3D VISUAL ILLUSION INTERPRETATION

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Abstract

Our initial research based on a combination of personal interests such as holographic art [Cole and Hayward 1995], 3D computer graphics and visual illusions led us to a theoretical study on a cross-platform application designed to quickly produce 3D raw meshes from 2D bitmap interference rings mainly for personal usage. But the keynote to this article is to demonstrate how big a simple idea can grow.

Early stages of this research is a manual image construction obtained through visual illusions and mental images due to the faculty that our brain has to fill what is not visible by the nearest memory [Luzy 1973]. The artistic aspect is that the result is totally random. The issue now is how to digitally translate the above faculty and randomness.

CR Categories: B.4.2 [Input/output and Data Communications]: Input/Output Devices—Image Display; D.2.2 [Software Engineering]: Design Tools and Techniques—User Interfaces; I.4.10 [Image Processing and Computer vision]: Image Representation—Volumetric; I.6.5 [Simulation and Modeling]: Model Development—Modeling methodologies.

Keywords: holographic art, visual illusions, interference rings

1 Introduction

I can see a bird, a smiling face, an angry wolf...and you? What can you see? Who has not seen, at least once, an object, clouds or a bunch of flowers, for instance, forming a shape or an expressive figure? This is what we call "mental images" [Ingalese 1980].

Here is a brief explanation on how mental images are formed. Light, reflected from the object one is looking at, enters the eye. This light is converted into electro-chemical signals and delivered to the brain which in turn translates that information into an image [Keenan 2009]. During this process, if part of the object is hidden, the human brain has this faculty to fill what is not visible by our nearest memories thus creating visual illusions. This ability to compose from total abstraction leaves our imagination to interpret mental images. Moreover, the mental images differ from several people looking at the same object.

It was obvious to us, 3D artists; the next step to this human faculty should be a three dimensional image interpretation. The above fundamentals set up the mainstream of our work: creating 3D characters (for our shorts) through visual illusion interpretation.

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Artists like Victor Vasarely, Salvador Dali or Octavio Ocampo have been working with illusions for years bringing their own influence and inspiration [Dali 1999]. For us, holography turns out to be highly inspiring. We have been experimenting ways to come up with "controlled" visual illusions and the most convincing results matching our expectations were interference rings obtained through light and shadows [Gil 2006], using a simple reflexion holography set [Gabor 1970]. From this point on our research project started to mould.

2 Early stages

There are several stages to this work. First, in a doctoral thesis (*Research and Experiments in Digital Imagery using Interferences*) [Appadoo 2006], we exposed our initial research: an artistic approach on our manual image interpretation and construction. Next step is to go digital. We will expose shortly a theoretical study on a cross-platform application but before here is a glimpse, through some sketches, on the various steps of the preliminary work.

2.1 The "recording" process

The use of optical elements (laser and lenses), holographic film and an object are essential to this experiment. Everything is mounted on a hard flat surface designed to absorb vibrations coming from the floor. The laser light, traveling through the concave lens, spreads over the transparent holographic film as well as the physical object. The recording process takes place at this very moment when the object reflects the light onto the holographic film [Saxby 1980]. "Controlled" vibrations through noises are deliberately caused to obtain more random interferences (Figure 1).

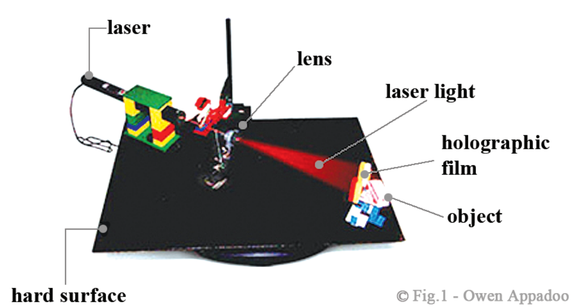

Figure 1: *Table designed to absorb vibrations*

2.2 The "developing" process

Once the object is recorded on the transparent film, the latter is dipped into several chemical solutions (similarly to photography):

1. The developing bath reveals an opaque brownish color.

2. Water to clean the previous bath.

3. A bleaching process for a few seconds so as to regain partial transparency. Allowing only a few seconds actually reveals a randomly textured patch; the interferences (Figure 2).

