3D and Education

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Odile Meulien Ohlmann is a French American, collector and sociologist. She did research on the new form of artistic expression with the art Historian and President of the French Museums René Huyghe at IPPAC in Paris, she created and managed the Museum of Holography of the Art, Science and Technology Institute, The Holography Collection ASTI in Washington DC. She published numerous papers on the Holographic art and perception. She collaborated at the Launch of Digital Holography as a CEO of Syn4D in Germany. Now, in Strasbourg at the French/German border, she conducts research in Holography while providing exhibitions and trainings.

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Abstract. Today the industry offers a chain of 3D products. Learning to "read" and to "create in 3D" becomes an issue of education of primary importance. 25 years professional experience in France, the United States and Germany, Odile Meulien set up a personal method of initiation to 3D creation that entails the spatial/temporal experience of the holographic visual. She will present some different tools and techniques used for this learning, their advantages and disadvantages, programs and issues of educational policies, constraints and expectations related to the development of new techniques for 3D imaging. Although the creation of display holograms is very much reduced compared to the creation of the 90ties, the holographic concept is spreading in all scientific, social, and artistic activities of our present time. She will also raise many questions: What means 3D? Is it communication? Is it perception? How the seeing and none seeing is interferes? What else has to be taken in consideration to communicate in 3D? How to handle the non visible relations of moving objects with subjects? Does this transform our model of exchange with others? What kind of interaction this has with our everyday life? Then come more practical questions: How to learn creating 3D visualization, to learn 3D grammar, 3D language, 3D thinking? What for? At what level? In which matter? for whom?

1. The present situation

The variety of media techniques available in 3D is confusing. These last 10 years the development of techniques is very significant. One development comes out, is replaced by another one, and finally just professionals keep updated. A whole list of names and products are available without reaching educators and educational institutions, as I experience it lately in France. Moreover, as I saw with children and teenagers, they have ideas of 3D, but they cannot identify techniques and the meaning of 3D except that it has relief. There is a lack of exhibition with educational goal. Moreover some companies are using word to describe their product which has nothing to do with their technical specification. The word Holography, for example, is very often used to describe the idea or even a product which do not record any object in time and space. This just sounds more attractive! This subject matter has been brought up in LinkedIn and the discussion shows that confusion in words and definition finally does not help customers’ education on a long term run; even so on short term, it can bring attention to the product.
2. New Media, new Behavior

There are a lot of engineering programs proposed at university levels in our western countries to teach the technical aspects of 3D. We can also find many trainings available in the use of 3D software packages such as cinema 4D, 3D studio max, Maya, and so on. The social aspect, the many changes implied by the multidimensionality of the medium on human behavior, and reading pattern are not included in the courses. Indeed we do not read a 2D images as a 3D one. And if we do not read it the same way, we should not write it the same way.

While working at Syn4D GmbH, we were producing synthetic digital holograms (Synfogram). Engineers could understand right away the advantage of presenting their project in a Synfogram. When coming to production we made a workshop with engineers how to create their files in time and space continuum, so that the final information could be read by engineers as well as non engineers. Engineers do visualize their prototype in 3D, with mathematical formulas, and some drawings. We were teaching them to think and create in 3D, in time and space, to understand the relation of the image to the viewer, its movement, its perception, and its knowledge. For example, we did create a synfogram of the Safety couplings for rail vehicles of express train produced by Voith Turbo. (1) The goal was to explain the functional safety of this device to engineers as well as deciders and politicians. The object was recorded on 12 seconds which we can see slowly or fast, as we want, with our own body movement without any other instrument. We can just bodily freeze the image, go down, back and forth, in time and space. The Synfogram indeed is a wonderful educational tool to explain machinery, medicine, biology. This means also that the reading of the image is not linear like in a 3D film it is fully multidimensional. In a 3D theater the spectator do not move in front of a 3D film, but with hologram viewer have to move. Children are the best viewer. We could even train them to repeat a movement like shows the movie done in Niederbrone les Bains in Alsace (7). They repeat the movement of a football guy by moving again and again repeating the movement at their rhythm. Still the presentation and visualization of the content is extremely important not just to be exact, but also to express the hidden situation, and make it available to the eyes, what a linear film would not be able to coordinate at the same time. Nevertheless any 3D image implies movement from the viewer, to search further to look from the side, to discover the many perspectives of the image. With children I made many questionnaires and what come out is that they like 3D images for the movement in interaction with themselves. The movement for them expresses “live”. Present teaching considers movement as problem and disturbing concentration. Movement is in French classroom totally forbidden.

