Creativity for Designers

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Abstract
This paper presents an introduction to modern and interdisciplinary concepts related to creativity and creative processes. The selected topics are of special relevance to professionals of any kind in connection with their work as designers. Some useful creative tools and approaches are also outlined. Finally, practical recommendations to enhance and apply creative work in design are elaborated.

Keywords: Design, Creativity, Creative tools, CPS

Why should professionals learn about creativity?

During the last decades, industrialised countries have experienced radical changes in many areas. New information, communication and biological technologies are reshaping the material, human and social basis of Society, giving new opportunities for development and at the same time creating new problems: pollution, depletion of resources, deterioration of the material world, deterioration of human beings, etc. For several years politicians, business people, experts, and NGO's have been emphasising the crucial need for creativity and innovation to be able to utilise the new opportunities and to solve the many serious problems that the World is facing today, both in the North and South.

The above-mentioned development means that professionals (engineers, architects, system designers, business consultants, managers, etc) as designers are facing new demands: creative problem solving in collaboration with a group of actors, participants and users. This means that the professionals need to have the capability to be able to redefine the necessary skills for a given task, and to access the resources for learning (learning to learn). The main qualification in this respect is the ability to facilitate design processes in a creative way, involving participants actively and being able to regard the design situation in relation to a dynamic context of different environments. The essence is the ability to alternate between modes of routine, reflection and creativity in interaction with the stakeholders, rather than being "locked" into one of these modes. The traditional understanding of design as a highly rational and programmed process is simple and straightforward, but it is insufficient if the task is new and part of a bigger relationship and system that is changing too. Therefore, the need of creativity methods for problem design in practice

In addition, professionals working creatively and facilitating creative design processes experience a constant contact with the pleasure of creation; their work sometimes becomes artistic activities. This will contribute to having a good and enjoyable life. Creative thinking can also become a life style, a personality trait, a way of regarding the World, a way of interacting with others, a way of working in groups, a way of living and growing. Living creatively means developing your talents, tapping your unused potentials and becoming what you are capable of becoming through interaction with other people, self-discovery and self-discipline.

In principle, there are two ways of escaping our more or less automatized routines of living, thinking and behaving. The first is the plunge into dreaming or dream-like states, where the rules of rational thinking are suspended. The other way is also an escape - from boredom, stagnation, intellectual predicaments and emotional frustrations - but an escape in the opposite direction; the spontaneous flash of insight that shows a familiar situation or event in new light signals. The creative process enables man to achieve a higher level of mental evolution.

In this paper we are focusing in developing creative abilities and some supporting tools. Thereafter, some uses of creative tools within design work will be outlined. But let us first introduce our conceptualisation of design and creativity.

What is design?

We have a broad conceptualisation of design. Design is everywhere. It is in the last artefact you bought and it is what makes online purchasing possible. A definition such as design is "making things better for people", is probably too broad. Nurses, politicians and priest are not designers although they could claim that they are making things better for people. Meanwhile, a definition focused only on products or computerised realisations of ideas exclude the work of graphic designers, service designers, visual artists and many other disciplines.

We see design as an activity that translates an idea into a blueprint or a conceptual model for something useful, whether it is furniture, a building, a graphic, a piece of art, a service or a process. A designer will combine insight and knowledge from other disciplines and turn a concept into something that is desirable, viable, commercially successful, aesthetical and adds value to people's lives.

Design is not only style and fashion. Design is not restricted to the surface of things and how they look. Aesthetics are important, but only a part of a bigger picture. Design is a fundamental activity in modern society. Everything around us is designed. Design decisions impact on nearly every part of our lives, be it the environments we work in, or the way we book holidays.

Good design begins with the users. No design is any good if it does not fulfil the user's needs. Therefore sometimes it is needed participative design. Good design is based on the user's needs, creativity and commercial insight. Creative thinking and creative tools are essential elements in any designer's toolbox together with rational and commercial approaches. Different designers use different methods – combining inquiries, market research, user testing, brainstorming, drawings, prototyping and trend analysis.

What is creativity?