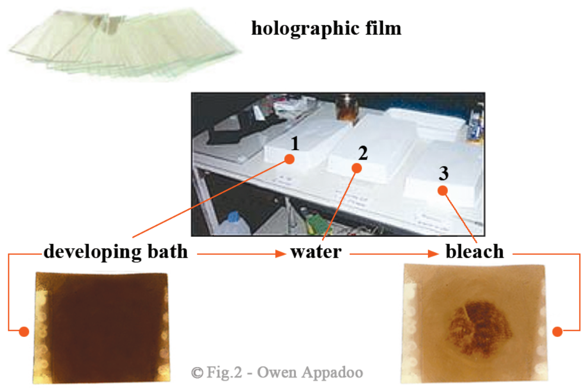

Figure 2: *Developing process.*

2.3 The "mental image-detecting" process

This step is purely artistic. This is one's own performance on visual illusion based upon one's personal life experience, imagination and inquiring mind in order to find a potential image (Figure 3).

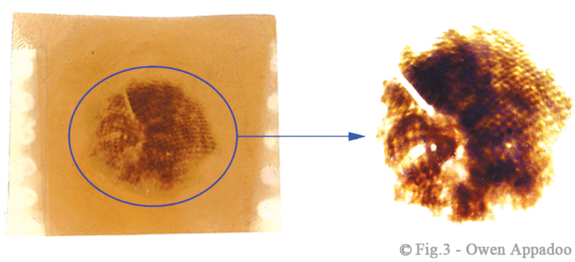

Figure 3: *Mental image-detecting process.*

2.4 The "image representation" process

The interferences play 2 major roles:

1. Once the image is found, rough sketches lead to a proper 2D representation of a character and its usual orthographic projections: front and side views. Those views help shaping the forthcoming 3D model.

2. The interference is also a valuable raw material for texture creation.

This preliminary work gives us a clear idea on the outcome (Figure 4). Original images are indeed created through traditional modeling and bitmap creation (Figure 5) but the whole process takes quite few hours or even days!

3 Yet to come!

We wanted to demonstrate, through this first approach, how big a simple idea could grow. Can it grow even bigger?

