CGI (Visual Effects) depended on more rather than Practical Cinema Techniques.

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3D Computer Animation

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Phil Organ

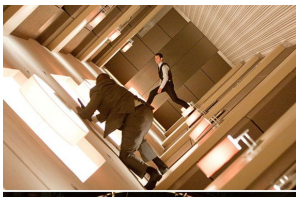
Maya, blender, Cinema 4D and Houdini are currently some of the well-known and widely used CGI software's that can successfully turn any idea into a realistic three-dimensional model. More directors and production companies are relying on this as a complete technique when it comes to filming. Using this technique benefits them as a company in several ways such as they wouldn't have to scout for a filming location e.g. because they could model that and digitally composite the environment into their desired shot. Currently there are a wide range of movies and tv shows that use computer aided visual effects into their shots/sequences. This is now leading to an increase in the demand for the use of computer aided Visual effects in those industries. These computer aided effects are depended on so much that some films tend to rely on artists to create a model of an environment, for example a park; rather than filming in a real park using a practical shot. However, through the evolution of cinema the human eyes have been able to slowly adapt to recognise what is a real shot and what isn't real. So, if more future films try to incorporate more CG shots and reduce real practical shots then this will be easily recognized by that film's audience because by then the human eye will be fully adapted to identify if its real or not.
When the demand of vfx is drastically increasing some directors are aiming to influence new director to continue using some of the current practical cinema techniques.

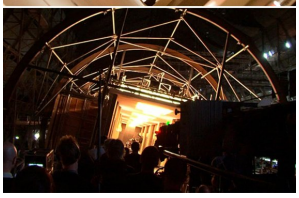
<u>Directors who still continue to use practical shots rather than referring to a CG aspect</u>
The very first director to be included on this list would have to be in no doubt be Christopher Nolan. Christopher Nolan has created some iconic films throughout his career such as the *'Dark knight Trilogy' (2005-2012)*, *'Inception' (2010)* or *'Interstellar' (2014)*. These films are all arguably praised to be masterpieces that contain some breath-taking visual shots that look like computer aided visual shots, when in fact they were practically shot using practical effects. Nolan is said to have three principle rules when it comes to making a film and one of this is using more practical effects rather than relying on the computer as explained in the following book; *The Cinema of Christopher Nolan: Imaging the impossible.*

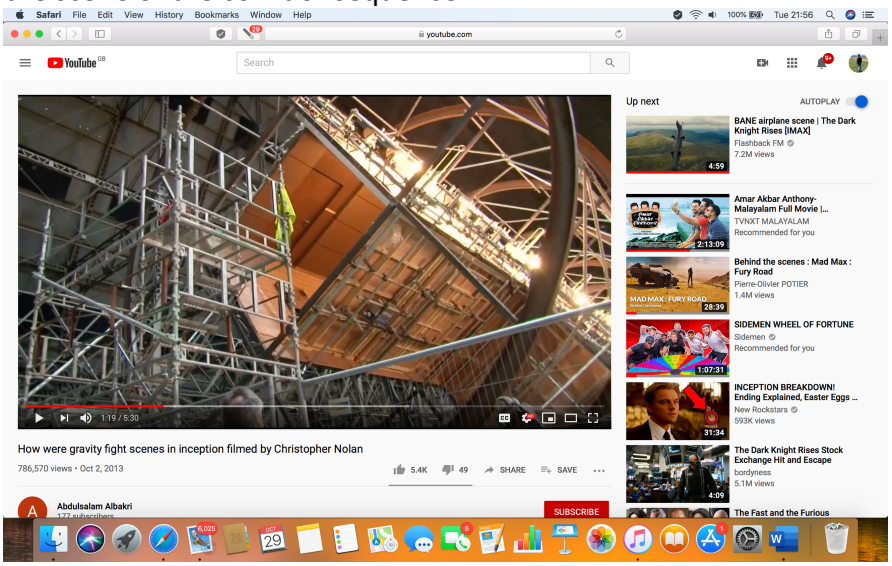
"Christopher Nolan's frequently expressed aspiration to provide the most immersive experience for audience of his films drives three hallmarks of his filmmaking practice: his commitment to film and resistance to digital photography and exhibition; his dedication to filming practical effects in camera and his increasing use of the IMAX format in opposition to 3D technologies."
Before analyzing Nolan's practical effects, his use of the IMAX cameras needs to be discussed. Christopher Nolan used Imax cameras because it allowed him to capture all the shots in a wider camera so that it can make his audience feel like they are brought into the sequence. Nolan was able to successful carry out this technique in iconic sequences like the introduction of the Heath Ledgers joker and the truck flipping sequence in his 2008 'The Dark Knight'. The trucking getting flipped over by Batman is a great shot where the Imax camera can be used because it opposes the use of a 3D truck as the wide camera allows its

