Digital Craft
Tools of the Trade
Reflection document

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Animation almost lives in a medium on its own, film. Motion is very difficult to communicate trough only one image, so showing multiple images is a necessity. A story contains a lot of motion, therefore film is the best to fit with animation. But animation can also be created without film. In essence it means creating life with motion, so creating a physical motion (like robotics) can also be seen as animation. Because of this, animation can be applied in a very broad way, it does not necessarily have to been seen as something just hand drawn or created by computer. The techniques vary a lot from analog to digital, with each its own different techniques and methods. Animatronics and puppets are for example analog techniques that involve physical motion and use physical power as a tool. Hand drawn, stop-motion, digital 2D/3D animation, motion graphics and visual effects are more techniques that involve digitalization or the computer as a main tool, and are most common in the craft of animation.

Animation is a craft that expands really fast. Over the last twenty years, animation made a giant leap forward in the movie industry with the use of computers and effects. Nowadays there are no films that do not contain a form of animation, but most times people are not aware of the effects that are animated. A lot of commercials use animation or motion graphics in big or in small amounts. Animation is not only the classic Disney movies or cartoons from earlier, but almost everywhere around you. With the progression of the digital world, more and more things are developed that contain animation. From interfaces to videogames, a lot of things contain movement and needs to be animated. The borders of animation keep expanding with the growing digital culture. The future holds a lot of new possibilities and ways of using animation due to the improvement in software and new purposes.

Throughout history, animation has made a lot of progression. It became well known by Disney and his movies and was a really specialized technique of making film due to analog ways of producing and the time consuming work of drawing. So during the last decade Disney mostly dominated the market. But during these times there were some artist who took animation as something else as Disney did. More abstract.
Oskar Fischinger was one of the first abstract animator before the WOII. He created a new form of using animation, together with music. He animated shapes frame by frame underneath a camera to visualize the music to which it was animated. He did this in an extremely graphic way, with lines forming into cubes, circles flying over the screen and shapes disappearing on beats of music. He was the first to look at music and film at this way.
During the second half of the last decade this combination of music with film started to turn into video clips of bands and artists. But things inspired by Fischinger's abstract films were not seen so much anymore.

The last couple of years live video techniques developed quickly and electronic music got combined with live visuals. Nowadays most abstract animation is made based on music, and is shown live together. It is the same idea as Fischinger had in the 30's, but now with the extra value of live

performance, made possible by modern computers. A lot of visual artist do performances with visuals inspired by Fischinger's animations.

New technologies do influence animation in some sort of way, but the general idea behind animation does not get changed by it. Techniques are being improved and productions are able to speed up through new technolgies. Digital animation became more or less a standard because of this, but through digitalisation, animation mostly became more broadly applied as craft.

New tools of the trade

As animation is in general most connected to filmmaking as an art form, the classical animation is based on two aspects; the craft of animation (i.e. drawing frame by frame movement) and storytelling. This is the most common and well-known form of animation because everyone is familiar with Disney, who has set the tone for the art. But in new media, animation expresses itself in a more broad way, which does not directly show. New art forms like game design, interaction design or visualisation techniques in film are all depending on a form of animation, but a form that is also new to the medium compared to twenty years ago. Animation is represented in a small way in these new forms of art. A lot of other disciplines are necessary beside animation to create interaction, video games or films.

Programming
Programming is one of the crafts or tools that have a lot of influence on animation during the past years. With the use of computers and animation software in the industry, the craft its only connection with coding was the high-end 3D market. In 1998 Macromedia Flash (currently Adobe Flash) started adding their programming language Actionscript to their Flash software. With this it became easier to enrich animations with interactivity as coding and drawing where combined in one package. Flash became the standard for developing rich internet applications (RIA's) and creative interactions in the video media. As Flash was easy to learn a very powerful on the web, non-programmers and artists experimented a lot with the power of this new medium and used it as their way of expression. Han Hoogebrugge is one artist that used the power of Flash in an extensive way for creating video clips and interactive art pieces on the internet. In this way animation started to express itself more through a new medium which combined animation and programming.

