SYSTEMATIC TRAINING MANUAL DESIGNED WITHIN DIGITAL DESIGN TO INCREASE THE LEVEL OF CREATIVITY IN A SHORTER TIME

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ABSTRACT
A big portion of the field of industrial design is dedicated to areas such as product design, communication, and packaging of different goods each of which in turn is divided into different sub-branches. Students learn manual design processes in their freshman semesters. They use software and computerized prototypes to learn how to present new ideas to employers and customers. Weather manual design by itself can respond to needs of trainees, has digitalization been able to solve the problem? Whenever one of these methods has been considered alone, a deep gap has been created between manual and digital methods. It should be kept in mind that manual sketching methods are still the best way to implement thoughts and process ideas. Digital methods should not be used as means to put down ideas. The important issue is the danger hidden in this phenomenon. Scientists have analyzed the operation of brain's gray layer cells and they have discovered that there is an image of human body in this part. The biggest part of this organ relates to hands, weather reducing activity of hands by the use of digital interfaces, will result in reduction of creativity level in the process of creation of product? The current study seeks to find the answer of this question one of the aims of this study is to prepare a comprehensive and methodological system based on synthesis by manual design and digital design which includes vast areas including both design and manufacturing of products.

Key words: Industrial design, digital design, training, sketching

1 INTRODUCTION

Industrial design freshmen learn hand sketching and take part in practical projects as in studios. They learn how to take notice of the problems and their proper solutions. Also they learn how to present their final ideas in the 3D sketches. Having said that, there is a preference for postponing digital designing in this educational system in order for the students to exert their mind and hands, such real tools they own. Our big problem that we are nowadays facing in education is the premature use of computers and digital software during the very first years of university education. Originality is at priority in hand sketching methods. This should not be neglected that the hand sketching methods are still the best means for executing thoughts and ideas. There is a lurking danger somewhere near. Scientists took notice of a pictorial whole human-like body over the surface of the cerebral cortex of the brain, with two abnormally big hands. [1]

Despite the upward trend of digitalization, we have not been able to enhance our stylist sketchers' potentialities. Due to such deficiencies, students have believed that our industry restricts hand sketching and there is no demand for such sketches in the market so that's why they have become more interested in digitalization and computerization. Having been looked at computers and digital tools as means for making ideas and creative works could damage the educational patterns. This would also mean a failure for the original process of making ideas come true with hands, forth brain and its different parts function the least in such systems, therefore creativity will not be fulfilled. On the other hand the relation between industrial design and digitalization has slowly developed over some years. [2][3]

Digital tools develop the process of designing in three aspects: 1) accuracy, 2) speed, and 3) quality. In th digital world, ideas for designing could be exposed to discussions, evaluation at no great expens However, in the past a presentation of an idea required mock-ups and then a prototype. This meant a gre amount of money and time. 3Ds made the affairs relating styling, functioning, and producing mo affordable. Digital tools brought us closer to the real world, so it is obvious and natural for the desig companies and the big studios to have gotten more interested in employing people with such alread mentioned qualifications. Today, there is a major support for designers as industrial engineer acknowledging them as a medium for resolving paradoxes that exist between hand and digital sketchin methods. It is important to answer to these questions: Does hand sketching suffice? Or has the digit world solved the problem? Taking into account only one of such inclinations could cause a dip ga between hand sketching and digital sketching. The relevantly educated people are either hand sketchin professionals or advocates of the digitalization. As a result creativity is not fully redeemed. It seems th the problem is caused by the educational system's lack of fore sight. [2][4]

Therefore contriving a comprehensive educational system in the form of a synthesis is the solutio suggested in this research; a synthesis of hand and digital methods, which are coordinated with th functions of both the right and the left cerebral hemispheres.

2 MATERIALS

In this research the Hegelian dialectical method is implemented to gather information and to strike balance between digital and hand sketching methods. In other words, this research allows a reconciliatio of paradoxes in things and mind; this is generally referred to dialectics. The Hegelian dialectics is founde upon the conflict between the thesis and anti-thesis, namely, each theses when encountering an anti-thes causes a paradox to emerge where in a new phenomenon forms, that is called a synthesis. A synthesis neither a thesis nor an anti-thesis, nor a tautology; it is rather a new phenomenon, a result of th interaction of a thesis and an antithesis. In order for the thought to accomplish a true knowledge of being it needs to be in concordance with it, but this concordance cannot be possible if thought does not transcen its status quo and the status quo of its counter, to a third level. Every matter brings about its ow contradiction; the first is called a thesis and the latter, an anti-thesis. The outcome of the encounter o these two is known as a synthesis. Synthesis is a combination of the two components and also more than combination. In this research hand sketching is considered a thesis and digital designing an anti-thesis. comprehensive educational methodology that is based upon the whole brain, which is a synthesis of han and digital sketching methods, is suggested as a multi-aspect solution to students' problems majoring i industrial design.

