CREATING PARTICIPATORY DESIGN TOOLS: A DIDACTIC EXPERIENCE

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The aim of this paper is to describe the didactic experimentation conducted on the involvement of the user in the design process at the Politecnico of Milan during the Final Synthesis Design Studio course and to document the interesting results of this experience. For students it is strategically important to understand the scenarios of the corporate reality they are about to fit in. The didactic choice requires the introduction of tools created and adopted by important design studios and research groups as well as practical experimentation through short exercises of the simplest approaches. The classroom workshop allowed the students to build up their own work instruments: a set of tools meant to support and stimulate the brainstorm phase. The material assembled during the experimentation was devoted to knowledge elicitation and creativity techniques. The achieved results have very interesting implications for both education and training.

1. INTRODUCTION

Design today is confronted with more and more complex scenarios with an evident need for new products or product systems developed around services, research and new technologies, user communication and interaction interfaces, ergonomics and environmental issues.

There is an evident need for different analysis methods and new design expressions capable of facing the extreme potential of new interactive products with such a strong link to ever growing technologies. New design methods should be structured on experiential aspects coming from the user/product interaction and should include cognitive, emotional and physical aspects. We now see the emergence of design approaches able to evaluate the users' "creative experience". Within the horizon of current research in Human-Centered Design, treated thoroughly by E. Sanders, the concept of co-design is increasingly predominant within the field of participatory design. Starting from such assumptions it is possible to refer to an evolved concept of design as a strategic chance for companies to generate innovation. We are currently taking part in a change of perspective in the relationship between design and social sciences and such change reflects on the migration to the so-called participatory design (or co-design), which involves the relationship with the user. We are moving from a design for the user towards a design with the user [1]. As a result, the user involvement is considered a relevant part of the design process.

2. REFERENCE SCENARIO: CONTEXT AND NEEDS

For the students attending the Final Synthesis Design Studio course (FSDS) it is strategically important to understand the scenarios and the environment of the business market they are about to enter. This step completes the final course of their three years educational path. Traditional market logics, where design is considered only for its aesthetic value or as accessory to the final product and not as business strategy, need to be rethought. It is extremely important for a young designer to contribute to the

reconfiguration of the relation product/user according to the needs of the ever more fluid and flexible markets and societies. Identifying needs, desires, behaviors and user experience are crucial elements for developing high quality products and services. "In the near future, designers will learn to use their own creativity to amplify the creativity of everyday people" [2, 3].

Today, more than ever, arises the need for a methodological approach able to consider, in a comprehensive way, the context of use, involving the "creative abilities" of the user. From this perspective, to introduce simple exercises enabling students to build their own tools to involve users during the creative phase, is a way to give them the chance to understand the value of delineating new design strategies.

From a didactic point of view the main aim is to teach a method, to be applied during the different design phases, able to support a young designer in the understanding of people's needs and desires not only on the physical and cognitive level, but on the emotional level as well.

The ability of a product to interpret and meet the needs of people's psychological and perceptive spheres, is linked, then, to different factors such as: expectations, desires and aesthetics as separate from social, cultural and generational references. These constitute a research area particularly relevant to design and which identifies new values for the design of everyday objects, a clear evolution from a business model driven exclusively by market needs to one design-driven [4, 5].

The active involvement of the user (Designing for People), defined in the traditional approach of User Centered Design, based on the evaluation of the physical and functional component of the interaction man-environment-product, is in contrast to the definition of "Designing with People" where the proactive participation of the user is the main focus of attention. The fundamental difference between the two types of research within design, in the way identified by the international scientific community, is that design with the user necessitates the employment of tools created by the designer with the purpose to stimulate, identify and select ideas generated by "non-designers". This is, for young designers, a key point to be understood as it enables a radical change of the approach to design and its users.

3.   CREATIVITY AND INNOVATION

In order to understand the perspective of who has to involve someone else in the design process, it is convenient to define creativity starting with the definitions given in the dictionary. Often such definitions are tautological (see Oxford which defines creativity as "the ability to create"), however, both Devoto-Oli and Zingarelli describe creativity as an ability, consequently not only an innate gift, but something that needs to be pursued, developed and improved. Creativity (mental phenomenon) always precedes innovation (economic, social and cultural phenomenon), generating ideas that once communicated, shared and adopted by the community, develop into innovation.

