

Dan - Production Management

by Dan Benallick

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Production Management (ADGD7005)

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Certificate of Authenticity

This is to certify that this research paper produced by me 'Daniel Benallick' is the outcome of my independent and original work. I have acknowledged all sources from which the quotes and imagery have been taken. The paper is free from any plagiarism and has not been submitted elsewhere for publication.

Name: Daniel Benallick

Title: Production Managment

Date of Production: 14/12/23

Subject: Scene VFX Breakdown

Abstract

In this document I will be delving into what it takes to produce a scene from the film Avengers Endgame. The scene I will be looking at is one of the final scenes, in which all the Avengers come together through portals to fight one final battle against Thanos' armies. There is a lot going on in the chosen scene, so throughout this research I'll be piecing together just how Marvel managed to pull off such a big scene.

I'll be looking at everything that goes into the making of the scene, going through each part of the production pipeline. Writing the script and storyboarding, getting the actors together, shooting the film, and breaking down the Visual effects (VFX) and Computer-Generated Imagery (CGI) Focusing mostly on the Portal effects and the army simulations.

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Introduction

I will be analyzing the VFX from the final battle during the film 'Avengers Endgame.' I will also be looking into what went into making this all possible from a Production standpoint.

Avengers Endgame is one of the top grossing movies of all time Grossing a massive \$2.7 Billion worldwide, beaten only by James Cameron's 2009 Avatar which has grossed almost \$3 Billion worldwide. (Mojo, 2023) (1) This is no easy feat, so how did they manage it?

With this being the 22nd film in the Marvel Cinematic Universe (MCU) and being the last film in the 'Infinity Saga' bringing the story to a close, the film itself was incredibly ambitious, but with a budget of almost \$540 million, one of the most expensive films ever made, it's no wonder they pulled it off. (Young, 2020) (2)

With almost \$140 million of that budget going into production and visual effects, and with so many different companies working on the film, no wonder they were able to create something incredible like that final battle scene.

"According to Dan DeLeeuw, Endgame's visual effects supervisor, 13 vendors worked on this show, with Weta Digital and Industrial Light & Magic generating the larger share (494 and 533, respectively), as Digital Domain, Framestore, Cinesite and Dneg assumed a large number as well, in addition to work by several other vendors."

(Moltenbrey, 2019) (3)

Link to the scene I am analyzing - [Avengers Endgame Final Battle Scene #1 4K 60fps 'Avengers Assemble' - YouTube](#)



Actors

A large part of the whole set up is getting the talent of the film. No actor equals no film. There was 166 cast members (*IMBD, 2019*) (14), all of whom would have needed to sign contracts and Talent Release Forms, which would have looked something like this;

TALENT RELEASE FORM (Rev. September 24 2011)

I authorize the undersigned Producer to make use of my appearance on:

PROGRAM TITLE: The Survivor
PRODUCER'S NAME: Timothy C. Salmon
PRODUCER'S PHONE NUMBER: [REDACTED]
DATE OF TAPING: September 25 2011

I understand that I am to receive 1% of any winnings the short makes, credit, and a copy of the short as compensation for this appearance. The Producer shall have complete ownership of the program. I give the Producer the right to use my name, likeness and biographical material to publicize the program and the services of the Producer.

The Producer may:

1. Photograph me and record my voice and likeness for the purpose of the production mentioned above, whether by film, videotape, magnetic tape, digitally or otherwise;
2. Make copies of the photographs and recordings so made;
3. Use my name and likeness for the purposes of education, promotion or advertising of the sale or trading in the photographs, recordings and any copies so made.

I further understand the master tape remains the property of the Producer and that there will be no restrictions on the number of times that my name and likeness may be used.