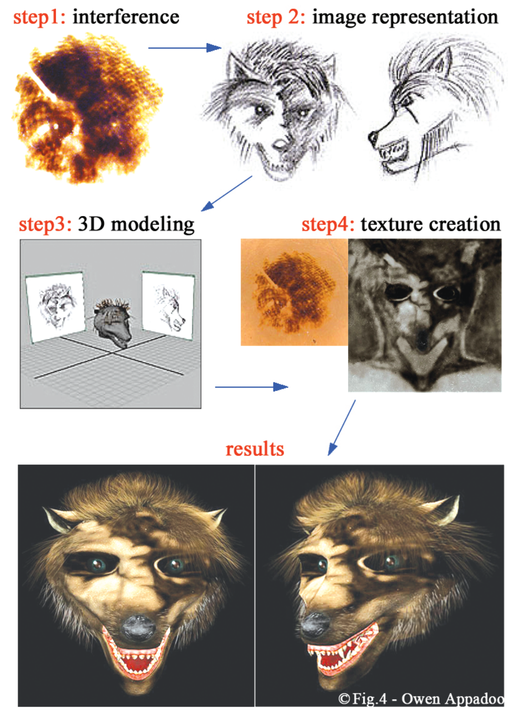

Figure 4: *Image representation process.*

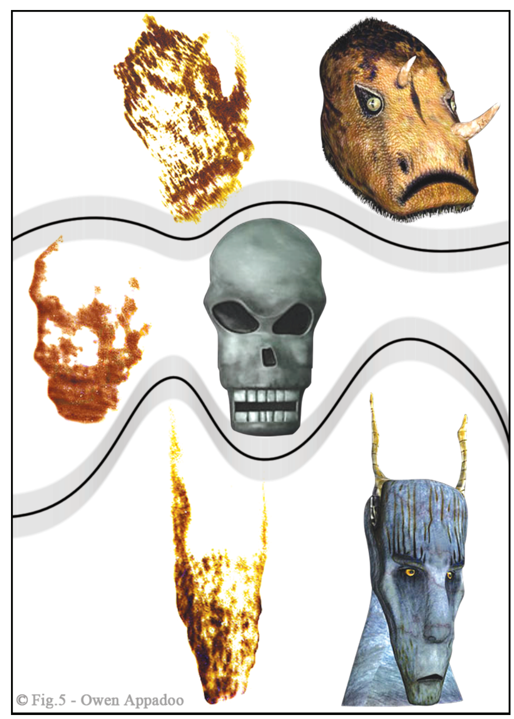

Figure 5: *3D characters from 2D interferences.*

As stated above, the process is time consuming. Is there a way to come up with a similar result almost instantly? Far from being IT experts, we think that a digital process would be a real deal. The main issue now is to digitally translate the above mentioned human brain's faculty as well as keeping randomness. Could we dream of an application able to translate a user's personal interpretation such as emotions, feelings and life experience into an image?

From an artistic point of view, we bring forward a theoretical study on a cross-platform application designed to quickly produce 3D raw meshes from 2D bitmap interference rings. The following sections will expose, methodologically, our thoughts.

Initially to match up with the "recording and developing" process previously mentioned, we thought of a computerized device based on digital holography [Mann et al. 2006] to create the interferences. A small apparatus equipped with an image sensor (charge-coupled device, CCD), a laser, some lenses and mirrors, a digital delay generator (DDG) and a usb port. The usb cable connected to a computer would be the link between a software application, the device and also the power supply for the laser (Figure 6).

Good try but off-board if the motto is "speed"! The target here is to obtain those desired interferences right? It would be much more convenient to generate interferences within the upcoming application without the hassle of a physical device.

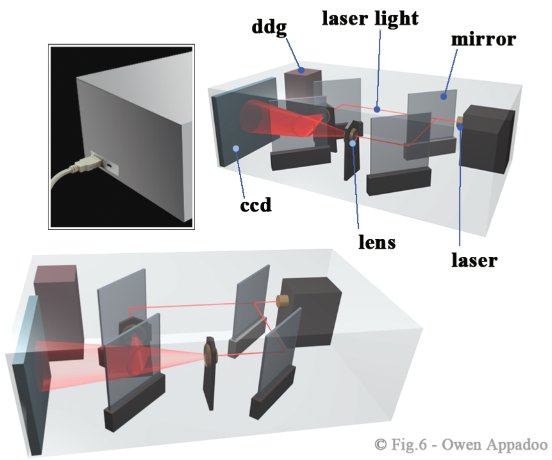

Figure 6: *Device based on digital holography.*

3.1 The cross-platform application

The application will act as a control panel, a user interface, through which the 3D character will emerge. The concept, in two phases, will be based on those primary functions:

Phase 1 (Figure 7): Interference recording through noise and/or images

- Noise creation through wave and frequency settings (or possibility to import sound files).
- A player to listen and save the sound effects.
- Importing bitmap images to simulate a real object.
- Noise simulation button.
- Thumbnail to show the recorded interference pattern and possibility to export it as a bitmap texture

Phase 2 (Figure 8): 3D model construction (in 3 levels)

- Level 1: Interpretation and life experience aspects can be translated by photos or drawings gathered throughout one's life journey.

▷ *The interference will go into a processing mode in order to detect likely 2D shapes. To do so the interference will be muddled with a database of imported bitmap images.*

- Level 2: Mental images can be translated into a computing process.

▷ *Contingent on the suitability, the quality and the amount of imported images, the application will capsulate the bitmap data and the interference ring into a few cleaned-up 2D image proposals.*

- Level 3: Another computing process to translate 2D information into 3D meshes.