But besides Flash, the last couple of years different programming languages started to pop up or became user-friendlier for video artists to use. Processing who uses Java as programming language, but packs it in an easy to understand package and node based applications like Max MSP and Quartz Composer opened a new way for artists to experiment with generative video and interaction with manageable programming. People did not have to learn whole programming languages to start programming. By connecting nodes with each other it became easier to understand the events behind all the code in the computer and took away the scariness of writing difficult commands of code to let something happen. Together with an open-source community behind these applications, sharing and learning from other people simplified the learning curve for making interactive applications for art.

Mocap
Motion Capture (Mocap) is a tool for translating real-world movement to digital data. It has a broad application for researching in the military and medical

field, but is also used a lot in the field of animation and filmmaking. It is used by reading specified points on the body of an actor with spacial scanning equipment, and translating the positions of these points into a virtual 3D environment. Animation sometime uses a similar technique known as ‘rotoscoping’, but mocap is not the same as rotoscoping is used by filming live footage and tracing this with hand drawn animation.

The first full animation film that used this technique for animation was ‘The Polar Express’ (2004) for which they recorded all the actors and linked their movements to the 3D models for the film. A problem was that the movements where so realistic that the animation became uncanny together with the 3D characters. Therefore the cartoony background of animation was not suitable together with the realism of motion capture as it got to close in the ‘Uncanny Valley’, an aesthetic measure model that states that if something moves or looks, but is not exactly like the real, it causes a revulsion from the viewer. So realism plays a great part in the use of motion capture. Therefore it is most used in high-end 3D production as movies like ‘Lord of The Rings’ (2001) where Smeagol is acted through mocap, or in videogames that use immersive storytelling through gameplay like ‘Heavy Rain’ (2010) where the story is more dramatically than entertaining.

After ten years of development on this field, mocap system are more advanced and easier to use and can track more details from the real world to translate to data. It is still mainly used in video games and movies but therefore has a lot of influence on the field of 3D animation. A lot of different systems are on the market for motion capture and tracking from budget to high-end production value. One of the most common is the Kinect because of its low cost and usability. These are suitable for experimentation. More advanced systems involve multiple camera’s in static studio’s but can process more actors at the same time with more tracking quality. These are used in big productions for film or games.

While motion capture more or less takes away the work of an animator, that does not mean animators are not necessary for working with mocap as there still remain some parts of the body that are not tracked but rather animated by hand for more realism. Animators always clean up the captured movements from the actors from small tracking errors and most time add animation for the face or hands.

Translating the physical to digital and back

A great part of the animation world exists of CG animation, which over the last years took over the old crafts of animation more and more and modernises it with computer driven techniques. Tools like drawing-tablets from Wacom for drawing on the computer with digital pens and software that tries to mimic the pencil lines of the real world became a great modernisation for animation in the beginning of this decade. Real old fashioned hand drawn animation with pen and paper was starting to become more rare, as the computer became able to speed up the process to create animations and made production

easier. Still, animators take great value in the pen and paper technique because the translation from hand to paper is the most powerful with a simple pencil. Drawing is a craft that involves a lot of feeling for the materials that you use. The pressure, tilt and speed of the movement from the pen give character in the line that is drawn. This character has a lot of aesthetic value in hand drawn animation. Digital devices like the Wacom tablets try to translate this pressure, tilt and speed as best as possible to the digital line, but are not truly the same.