3. How and what to teach

3.1 Compositions in Time/space

3D refers to a time space/relationship which put everything in relations. Creating an image in 3D is a matter of capturing multidimensional compositions where all parameters move together; the different objects of the scenery as well as the viewer. In case of a hologram the viewer is fully interactive and capture physically, with the full body, the many information contained in the various sorts of
holograms (full aperture, integral, and digital hologram/Synfogram). This multiplicity of choices in reading 3D image is resulting of the time space relationship which shows that we can never see the whole at once; always we search new perspectives to « see” more. The reading patterns of each individual differ from each others. The order is not pre-established, the individual build it up according to one’s perception and interest. So to teach we need to exchange with the different participant to let them experience the different perspectives of each one. This experience of seeing 3D imaging reinforces this ability of choices, and opens the mind towards other possibilities that one would not have thought about alone. When the participants realize the quantity of choices they access, they feel stimulated and can compose a canvas of ramifications which are far beyond their first individual approach. The necessity of searching implies a decomposition of the composite subject. Decomposing the object in relation with the whole surrounding in movement is extremely useful to create in 3D but also to evaluate different aspects of a subject, not just alone but in exchange with others. This contributes to the process of learning and should be part of any teaching concept. In 3D Stereo Cinema, this multiples information is difficult to capture as well as it is disturbing to look at. This is why cameramen use for live event, some fixed camera to identify a space and just focus on the movement of a character. The top view is very often chosen in order to give access to this frame view. A new grammar is imposed to 3D creation of movie makers and pose them problem. Holographers already know about positioning camera, setting up a space, relating image, viewer and environment. So their knowledge could be more spread and integrated in new cinema teaching programs.

3.2 The Holographic experience in the perceptive process

The physicist Regis Dutheil (2) explained: “it is immediately after the production of an electrical activity that the person perceives the visual sensations, having the feeling that he saw something. Between the short instant which separate the production of an electrical activity and the perception, something happens. This little gap of time between the visual sensations and the perceptive representations can be the result of the correlations existing between the information stored as references and the new information which finally give the signification.” This supposes that to recollect 3D information we need to destabilize our perceptive 2D system and its codified parameters. For more than 25 years, I have been able to observe hundreds of thousands of viewers. The confrontation with the holographic image, this visual of light in volume, floating in space and changing of perspectives at the rhythms of our movement, has the advantage to destabilize our believe in a unique and materialistic reality, this invariance which we build up and use as references, separated from us. In my paper the” holographic thinking”(3), I explained that Experiencing a hologram is more than seeing. Seeing is not anymore a matter of our eyes but of our full body in movement interacting with the observed subject. By creating a gap in our perception of a unique reality, the experience of the holographic image opens the door to new territories of investigations, knowledge and creativity. The neurophysiologist Karl Pibram, (4) who demonstrated that the brain works as a holographic model, suggests to each the holographic paradox to children at school. Meanwhile it would contribute to give a base of observation to evaluate new structure of knowledge and be able to produce new pedagogic concept based on experience and movement!
3.3 Virtual and New realities

If we take the example of visual perception, we now know that it is nothing else as a sensorial message resulting from the first stimulation of some cells in our retina through the transportation and processing of the signal into the brain. However, what we do not see how it interacts with other perceptive organs, for example the eyes sense with the ears. There is some experimentation where information of sound, touch and visual are experienced in different time frame or reversed or displaced producing some discomfort or dizziness. This would suppose the existence of a certain order or organization to harmonize the whole. The contents, a composition of many parts, which are proposed in many 3D films, animations and visualizations, seem to be simplified, and make the viewer smiling. When we think that our mind already simplify the compositions from the initial information received, to fit the references or invariant stored, the remaining information is very poor and not so good finally for education. Nevertheless, the access to realities created with addition and multiplication of components even so not perfect, are not produced with reduction and subtraction of information. This is already a teaching. It just needs to become clearer, and not just unfolded, hidden. 3D in comics and games avoid confrontation with our 2D representation of reality by entering an imaginary, another reality, so called virtual reality. The success of Avatar is significant. 1st the quality of images - 2nd the content, placed in an imaginary universe, opened to creativity, free from pre-conceived ideas, and capturing the essence of 3D, by entering multidimensional levels of realities. The science fiction of Avatar, such as the neurons connection at the root of the tree, kind of dreamlike life, is so strong, that the defeat of our usual material reality of confrontation is acceptable. Holographic ideas transgress too our believe in one material reality, it confronts the viewer to many questions about our representation of the world, which many often viewers are still not ready to consider and prefer to give back holography to a scientific model away from them. With holographic representation we enter into a new dimensionality of our universe which will take time before being accepted culturally and socially. This is one element of explanation in the slow immersion of the holographic concept compare to the reassuring and blooming 3D stereo-system.

