user observation can be done with screen sharing applications.

Thinking Aloud
The Think aloud protocol is a method of gathering data which is used in both usability and psychology studies. It involves having a user verbalize his or her thought processes while they perform a task or set of tasks. Often an instructor is present to make sure the user is more vocal as he or she works. Similar to the Subjects-in-Tandem method, it is useful in pinpointing problems and is relatively simple to set up. In addition to this, it can provide insight into the user's attitude, which can not usually be got from a survey or questionnaire.

Subjects-in-Tandem
Subjects-in-tandem is based on pairing subjects in a usability test to get important information on the ease of use of a product. Subjects tend to think out loud and through their verbalized thoughts designers learn where the problem areas of a design are. Subjects very often provide solutions to the problem areas to make the product easier to use.

Cognitive walkthrough
Cognitive walkthrough is a method of evaluating the user interaction of a working prototype or final product. It is used to evaluate the system's ease of learning. Cognitive walkthrough is useful to understand the user's thought processes and decision making when interacting with a system, specially for first-time or infrequent users.

Benchmarking
Benchmarking creates standardized test materials for a specific type of design. Four key characteristics are considered when establishing a benchmark: time to do the core task, time to fix errors, time to learn applications, and the functionality of the system. Once there is a benchmark, other designs can be compared to it to determine the usability of the system.

Meta-Analysis
Meta-Analysis is a statistical procedure to combine results across studies to integrate the findings. This phrase was coined in 1976 as a quantitative literature review. This type of evaluation is very important to determine the usability of a device because it combines multiple studies in order to provide very accurate quantitative support.

Persona
Personas are fictitious characters that are created to represent the different user types within a targeted demographic that might use a site or product. Alan Cooper introduced the concept of

using personas as a part of interactive design in 1998 in his book "The Inmates Are Running the Asylum". He had used this concept, though, since 1975. Personas are a usability evaluation method that can be used at various design stages. The most typical time to create personas is at the beginning of designing in order to allow designers to get an idea of who the users of their product will be. Personas are the archetypes that represent actual groups of users and their needs, which can be a general description of person, context, or usage scenario. This technique turns marketing data on target user population into a few physical concepts of users to create empathy among the design team.