A SNAP INTO THE (NEAR) FUTURE WHEN INDUSTRY MEETS EVERYDAY LIFE

Mário RAMALHO[1]

[1] *ACAII/IST, TULisbon, Av Rovisco Pais 1049-001Lisboa Portugal, mar@dem.ist.utl.pt*

Abstract: *Camões the Portuguese poet wrote, back in the XV century, «Todo o mundo é composto de mudança, buscando sempre novas qualidades». And it is still looking for new 'qualities'. Back in the XV century, Guttenberg invented the press. This remained the main information and knowledge diffusion system for nearly six centuries. It was until the end of the XX century that a concurrent system tackles this place. Beyond the computer was the personal computer that triggered the change. In this paper we will try to gasp a snap of the future to understand what could change with the advent of the low cost 3D (scanner and printer).*

Keywords: *3D scanner, printing, virtual technologies.*

1. Introduction

Back in the XV century, Guttenberg invented the press. This remained the main information and knowledge diffusion system for nearly six centuries. It was until the end of the XX century that a concurrent system tackles this place. More then the computer was the personal computer that triggered the change. In this text we will try to gasp a snap of the future to understand what could change with the advent of a low cost 3D printer[5] [9] [11].

Effectively in the last years everyday life changed in many aspects. If we return to the 70's, there was the typewriter. Letters, (mainly commercial letters) where typewritten (that was a profession!).

Later, with the advent of the personal computer, texts start to appear justified; figures could be inserted on the text, in place, with professionally numbered legends, footnotes, endnotes and all the typographic items that really made a professionally made book. With the advent of the laser printer, another smaller and silent wave starts. By this time everybody was predicting the 'paperless office'. Although many people argue that the number of paper documents in circulation really increased. The possibility of making 'professionally' looking documents was a must. Later, a low cost high definition printer, bring this possibility home. Leaflets start to be composed and printed at home. Personal invitations start to be composed and printed at home. All letters start to have a monogram on top.

2. Photography

A concurrent wave happened with photography and the appearance of the digital photography. Since the early XVIII century, Niépce and Daguerre [4], it was possible to retain a detailed, permanent and objective visual impression of a scene. This process was open to the masses in the 60's with the instamatic cameras. Although a still expensive process (it requires the film, processing and printing), turns the snapshot a common activity. Later, the scanner allows for the inclusion of images in texts, and at last the digital photography contributed definitively to the layout of today's documents.

But digital photography triggered a second change. Professional photography is usually associated with a studio. Not only due to the exposure conditions, but also but the need of post processing (light correction, noise, reframing, etc). However some of focus areas, due to the nature of the subject (fast moving, short availability time or other), it is difficult

to warrant that you are able to snap it at the first (or second) shot. Digital photography opens these subjects to a much wider public (with very good results indeed).

3. Sculpture

Sculpture is a very ancient activity from mankind. If painting can be retraced to more than a hundred centuries ago, (e.g Lascaux, Chauvet and Altamira paintings),[1][2][3] sculpture can be also dated for along time, (e.g. Venus figures from the upper Paleolithic).

These arts where used several years ago for the making of industrial prototype models. If statues require a more or less complex process until the brass final setting, models for study or evaluation are simpler to do. Carved in wood, plastic (for instance Perspex), some can still be seen in museums, as for instance the Museu de Engenharia Civil (Civil Engineering Museum) on the IST campus.

4. The objective

One of the problems is the definition of the object itself. Although painting programs and photo directed image processing become usual, a scanner is still not a common accessory to the computer. But, following the same line, as high definition printers opened the market to the handheld text scanner, this evolution should prompt a similar evolution. For a large size, body size scanners have appeared to the market, although with a limited resolution, although they can be used for smaller objects. A world of applications is waiting for smaller, easy to use scanners. Similarly, has Android and Apple prompted the applet market, it can be forecasted a "thinglet" market. Similar to the creative commons photo market, and Clip Art market, made of models that you can do or print in home.

One question is evaluating the capabilities of the use of a low 3d scanner to reconstruct the image from a scene, mainly with the use of MS Kinnect pairs of images. An example is presented in Figure 1. On the right side is the depth image, on false colors. The light blue is the nearest, and the dark blue correspond to areas where no depth information is available. Although a small resolution image, the depth image gives invaluable information for the segmentation of the scene.