Creative thinking consists in facing problems from a basis of solid knowledge, and yet adopting new perspectives, with the aim to find innovative and effective solutions for any purpose. This way of thinking often revels a less than linear flow, and consists in collecting, selecting and reconfiguring only important information among all that which is available, and in identifying relationships that assist the creation of new results [6].

In Science and Method, Henri Poincaré, describes creativity as the ability to combine existing elements into new useful configurations and asserts that the intuitive criterion to recognize the usefulness of the new configuration is "its beauty" [7].

Often, creativity is considered a privilege belonging to few talented people, but research shows that most people have potential creative ability. Psychologists J.P. Guilford and E. de Bono, who have investigated the human mind and its mechanisms, divide the ability of thinking in convergent and divergent or vertical and lateral (for de Bono) identified by the way they deal with problems. The first type of thinking proceeds by linear sequences: cause-and-effect, assumptions and consequences. The second type of thinking proceeds in a non-sequential way and works by similarities-analogies and differences, symmetry and asymmetry [8, 9]. When the aim is to have a truly different and innovative solution it is necessary to change mental patterns to be able to see things from a different perspective.

It is essential to abandon the convergent/vertical thinking, the one based on logical deductions, to enter into the creative lateral thinking [10].

Scientific research is orientated towards the development of creativity as an educational process to be adopted within companies as well. There are various methodologies and many techniques conceived and developed to stimulate creative solutions. These tools are used with the aim of promoting and generating creativity, brake set patterns, stimulate imagination and, depending on the method used, improve the environment where creative ideas originate and are developed.

4. COLLABORATIVE DESIGN TOOLS

User involvement seems to be an attitude, a new way to consider the user as part of the project. It is a basic requirement to develop solutions able to meet the desires of the user.

This method, defined as participatory design or co-design, relies on two different approaches to the project. The first considers the co-operation between researchers and designers as divided into two different levels. The initial stages are carried out by researchers who interpret and translate the results into design criteria used then as starting point for the designers. In the second approach, on the other hand, the roles of researcher and designer may overlap.

In both cases the final users are involved in a direct and proactive way in the design process, they are not only the targets for the final product, but they become part of the creative development of the product itself. It is necessary for the user to be actively and constantly involved in all the research phases. As Sanders explains in "How Do We Experience Access?" [11], there are many ways to access information from people about their memories and experiences and it is by carefully listening and interpreting that it is possible to get in real contact with them.

People have to interface with situations and describe them, trying to focus on the process, interact with objects, make some actions and gestures and share and discuss the experience with the designers trying to point out obstacles and limitations met in relation to the given object or a gesture.

Participatory design techniques are becoming tools highly used in the design of new products and considering this methodology at an early phase of the research is crucial. Teaching this kind of approach that relies on the complete involvement of the user in all the design phases, it is not exclusively a theoretical exercise, but a new way of thinking and acting able to change the roles in the design process.

The constant and active user participation aims at evaluating the interaction between user and product and interpreting the emotional and physiological responses.

4.1. The didactic experience

Considering the importance of knowing and developing tools able to highlight creative aspects arising from people's experiences, during the FSDS course, part of the lectures were devoted to the introduction of new methods of investigation and new tools.

The FSDS at the Design Faculty of the Politecnico di Milano uses an innovative educational model for design: during the course, the knowledge and experience of the professors become part of the student's hands-on designing.

The course is made up of three main stages: 1. Analysis: developing a research focused on defining the brief and the design requirements; 2. Concept: the design goals start "coming to life" in the new ideas: the concepts; 3. Final project: the concepts are developed into an executive standard, bearing in mind technical and production constraints. The educational model uses three different didactic modules: 1. Theoretical/methodological lectures, given by each teacher of the laboratory according to his own working field, are organized in order to support specific moments of the process; 2. Seminars with professionals, companies or experts with multidisciplinary skills, are organized in order to provide the students with a wider view of the design issues; 3, Tutoring activities: revisions of the projects. While students work in the classroom the teachers and tutors help them develop their design process via systematic revisions. This is the most important module and it is when learning becomes practice.

The students' design process is not linear: it is meant to give the students the incentive to expand and question their work. Thus, the model is iterative and not just consecutive as it builds up the student experiments by inspecting and fine tuning the design according to the learning level and the ability to focus on specific issues.