audiences to see the truck in a 3-dimensional look and brings them into the scene. By carrying out this sequence using the Imax carry allowed Nolan to feel like they are in front of the truck when it got flipped with the joker inside it. Going back to his practical effects use, this technique is clearly visualized in Nolan's 2010 blockbuster 'Inception'. Within this film there was a shot where a hotel corridor begins spinning with actor Joseph Gordan-Levitt fighting in this spinning corridor. Since this was a complex shot, knowing that visual effects could make this shot easier to work with, Nolan continued to stick with the use of a practical effect. Nolan was able to successfully create the sequence you saw in the final film all thanks to a rig his production team created. They created a full corridor within a rig, and then motors were used to rotate the rig at a full 360 degree to create the effect of alternate directions of gravity. Images to the right is the rig constructed by Guy Hendrix Dyas, the production designer working with Nolan on the film. The Image below is a screenshot of the behind the scene of the corridor sequence:









This technique alone allowed Nolan to capture performance and emotions from the actors when they interacted with the rig. This is something that cannot be captured with the use of a greenscreen or a CGI asset. Dyas was able to give other designers the opportunity to work and get experience with working in a film set with the help of this rig. However, some artists can argue that with technology advancing at a steady speed, similar emotions and acting obtained from the practical shot can be captured with a greenscreen and other props like a climbing harness. But this defeats the point of real interaction because the actor or actress are being told how to deliver and express their feelings and emotions rather than naturally obtaining that.

"Christopher's Strong preference for practical effects is why these films have a realism most other epic do not."

The quote above is from a book called; *The Art and Making of the Dark Knight Trilogy.*

Nolan's vast use of practical effects have been a key factor in all his masterpieces, even in

his sci-fi blockbuster inception. But if you backtrack Inception wasn't the only film Nolan was able to apply his practical effects and make it seem like it was done with the use of CGI. For Nolan's 2012 'The Dark Knight Rises', batman was given the batwing (a drone like vehicle). Throughout the film the batwing was only included for a few shots but instead of creating a CGI version of the drone and make it seem like a real object, Nolan with the help of his production designers created a life-size model of the batwing. The batwing was created with the help of production designer Nathan Crowley and special effects coordinator Chris Corbould. The final models were '28-foot-long and 17-foot-wide', Corbould and his team built two versions of the batwing in the course of five months.



Using cranes, helicopters and some supported cables, Nolan and his effects team were able to imitate the batwing flying throughout the city, as shown on the right. Furthermore, the batwing was also mounted on a purpose-built vehicle that they had built which had hydraulic controls so that the team could use it to simulate its movement.

"To make the Bat appear to ply, Corbould's team built their own rigs. One of them a truck with a 10-foot-high hydraulic arm, had internal mechanics that allowed three operators to maneuver the craft."

The use of this technique allowed Nolan to capture natural real reactions and expressions from the actors when they first see the batwing in its shot. The batwing sequences were done so flawlessly that it looks like a CGI object, this alone shows the power of practical effects and how it's gradually catching up to CGI. Even though the batwing was something that could have been easily brought to life using CGI, Nolan said the following to effects coordinator Chris Corbould.