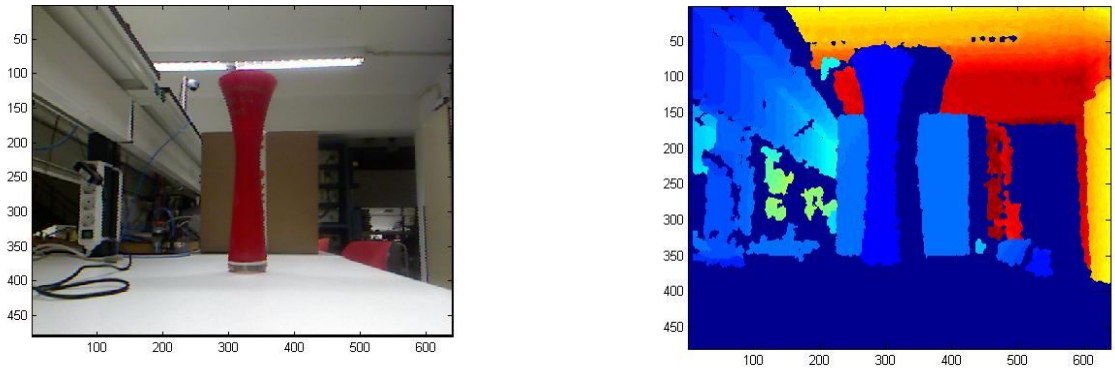

Figure 1 – Image and depth from an object

In figure 2 a similar scene is present with a more clean background.

These images can be connected, allowing putting in evidence the depth and the corresponding points. However this process must have into account the depth shadow, as can be seen in figure 3 (right).

Images obtained are not ready to be exported, and the use for a virtual model

should take into account information from depth and color.

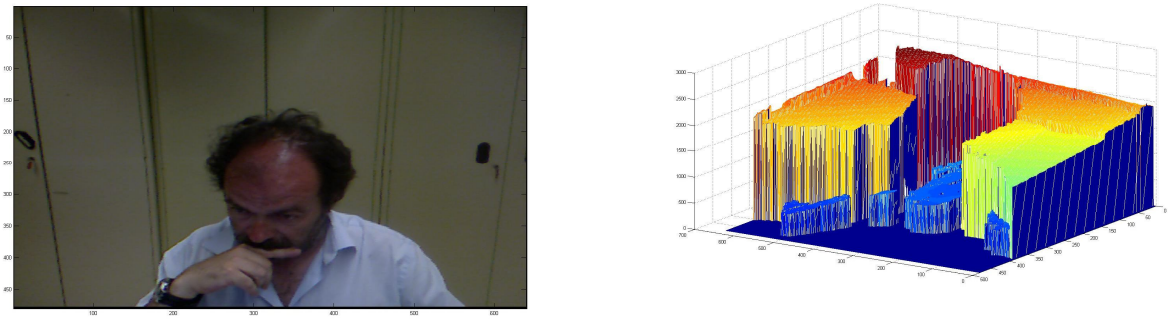

Figure 2 – From a person

Mainly, at short distances, the shadow will create an additional problem for the direct use. Although the images are quite enough to identify objects and evaluate some characteristics for robot vision, such an apparatus should bring a more defined and smaller area covered (Figure 4).

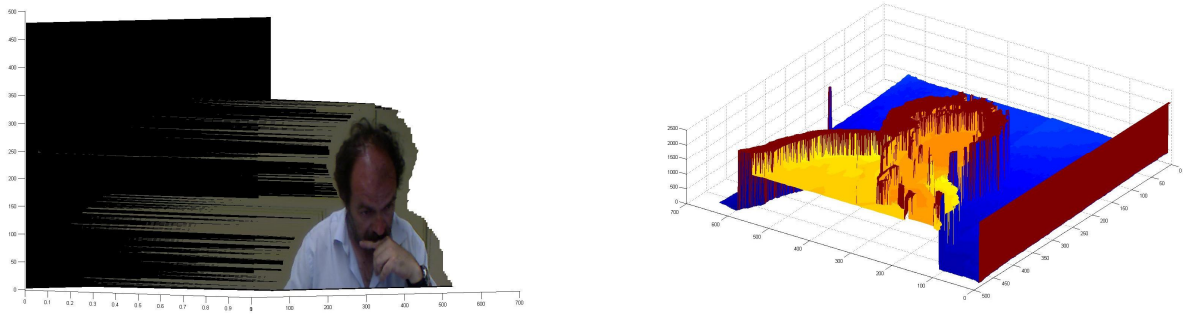

Figure 3 – Perspective representation and depth map processed

5. The printing

3D models have been around for a long time. The earlier is the paper foldable model. Among them an older technique used for 3d puzzles has been reused for 3d models: object slicing.

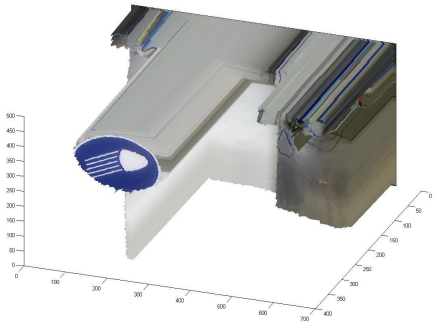

Figure 4 – Traffic signal in front of a wall

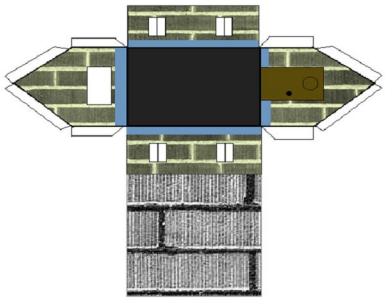

Figure 5 Paper Foldable model

The basis is to slice the object, and reproduce it but assembling one over the other by the correct order. This can be done with paper, cardboard, resin or plastic.[6][7][8]. The main issue is the vertical resolution of the model, price and assembly time.