Name (please print) Johnny Wood Date: SEP 25 2011
Address [REDACTED] City Las Vegas, NV State NV Zip Code 89131
City Las Vegas State NV Zip Code 89131
Talent Signature (Parent or Guardian if under 18 years of age) [REDACTED] Date: 09/25/11

(*Salmon & Salmon, 2012*) (4)

"The Production manager needs to keep atop who is being hired for how much, and what bonuses the Performers want that will no doubt affect the budget"

(Patz & Deborah, 2010) (6)

All this would have created big roadblocks during the filming of this scene. Managing to get all the actors together for the shot. This shot is massive and brings together all the characters we've seen throughout the MCU.

Sure, there's a CGI counterpart for all the characters, but they wanted as many of them on set as physically possible.

"In this particular sequence it was logistically very challenging as well, because we had so many cast members, and everybody's off doing different films. They're doing their own films, other projects all around the world, so that was a massive challenge." – Trent Opaloch (Chitwood, 2019) (7)

This created challenges like only having access to certain actors for maybe 3 or 4 hours at a time. Which in turn meant everything had to be perfectly set up when they arrived so they had as much time to shoot and get as much from the shots as they could.

This led to executive producer Michael Grillo having ever changing paper and digital calendars of shoots, locations and actors whereabouts.

"Coupled with his digital calendars that helped him track the whereabouts of any given actor down to the hour, no one could elude him. At a glance, he could optimize any actor's window of time to when the Russos needed them."

(Anderton, 2021) (16)

With about \$200 million of the budget going towards the actors this was something they couldn't afford to mess up! *(Young, 2020) (2)*

There is only one shot in the sequence where most of the actors were present and that's the iconic scene just before they rush into battle, where Captain America is holding Thor's hammer and says 'Avengers Assemble'

In other scenes though they were not so lucky and had to rely on post production and CGI to get the characters onto the screen, for example in the shot just after, where they are running into battle, some of the actors that were not available are flying into battle, making it easier to CGI them in at a later date.

Thanos

The final battle of endgame is a massive combination of characters and story all coming together at a single point. With the big bad guy Thanos at the center of it all. The actor who played Thanos, Josh Brolin, actually almost rejected the role, but due to the depth and lore behind the character he ended up taking it.

"They dropped off the huge bible of Thanos and what he meant in the Marvel Universe and his trajectory and his relationship with Lady Death and all this stuff. And I thought it was really interesting "

"It was the bible that did it. I was reading through volumes and volumes of information, and I thought, this is really cool, and I love how in depth this has gone." – Josh Brolin



(Reynolds, 2023) (10) Image via Disney/Marvel Studios

Thanos was originally supposed to be a big over the top scary character, but Josh played him in a much more subtle and menacing way. With subtle flinches in his acting making the character more terrifying. This lead Jen and Marvel to call upon 'Digital Domain' and 'WETA'

visual effects companies to bring the character to life.

"Digital Domain and WETA were key in Thanos' development, we gave them all the scanning data and footage, and in a couple of months they turned around a version of Thanos that looked crazy like Josh" – Jen Underdahl

(How Avengers: Endgame's Visual Effects Were Made | WIRED 2019) (11)

Despite the great VFX they wanted the rest of the characters to be able to properly interact with Thanos during the scenes. This meant setting up proxies and displacement suits for Josh to wear while on set.

With Thanos being 15ft tall, it was important for everyone else to be able to interact with him properly, whether that be punching him in the right spot, or being able to match his eyeline during conversation.

Scheduling and Planning

With the 13 VFX studios, 166 actors and over 2000 people in the VFX departments (IMBD, 2019) (14). The making of the film needed a strict scheduling plan in place. One of the most common forms of scheduling is the Gantt chart, a visual, graphical representation of the schedule that can easily be uploaded, viewed and edited online in real time. Making it easy for everyone to know what is happening and when. Below is what a Gantt chart for the final battle scene might have looked like.