"At first, Corbould thought the Bat would be all CG, a notion Nolan quickly corrected. He said, absolutely not. We're going to do so much of this for real, and what you build is going to be the benchmark for what the CGI people have to come up with"

This quote obtained from the blog, *Batman's Got a Brand New Plane;* clearly shows Nolan's originality when it comes to filming his projects because as said before the batwing would have been a simple task to create as a CGI object but Nolan wanted to oppose as much use of CG and bring realism to the screen.

Nolan used life-size practical models for his previous batman films rather than relying on the computer to create a CGI model. The Tumbler and the Batpod (Batman's bike) were both manufactured inside Nolan's Garage and he used real models to bring more realm to his films. The tumbler design was initially proposed by Nolan after building a concept art of the tumbler using play-doh, the shape in Nolan's words were "very very crude, more like a croissant than a car"; *Batman Begins special featurettes DVD.* This and the quote from the book are enough to say Christopher Nolan goes so far when it comes to his practical effects and this has allowed him to make his batman trilogy one of the best superhero genre moves to date when it comes to its effects and filming techniques.

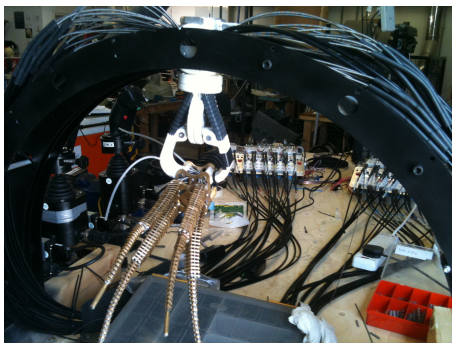
However, you could argue even though Nolan used a practical tumbler during set, when it came to certain sequences Nolan had no other solution other than to use a computer-generated model of the tumbler. This in particular is the roof jumping sequence in the 2005, Batman Begins. Due to the complexity of this sequence, Nolan and his team's solution was to use a CGI model of the tumbler jumping on top of the buildings during the wideshot. Even with this Nolan continued to reduce the use of CGI in this particular sequence. To reduce the use of CGI for this action sequence, Nolan's production designers created a roof set inside the studio and then filmed the life size tumbler driving on top of the roof. The image to the right is a set photo of the life-size tumbler being driven across a roof. Nolan was able to use this shot and integrated it with the CGI sequence. The greenscreen in the background was another small shot that was digitally composited with a CGI environment. While trying to incorporate CGI in the slightest of ways, Nolan aims to capture some of those complex shots with the use of some practical aspects thus creating the rooftop set.



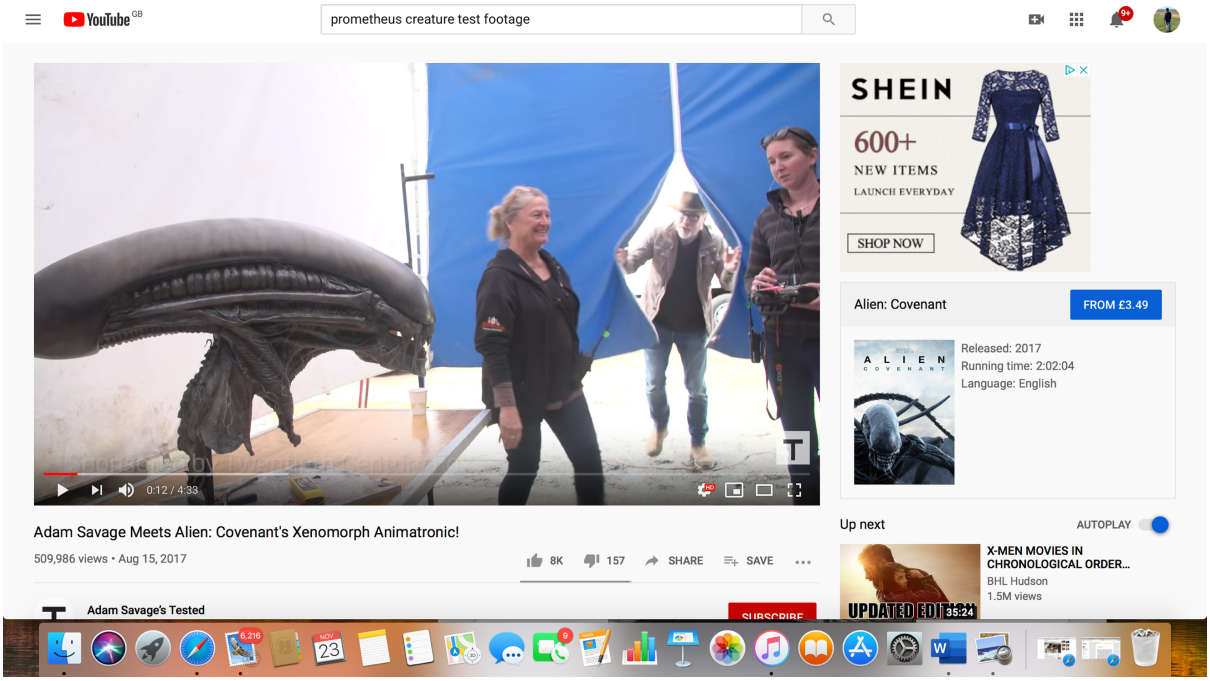
"Digital technology is evolving faster than ever, but practical methods are catching up. Developments in techniques like laser cutting and 3D Printing mean that mocking up a model is now much quicker and cheaper, while also affording the director more opportunity to play."