4. Spreading of 3D thinking through different media

4.1 Techniques and pedagogic goals

The choice of the techniques to present educational matter need to be related to a certain pedagogic goal. 3DStereo directs our eyes in a way that we are looking at a scene behind through 2 holes of a garden fence. Instead of having a quantity of images available to our perceptive information, like in a hologram, we just have a series of 2, 6 or 9 images tricking our senses organs. If the viewer is not fully conscious about it, its perceptive awareness makes the image suspicious, creating a kind of reserve toward 3D images. With digital hologram, the content might be week; still at the production, the technical properties of the light recording, can compensate week content, as the image is always moving in relation with the viewer. Visual immersion with large scenery interacts with the body through glasses and with computer control. With this system, exploration, discovery of a historical situation or geography could be very attractive for schools, making the teaching a living experience, but schools systems want still pupils, and minimum of individual experience. This implies new educational policies, with consistent Investment not just in the material, but in training and in new pedagogic material.

4.2 Training for Teachers

New, in France is the way dissertations in literature have to be written to pass the “Bacalaureat” (final diploma of high school). The pupil should not present their idea in the traditional structure of thesis, antithesis, and synthesis but in finding a problematic by deciphering the major points, and their inter-relations. This new training which for my holographic mind, open much more possibilities to
elaborate and understand the complexity of a content, is mistreated by most of teachers in French literature as they just received a usual linear training and no information and support in presenting a method they never had time to experience or learn by themselves. Finally they cannot transmit it properly to their students. This short example reflects the most difficult part in social evolution: the training, and preparation of a new generation to the significant mutation of our time.

4.3 The implicate training of the holographic thinking

Some media stimulates the approach of a kind of Dynamic linearity or pattern reading instead of a linear dualistic approach even so there are not all in 3D. These media do not suppose to train our mind in 3D so this is what I call an implicate training, inspired by the theory of David Bohm and its Implicate Order, (5) which lays in front of us hidden to our believe and perception. A good example is Internet or now most of new touch screen, phone and tablets. Make a bit of searching in Internet. What do you see?. What do you have a holographic structure where each point stands by itself, contained the whole and composed it. To read the information on the Internet screen you might have the first habit to « scan » the screen with your eyes from top left to bottom right, as we use to in our western habit of writing. Instead, the eyes make incredible movements up, down, side to side, center back left, up right and so on, the hand can move the screen in many directions, creating a pattern which has nothing to do with our usual diagonal line top left, down right , etc. The reading process of a traditional printed page is linear; this other reading forms are expressing a dynamic linearity, or a pattern reading. (3) This way of reading exercise our perception and contribute to train our mind in moving within a multidimensional net of information, in fact training us to think holographically. More than exercising perception it emphasizes individuality and develops fantasy, liberating the frustration of a compressed perception used to fit one standard. The only problem is that teaching is a matter of repetition and awareness. Repetition is there, may we need to work on the awareness.

5. My Teaching experience

5.1 Context

Since 25 years I have been teaching the public in America, in Germany and now back in France, about 3D and time space relationship. I noticed that the cultural habits changes very much the reading of visual representation, and also the teaching we need to consider. Aware of these differences, I worked on the similarity to organized holographic exhibitions and workshops. This gave me a wonderful platform of research. Lately, in Germany and in France I have introduced different other 3D techniques now available on the market, may it be 3D presentation with monitor, old and new stereoscopic presentation, anaglyph, and other printing material like lenticular.

In France, the Minister of education introduced to the program of colleges and lycées, children between 12 and 16, new programs, such as art/time and Space, and production of a project in 3D. Also the idea is very good, teachers are confronted to a field that they do not know, they did not receive any training about it and have no pedagogic material available on the subject. I have been asked by teachers to contribute with my experience to program. For example, I conducted a program for the high school Jean MONNET between January and May 2011 sponsored by the Academie de Strasbourg, and the Region Alsace. The program has been financed by ACSIMA, Groupement d’intérêt public Action Culturelle en Milieu Scolaire d’Alsace, and the DRAC. The project, a walk around images in 3D and 4D, including holography was born of a meeting with Annick Sary, an art teacher, and on a common desire to discover the meeting of art and science.
5.2 My Program

My program consists of 2 parts:

- **The first part** is the shock of the images floating in space that allows young people to experience physically the time space relationship. Students are encouraged to discover the exhibition organized in the college and where I provide a guided tour with a variety of small experiments and animations. Each group of maximum 12 persons has the duration of a course session to discover, analyze, discuss the questions of reality, image, perspectives ... from 2D, 3D, in relation to time, the movement ..., the place of the spectator, its role and its perception ...