All individuals are creative; creativity can be enhanced or blocked in many ways. We consider creativity developmentally, opposite to those who believe that a person's creativity was established at an early age. However, research has shown that creativity does not develop linearly and that it is possible to use activities, teaching methods, motivation and procedures to produce growth, even in ageing. Creativity is an infinite phenomenon; you can be creative in an endless manner (P.E. Torrance, quote in Goff, 1988),

We can characterise at least three types of creative persons. First, the problem solver one where the person (subject) is trying to solve a problem (object) in a creative way, this is the case of professional designers. Secondly, the artistic person (subject) who creates a new piece of art (object) usually it will be a close interaction between the subject and object, the "soul of the artist" will be in the object, this object can be a product (painting, music, film) or a process (dance, theatre, performance). And thirdly, the persons that adopt creativity as a life-style being creative at work, at home and everywhere, both in an extrovert and introvert way (inventors, some artists, mode designers, etc).

Creativity in each individual has three components: expertise, creative-thinking skills and motivation (Amabile, 1983). Expertise is in a few words knowledge in its many forms: technical, procedural and intellectual. Knowledge can be acquired both theoretically and practically. Learning to learn is an important tool for becoming an expert in modern Society. Creative-thinking skills determine how flexibly and imaginatively people approach problems and tasks. It demands courage to be creative because you will be changing the status quo. Individuals can learn to be more creative and can learn to use creative tools in problem solving. Motivation is the last component. An inner passion and desire to solve the problem at hand will lead to solutions far more creative than external rewards, such as money. This component, usually called intrinsic motivation, is the one that can most immediately be influenced by the work environment. Individual creativity gets killed much more often that it gets supported. Mostly, it is not because management has a vendetta against creativity, it is undermined unintentionally because of the optimisation of short business imperatives: co-ordination, productivity, efficiency and control.

It is difficult to give a simple and general definition of creativity. We will restrain to study creativity in relation to design tasks and problem solving in general. *Creativity is the ability to challenge assumptions, break boundaries, recognise patterns, see in new ways, make new connections, take risks, and seize upon chance when dealing with a problem (Herrmann, 1996).* In other words, what you do is creative if it is new, different and helpful. In addition, it is important to enhance that the creative process is *heuristic* rather than *algorithmic*. A heuristic is an intuitive guideline or rule-of-thumb that can lead to learning or discovery opposite to an algorithm that is a complete rational and mechanical rule for solving a problem. In few words, creativity is an intuitive process for discovery that sometimes ends in a product, a process, an idea or just a new experience.

Barriers to creativity

To be creative you have to be open to all alternatives. This open mindedness is not always possible to meet because all humans build up blocks or mental locks in the maturation and socialisation process. Some of those locks can have external causes, such as family environment, the educational system, and organisational bureaucracy. Other blocks are internally generated by our reactions to external factors or by physical factors. A key to improve your creativity is to become aware of your locks and do something about them. While everyone has blocks to creativity, blocks vary in quantity and intensity from person to person. Most of us are not aware of our conceptual blocks. Awareness not only permits us to know our strengths and weakness better but also gives the needed motivation and knowledge to break down these blocks. Mental locks have been identified as perceptual, emotional, cultural, environmental, and intellectual (Goff, 1998).

Perceptual locks are obstacles that restraint us from clearly perceiving either the problem itself or the information needed to register the problem. It is well known that our eyes can deceive us in observing some figures. Our perceptions are not always accurate.

Emotional locks restrict our freedom to investigate and manipulate ideas. They prevent communicating our ideas to others. These locks are also called psychological barriers and are the most significant and prevalent blocks that impede innovation. Fear of something new is a common characteristic of many individuals in the developed world.

Cultural locks are adapted by exposure to a given set of cultural patterns. The culture of the industrialised countries trains mental playfulness, fantasy and reflectiveness out of people by placing stress on the value of efficiency, effectivity and moneymaking. Taboos and myths are predominant blocks to creative behaviour. Therefore, it needs courage to be creative in a culture that does not support creative changes.

Our near social and physical environment imposes environmental locks. Creative persons have usually had a childhood where they were free to develop their own potentialities. We have seen that organisational climate can be a barrier or a stimulus to creative activities.

Intellectual locks are caused by conservatism and lack of willingness to use new approaches. The same approaches, the same tools and the same persons are tackling the same problems for years. Persons with intellectual locks are usually very negative to changes and are fast to criticise new proposals.

