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History of Animation

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This paper will be analyzing more technical elements of the development of 3D animation and computer graphic imagery, something I've always had great interest in but have never formally researched previously. This idea came about after the eye-opening and inspiring lecture on November 28th, the early "Computer Animation" class. Specifically, I was surprised by many technical elements that were present in some of the animations, which were long before *Toy Story* or other Pixar works, who I had ignorantly previously thought were the sole pioneers in the field until after their first feature film. This paper will be a more formal research and analysis, analyzing the key moments from that lecture and subsequent lectures showing 3D animation, and also more of my own research into the first appearances of specific technical features of 3D animation, such as reflections, soft bodies and morphing, dynamic shadows and more.

I want to begin by recounting some of the elements I was shocked to see in the animations shown in the lectures. The lecture on the 28th was particularly inspiring for me because I was genuinely taken aback, and realized my knowledge in this topic, one I'm both interested in and have worked with in the past, is rather lacking and incorrect. My presumptions before starting research for this paper were that, aside from a few formal experiments in CGI, Pixar was founded and created content as the sole animation firm until after the feature *Toy Story* (1995) which may have inspired other companies to tackle computer

animation (Disney, Dreamworks, etc). However, as I saw in the lectures, and researched afterwards, I quickly realize there's a whole world of little discoveries from countless sources that all build to the current state of 3D abilities off-the-shelf software now can handle.

We started with *High Fidelity* (1984, Robert Abel & Associates) first, and I largely expected all that I saw – generic global lighting, basic geometric shapes that form objects, basic animation. In retrospect, one key feature of *High Fidelity* that I hadn't realized the significance of at the time was the textures mapped onto the objects. I realize now basic shaders were more commonly used, which apply a color/lighting/effect to an object as a whole, compared to the more advanced texture or material renderers that were developed later, and which must have been used for this short. What I was more taken aback by during the class were the shorts *Sexy Robot* (1984, Robert Abel) and *Grinning Evil Death* (1990, Mckenna/Sabiston). Given the year it came out, the fact that such a reflective material could be used for *Sexy Robot* was unexpected- I still thought that anything before *Luxo Jr* (1986, John Lasseter) would be too basic for such technology. Much of the technology used during these years had to be developed by the artists/creators themselves, from the modeling and animating to the rendering. There was no expansive off-the-shelf software like we have now, so such fast advancements over the course of 5-10 years was very shocking to me.

Grinning Evil Death's technical elements that caught my attention were the inclusion of string/rope effects (for the telephone wires) and volumetric lighting from street lamps. After viewing it now, it is possible that volumetric lighting wasn't used, and that it was a simple trick of a slightly transparent overlaid cone/image that makes it seem like volume lighting. But I

still can't tell, and I cannot find any research to prove or disprove this. And finally, being a Pixar fan, I was excited to see *Luxo Jr.* again, although I already knew a lot about it. I know that the power cords in the lamps are hand-animated when they move, which again was the reason why I was shocked to see such realistic, potentially physics-based simulations of rope movement in the 1990 *Grinning Evil Death* short.

For this paper, I set about finding the earliest versions of some technical elements that I thought would be hard to develop until later. These technical elements range from motion blur to hair/fur simulations, and the discoveries I made while researching were quite enjoyable and educational for myself, and perhaps for the readers of this paper. I will attempt to go as chronological as I can. From my own research, the official "first 3D computer animation" was *A Computer Animated Hand* (1972, Edwin Catmull) [S1], who is one of the founders of Pixar. This animation was done as a class assignment, and involved manually plotting the vector points of a hand in 3D space, after he had modelled it in person. The piece had the hand wiggle fingers and move around, and used a shader renderer as well [S2]. The film *Futureworld* (1976) [S4] featured the hand animation, as well as the first facial animation done by Fred Parke during his thesis at the University of Utah.

Nowadays there seems to be this divide between photorealistic CGI used for special effects in films, and CGI used for more traditional animated features. Whatever the debate may be now, I believe the two should be treated equally in the early developments of any kind of CGI, as to me it is all animation. Therefore it's important to recognize some early block buster films using CGI, in particular *Star Wars* (1977). George Lucas recruited Edwin Catmull for the

project and eventually helped start Pixar as an offshoot of the visual effects program. In *Star Wars*, vector-based wireframe animation was used for trench run and death star sequences. In *Star Trek II* (1982), a fractal-generated landscape was used for one of the planet sequences [S11]. This is particularly cool for me because I just finished a project that involved making landscapes out of fractals, and I personally felt like a part of history even though I didn't contribute to the technology in any way [S3]. Although the fractal landscape from *Star Trek* is a particularly useful and cool technological advancement, these all seem to fit well in the timeline in relation to Edwin's first hand animation.

However, continuing here on out, I'm more shocked with the advancements in regards to the years they came out in. *The Adventures of André and Wally B.* (1984) was created by The Graphics Group, a division of Lucasfilm that was later rebranded as Pixar, and featured the groundbreaking first examples of the squash/stretch effect and motion blur [S5]. Immediately after, the film *Young Sherlock Holmes* (1985) contained the first fully CGI character, created by John Lasseter (currently the CEO of Pixar), which contained shockingly realistic rendering and animation that matched the physical camera movements of the film it was in [S6/7]. Reflection mapping, which we saw a little bit of in *Sexy Robot* (1984), was first created by Jim Blinn, who presented his findings at Siggraph 98 in 1976 [S8]. However, the first major example of its use was in the film *Flight of the Navigator* (1986), which featured a highly reflective alien spaceship [S9].

The second half of the 80s really kept pumping out new technology after new technology. The first big example of 3D morphing was introduced in the film *Star Trek IV* (1986)

[S10], *Luxo Jr.* (1986) showcased photorealistic dynamic shadows (but not string physics!), *Akira* (1988) used CGI to render falling object paths with gravity physics and digitally visualize parallax effect, lighting and lens flares for the film, and lastly *The Abyss* (1989) featured 3D rendered water effects [S4]. The 90s and beyond demonstrated a few more milestones in CGI. *Terminator 2* (1991) used personal computers to render the blockbuster film, *Toy Story* (1995) was the first computer animated feature film and *Jumanji* (1995) contained hair and fur simulations in their CG animals.

This research was particularly important for me, so I don't spend my time spreading incorrect facts or believing in my own misconceptions. Both the lectures and my research proved to be eye-opening in just how early many techniques showed up. I personally had always thought a majority of these, such as water simulations, morphing, and other effects were created after *Toy Story*, perhaps because I always assumed *Toy Story's* fame as "first animated movie" also meant first in everything else. How ignorant of me. I still couldn't find the origins of rope simulations or volumetric but now I can assume it's sometime between 1975 and 1985.

Sources

- S1 [The Imaginer – University of Utah](#)
- S2 [A Computer Animated Hand](#)
- S3 [Endless – Fractal Generated Sci-fi Film](#)
- S4 [Timeline of Computer Animation in Film and Television](#)
- S5 [The adventures of André and Wally B.](#)
- S6 [Young Sherlock Holmes](#)
- S7 [Young Sherlock Holmes – Stained Glass Knight](#)
- S8 [Reflection Mapping](#)
- S9 [Flight of the Navigator – CGI Spaceship](#)
- S10 [Star Trek IV – Time Travel scene](#)
- S11 [“Genesis effect” for Star Trek II – The Wrath of Khan](#)