Pre-Production

Script Writing

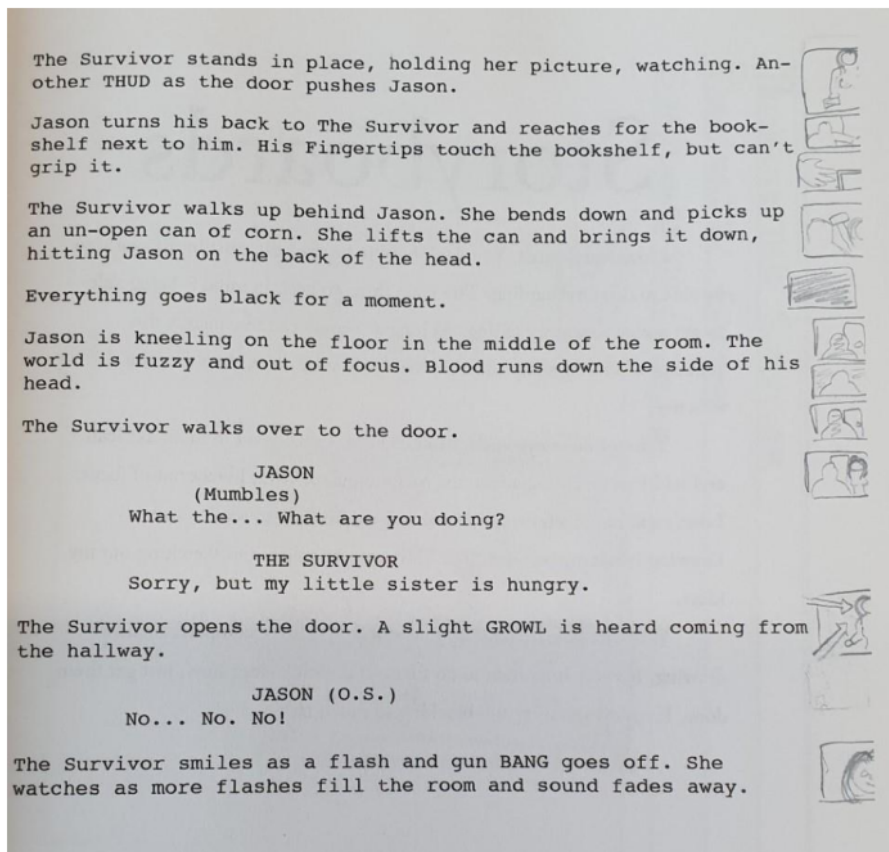
Writers Christopher Markus and Stephen McFeely started coming up with ideas for the endgame script all the way back in 2016! The 'Portal Scene' or 'Final Battle' was one of the final bits of the script and film to be written and finalized.

"The end battle in "Endgame" underwent a lot of changes over the course of writing. We actually didn't photograph most of the end battle until 2018" – Jeff Ford (Editor)

(Pearson, 2023) (8)