The first step gives the students the skills to structure their preliminary research: choosing the context, historical references, benchmarking, the state of the art, materials and technologies; but also everything that concerns the use analysis: the target users, the conditions of use and possible competitors. It also involves user groups via interviews, questionnaires, direct observations, etc. This underlines both the issues involved as well as the specific aims of the final product. It should be noted that in the UCD approach the user is considered in a broader sense, is not only the final consumer, but also every other figure involved during the whole product life cycle.

Students are encouraged to carry out trials with users and compare a range of products, similar to the one to be redesigned. The idea is to involve users form different backgrounds in a typical environment of use of the product in order to highlight possible design directions.

Interviewed users are not usually involved in the concept and design phases due to didactic timing, but are involved in the final phase of product development, when usability is tested using mock-ups. This step is useful to make the latest changes to the product and allows students to learn the differences between the ideal model of the designer and the model for the user.

In the second phase the design goals and requirements become real through the concepts; and finally students are able to design, freeing their imagination.

This module stimulates the students' creativity by working on analogies and brainstorming techniques. This didacticism includes the teaching, through lectures, of some of the tools designed and used by leading design firms such as IDEO, Design Continuum, Philips Design, and an experimentation phase through short class exercises of the basic techniques.

The didactic approach takes the definition of creativity as its points of departure along with the valorization of lateral thinking followed by a description of the tools related with the different phases of the design process. Due to the quality of existing techniques and the inexperience of the students, two or three of the most interesting techniques are presented for each phase during the lecture. The techniques characterizing the process of idea generation are grouped in six main phases (http://www.mycoted.com):

1. Preparation: create a working space comfortable enough to let people express their creativity; organize "creative groups"; localize the people capable of acting as catalysts of creativity in group work; 2. Problem Definition: including problem analysis, redefinition, and all aspects associated with defining the problem clearly; 3. Idea Generation: focusing on creative aspects and the development of new ideas — the divergent process of coming up with ideas; 4. Idea Selection: the convergent process of reducing all the many ideas into realistic solutions; 5. Idea Implementation: turning the refined ideas into reality; 6. Processes (evaluation): collecting the results and their evaluations from the creative session. Schemes and techniques that look at the overall process from start to finish.

The use of creative techniques is an on going process. Some of these techniques are: brainstorm; story board; lotus flower; morphological analysis; mind maps. These are some examples of tools introduced together with behavioral maps and "in depth" interviews to deeply understand the root cases; unfocus group to further creative freedom; atypical questionnaires to investigate interaction behaviors, style and aesthetics, etc. In a more advanced phase of the project, after the brainstorming, arises the need to build fast models able to help the visualization of possible solutions, using techniques such as: mock up everything and create scenario, able to support the shaping of any kind of model with any possible user [12].

One of the methods to involve people in the design process is certainly the game. Both Philips and IDEO have developed kits enabling the designer to approach the creative phase in a dynamic and engaging way. Philips Design [13] has developed "Spark", a game to stimulate creativity and innovative thinking. IDEO Method Cards is a collection of 51 [14] representing diverse ways used by design teams to understand the people they are designing for.

The learning scheme adopted relies on the three following phases: representation of conduced analysis; problem identification; preparation of tools to support the brainstorming session. The exercise aims to teach students how to build their own tools.

The students are asked to produce a number of cards, able to stimulate the generation of ideas, to be used during a simulated brainstorming session. The material made to support the experimentation is devoted to knowledge-elicitation-tools such as card sorting [16] and brainstorming.

FSDS students work in groups of three during the first phase of research and then individually during the following two phases. During the class exercise, groups are organized in macro-groups of 12 people where each design team (of three people) is charged with the organization and presentation of the material for the creative session to the colleagues.

From the experience of teaching as part of the FSDS team emerged the tendency of students to become stuck on information gathering (group phase), rather than proceeding to the phase of solution generation. Groups, indeed, are an excellent opportunity to generate creativity since the creative process, supported by a "collective brain", is faster. As claimed by psychologist K. Lewin, the group is something more than the sum of the singular parts. The brainstorming simulation sees qualitative disadvantages compared to the ideal number of participants and positive attitude.