This is a perfect quote to back up Nolan and other directors who continue to use practical techniques. Even though technology is advancing, a practical shot within a practical environment cannot be recreated using VFX. But if it was created the final outcome will not be anything like the practical shot because the artist will have to incorporate the lighting, colour etc

Another director that comes under this has to be Ridley Scott. This individual has directed some well-known films such as blade runner, Gladiators and the Martian. However, the film that he had created that makes him important to the list is Prometheus and Alien: Covenant. The reason these two films are important is because both films used another cinema technique within their film sets which dates back to 1960s. This technique was first used and introduced in Disney's live action Mary Poppins (1964), this was the use of animatronics. At this era animatronics in film was starting up so it wasn't to the best. 1984 animatronic was used in another iconic film by James Cameron, and this was The Terminator. Even though the animatronic sequence was only used for a quick 10 seconds sequence, the animatronic technique was useful rather than relying on CGI at that time. Finally, the best use of animatronic was in Steven Spielberg's 1993 Jurassic Park, this was the start of realistic animatronics and this is the influence incorporated in ridley Scotts, Alien films. As explained Instead of creating a CG model of the alien chestbursters e.g. and then hand animating it, then digitally compositing into Ridley Scotts film. Scott got his production to create animatronics of these creatures. The image to the right is an example of an animatronic alien created by Neal Scanlan, he was the creature and special makeup FX supervisor for Prometheus. Scanlan was also in charge of the animatronics for Jurassic park. These animatronics did such a good



job that it fooled the audience's eyes as they thought the animatronics were 3D computer animated models. This technique allowed the film to bring back another cinema technique rather than depending on the computer and 3D software's to create the creature just like every other science fiction film. The screenshot below is a video of Adam savage, a special effects designer visiting and interacting with one of the alien animatronics they had created for Alien Covenant. Just from this video alone you can see how Adam savage was able to interact with the alien head, and this is exactly what can be captured by the actors when they see the alien during set.



The designers of the animatronic went as far as making the alien look very realistic using detailed skin materials and various facial expressions showed by the animatronic head. Just the growling action is enough to capture real emotions from other actors when they interact with the alien. Furthermore, as explained before this is quite difficult to capture if the aliens were digitally created because the film production wouldn't be able to bring it to life on set. If more production houses continue to use animatronics for the creatures and animals rather than using CGI models, then this can allow other practical effects to be used further.

This wasn't the only area where Ridley Scott showed that he didn't need to rely on VFX and CG assets to make a shot look realistic like other films do, the specific sequence that Ridley used practical effects was with the engineer's cockpit sequence. This sequence looks like it was completely digitally created due to the size and complexity of the big cockpit. However, this sequence was a real practical shot because the production created this cockpit set inside the 007 stage located at pinewood studios; England. The image below is the Prometheus set used in the film.