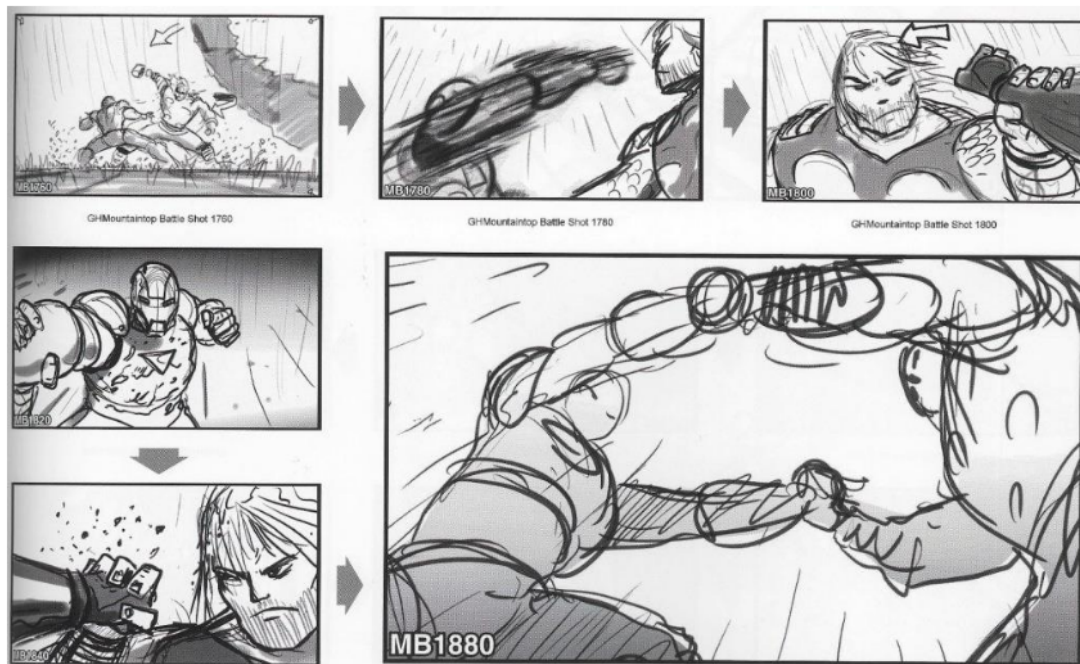
Storyboard and Thumbnails

In the very early stages of the storyboard process there would be 'Thumbnails.' Very quick drawings that would be quickly drawn onto the script itself to give an idea of what might be happening in the scenes.



(Salmon & Salmon, 2012) (5)

The next step of the process would be the Storyboards. where a group of storyboard artists get together and produce drawings for all the major scenes in the film. These can then be used as reference for the other departments such as VFX or Animation.



(Surrell, 2012) (9) A storyboard from Bryan Andrews

Pre-Visualization

A huge part of the Endgame production was Pre-Visualization. they got the company 'The Third Floor' to produce Pre Vis animations for every single scene in the film. Looking at some of the Pre Vis shots for the final battle scene, you can see that some of the final shots were almost identical to the Pre-Vis.



(Insider, 2021) (12)



(Insider, 2021) (12)

This shows the importance of the entire process from Script to Storyboard to Pre-Vis. All they had to do when they got to these shots was to get the Actors in the right place and shoot the footage. The VFX and Animators could start before the shot was finished as well, as they already knew what components they needed for the scene.



(Insider, 2021) (12)



(Insider, 2021) (12)

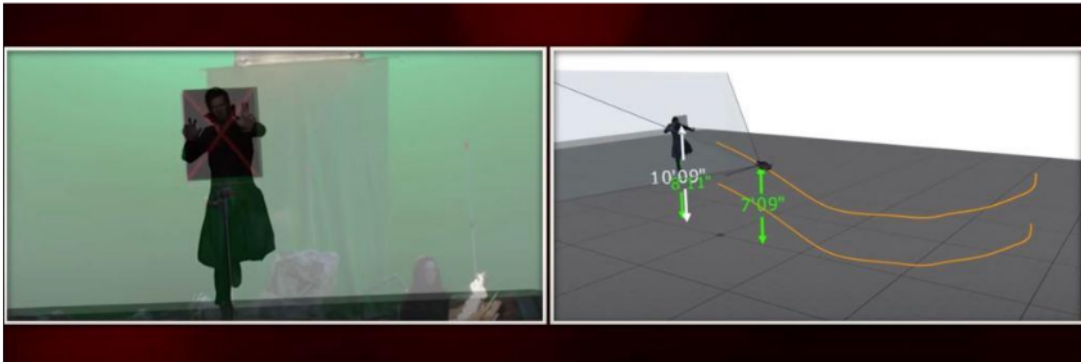
Above is a comparison of one of the portal scenes, the Pre Vis and then the final shot. Although not identical, they are still very similar. With the Pre Vis giving a good base layer for the shoot.

The challenge with the Portal scenes was the order in which all of the heroes arrived. It was such a pivotal point in the film, with hours and hours of story and character building all leading up to this point. The order in which each character appeared was incredibly important.