3 TRAINING PROGRAM

Educational programs provide opportunities for learning, but the reality of learning is continuousl changing. Thus, our understanding of learning is built upon the opportunities that we are making fo students during their school time. The concept of learning is known to be under the influence of the resul of some brain-related researches. From this perspective the brain is a unique whole dissected by differe educational systems. Therefore our knowledge of the process of the brain could be influential upon ou syllabuses. Human brain consists of different parts, but the current educational system is dealing with little part of it. Today, the educational system has been built upon a narrow part of the brain, which coul be found on the left cerebral cortex. Stranding some particular parts of the brain annihilates the integrit and the systematic intensity of it. The brain is an integral totality, which is fragmented under educationa circumstances.

Ned Herrmann's (1998) brain dominance instrument determines that our institutions are at most focuse upon logical-sequential demonstration skills, and therefore they utterly over shadow our creativ capabilities. Thus, teaching hand sketching in the early years at university is in concordance with th formulation, since hand sketching is about creativity and the long-term constant use of the brain for han sketching will help the promotion of the creative intellectual activities of the students. The father of th brain dominance instrument, Ned Hermann, suggests that the brain is not only physically but als

functionally specialized. He explains that people are not equally using the two cerebral hemispheres. The person who solves problems analytically, with the help of numbers and statics, or somehow formulates them logically-sequentially, he/she is using his/her left cerebral hemisphere. On the contrary, if the person is looking for images and patterns that are sensationally influential and he/she intuitively understands the totality of a phenomenon, he/she is indeed using the right hemisphere.

People during their learning period that is based on the brain make a number of nets in their cerebral cortex. These nets have a great amount of information about different concepts. The brain makes such nets in three ways: 1) Objective experience: direct encountering with the phenomenon and creating nets that are loaded via the real physiologic connections between the neurons,2) Symbolic learning: using signs or symbols of the real things,3) Theoretical learning: in this level learning is simply achieved through theoretical information and majorly through words and numbers. [5]

As it is obvious learning redeems itself through objective experiences. In fact, the suitable learning process to the brain is the learning gained through objective experiences. The same happens with hand sketching. People while sketching various objects they do this in accordance with the images they have already made in their minds about how to use those objects. At the end, they accentuate with creativity and giving birth to a new object. More of importance is the role of the objective experience in creating objects that are hand-sketched. Hand sketching plays an important role in designing overall and also as an external memory for demarcating the designer's knowledge and capabilities. However, hand sketching is known as a means for the designer to communicate with it with the work, the others and also it could be held as an excuse for the deficiencies of the work. In digital sketching education symbolic and theoretical learning take place. Making use of sketching media like tablets and Wacom, which simulate hand sketching on paper, is considered symbolic and theoretical learning. In this educational system using software and digital systems are taken into consideration. This system takes advantage of signs, symbols, icons and numbers to transfer information to students and finally the outcome will be three-dimensional and open to numerical and technical calculations. Today, we need to strike a balance and respect for all kinds of thinking capabilities. Now is the time for us to learn how to take advantage of such capabilities and compound them for the sake of thinking, solving problems and implementing the whole brain.

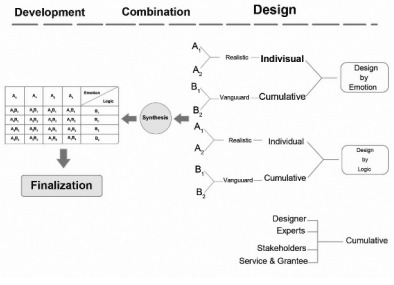

Figure 1. Alternative for Design thinking according to solve project (source: Author)

According to what has so far been mentioned we could suggest that our educational system insists upon logical and sequential skills and by doing this it is overshadowing hand sketching and as a result creativity and old methods of designing have been underestimated. Also, in our educational system there has been a greater focus on digital education and the students have been led towards using digital accomplishments of the today's world. Thus, students' creativity has been forsaken. On the contrary, using digital tools and relevant software as means for cultivating creativity and reaching new ideas have been encouraged; this is irrational and wrong. Contemplating an educational solution with an emphasis upon making advantage of the whole brain has lately been discussed as a breakthrough. If we consider designing with hand in close relation with emotional aspects of people, this statement is plausible that the emotions are the first to judge and to help us determine what is good or bad. The right cerebral hemisphere, the more visual one, is the center for information processing based upon primary and apparent judgments that are made according to