The exercise is organized over three days. The first day, the preparation of the creative session, starts form the graphic interpretation of the information collected and the definition of the problem to be explored during the activity. The leading group would have 10 minutes (max.) to introduce synthetically the topic. Students are invited to use mental maps, a technique of graphic representation of knowledge introduced by psychologist Tony Burzan around 1960. A map is a highly effective tool of abstraction and mental organization, it enables students to articulate, organize and structure information, thus supporting and easing creative thinking.

Figure 1. Mind map of problems involved in asthma (left) and sleep therapy (right).

Young designers use diagrams to graphically visualize the concepts: the main idea is placed in the middle of the scheme, while information and details are placed on the external rings.

After the completion of the formalization of the aspirations and visualization of the issues and/or requirements starts the production of the cards based on the IDEO model. The cards are classified as four suits: Ask — recruit people to have information useful for the project; Look — observe people to understand what they really do instead of believing what they say they do; Learn — analyze collected information to identify models and possible intuitions; Try — simulate activities to try and identify with people and evaluate suggestions or possible design directions. Students are asked to produce at least one for each kind and encouraged to make some more for Try.

Understanding the difference between the cards Ask, Learn, Look and Try is often complex and requires an extensive effort in class. It can be useful to show examples of incorrect cards, but it is usually necessary for a tutor to work together with the students to make sure the cards are understood and used correctly. For example in TRY, create situations and interactions using uncommon objects, it is not correct: to ask to the user to try and wash the dog following the method they consider more appropriate as that has to be considered LOOK, observe user habitual behaviours. To give users a

serial of electronic devices with different features, invite them to choose one and motivate such choice, despite the use of physical objects, is not a TRY, but a ASK as it is a direct request requiring a direct answer.

In LEARN, where the user is expected to show the designer a known information or task and analyze it, it is not correct: to ask a diabetic to perform and illustrate the procedure of a glycolic control as it is clearly a LOOK and a ASK.

Some examples of the cards developed by the students during the class workshop will follow to describe their educational value.

The result was unique and educationally stimulating. In the following pictures it is possible to see the development from ideation to production of some cards.

Figure 2. Preliminary sketch for the design of a Look card. The purpose is to observe users while using a glucometer without the support of a surface (by A. Appiani).
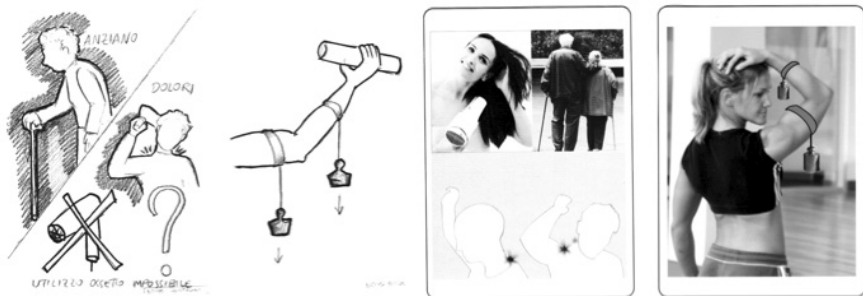

Figure 3. Sketches for Learn and Try cards (left) and their final images (by E. Bertolini).

The first images are the ideational sketches of cards to be used during the creative session with the colleagues acting as users. Each student has set up 4 cards (one for each category) thinking, in relation to his project, to the information he wanted to collect, the direct observations he was thinking of doing, some actions and experiments he wanted the user to execute. Obviously, the cards are built on a hypothesis based on previously gathered information related to the design to be developed. Each card should have a short text explaining How and Why as well as an evocative image. Figure 4 shows the cards for the design of a portable aerosol. The design of the device has adopted an approach of lateral thinking [10].

The ideas described in these cards originate from a technique of image association to discover information about cognitive aspects of the user; in Learn comparison is used to try to understand which objects allowing a hand-free transport are more or less invasive while for the card Try it is asked to transport a bottle from one place to another using only a selection of objects. From these cards it is possible to guess that the student was interested in investigating different aspects of the objects portability.

Figure 4. Cards for the design of a portable aerosol (by B. Anselmi).

As in the previous case, the ideation on the card Try for the design of a juicer (see figure 5), the group decided to use a lateral thinking approach. During the brainstorming session, they selected various items meant to help extract the juice from an orange and create a fun atmosphere able to release spontaneously the flow of ideas.

Figure 5. Trying to extract the juice from an orange.