Addictive manufacturing has been around for many years. It is the natural extension for

cad drawing. Laser sintering, fused deposition or laminated object. Some manufactures present 3d color printers making use of different colored plastic or even engineering materials like rubber or abs-plastic, or, chocolate [12].

6. The near futures

Among the activities that run in parallel with professional applications, as prototyping, several have their counter part on hobbies. They rely on a small scale reproduction of objects that from some reason are appealing to the practitioner. Examples are doll houses, and diorama making. Doll houses are a reproduction of a full house, with more then one floor, furniture, appliances made to scale. They are directed to small children. Dioramas are three-dimensional full-size or miniature model, sometimes enclosed in a glass showcase for a museum. Scale models are marketed since the 40's (e.g. Airfix plastic models). Usually the models covers planes, cars and trains. These where marketed on the standard model (e.g. a car would appear in the standard version). Modellers try to change them in order to reproduce a more appealing or meaningfull version, as the ones that where on the Group Two Rally specs. This cars where allowed to be tranformed, as for instance, larger wheels and consequently larger covers. Some of this cars where handmade and triggers a market of acessories and small parts (whell trims, race tyres, lights). This markets provides some niches, as for instance for a white ink printer.

Figure 6 Plastic Model

Looking trough the web its already to discover creative commons models that range to statues, belt bucles, pieces, a car models , keychains and others.

The colour inkjet printer opens for the inhouse and personal invitation (it was statement of culture) to draw and print invitations, christmas cards and so on. The additive printers will prompt an in house gift or utility, (e.g. models, keyrings, etc). This prompt a market for more refined and coloured paper to appear the in supermarket shelfs.

Another plethora of objects, are educational models, which could be tailored to specific lessons and objectives. Not only on drawings, but on the small models that students can handle, assemble and modify.

There's another plethora of objects that are suitable for this market, like for instance small decorative objects for the house or pendants and earrings, which could be easily personalized.

Conclusion

In the previous text we where trying to analyze the outcomes, changes and possible small possibilities that arise from the 3d in house printing. We looked backward in our memory and try to realize what little changes had happened until the world today. It seems puzzling, but when the world starts to change for virtual reality and immersive virtual reality, it seems to be possible to drive to the object as a display of ideas and presentations. We tried to analyze if a similar pattern could be triggered in a near future, in order to analyze their impact.

Aknowledgements

This work was supported by Strategic Project, reference PEst-OE/EME/LA0022 /2011, through FCT (under the Unit IDMEC - Pole IST, Research Group IDMEC/LAETA /CSI).

References

[1] http://www.lascaux.culture.fr
[2] http://www.culture.gouv.fr/culture/arcnat/chauvet/en/
[3] http://blogs.scientificamerican.com/observations/2012/06/14/oldest-cave-paintings-may-be-creations-of-neandertals-not-modern-humans/
[4] A History of Photography: From 1839 to the Present; Therese Mulligan, David Wooters, Taschen, 2005
[5] Progress in Additive Manufacturing and Rapid Prototyping, J.-P. Krutha, M.C. Leu, and T. Nakagawa, CIRP Annals - Manufacturing Technology, Volume 47, Issue 2, 1998, Pages 525–540, Available online 10 July 2007.
[6] Emanuel Sachs, Michael Cima, James Cornie, David Brancazio, Jim Bredt, Alain Curodeau, Tailin Fan, Satbir Khanuja, Alan Lauder, John Lee, Steve Michaels, Three-Dimensional Printing: The Physics and Implications of Additive Manufacturing, CIRP Annals - Manufacturing Technology, Volume 42, Issue 1, 1993, Pages 257–260.
[7] Xue Yan, P Gu; A review of rapid prototyping technologies and systems, Computer-Aided Design, Volume 28, Issue 4, April 1996, Pages 307-318
[8] J. Stampfl, A. Wöß, O. Kolednik, P. Fratzl: "Object reconstruction and object construction: Applications in materials science"; Recent Research Development in Applied Physics, 5 (2002), S. 89 - 106.
[9] Worldwide Trends in Additive Manufacturing, Terry Wohlers RapidTech 2009: US-TURKEY Workshop on Rapid Technologies
[10] http://www.objet.com/portals/0/docs2/FullCure_A4_il_low.pdf
[11] Additive Manufacturing: A Framework for Implementation; Stephen Mellor, Liang Hao, David Zhang; http://www.medifas.net/IGLS/Papers2012/Paper123.pdf
[12] Hao L, Seaman O, Mellor S, Henderson J, Sewell N, Sloan M Extrusion behavior of chocolate for additive layer manufacturing, 4th International Conference on Advanced Research in Virtual and Rapid Prototyping, Leiria, Portugal, 6th - 10th Oct 2009, Innovative Developments in Design and Manufacture, pp 245-250