forms and images. Such issues make us believe that the process of conceptualization is somehow a visual (virtual) way of demonstration involved in designing objects; the objects in whose creation hand sketching plays an important role. This way of demonstration works as a perceptive knowledge, which can make the process of designing begin. As the results show from a study that examined a group of Iranian industrial design students, hand sketching mesmerizes theories and subjective ideas and causes a kind of an interaction and connection between the entire ideas and other subjective designs. As a result, a designer while sketching is balancing between his/her virtual thinking and demonstrating and his/her practical knowledge. That's how a designer looks for functional and applicable resources as the aim set for sketching, in order to professionally pursue designing. On the logical level the phenomena of perception takes place. On this level, the designer starts the work with a logical and functional outlook; he is provided with an accurate knowledge of the ambience of what he/she is designing, of the context of the subject matter which is at issue, and of the restrictions and possibilities he/she will be facing during the process of designing. This level of designing is completely associated with the left cerebral cortex and the analytical levels. The phenomenon that has been created is previously well examined. There is an absence of creativity in this digital design that is without any emotions involved in it. [6][7]

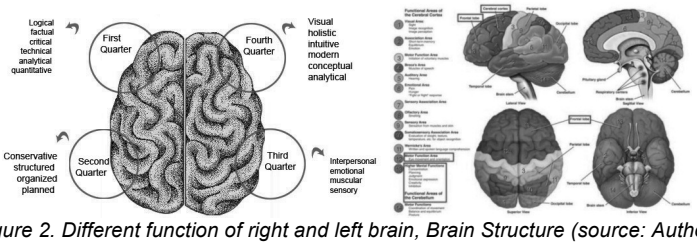

Figure 2. Different function of right and left brain, Brain Structure (source: Author)

Gaulin 1983 in his book *Intellectual insight, learning through visualization* demonstrates that "being intellectually active takes us beyond the limits of the lineal way of thinking and enables each individual to intuitively have a direct and immediate experience".

Paul MacLean (1978) believes that neo-cortex is the center for the supreme human. It is the place in where take place such things as logical thinking, analysis, conceptualization, creativity, insight, and transcendental emotions such as pantheism, enthusiasm, synergy or cooperation (but not competition), serenity and the highest point of being. The brain controls all the deliberate movements of the body. One of the parts of the brain, which is more involved with such movements, is called motor cortex. Cerebral cortex (Cortex and motor cortex) has grown magnificently in humans. Cortex is composed of neuron layers and has various centers and divisions. Neo-cortex talks with the help of the same subjective and internal pictures, insights and emotions. It is a means to receive insights and to develop. Such intellectual pictures influence the development of the brain and the body acts as a form of comprehensive scheme for humane activity. In 1870 Gustav Fritsch and Hitzig electrically stimulated a part of the cerebral cortex of a dog, and they observed that depending upon what part of the cortex has been stimulated, a particular part of the body contracts. Finally they realized that if this small part of the cortex is destroyed its counterpart organ gets paralyzed. This event proved that each part of the body has a special region in the motor cortex, which controls its movement. It is valuable to know about the *motor map* that there are a few parts of the body that can make the most delicate movements; they take up a greater space than the others do. A pictorial representation of the whole human body is present there. This is important to know that the biggest part of this pictorial body belongs to the hands. Believing in what has been said about the brain cortex could help elevating hand-sketching ranking. [8]

Each brain has individual features. This individuality requires individual education program for each person. Differences are not taken into account in our culture and the students are put into a single educational system; only the needs of the people with their left cerebral hemisphere dominant are met. Indeed, limbic system and the right cerebral hemisphere, which is the center for creativity and visualization, are neglected. This does real harm to the educational system and in particularly to the field of industrial design. That is why people have forgotten all about the creative ideas brought about by hands

and they have become software executives devoid of innovatory potentials. The largest problem facing the graduates of the current educational system majored in industrial design is their incapability to see holistically the recent presented information and their failure in recognizing the patterns of it. Applying some dissecting teaching methods to the educational system causes this problem. In this methodology the new information content is divided into small pieces and is presented to students in a single way. That's how the student cannot recognize the whole image or the aim of the new information that must be reached at the final point.[9][10][11]

4 RESULTS

According to the results of the researches done, it is plausible to say that in the brain-teaching program, the educational structure underlying the field of the industrial design, which would be a synthesis of digital and old methods, can demonstrate the primary orientation of its program. Now this could be demonstrated that the educational systems are frequently set upon a different road than the real life.