For the aliens franchise these weren't the only practical effects used. The directors of all the alien films even James Cameron used either an animatronic version of the alien or created an alien costume that someone could wear as shown on the right. This idea was more beneficial than creating a full CG alien because if the alien was digitally created then the interaction and emotions would have been weak, but with this someone could wear the costume and behave like a creature and give out a realistic act. This technique is always a better outcome because the use of an alien costume meant that the other casts could practically interact with the alien thus making the expressions and movement better. This technique is still to date practical when it comes to creatures because there are some outstanding creature makeup artists who can create real looking creatures without relying on CGI. This will still continue to capture a better acting performance from the creature and actors when compared to a CG creature. Creating a CGI model can also lead to requiring more artists to animate its movements especially for the first alien's era (1979), this was a time when CGI was starting up, meaning the animated version wouldn't have been to the best of today's quality. However, you could argue that the most recent Alien franchise which was Aliens: Covenant was released when CGI is still advancing and evolving, so a CGI version of the creature could have been successfully used. However, the time to create a practical creature suit or make up will always be quicker and more affordable than a CGI version because artists will require up to a year to create a fully animated photorealtic creature.

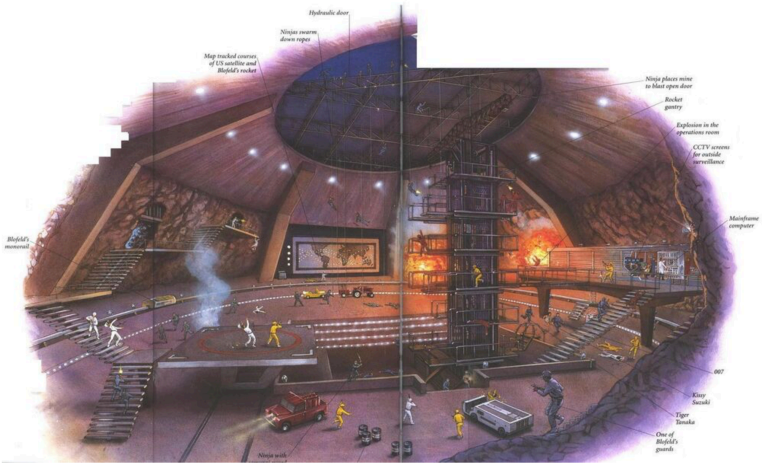
"Compared to CGI, the practical creation of say a monster, or even an environment enables the actors to interact with it directly making the experience seem more real rather than hollow"

This is an extract was an online article called '*Practical Effects Vs CGI'*. This clearly backs up the idea that this cinema technique that all the alien directors used allowed the film to capture more emotion, such as real fear when the actors first see the Alien. This is something that is quite difficult to capture if a CGI model is used because as humans, your senses react to what you see, feel, taste etc. So, if an individual cannot see something then

they wouldn't be able to react naturally, and a CGI creature will only capture emotions from actors and actresses that are instructed by the directors.

Practical Environmental Effects

Building sets for films rather than creating a digital environment is another good cinema technique which is still carried out today by certain film makers. One of these are the film makers of James bond, the executive producers of James bond still carry out some of their filming inside pinewood studios and the 007 stage. Pinewood studios was the birthplace of the first bond series; 'Dr. No' (1962) and this has continued to be the base for bond installments since then. From Dr. No right up to the most recent installment Spectre. The Bond series have included certain iconic shots that still to date make audiences think whether that shot was real or created using a 3D software. A good example was in Lewis Gilberts; 'The Spy Who loved me' (1977). This particular bond series included an underground submarine base. At first glance this will look like something that was created with the help of a computer aided 3D software, but in fact the submarine base was a complete set created within the 007 stage in pinewood studios by production designer Sir Ken Adam. Sir Ken Adam was also the production designer behind the volcano lair from 'You only Live Twice' (1967), Image to the right is the initial design of the liar used to create the final practical set. Creating large sets like these and using this cinema technique allows the film cast to interact with the environment further, this cannot be achieved when a computer-generated environment is included.