Creative abilities and supporting tools

There are a variety of abilities that characterises creative individuals or groups. Four of the key abilities will be discussed in this section as well as tools to enhance them in concrete problem solving or design situations. They are: Fluency, flexibility, originality and elaboration. In this paper some few tools will be presented, those being the most popular in creative work. Creative tools can also be found in the following addresses:

www.ozemail.com.au/~caveman/Creative/Techniques/index.htm
www.thinksmart.com
www.creax.com/creaxnet
www.creativity-portal.com

Fluency is the production of multiple problems, ideas, alternatives or solutions. It has been shown that the more ideas we produce, the more likely we are to find a useful idea or solution. Fluency is a very important ability especially in the creative design process. To have too few alternatives is not a good thing in design work processes. There are many tools for producing ideas, alternatives and solutions. Several researchers have shown that training and practice with these tools cause a better fluency.

One creative tool, which has been widely used with big success for generating many ideas, is Brainstorming (Osborn, 1953). It was invented for the sole purpose of producing checklists of ideas that can be used in developing a solution to a problem. The tool is directed to generating unconventional ideas by suppressing the common tendency to criticise or reject them summarily. In a Brainstorming session no criticism is permitted, and freewheeling generation of a large number of ideas and their combination and development are encouraged. Brainstorming is founded on the associative premise that the greater the number of associations, the less stereotyped and more creative the ideas of how to solve a problem will be.

However, nothing in Brainstorming is directed at changing the assumptions or paradigms that restrict the generation of new ideas. This is an excellent technique for strengthening fluency, fantasy, and communication skills. It is a good idea to have a facilitator to prepare and warm-up the Brainstorming session, to lead and support the session, and to evaluate the whole process. This tool gives the possibility for the group to use more than one brain achieving a synergetic effect. Generate a multitude of ideas and some of them will be truly useful, innovative and workable. Asking individuals for inputs gives them an increased sense of importance and produces an atmosphere for truly creative and imaginative ideas to surface and be acknowledged. Brainstorming has been used for a wide diversity of problems, including not only design, marketing and product issues but also strategy development, planning, policy, organisation, leadership, staffing, motivation, control, and communication. However, this tool is not appropriated for broad and complex problems demanding high-qualified expertise and know-how. Some of the ideas produced may be of low quality or obvious generalities. Brainstorming is not a good idea for situations that require trail and error as opposed to judgement.

Flexibility is the ability to process ideas or objects in many different ways given the same stimulus. It is the ability to delete old ways of thinking and begin in different directions. It is adaptive when aimed at a solution to a specific problem, challenge or dilemma. Flexibility is especially important when logical methods fail to give satisfactory results. Looking at modern paintings requires flexibility, they demand looking from different perspectives in order to see different objects, images and symbols. Seeing persons or objects in the clouds requires the flexibility of seeing concrete shapes in cloud formations. Flexible thinking provides for changes in ideas, detours in thinking to include contradictions, differing viewpoints, alternative plans, differing approaches and various perspectives of a situation.

A family of creative tools, known as verbal checklists, has been developed to enhance flexibility in the creative process. Usually this is a checklist of questions about an existing product, service, process, or other item to yield new points of view and thereby lead to innovation. The idea behind the verbal checklist is that an existing product or service can be improved if one applies a series of questions to it and pursues the answers to see where they may lead, this for instance the case of the technique known as SCAMPER (Eberle, 1971). The main questions take the form of verbs such as Modify? or Combine? These verbs indicate possible ways to improve an existing product or service by making changes to it. Then you add definitional words to the verb, for instance combine ideas, combine appeals, combine purposes, combine units, etc.

Another important tool for encouraging flexibility is the use of provocative questions. These questions will open up a situation to a broader and deeper direction of thinking which otherwise might not be produced or considered. They encourage people to think about ideas or concepts they have not thought about previously. Some provocative questions can be: What would happen if: water tasted like whisky? Cats could bark? Women could fly? How is: A PC like a ship? A flower like a cat? A sunset like a lake? A car like a fork? What might happen if: It never was Sunday? It was against the law to be perfectionist? People were not creative? Image what might happen if: By law it was forbidden to have children? Cars could fly? Men could have children?