"It was an exercise in balancing how much time we spent with each team member, how we brought them into the team, how they fractured, and how they came together again. It was delicate, and we took a lot of time to get that balance right."

(Pearson, 2023) (8)

Pre Vis can help in other ways as well, such as figuring out camera placement and moves.



(Insider, 2021) (12)

In the above image there is a digital representation of a camera in front of an also digital Dr Strange. The camera has motion paths, lens and distance information that can all be translated and input into the real cameras on set, resulting in easy set up for shots.

VFX and CGI

It all comes down to Visual Effects (VFX) and Computer-Generated Imagery (CGI) to finalize the shots and bring it all to life for the audience and the big screen. With so much going on in this final battle, it heavily relies on GCI.

"We ended up delivering just under 500 shots for the movie and they're all in that final battle." – Matt Aitken of Weta

(Marshall, 2019) (13)

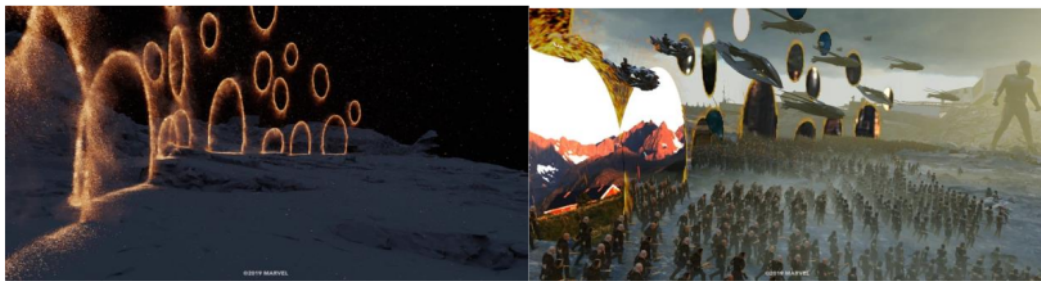
Portals

First there's the portals. A key element to the scene, containing a lot of layers. The portals themselves have never been seen on this type of large scale before, with so many shapes and sizes, they've all got their own complex simulation behind them. Then there's dust, ash and wind. Not just from the current environment, but also from the environments the portals are coming from.

"Those environments were all digital because of the camera moves that were required. We would track the on-set camera and then render the environment with that same camera"

(Failes, 2020) (18)

To get the environments for the portals the Matte painting department would digitally create most of them. But a lot of the portals were coming from places that had previously been used. So going back to the importance of organization, some of the CG props, buildings, and environments could just be pulled from the archives and placed into the scene. The portals also give off a lot of light that needs to be considered. How they interact with the scenery, in and outside of the portals, characters, and dust in the air.



To get from the first image to the last, the lighting, particles effects, animation, simulation is all rendered separately and then brought into a compositing software such as NUKE, where they are all layered on top of one another to create the final look.

Armies

For the two big colliding armies the crowd simulation software 'Massive' was used. For this process, there would be small groups of actors providing motion capture information for all the different factions within the armies.

"We were really careful to have each of the different flavors of the army, the Asgardians, the Ravages, the Wakandans, and even then, there's lots of different flavors of Wakandans soldier. Then we've got the Saharans and we've got the Chitahuri, and we've got Thanos' army."

(Failes, 2020) (18)

This motion capture data would then be plugged into Massive, and the huge armies that are seen in the movies would be crafted by digital artists.

"We had artists on this film who did the battle scenes for Lord of the Rings, and so this was like taking them back to those heady days of giant armies clashing in a complex battle sequence. "

Matt Aitken – WetaFX

(Aitken, 2019) (20)



Sound Design

Usually being the cherry on top and what brings everything together, the sound design happened a little bit differently for Endgame.

"We start the process very early with sound design. As soon as they have picture and pre-viz, they are sending stuff to us and concepts to us to try to get us to start thinking about and creating things for the film."

(Andersen, 2019) (21)

This meant that a lot of the CGI and VFX work was done based on the early sound design. Which influenced the final sound design.