The titanic is another great example when it comes to a practical environment and practical shots. James Cameron's blockbuster consisted of a lot of practical shots, this was from building sets of the interior of the titanic and the full titanic itself. A real-life size set of the titanic itself was constructed by the production team as shown on the right. This just like the other sets allowed the team to capture real expressions from the actors when they see the ship. This also allowed the cast to behave like they are on a real ship and this can't be recreated if a greenscreen was used. This was not the only areas where James Cameron stuck with practical effects and practical resources rather than relying on the computer to work its magic. The wreckage scene in which the team finds the titanic underwater, was the real footage that James Cameron acquired when visiting the wreckage site. However, some could argue that Cameron could have made a 3D model of the wreckage to capture certain shots such as the inside etc. Well, if the wreckage was digitally recreated, then there would have been a few issues. The first issue was that since this movie came out in 1997, the CGI side was only gradually evolving. As a result of this if artist did go onto creating a digital model of the wreckage, they would have no resources on the material of the wreckage other than some



raw footage because the real wreckage lies 12,500 feet under the Atlantic Ocean. Without the material as a reference artist may not be successful at replicating a similar titanic wreckage.
Another example of a practical shot and a practical environment was again in Nolan's; The Dark Knight. The scene in question is the hospital explosion sequence. This scene is another great example to showcase Nolan's objection to the use of CGI and FX simulations.
Building a set of the hospital and then using safe practical explosions to bring down the building was a great way to show the originality of the sequence. However, one could argue that Nolan's use of a real explosion can cause some safety concerns because if a single calculation went wrong then it could result in some great impacts to the production (such as injury). But if the explosion sequence was left to a qualified CGI company then their artists could have created a model and carried out an explosion simulation which would look exactly like a real practical explosion or even better. The images below are screenshots from the special features from the Dark Knight film, the video showed how Nolan and his team were able to successfully perform a controlled explosion without the help of any visual effects.





<u>More realistic CGI as technology advances</u>
Even though the practical effects or the practical environments look and behave better than a computer-generated version, technology is advancing meaning CGI assets are becoming more realistic. This allows directors to explore their ideas when it comes to creating their films with the help of some computer-generated pre-visuals and models. *Digital Visual Effects in Cinema: The Seduction of Reality,* is a book created written by Stephen Prince. This writer explains how the use of visual effects can be bring certain shots that cannot be created in real life seem realistic as explained;

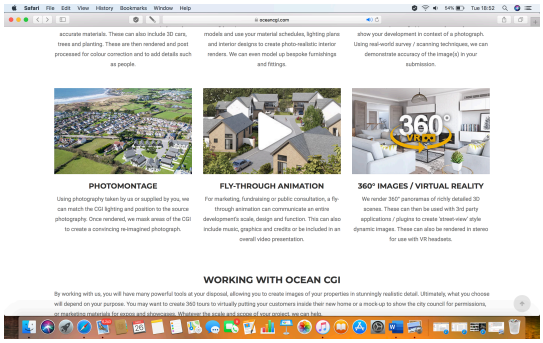
"Visual Effects provide film-makers with avenues toward realism."

This backs up the idea that directors can now rely on arts to create CGI objects/models that look realistic for sequences that may not be practical in the real world. As technology advances this will continue to become better thus increasing the demand of Visual effects. Visual effects and CG models aren't just used in the cinema industry, but it's used in other work areas such as to sell products. For example, Car manufacturers now use 3D software's to allow their customers to create a 3d model of their desired vehicle. Using 3D models allow manufacturers to visually show their customers what they vehicle will look like when

it's completed in their bespoke spec. This approach is also heavily adopted in the architectural and real-estate side.

"First impressions are critical. An eye-catching, photo-realistic CGI of a property can leave a lasting impression on customers, improving recall and moving them further along the sales funnel."