Originality means getting away from the obvious and commonplace or breaking away from routine bound thinking. Original ideas are statistically infrequent. Originality is a creative strength, which is a mental jump from the obvious. Original ideas are usually described as unique, surprising, wild, unusual, unconventional, novel, weird, remarkable or revolutionary. You need courage to be creative, because as soon as you propose a new idea, you are a minority of one. Belonging to a minority is unpleasant. In addition the original thinker must be able to withstand the ridicule and scepticism, which will be directed toward his/her ideas and himself/herself. To enhance creativity we have to be respectful of unusual or crazy ideas or alternatives.

Picture Stimulation is a very popular technique used to provide ideas beyond those that might be obtained using brainstorming. The members of the group will look at a set of selected pictures and relate the information gained from the picture to the problem, otherwise the rules of brainstorming should be followed. Photo excursion uses the same principles of picture stimulation but instead of using prepared pictures for stimulation, participants are required to leave the building walk around the area with a (Polaroid or digital) camera, and take pictures of possible solutions or visual ideas for the problem; when the group reconvenes, ideas are shared. Another related technique is the Object Stimulation tool where instead of pictures a variety of different objects (e.g. a hammer, a pencil, a board game, etc.) will be used. Sometimes you can use words instead of pictures or objects, an associate them to the problem to be solved.

There exist a number of computer programs that can be used to generate alternatives and otherwise add creativity to the design process. They will include a huge amount of words and phrases together with many idea-associations that are linked to several

thousand questions. The words, phrases or questions, randomly selected, will provoke ideas and associations that have to be related to the problem in question.

Originality can also be enhanced by analogies and metaphors. An analogy is a comparison of two things that are essentially dissimilar but are shown through the analogy to have some similarity. A metaphor is a figure of speech in which two different universes of thought are linked by some point of similarity. In the broadest sense of the term, all metaphors are simple analogies, but not all analogies are metaphors. Nature is a good source to provide analogies. Poetry is a good source of metaphors. Similes are specific types of metaphors that use the words "like" and "as" - for instance, the wind cut like a knife; his hand was as quick as a frog's tongue, he sees like a condor and digs as fast as a mole. Similes can be used to suggest comparisons that offer solutions.

Elaboration is to structure and find paths in a convergent process following after a divergent process. Mind Mapping is a visual and verbal tool usually used to structure complex situations in a radial and expanding way during the creative design process (Buzan, 1983). A Mind Map is by definition a creative pattern of related ideas, thoughts, process, objects, etc. It is difficult to identify the origin and the creator of this technique. It is quite probable that this tool has been inspired by research on the interplay between the left and the right hemisphere of the brain. The principles to construct mind maps are few and easy to understand. The best way to learn it is by practice. After short time you will do it automatically. If it is difficult for adults it is because they think linearly and take notes in a linear way (using the left hemisphere of the brain). To make mind maps you have to draw ideas from the centre of the paper and move in a radial and parallel way, to do that you have to use both your creative and your logical brain. With some experience you develop your own style, your own pallet of colours, your own symbols, your own icons, etc.

A Mind Map contains usually the following elements:

- The subject or the problem that has to be studied or analysed will be placed in the centre of the paper
- Keywords (names or verbs) are used to represent ideas, as far as possible only one word is used in a line
- The keywords are connected to the centrum through a main branch and sub-branches
- Colours and symbols are used to emphasise ideas or to stimulate the brain to identify new relations
- Let ideas and thoughts flew free, avoiding too much evaluation during the period of elaboration of the map.

The Creative Problem Solving (CPS) Approach

Complex problem situations or messes demand a combination of rational and creative approaches. The CPS approach provides a framework to deal with messes.

The five steps CPS approach is described as follows:

1. *Fact finding:* Observe carefully and objectively, like a camera, while collecting information about the problematic situation. Explore and identify

the facts of the situation. *Action:* Who? What? Where? When? Why? How (is and is not)?