As drawing has become digitalised in animation, the ‘stop-motion’ technique stayed the same for a longer time. Stop-motion or puppet animation is like pen and paper an old technique, which stood at the base of animation in the early days.
The value of stop-motion animations like for example the movie ‘The Nightmare Before Christmas’ and series as ‘Wallace and Gromit’, is the power of the real materials that the whole animated world is created from. Everything in these animations, which within traditional animation is drawn by hand, are build and made of real materials. Because of that this form of animation has a lot of other disciplines involved. Carpenters to create the backgrounds, dressmakers to sew costumes and sculptors to create the puppets for animation. All these crafts have no close relation to computer techniques for production and stay more or less untouched for a long time.

But nowadays, digital 3D techniques are able to create the same reality as the stop-motion technique, and raises the same struggle as the pen and paper issue for animators. 3D has more efficient production and flexibility, but still lacks the feeling of real material. With the new production methods with 3D printers, new possibilities arise for sculptors and animators to produce puppets and speed up production. Traditionally sculptors created a model out of clay for the design and production of animation characters, but this is a time intensive process. With the use of the computer, revisions of the design can be made faster. Artists can prototype characters in 3D software and have the flexibility of the computer to find the best design. These designs can be printed with a 3D printer to review them in reality instead of looking at a screen. This is nice development for designing in stop-motion, and gives better end results.

In Laika’s latest animation movie ‘The Boxtrolls’ a good example of the use of 3D printers in animation production can be shown. The characters for the movie were still hand crafted, but the faces and expressions were developed with 3D software and printed afterwards with special 3D printers. Animators worked together with CG artists to create thousands of unique facial expressions for each character during animation. Normally tenths of artists would need to sculpt these expressions by hand, but with the five printers they were able to produce a tenfold more faces with only three people printing. These printers are not the average 3D printer but printed the models through hardening a powder with specific colour pigment mixed in. By building up layers, they printed already colored models of the faces.

This is a great leap forward for animation production in the field of stop-motion productions and shows the power of modern tools for a craft like this.

My tool of the trade

As I studied animation in the last three years, my interests within animation changed from classic 2D animation to 3D and special effects. I was always intrigued by the power of special effects in creating realistic looking images, and wanted to be able to create art like that. But, as I tried to learn 3D before I started my study in animation, I lost interest because of the high learning curve in 3D visuals and complexity of the software. 2D animation was better to start with, and the first part of the study was only hand drawn animation. As I learned the basics of 2D animation and got introduced to Maya, my interest in 3D got stimulated again. I thought hand drawn animation was a pain as all the drawings had to be scanned manually one by one at our lessons. 3D showed me new possibilities for expressing my creativity and suited me more. I was again fascinated in how these digital worlds could create realism out of nothing real.

I continued my study in learning more about 3D graphics, but thought it would be a loss if I would only focus on that, during my researching in the 3rd year, I came along these new art forms of combining digital images with objects in spacial environments, and wanted to step away from the flat square screen of film, and research the possibilities of animation in the physical space. A new world opened before me. Animation as a new visual experience outside the standard display screen. I started to research about projection mapping and interactive installations, and chose to do my internship in this field.

During my internship I did a lot of animating for mapping installations, but these were on a whole different level compared to animations I made during my study. I worked with an animator like myself and two graphic designers, from which one programmed applications to create generative animations for the installations we made.
As I used animation software to animate for the installations, the graphic designer used his apps to create almost same looking animations, but in real-time. The images he created where not as detailed as mine, but where created way faster, and could be changed on the spot. This made me see that 3D graphics and computers are as well able to create almost real looking images in real-time compared to conventionally rendering minutes to hours.

The project I made for the Tools of the Trade is a combination of what I learned in the past years of my study and my internship. As I am interested in 3D graphics and the ability to create realism in animation, I wanted to research what the possibilities are for 3D animation in real-time, considering realism. While animation is a medium that gives possibility to tell stories trough motion and is able to create imaginative worlds, I think realism in animation can improve the credibility in these alternate worlds of reality. If this world exists in real-time, the viewer can have influence through interaction, increasing the experience.