This was acquired from a business website that creates 3D visuals for clients from the architectural side. The website called *Ocean CGI* is a great example to show that the advancing evolution of CGI has allowed a new area to use CGI visualization rather than just to tell a story for movies and tv series. This company and other rising companies who use CGI technology are able to give their clients a virtual reality experience of a 3-dimensional scene (a new property e.g.).



The vast improvement of CGI can be noticed in the most recent films, especially the 2018 'Avengers Infinity war' and 2019 'Avengers Endgames'. Both of these films were filmed back to back and both included a large number of CGI shots in each film. From both films, one aspect that showed the vast improvement to CGI was through one of the primary characters; Thanos. Thanos was a fully animated CGI character that was digitally created in such a way that in the audience's eyes Thanos looked like a real-life character. However as argued earlier, the use of CGI characters or objects will reduce the lack of real emotion and interaction. Well for both Avengers infinity war and endgames, the Russo brothers; the directors of both films overcame this issue and tackled it by using motion capture. The directors were able to film sequences of Thanos by getting Josh Brolin, who portrays the character to act out his character Thanos in front of the actors that share the same shot as him. With Brolins involvement in the sequence the directors, other casts, the technicians etc; could get an idea on where thanos is positioned, for example when it comes to camera movement. This also allowed the other casts to act as if thanos was there in front of them to interact etc.

"90% of the motion capture of Brolin was done on the film set, with the motion capture cameras and sensors built into the elaborate sets. That was really nice for the actors to work in a built set as opposed to in just a blank capture volume stage."

This figure from; *Making Thanos Face the Avengers,* is enough to tell how much the directors wanted Brolin's acting as Thanos in the actual built film sets rather than allowing animators to make a 3D model and animate Thanos using a computer. Motion capture wasn't the only technique used to capture all of Brolin's performance as explained in the same article;

"For their faces the actors wore helmet camera rigs (HMC) filming in stereo at HD resolution at 48 fps. These were mounted vertically and at the front of the actors faces. Each actor, including Brolin, who would be digitally recreated had tracking markers on their faces."

Using Motion capture and facial recording of their expressions were perfect references for the animators to animate the CGI thanos and then place that version on top of the scene. Even though Thanos is fully CG, his acting and interaction with other characters were successfully captured with real acting, as said before this technique helped with timing, camera movements etc. Furthermore, Avengers Infinity War and Endgames incooperate one of Nolan's cinema rules and that was to film the entire two movies using Imax cameras.

This can be seen when you watch the film in an IMAX cinema because it takes you into the film.
Nolan who opposed and objected with the idea of using CGI shots over practical shots created Interstellar that contained a lot of sequences that neglected Nolan's rule of using Practical effects. However, there was a reason for this and that was the fact that Interstellar was a space mission film that contained a lot of shots that couldn't be practically made, in particular the Blackhole sequence. However, you could argue that even for the blackhole sequence Nolan didn't completely rely on the advanced computers and CGI companies to do that because Nolan got his production artists and fx companies to work with astrophysicist Kip Thorne to understand the full depth of a blackhole. Since FX technology is still advancing and new changes are being implemented, Nolan's fx team were able to add the calculations obtained from the research gathered with Kip Thorne into the fx software so that it could create a blackhole simulation independently. The outcomes also allowed Nolan and his fx team to help the science community by giving back a lot pf physics papers containing various results.

"Their research eventually led to a paper, titled 'Gravitational lensing by spinning black holes in astrophysics, and in the movie interstellar', which has been published today in the institute of physics publishing's journal classical and quantum gravity."
This extract is from an article called; *Interstellar VFX research leads to scientific paper on wormholes.* This is a great example to show that CGI is advancing and evolving as a steady pace where anything impossible is becoming possible to visualize with the help of CGI. This also shows that as CGI continues to evolve it could be used further in the physics side to help further understand the solar system and other galaxies.