2. *Problem finding:* Clarify the challenge or problematic situation by considering different ways of regarding and reflect on those possibilities. *Action:* In what ways might we…? How do we…?
3. *Idea finding:* Look for more diverse ideas, alternatives, options, paths, ways, and approaches, use various methods and techniques (divergent thinking). *Action:* Make new relationships, associations, and connections, magnify, minify, combine, rearrange, change, reverse, turn upside down, and inside out.
4. *Solution finding:* Examine ideas in new and different ways, from even more viewpoints and criteria; become aware of consequences, implications, and reactions to tentative idea/solution. Select or combine ideas to create a plan of action (convergent thinking). *Action:* Effect on whom? Effect on what? How to improve?
5. *Acceptance finding:* Develop a plan of action, considering all audiences that must accept a plan. Seeks ways of making the idea/solution more workable, acceptable, stronger, more effective, and more beneficial. *Action*: What objections will different groups have with the idea/plan? How might be set this plan into action? Who is going to do that?

Experience has shown that it is recommendable in a CPS process, at each step to start with *divergent thinking* to produce as many ideas or solutions as possible and thereafter to switch to *convergent thinking* to select the few most promising ideas. It is not unusual that in a group some members will very easily diverge, that is build a list of alternatives, while others will converge very fast by trying to select the best solution from the list and the rest will be passive not knowing what is required of them. Hence the need of *a facilitator*, he or she designs a clear and visible process to align the group. The facilitator will support the process, will elaborate a plan of steps to be followed, will organise a work-shop, and will manage the whole problem solving process to secure that an action plan will be elaborated and implemented. The facilitator is the designer of a participative problem solving process.

Styles of Creativity

Individuals exhibit various degrees of creativity throughout their lifetime. Usually, we have settled into a pattern or style of creative thinking. Just as it is valuable to understand your locks to creativity, it is important to understand your own style of creativity. Each of us has different personalities, although we all have the ability to be creative, personal differences and preferences cause us to approach creative design problems in different ways. This is very central especially while working in groups, because each person has a contribution to make due to his or her unique profile. Creative groups are very effective if different styles of creativity are combined, to stimulate our thinking in different directions and to cause us to re-think our usual approaches.

A person's creativity style is founded in how he uses information to stimulate his creativity. Each creativity style prefers a different method for generating and evaluating ideas. Research work shows that preferences for style can be classified in four categories (Miller, 1989):

- The *modifying* style likes to ask: What can we adapt to improve upon what has worked before? These people are more comfortable working with facts and

making decisions. They seek solutions using methods that have worked before. They are precise, reliable, efficient and disciplined.

- The *visioning* style likes to ask: What can we realistically image as the ideal solution over the long term? These people trust in their intuition and like to make decisions. They seek solutions that focus on maximising potential. They are persistent, determined, hard working and visionary.
- The *experimenting* style likes to ask: What ideas can we combine and test? These people emphasise fact-finding and information gathering. They seek solutions by applying pre-established processes and experimental trial and error. They are curious, practical, and good team players.
- The *exploring* style likes to ask: What metaphors can we use to challenge our assumptions? These people like using their insights to guide them. They collect lots of information hoping that it will help to approach problems from different angles. They are adventurous, dislike routine, and like to be challenged.

Uses of Creativity in Design

Creative tools and the CPS process can be used in connection with design tasks, in general, and more specifically in relation with the design of a product, a process, a project or a system using both heuristic and algorithmic approaches. Here we will see other types of applications.

Future study is an area that should be of interest to designers. It is the examination of future alternatives and possible results before they are put into action. Studying the future encourages individuals to thing more creatively about future possibilities and the impact of present actions on the future. Future studies have four essential characteristics:

- Opportunities to think creatively and to be creatively expressive
- Interdisciplinary studies and activities designing the future
- Lots of practice in teams
- Future oriented topics of wide interest and concern.
- Combination of creative tools with both hard and soft approaches.

Inventing, design and innovation is another interesting area. It involves interdisciplinary studies and the exploration of science, management and engineering with a purpose. Learners need opportunities to see concrete applications of scientific principles, which they get by studying and experiencing the inventing process. Inventions are such a significant part of our lives that it is difficult to imagine any subjects taught in schools which do not have direct relation to the broad topics of inventing, inventions, innovation and inventors. The inventing process is a very creative one, depending on the participant's style of creativity. Getting the initial idea is like an engine getting a spark to start, it sets off a series of reactions and sequence of events. Once an idea is communicated it is then time to brainstorm about it. Then develop a prototype. A careful evaluation is then made of costs, feasibility, marketability, time, other resources, etc. in order to decide whether or not to continue with the idea. If yes, then an action plan will be made.