The researches that have been done on the structure of the brain shows that the cerebral hemispheres do not work separately and that learning as the utmost function of the brain guarantees the whole function of it. However the content of what has been learned should be stimulating both of the hemispheres. According to the results of Hart's research (1983) the brain is essentially stimulated for learning. But unfortunately in the educational systems we are experiencing a noticeable decrease in brain capabilities. Patricia (1382) demonstrates that we must focus on educating the both cerebral hemispheres, since they always work together. The left cerebral hemisphere processes the context and the right one takes the environment into account. We can conclude that the left cerebral hemisphere processes data and generalizes students' information, who are enrolled in computer systems 3D digitalized design programs. The right cerebral hemisphere is the center for creativity, hand sketching, and expressing ideas in the forms of initial sketches on paper. Thus the content should be developed in an environment, which is relevant to the life and the experiences of the individual student. Namely, both sides should be educated.

As McCarthy mentions teaching methods should focus on different learning approaches of different learners. Therefore the teaching methods should be contemplated in a way that it could involve the whole brain and provides great opportunities for all learners with different learning styles. McCarthy (1990) suggests a teaching method that is called the whole brain method (4-quadrants). This method combines the right cerebral hemisphere and the left. The whole brain teaching method could provide a map for programming for education, so each student could make use of it, no matter what year they are in. Therefore if under the influence of a whole brain teaching method we consider hand sketching methods distinct functions of the right cerebral hemisphere, which is the center for creativity and visualizing, and digital sketching methods distinct to the left cerebral hemisphere, which is in charge of analyses and statistical processing, we could conclude that a synthesis of these two methods is the whole brain teaching method indeed. The four-quadrant method, which is rather a combination of the left and the right cerebral hemispheres, namely a combination of hand and digital methods, is a step away from the whole brain teaching method. This method both receives and processes data.

According to the four-quadrant method there are two essential hypotheses: 1) each student holds on to his/her own learning style and his/ her prior cerebral hemisphere,2) Teachers are busy designing their own teaching strategies to systematically satisfy the students' demands. The whole brain teaching method can enhance thinking skills as well as interpersonal skills.

5 CONCLUSION

The development of our knowledge of the brain function invigorates our uncertainty about the teaching methods. Therefore if we see education as an attempt to guide the brain function, it would be necessary to coordinate education with the brain. Under the current circumstances of the industrial societies and the complicated information era plus computerization of systems, the left cerebral hemisphere which is the analytical, logical, renewing and organizing part of the brain, is managing a great number of functions of the brain. The right cerebral hemisphere is holistic and intuitive. This hemisphere controls a great part of our unconsciousness. Most of our intellectual activities including art activities and philosophical activities as well take place in this part of the brain. Hart says: "optimal learning and teaching occurs when the brain

is properly challenged. Learning based upon the brain works accordingly with the brain's mechanism, but the old education most often restrains the brain from its natural functioning and underestimates it." He thinks that earning via visual and practical means causes the learner's brain to have stronger and more novel relations. Also, sketches relate and stimulate designs and he thinks that the act of designing is a synthesis of emotions and aims. Designing is a meeting place for all these levels of knowledge. Thus, indeed, designing is a process of transforming, translating the internal ideas and theories of the designer and making them interact with the sketched outputs. According to the results from the late researches, the strong relation between sketches, perception and the practical and practicable strong resources are influential on designing knowledge. Promoting interesting sketches either by hand or digitally could bridge the levels and create a consistent and continuous trend. Another important point to note is this that designing with the help of and in an interaction with digital media is an effective way of developing knowledge in this field.

The reason for the failure of digital sketching, despite its high quality and speed in the different levels of sketching and finishing of the work, to properly replace creativity and the emotional aspect of hand sketching, has been the improperly working interfaces and the improper interaction of designers with the system. Designing systems based upon an easy interaction of the designer with digital media are the proper and synthetic solution. Digitizer, a product with the ability to three-dimensionally design does not have the current interfaces' limitations. That's been possible via a combination of hand-sketching system and Wacom, and in the next step by making it into a 3D holographic format. In the near future, we can conclude that designers will be able to work with having 3D glasses on while he/she uses his/her hand on a 3D holographic model which resembles the process of hand modeling. This will bring the form closer to the initial sketching. Afterwards the file will be rapidly sent to modeling systems and enter the real world in the form of a model with volume. The advantage of this system is the simultaneous use of mind and hands. One more advantage is the possibility of touching the work with hands just like hand modeling which is based upon the thinking that is the work of the right cerebral hemisphere. In addition, this system is combined with the digital media and it is accurate and fast in thinking which simulates the left cerebral hemisphere. In this synthetic system one can use hands, mind, and objective embodiment on an equal level and can tangibly sense the relation between applicable sketches and intellectual perception with the virtual 3D model that is made in the Digitizer. In this system the mind of the designer and the sketches interact with the virtual 3D world and this will pave the way for further accumulation of design knowledge, including both sketching and perceiving.

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