With the push of hyper-realistic CGI, photorealistic animals in an area where drastic changes have been implemented. As more companies use the ever-advancing technology to create CGI objects, some of these photorealistic animals or assets are beginning to give audiences the impression that it was a realistic shot. A good example that showcases some of the best photorealistic animal renders, has to be the 2019 live action remake of Disney's, The Lion King. Jon Favreau and his team of visual effects artist did such as detailed job on creating the photorealistic animals, that when the film is seen the CGI animals can easily be mistaken as real animal until they realize animals cannot speak. They were able to achieve this great accomplishment by giving the CGI animals a detailed texture using real life animal reference. The VFX team behind the lion king were also able to take a step further with their models by using the advancing computer technology to give each of their CGI animals simulated fur/hair. This gave the models the final realistic touch to make it seem like that image of the CGI model was an image they were able to capture from the wild. The VFX team also hand animated all the animals using real animal footage they captured from their trip to Africa, these hand animations were carried out for the muscles, expressions, movement etc. All of these ingredients allowed the team to create a super real-life looking environment completed with various 3D species of animals and birds.



"3D artists have become incredibly good at crafting photorealistic CGI already. In fact, for still images, it's becoming nigh impossible to tell whether something is a render or a picture."
This quote acquired from the article, *Photorealistic Renders: How to convince people something digital is real;* is talking about the current photorealism renders offered by the highest of CGI software and the capabilities of the best artists. If this is the start, then as technology evolves further within the CGI side then further realistic renders will be produced. This can lead to audiences and others being unsure whether that shot is computer generated or due to its realism some may even automatically believe it's a real image without any debates. However, if more films continue to use further photorealistic CGI elements in the future then the use of practical cinema techniques will start to die down because productions can rely on CGI to create a specific sequence.

Mowgli: Legend of the jungle was another film that used photorealistic animals, but for this project rather than hand animating the animals the director Andy Serkis went with another approach. This was to use the evolving motion capture suit to capture the acting of the actors and actresses portraying each primary animal. This project brought out a different outcome when compared to the lion king because for Mowgli, Serkis wanted the animals to have certain human like features rather than making them fully photorealistic. This allowed film to have the actors who play the animals to behave and interact with Mowgli as if they are an animal, this enables them to also get into character. The image to the right is a screenshot of one of the CGI characters from the film. This character was played by Benedict Cumberbatch and his facial features can be picked out from the tiger's expression. Using human like features on the animals is beneficial because the fx artist can use the motion capture data and the actors facial data to animate the final CGI versions.



Continuing with the 2019 version of The Lion King, this was also the first film to be fully filmed using virtual production. This is another breakthrough for the cinematic industry with the help of advancing technology. Rather than creating the Lion king environment on a computer and viewing it on a monitor, Jon Favreau was able to step inside the environment the artists had created using VR technology. The benefits of this technique were that Favreau and his team were able to interact with the environment, the CGI animals and each of the animated sequences so that they could get a feel of this fictional world. With each VR session the team could narrow down what could be improved, such as the animation of a sequence or experiment with the camera angles till a perfect camera sequence is obtained for a desired shot e.g. Even though all the animals were hand animated using real animal references, the main characters such as Simba, Scar, Pumbaa etc. were animated using references of the actors that portrayed them. The actors who portrayed the main character acted out sequences on a set so that the animators



could use their acting footage to animate the characters to act with emotion like the actor that portrays them. Another technique this project used that made the environment for this film feel more realistic was with the use of the scatter tools. This tool allowed the VFX team to sprinkle elements like rocks, leaves and other pieces across the surface instead of placing each element onto the surface one by one.

To conclude even though audience are still able to identify what is real and what is computer generated, as the evolution of CGI and computer technology advances, future films as well as tv series will be able to make their audiences believe everything they see is real. Film productions will be able to accomplish this achievement by using the ever so evolving photorealistic renders being offered by the top CGI software. This will lead to the audience's eyes being fooled further and making them believe what they see is real when in-fact it is not real. This can also impact the current cinema techniques because if film productions can use the evolving CGI technology to make whatever they desire seem realistic then this technique will be relied on more, meaning the use of practical effects will start to decrease in demand.

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