IT design and design of computerised systems is also and area of central actuality due to the many possibilities of this technology. This for instance the case of strategy development, planning and knowledge management for organisations were it is

necessary to design inquiring and information systems. Here creative and participative approaches are of central relevance to avoid the design of unusable systems or artefacts. The design of a facilitation process to solve a task is an area of special interest for designers, see further Vidal(2003)

Every-day-creativity

Every-day-creativity is an activity that can be carried out at work, at educational centres, at home, etc. The purpose is to focus on those small or big problems that are irritating and takes time and resources during the day, everyday. Usually, nobody is responsibly for them. It is advisable to carry out a creative workshop of one-day duration to take care of all these problems.

There are several attitudes, simple techniques and ways of life that will awake, support and develop your creative potentialities. Everyday creativity in different situations is a very important attitude and way of life that surely will enhance your creativity also at your work. Let us see some recommendations that work for individuals and group of persons.

Break away from routines. Try to break some of them, do things that you have not done before. In the morning, at work, at the evenings, you should start with small things. Go to the library and study books about subjects you have not known even existed before. Read about the life of highly creative people: Leonardo, Einstein, Picasso, etc. Experiment for instance while cooking. If you do not cook, begin just now because cooking can become a highly creative activity. Your relatives will surely assess the quality of your innovative dishes.

Create inspiring circumstances. Potentially everything can be used as a source of inspiration, as far as we are open to seeing connections or relations to our own situation. Words, pictures, books, films, persons, etc. can stimulate the ability of our brain to produce analogies. Music, pieces of art and performances are usually central sources for inspiration. Some people have been inspired by walking in a forest or at the beach to find an analogy to solve a problem. Some examples are Velcro, potato chips, etc. Inspiration is a key factor while creating metaphors. Studying poetry you can see how inspiration is a way to create metaphors.

Be both open and closed minded. Open-minded means to be willing to consider new ideas: to diverge, to expand, to fly, and to see wholeness. Closed-minded means to be willing to consider a single idea: to converge, to focus, to dig, and to see details. A creative person should be able both to fly, to have an overview, and to dig, to discover the roots. It is a mythical creature half a condor and half a mole, with a well balanced big brain that switches from flying to digging.

Search for information and knowledge. Now-a-days using Internet you have access to an enormous amount of information and knowledge that can be of relevance to your problem or the subject you are dealing with, but you have to be critical about the quality of the obtained information and who is providing it. This is important because you do not need to start from zero or rediscover the wheel before designing a new vehicle. You have to be creative while searching for information and knowledge, finding the right key words, and here serendipity plays a central role. Serendipity is

the faculty of discovering pleasing or valuable things by chance; this means that you have to be ready, well prepared to be able to see the illuminating idea or clue.

Last, use your fantasy and visualise a situation then try to simulate how such situation develops. Creative people are usually visual thinkers. Relax, play some relaxing music and daydream about a situation or a problem. Stop working if you are not able to find a clue to a situation or a problem, do something else or go to sleep. You might incubate in your dreams and often illumination will arise when you wake up. Get acquainted with artists, inventors, designers, composers and other creative persons and learn some of the tricks and techniques they use when they run out of ideas.

Conclusions

We have shown the importance and relevance of creative approaches for most kind of situations faced by designers of any speciality. In our conceptualisation creativity is an essential part of any kind of design activity. Creativity is a multi-disciplinary field with many practical applications to science, engineering, human and social sciences, business, management, every-day problems, etc. We have also seen that creativity can be enhanced by praxis. The literature about creativity has grown exponentially during the last years; Vidal (2002) contains a rather complete list of references.

According to Heinlein (1973), a human being should be able to change a diaper, plan an invasion, butcher a hog, con a ship, design a building, write a sonnet, balance an account, build a wall, set a bone, comfort the dying, take orders, give orders, cooperate, act alone, solve equations, analyse a new problem, pitch manure, program a computer, cook a tasty meal, teach children, fight efficiently, and die gallantly. And he concludes: “Specialisation is for insects”. You need creativity to avoid the fate of specialisation. Creativity is an act of liberation, the defeat of habit by originality.

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