The last couple of years, video game graphics made a great improvement thanks to competition between game studios to create more photorealistic game graphics in each released game. As the technology is far developed, it is not yet able to create full photorealism due to rendering time. This is still the distinction between movie effects and game effects. Both are based on the same 3D techniques, but quality of the rendering results in the most realistic image. Conventional 3D rendering takes minutes to hours to render one frame. As game graphics need to be rendered in real time because of the interaction, 30 to 60 frames need to be rendered per second to create a smooth moving image. The most advanced graphic cards are able to play the newest games at these speeds in full quality. This quality is not as detailed as movie effects are now, but should eventually be able to reach the same quality as movies with the progression of computer technology.
Some games of the last couple of years already come really close to the movie quality. 'Beyond: Two Souls' (2013) created by 'Quantic Dreams' shows that video game graphics are able to create highly detailed effects that create convincing looking graphics.

As I wanted to make something that shows the power of modern day graphics and the use of interaction, I based my concept on recreating reality with a game engine. Initially my idea was to have the viewer look into a realistic looking world, like looking through a portal to a different reality, but the idea would be more powerful if the world you were looking at would be a digital replica of the real world. So I wanted to create a mirror effect, were the perspective would be accurately shown corresponding to the viewers eyes. If the image would adapt itself to the position of the viewer, the interactive element would amplify the experience and use of real-time rendering.

As I started developing the system, I researched several techniques and software packages that would give the best result in the amount of time and complexity of the project. I chose to use Unity 3D as game engine because of its flexible background in programming interactivity and the Xbox Kinect for tracking the viewers position. The Unreal Engine was the alternative for Unity, but lacks the flexibility for creating installations. Initially I tried to use the Kinect directly in Unity with a plugin from ZigFu, but after working with, it became too complicated to give the result I needed. Eventually the system worked better with Processing and using the SimpleOpenNi library. With the help from Brigit Lichtenegger I was able to make the Kinect track the head position of the viewer. This position in 3D space is send to Unity through an OSC connection, and linked to the Unity camera that simulates the viewer's eyes. This camera would be pointed to the place where the final image would be displayed in the physical world. Depending on the location and angle of the 3D camera, the final image would be calculated with a virtual reflection of the space. If a person steps into the view of the Kinect, he or she can walk around in this view and see a displayed reflection that gives the impression but is not real.

To create this reflection I started to recreate the whole space of the exhibition in 3D by measuring and taking pictures of everything. I tested this first at

home and already noticed it was hard to let the perspective in 3D correspond to the eye. The eye cannot be compared to a camera, so finding the right settings for the view angle in 3D was difficult. But the biggest problem was the lighting of the scene. I was able to fake the sun and normal lights, but missed the feeling of ambient lighting. After researching about the lighting in videogames and game engines, I noticed I missed the ability to use a technique in Unity called ‘global Illumination’ (GI). This is the lighting model for light bouncing of materials and illuminating its surroundings. Calculating GI is intensive process for computers, so is very new and not represented in a lot of game engines yet, except the Unreal Engine, to which I could changed using. But Unreal has no inputs to connect Kinect data to and has no flexibility to what I wanted. Only the next version of Unity would have been the solution to this, as version 5 shipped with real-time GI calculation, but is not yet released during the project. As time ran out, the best solution for the project was to scale down the idea and use a small and more detailed subject to make a reflection of. All the experimenting prior gave me the possibility to focus on the things necessary for creating the new 3D space quickly and more detailed. The steel pillars in the exhibition space were the most interesting pieces to use. Therefore the final installation exists of a projection in front of one of the pillars, projecting its reflection on the floor in the form of a puddle of water.

In the end, researching real-time rendering and their connection to interaction broadened my insight for animation in the future. Interaction and photorealistic graphics can give results that are believable for the viewer, so the immersion becomes even more powerful than watching a movie. This means that these technologies, like game graphics and tracking systems, can bring fictional worlds closer to the viewer and reality.

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