The cards can be used to identify specific characteristics for the product and to refine some of the earlier design choices. The card Learn of the design team for a deep fryer show a visual approach, for the selection of the functions that should necessarily be preserved in the product, by providing a selection of images to be ordered by relevance. The same team also decided to simulate the immersion of food to be fried using small containers full of water where the "users" had to dip frozen potatoes using the material made available by the design team (nets, skewers, wooden spoons, ecc).
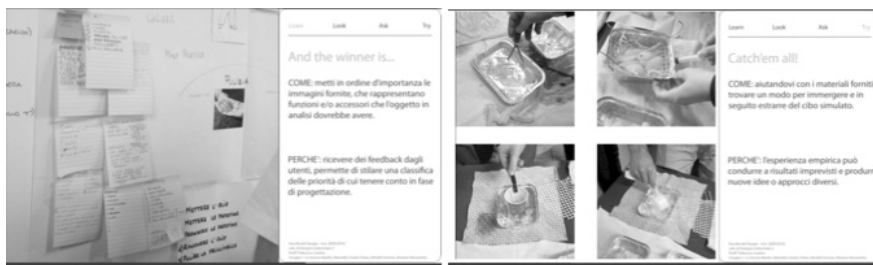

Figure 6. Cards Learn and Try for design a deep fryer (by LoIacono, Mareddu, Miraldi, Molana).

The last day is devoted to the simulation of the brainstorming. Starting from the meaning of the word brainstorming "brain storm", the students are reminded that ideas are generated as a consequence of each other. The starting point would be the design issue followed by a free flow of more or less possible solutions and ideas.

Brainstorming comprises two phases: the divergent and the convergent. During the day the students only experience the first one, the divergent phase, in which ideas are produced freely and in big quantity. The group leading the brainstorming session should stimulate the others to propose ideas and write them down using key words. The convergent phase, where ideas are selected, evaluated and restricted to a small selection of the most interesting ones, is undertaken individually by each student and supervised by the faculty. For all creative techniques the following is fundamental: don't make judgments; use analogies and metaphors; invent ideal solutions, starting from imagination goals; link concepts, technologies or objects not previously related; generate a high number of possible solutions.

The creative exercise takes place simultaneously for 3/4 macro-groups. After the 10 minutes dedicated to the initial description of the issue every design team has an hour to carry out the activity and use the cards and the tools previously produced for such purpose.

5. CONCLUSIONS

Creativity is the base for *innovation* and they are complementary activities. There is no innovation without creative ideas. Innovation enables companies to be competitive, which is why a young designer's knowledge of creative techniques may play an important strategic role for companies. Understanding a structured design process is essential for a young designer's ability to master innovative tools, methodologies and determine the interaction between user and product in designs with such features as: strong social value, innovative materials and technologies and a remarkable impact on life quality. To better understand this kind of educational approach towards young designers it might be interesting to mention the European Year of Creativity and Innovation 2009 focused on raising awareness on the importance of creativity and innovation as key drivers of personal, social and economic development. The aim of the Year was to promote creative and innovative approaches in different sectors. Innovation and knowledge economy, the transition towards a creative economy, education for creativity and innovation, creative ideas and innovative solutions are arising as crucial factors to rescue Europe from the current economic crisis. There are some important initiatives that aim at raising awareness and urging European companies to invest in the development of creative abilities with the use of methods and techniques to promote creative environments and, therefore, innovation. For example the "CREATE project" [15] focuses on the companies' ability to be creative. In connection with the foregoing, a young designer with the ability to handle specific tools and techniques aimed at stimulating new ideas and group problem solving may contribute positively to the competitiveness of any company.

In Italy, at present, strategies adopted by design-driven companies don't relay on the user involvement as a proactive design resource. It is in such context that becomes extremely important to form young designers with an understanding of the value of such user approach and it is aim of the described didactic method to do so.

Considering the foregoing becomes strategic to find educational methods able to give students the ability to develop creative instruments and the understanding of their importance within companies economic growth. As students approaching the FSDS course have no experience of management and stimulation of creativity, the first aim is to show them existing instruments, traditionally used in other disciplines, which can be adapted and turned into new working tools by designers. It is of great importance to make students understand what potential has designing a "personal" tool to stimulate creativity. The evidence of the results of the method, introduced two years ago, are in the high Bachelor evaluations achieved and in the two patents awarded by projects coming from the FSDS course.

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