A quiz is provided at the end of the session.

- **The second part** is a workshop where the students repeat and experiment a basic technique that can be reproduced at home. I chose the anaglyph imagery because it is easy to understand. The children can make the 2 images and combine them with a computer program. The pupils learn to:
  - Discover and understand the technical properties and appropriate concept
  - Design a project, prepare and mount it to photograph it for a 3D image (calculations of distances and adaptation of different shots required)
  - Shooting sessions
  - Data processing, printing test, visualization using special glasses.... discussion and analyze of the image. And recovery (adaptation distances photos) if the result is not conclusive!

In this way pupils can learn a technique which they can recognize outside, on newspaper, and in the film industry. I did show them also how from this basic old technique, new technologies have been developed to come to use pair of 2 images with 5, 6, 9 repetition on a screen for 3D monitor, for example. This workshop allows pupil to understand other techniques of our present time such as S3D and M3D. The teaching about geometry and light were also repeated at the same time in the courses of math, and physics. In this way pupil can evaluate that observation belongs to all matters, as well as fields apparently separated like art (often just associated to drawing or painting) science and technology.

- **Result** The teachers, the college and the pupils who participated were very happy. The program went further in a week end of science where their created anaglyph portraits.

Annick Sary, wrote: For the first part of the project, we can agree on the fact that many students enjoyed the visual and sensory experience. We would have liked to accommodate more students, open exposure to a wider audience but the time allowed and the security of the works we do not allow it.

Some pupils (Classe 3D)

"I find it interesting that the system is to come to see a different picture, when a group is all we see an image or different colors. I think it's great. » GV

Class 3B ""I found the newspaper in 3D interesting (Das Bild 08.30.2010), I had the feeling of being in the news. I liked the hologram of the little boy with his glass and bottle and the fact of moving to see all the images. "SN

6. Conclusion

If we start thinking 3D we can imagine a different way of treating the visualization. The problem to think 3D lay in our education and habit of thinking. Educating in 3d and with 3D is a big responsibility. We are coming from a 2 dimensional world of surface, related to a universe framed by the scientific determinism, and Cartesian dualistic mind to encounter 3 -dimensional representation of new realities. It supposed a radical change in the way we conceive education and need to have trained teachers. This can be done only with new educational policies and new research on the implication of a world passing from a representation in 2D to a representation of reality in 3D. Such research needs interdisciplinary participations including social researchers. We are at a turning point, where new techniques and science open new territories of multiple possible where all is in relations with each other: The 3D techniques, contribute to show what our human perception forgot to see. And
if holographic visual disappeared from exhibition, holographic philosophy is spreading through other fields.

References

[1] Odile Meulien O and Dietmar Öhlmann April 2008 *Syn4D displays for a new generations of Holographic Applications* (Proc. SPIE Europe (Strasbourg)
[2] Pr. Régis Dutheil et Brigitte Dutheil 2006 *L’Homme Superlumineux* (Sand)
[3] Odile Meulien-Ohlmann 2000 *Holographic Thinking* (Proc. SPIE 4149 p 246 St Poelten)
[4] Ken Wilber *Le paradigme Holographique, Interview with Karl Pibram* 1984 (le jour Editeur)
[5] David Bohm 2002 *Wholeness and the implicate Order* (Routledge, Taylor and Francis Group)

More references

[6] The Art, Science and Technology Institute, Holography Collection has been created in 1982 in DC, as tax exempt organization under section 501(c)3 and closed in 1994. It has been the first museum to present an exhibition of holograms in a completely clearly lit area and received the acclaimed of the public and the press. In 1989 it has been compared to the exhibit of Holograms presented at the National Geographic (DC) organized by the Museum of Holography of New York, “March 24 1989, Washington Post” “Holograms: Duds and Gems. It received the award of the “ Best exhibit” of Washington DC in 1986 by the Washingtonian Magazine.

[7] Odile Meulien and Dietmar Ohlmann “*How to do a synfogram*”, video youtubehttp://www.youtube.com/watch?v=2Rqd00aLYu8&feature=related. Short cut of different works done with and by children, in Braunschweig (D) and Niederbronnes Bains (F) in 2007 and 2008.