▷ *This final step will be the actual construction of the 3D model according to the above-selected 2D image. The result will be a raw low polygonal 3D mesh (to match the requirements of game design) with 2 options: a 3D mesh representing either a face or the entire character (face and body). The mesh will appear in a window offering some basic VRML options: zoom-in/zoom-out and 360 degrees navigation. Last but not least, the application will offer the link towards several 3D software thus exporting for 3ds Max, Maya, Blender, Lightwave and many more.*

4 Conclusion

From a simple textured material this project has become quite challenging.

The next lap before stepping into real coding is to be assessed by 3D companies to see if it is a worthwhile research. Well established 3D companies with colossal budgets do have dedicated teams for designing and modeling custom-built characters but thinking of independent directors dealing with the whole process of film making, this research may help a project along. This is not the "absolute" solution that would help producing original images. Currently many tools are available to 3D artists which help to speed up the modeling process, including 3D sculpting software or 3D scanners. In addition, procedural modeling tools and plug-ins (e.g FaceGen) or the more traditional use of 3D "morgues" or asset libraries significantly enhance the efficiency of 3D modeling [Carlson 2003].

What do we offer more? We bring forward a multiple character generator and certainly originality. This solution should reduce a significant amount of work days into a few minutes and could be a useful tool to start off with modeling. Thinking of those who do not have drawing abilities or those who do not want the hassle to look for pencils, papers and traditional scanning and image retouching process, this could be a serious advantage.

The main difficulties will be the translation of our artistic vision into programming feasibility. In other words trying to reproduce the human brain's faculty digitally will not be an easy task. It would be wise to first simulate the whole process through an animation. Since we are not computer programmers, a video expressing our goal would be much more eloquent than thousand words if we consider sponsoring or even subcontracting.

Once again, claiming to offer a viable alternative to 3D modeling, considering all the efficient tools already available, is not the purpose. Designing such a tool is for internal use mainly. If this could contribute somehow, fair enough. What matters most is the mushrooming process of this project from day one and how far can we bring our work. Even though this project is not targeted for a commercial use, nevertheless, we are focusing on a professional approach for credibility. This research will certainly create an interesting synergy between artists and software engineers, where everyone's point of view will be a valuable contribution... work in progress!

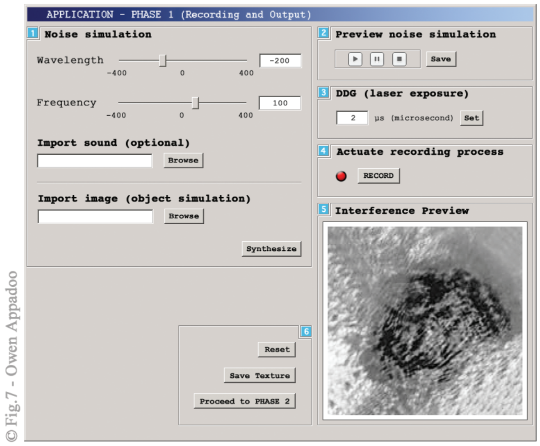

Figure 7: *Phase 1 of the application.*

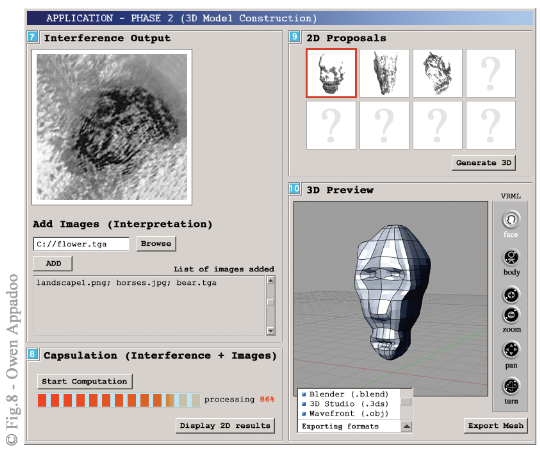

Figure 8: *Phase 2 of the application.*

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