With the film being the sequel to 21 others all linked through the MCU, there was already a massive catalogue of sounds to pick from. With all the previous heroes, and some of the scenes from the previous film appearing in some of the portals, this catalogue of sounds was indispensable.

Sound design is incredibly important, not just the sound effects but the music too, this can make or break a scene. One of the final battle's more impactful moments is when we see all the avengers together about to run into battle. This is a big turning point from what was thought to be a lost battle to a now hopeful outcome. Here we go from silence / sad music, to none other than the main avenger's theme. Not only a much happier theme, but a very familiar theme for long-time fans, almost bringing a sense of comfort.

A lot goes into how the viewer experiences the sound. During the final battle there is a mixture of loud explosions, and closer quite intimate scenes which all need to be balanced well, without taking you out of the experience.

"Dolby Atmos system can push out up to 128 individual sound objects from the different speakers ranged around the theater"

(Trenholm, 2019) (22)

So not only are sound levels important but so is the sound direction. Giving the sound designers even more of a chance to immerse the viewer in the film.

Summary

So, there's quite a lot that goes into making a single scene or sequence. Especially one as big and as impactful as this one. It requires lots of time and meticulous planning if you're ever going to see the outcome. Organization is key, being the 22nd film in the franchise, there are 100s of sounds, effects, cuts, edits, takes, shoots. Which because organized and filed away correctly could be drawn upon to help in the production of this film.

Luckily, Marvel Studios is a multibillion-dollar company, with access to any resources they need. That doesn't mean that the film didn't still come with challenges that they needed to overcome.

It's a big film with lots of very popular actors, some of which would have been working on multiple films at once. The final battle is also a very VFX heavy sequence, having to keep track of shots and digital files would have proved a challenge without proper organization.

"The fact that they pulled it off without having any major problems in production is astounding."

Anderton, 2021) (16)

The small quote above, pulled from an article on the Slash Film website, shows that they managed to get through most of the production without hiccups.

No easy feat but looking into the production there's nothing dramatically different that Marvel has done to stray away from the standard production pipeline. Obviously, they have the money to get companies to Previsualize the entire film, but if you stick to the basics, and keep organized, that should get you most of the way.

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Dan - Production Management

GRADEMARK REPORT

FINAL GRADE

75/100

GENERAL COMMENTS

- The research paper offers a detailed examination of the production management aspects involved in crafting a scene from "Avengers Endgame." It delves into various stages, from pre-production to VFX and CGI, providing valuable insights into managing a complex project.
- Structure and Organization: The document is well-organized, featuring clear sections such as Introduction, Actors, Scheduling and Planning, Pre-Production, VFX and CGI, Sound Design, and Summary. Each section is appropriately titled, facilitating easy navigation and understanding.
- Clarity and Coherence: While the language used is generally clear, some sentences are lengthy and could benefit from being broken down for improved readability. Additionally, providing a brief overview or roadmap at the outset could better prepare readers for the content.
- Citation and References: The paper includes a bibliography with proper citations, lending credibility to the information presented. It's important to ensure consistent application of in-text citations throughout and to address any missing citations within the body of the paper.
- Visual Elements: Incorporating visuals like images and charts could enhance the document further. For instance, including a Gantt chart to illustrate the project timeline mentioned in the Scheduling and Planning section would complement the detailed explanations.
- In-Depth Analysis: The paper provides a thorough analysis of various aspects, including managing a large ensemble cast, the role of VFX, and sound design. Detailed breakdowns of portal effects and army simulations offer valuable insights into production intricacies.

- Recommendations for Improvement:

Break down lengthy sentences to enhance readability.

Provide a brief introduction or roadmap at the beginning.

Ensure consistent use of in-text citations.

- Conclusion: Overall, the paper effectively explores the production management of a scene from "Avengers Endgame," demonstrating a solid grasp of the film making process. With adjustments for readability and visual enhancements, it can become an even more engaging and informative piece

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